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Studies on the Trombiculid Mite Fauna of India

Stan Fernandes S.J.
S.M. Kulkarni



ZOOLOGICAL SURVEY OF INDIA

OCCASIONAL PAPER NO. 212

**RECORDS OF THE
ZOOLOGICAL SURVEY OF INDIA**

Studies on the Trombiculid Mite Fauna of India

STAN FERNANDES S.J.

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Edited by the Director, Zoological Survey of India, Kolkata



**Zoological Survey of India
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STAN FERNANDES S.J.
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INTRODUCTION

The family **TROMBICULIDAE** Ewing 1944 has attracted much interest among acarologists due to its importance in public health. Though just one among some 220 families of mites, it comprises over 3000 species among the 40,000 acarine species described to date.

The family name alludes to the tiny ‘thrombus’ or blood clot produced at the site of the bite by the parasitic larva or ‘chigger’. While chiggers have probably been known from prehistoric times, the Chinese lay claim to the first description of the ‘shaman’ or ‘sand mite’ as vector of ‘tsutsugamushi’ disease by the Chinese physician Ge Hong in the early 4th century (Wen, 1978). Wharton and Fuller (1952) list the variety of names by which this family has been known the world over, including red bugs, harvest mites, itch mites, scrub mites, *bichos colorados*, *herbstmilben*, and *tsutsugamushi*.

The interest in the family stems from the implication of species of larval trombiculids in the transmission of disease. Over 17 chigger species, which have evolved primarily on reptilian hosts, have been widely known to cause severe dermatitis or chiggerosis (scrub itch) as accidental parasites of man and domestic animals, by the allergic reaction to their saliva. Vercammen-Grandjean and Langston (1976) have provided an historical review of studies on the pathological aspects of rickettsiosis.

Intensive trombiculid systematic studies date back to the 1940s, following the incrimination of certain chigger species as vectors of the then dreaded disease, ‘scrub typhus’. This febrile illness, caused by infection with *Rickettsia tsutsugamushi*, is known to be endemic in the Oriental, Australasian and Palearctic regions, but not in the New World, Europe or Africa (Nadchatram, 1984). It posed a serious problem to the Allied and Japanese troops engaged in combat manoeuvres during World War II, especially in the Indo-Burma front, with reported casualties being second only to malaria. The disease was eventually brought under control with the use of sulpha drugs and antibiotics. Tetracyclines are currently the drugs of choice in the treatment of scrub typhus (Twartz *et al.*, 1982). Audy (1968) describes the collaborative efforts of the U.S. Army Typhus Commission based at Myitkyina, the British Army Scrub Typhus Research Laboratory at Imphal, and the subsequent post-war investigations with their colleagues at the Institute for Medical Research, Kuala Lumpur, which led to the successful and dramatic tests of chloramphenicol against scrub typhus in late 1948.

Following the impetus provided by wartime studies, research continued with remarkable progress being made in the science of these mites in several countries. This interest has dwindled over the years. As with systematics, the most essential, and yet the most neglected biological science (Crowe *et al.*, 1989), trombiculid taxonomic research presently receives little attention. There have, however, been very significant contributions by a few workers over the last three decades. Thus, Nadchatram has done extensive research on the chiggers of South East Asia (Nadchatram and Dohany, 1974), Goff on Papua New Guinea chiggers

(Goff, 1982a), and Domrow on the Australian trombiculid fauna (Domrow and Lester, 1985) to follow up the pioneering work of Womersley (1952), Wharton and Fuller (1952) and Audy (1957). Vercammen-Grandjean intended to publish a collaborative revision of world chiggers in a series of volumes, but lack of resources led to a premature termination of this monumental project (Vercammen-Grandjean and Langston, 1976).

Barring the initial enthusiasm, chigger studies in India have been neglected despite the medical importance of this group. S.L. Kalra was the pioneer medical researcher investigating typhus diseases on the Indo-Burma border during World War II and the post-war years. Because of the cordial relations between Audy and Kalra, the Indian chigger collections were sent to Audy at the IMR. These collections were described by Womersley in his publication of 1952. Varma (1969b) has recorded several cases of scrub typhus during the Indo-Pakistan conflict of 1965. More recently, Wanchoo *et al.* (1973) reported an unusual outbreak in Punjab, with the unearthing of fresh endemic foci. The present work aims at providing a comprehensive picture of the Indian trombiculid fauna. It is based primarily on an exhaustive study of the chigger collections at the NIV, Pune. The NIV has conducted a series of chigger surveys over the past 3 decades in different ecogeographical regions of India, including the Western Himalayas, Sikkim and the hill Districts of West Bengal (Rao *et al.*, 1973), Rajasthan (Kaul *et al.*, 1978), Maharashtra (Kulkarni, 1979; Kulkarni *et al.*, 1979), Goa (Fernandes, 1984), Orissa, Gujarat and Karnataka. The total chigger collection numbers some 1,80,000 specimens, taken from over 80 host species, primarily small mammals, at elevations ranging from sea-level in peninsular India to 4,450m in the Himalayas.

In bringing to a conclusion the study of the NIV Himalayan chiggers, the last group of haematophagous arthropods from the Himalayan survey that remained to be studied (Fernandes *et al.*, 1988), this work incorporates a taxonomic revision of the earlier NIV chigger studies. It also updates previously published trombiculid taxa from India in the light of modern concepts in chigger systematics. This work has been designed as a consolidated reference manual to assist acarologists, entomologists and public health workers in India not familiar with complex chigger taxonomy, as a guide to the recognition and identification of Indian chiggers. It reveals the rich and diverse chigger fauna of India with the description of 57 species new to science, recording 204 species representing 28 genera in the subfamilies **LEEUVENHOEKIINAE** and **TROMBICULINAE**.

The focus of this study is taxonomic, based on larval morphology. The diagnostic characters and detailed descriptions or redescrptions are provided for each species, together with standard measurements, collection records and critical remarks. The standard sequence of descriptions is followed here: the type species of a genus is described first, and descriptions of the other species in that group follow in alphabetical order. Illustrations are presented for 160 species of which the type or reference specimens are accessible. Simple keys to genera and species have also been given to facilitate rapid identification.

REVIEW OF THE LITERATURE

The history of our knowledge of world chiggers has been covered in a series of publications starting with Gunther (1952), Wharton and Fuller (1952), Womersley (1952), Radford (1954), and more recently by Nadchatram and Dohany (1974), Vercammen-Grandjean and Langston (1976), Prasad (1982), and Domrow and Lester (1985). Two modern publications attempt to consolidate this knowledge : Goff *et al.* (1982) have assembled a reference glossary standardizing and clarifying the terminology applied to chiggers; and Goff *et al.* (1986b) have presented a comprehensive chigger bibliography that includes references to systematics, biology and ecology covering the period 1758 to 1984.

Trombiculid fauna of India : The work of Mehta (1937) marks the beginning of trombiculid mite studies in India, though a few species were described earlier by Oudemans (1914) and Hirst (1915). Prasad (1982) and Fernandes (1984) have reviewed Indian chigger studies. These studies, though sketchy, already indicated the rich Indian fauna. Important contributions have been made to the knowledge of this fauna by the British and U.S. Army teams working in co-ordination with Indian civilian and army personnel during the war years, primarily in the North-East (Audy, 1957, 1968; Audy and Womersley, 1957; Audy *et al.*, 1953; Mackie *et al.*, 1946; Radford, 1946b, 1948a, 1953a, 1953b, 1954; Sinha, 1954; Traub and Evans, 1954, 1957; Traub and Morrow, 1955, 1957; Wharton and Fuller, 1952; Womersley, 1952; Womersley and Audy, 1957), by the NICD (Srivastva and Wattal, 1971, 1975a, 1975b, 1981; Wattal *et al.*, 1967a, 1967b), and by the NIV (Bhat, 1971; Fernandes, 1984; Fernandes *et al.*, 1988; Kaul *et al.*, 1978; Kulkarni, 1973, 1974, 1979, 1981; Kulkarni and Mahadev, 1973; Kulkarni *et al.*, 1979). Besides these, major contributions to Indian chigger studies have been made by Domrow (1962e), by Hiregaudar (1958), Hiregaudar and Bal (1956a, 1956b), Joshee (1964), Mitchell and Nadchatram (1966), Mitchell *et al.* (1966), Nadchatram (1979), Nadchatram and Joshee (1966), Nadchatram and Traub (1966), and Vercammen-Grandjean and Langston (1976). Audy (1954a) reported just 63 trombiculid species from India, Prasad (1974) 93, and Kulkarni (1979) raised this number to 123 species known from India. In this study, 204 species are recorded from India, which compares favourably with the number of species recorded from Afghanistan (14 species), Japan (73 species), Malaysia (150 species), Nepal (57 species), Pakistan (38 species), Papua New Guinea (149 species), and Thailand (126 species).

Chigger-borne rickettsiosis : The tremendous development of the knowledge of world chiggers is primarily due to the involvement of certain species in the transmission of scrub typhus. This rickettsial disease is difficult to diagnose clinically since the eschar and rash (Fig. 1) are not always seen, and common clinical features such as fever, headache and cough do not distinguish it from other infections (Brown *et al.*, 1978). Lewis (1985) points out that scrub typhus is probably one of the most underdiagnosed, underreported and least recognized febrile illnesses occurring within the endemic Asiatic-Pacific region. He suggests that the true incidence of this disease is masked by the practice of treatment of fevers of unknown origin by tetracyclines. McDonald *et al.* (1988) confirm this in reporting a case of *R. tsutsugamushi* infection in a Canadian tourist returning from a trek in India and Nepal.



A



B

Fig.1. Photographs of patients with chigger-borne rickettsiosis A. facial rash 2 days after onset of disease; B. rash on back 18 days after onset.

Traub and Wisseman (1974) have proposed the term 'chigger-borne rickettsiosis' for this disease in man. In their detailed review, they relate the characteristic epidemiological features of this disease to the attributes of the vector chiggers. They have listed seven species as major vectors of chigger-borne rickettsiosis, all in the subgenus *Leptotrombidium*: *L. akamushi* (Brumpt, 1910), *L. arenicola* Traub, 1960, *L. deliense* (Walch, 1922), *L. fletcheri* (Womersley and Heaslip, 1943), *L. pallidum* (Nagayo *et al.*, 1919), *L. pavlovskyi* (Schluger, 1948) and *L. scutellare* (Nagayo *et al.*, 1921). Goff (1984b) and Nadchatram (1984) add another eight species that have been currently accorded vector status. *L. deliense*, *L. dihumerae* Traub and Nadchatram, 1967a and *L. subintermedium* (Jameson and Toshioka, 1954) are the vector species reported from the Indian subcontinent. Traub and Wisseman (1974) further suggest that species of *Ascoschoengastia*, *Gahrlipeia* (in which they include *Schoengastiella* and *Walchia* as subgenera) and *Neotrombicula* may be important as intrazootic vectors, maintaining the disease cycle in animals. However, on the basis of ecological studies in Malaysia, Nadchatram (1970b) believes that species of Gahrlipeini are not involved in the epidemiology of the disease.

Life cycle of the trombiculid mite : Trombiculid mites are parasitic for only a very brief period of their life cycle, the larval stage. Their biology has been well investigated by a

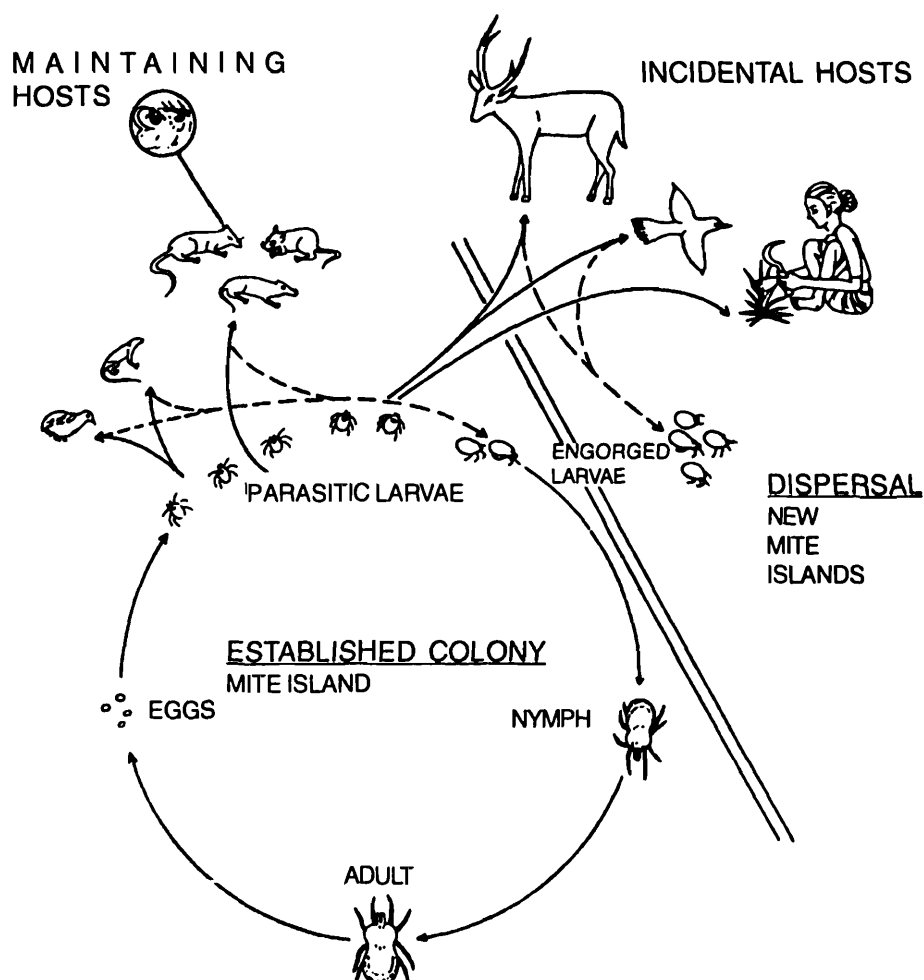


Fig. 2. Life cycle of a trombiculid mite.

number of workers (Sasa, 1961; Nadchatram, 1970b). Audy (1968), while reviewing earlier studies, illustrates three different aspects of the trombiculid life cycle. Figure 2 draws from these to outline the life cycle and formation of new 'mite islands' by dispersal through incidental hosts. Goff *et al.* (1982) summarize the seven distinct stages of the trombiculid life cycle : three active stages - larva, deutonymph, adult; and four inactive stages - egg, deutovum, protonymph, tritonymph.

The egg hatches into an inactive deutovum, from which the hexapod larva emerges after a period usually equal to the time spent in the egg stage. Prior to attachment, the unengorged larvae may be found usually in clusters on the ground or on grass-blades, dead leaves or twigs awaiting a suitable host (Gentry *et al.*, 1963). Nadchatram (1970b) has grouped Malaysian chiggers into seven ecological categories. He correlates the colour of the idiosoma with the habitat and vector potential of a species. The dermatitis-causing species and the vector species of chigger-borne rickettiosis are pale orange to red. The remaining species, which are white to yellow in colour, have a limited host range and very little or no opportunity of coming into contact with man. When located, the chigger crawls onto the host, seeks a suitable site and attaches by inserting its chelicerae into the host skin. They take a single feed of tissue-juices through a feeding-tube or 'stylostome'. During engorgement, which may take a few days or even weeks or months, depending on the species and the environmental conditions, volume increases of 25x to 120x are common.

The engorged larva then drops to the soil, going into a quiescent stage, the protonymph, in which the fourth pair of legs develop within the cuticle. The emergent octopod deutonymph is free-living and feeds on other small arthropods or their eggs. The inactive tritonymph is finally followed by the sexually mature adult which, like the deutonymph, is a free-living predator.

The mode of insemination in trombiculids long remained a mystery till Lipovsky *et al.* (1957) observed that females were inseminated by means of spermatophores deposited by males on the substrate. Eggs are usually laid singly in the soil, 20 to 30 days after emergence. The adult female lays as many as 400 eggs during her life time. The life span of an unfed larva is approximately 3 months, that of an adult one year. The duration of the life cycle is known to vary according to species, food supply and environmental conditions (usually ranging from 40 to 100 days). In tropical regions, trombiculids appear capable of continuous reproduction. In temperate regions, only one or two generations are produced over a year. In species having an annual cycle with periods of hibernation or aestivation, the unfavourable periods are apparently passed in the adult stage.

Relationship to habitat : The distribution of chigger species is known to be habitat specific and different species have characteristic ecological requirements (Jameson, 1968; Nadchatram, 1970b; Sasa, 1961). The chigger-habitat relationships are determined primarily by the requirements for development of the post-larval stages (Crossley, *in* Goff, 1979c). Thus, the more general the requirements of the post-larval stage, the more widespread the chigger species.

Though species of the subgenus *Leptotrombidium* have a narrow range of ecological tolerance, *L. deliense* is highly adaptable and has been collected in a wide range of environments (Audy, 1949; Goff, 1984b). In India, this species has been reported from elevations ranging from 2100m in Kashmir (Kalra, 1952, 1959), to above 3780m in the eastern Himalayas (Varma, 1969a, 1969b). Traub and Wisseman (1974), however, raise doubts about the authenticity of reports of *L. deliense* above 1200m in the Himalayas. *Schoengastiella ligula* Radford, 1946, one of the dominant species of the Indian subcontinent, is reported to be even more adaptable. Traub and Morrow (1955, 1957) record this species from almost every type of habitat upto elevations of 2000m; while, Srivastava and Wattal (1971) report collections upto 2500m, and Saxena (1985) at 3000m in Himachal Pradesh.

Chiggers of the genus *Trombiculindus* provide an interesting example of adaptation to xeric habitats. Their foliate or expanded setae are regarded as modifications for maintenance of body moisture in arid environments (Traub and Nadchatram, 1967b; Traub *et al.*, 1968).

Changes in the environment through deforestation and settlement tend to eliminate most of the native trombiculid species, and allow minority species to become very populous together with introduced species. Audy (1954a) confirms this premise with examples of collections made by several workers in settled and undisturbed habitats. Among these, he cites Mehta (1937), who trapped only in domestic and peri-domestic areas in urban and semi-rural localities of the Simla Hills. He recorded five species from 1,204 rats and shrews from the townships of Jabalpur and Bangalore, but at least 18 species from 485 rats trapped in forested and undisturbed habitats of Kumaon Hills, Jammu, Kashmir and Ladakh.

Influence of environmental factors : Several factors are known to affect the distribution of chiggers including time, space, soil, temperature, rainfall and humidity (Traub and Wisseman, 1974). Collections made in the same patch of scrub a few months apart, give completely different pictures of mite incidence (Audy, 1954a). Sasa (1961) reported temperature as the main factor determining chigger abundance in Japan. Van Peenan *et al.* (1976) confirmed this for the Pescadores Islands near Taiwan. Studies in India, however indicate rainfall as the key factor (Audy, 1958; Kalra, 1947; Kulkarni, 1979). Traub (1949) observed that *L. deliense* was far more prevalent in the wet season than in the dry months in Assam. Kulkarni (1979) and Wattal *et al.* (1967a) confirm his findings for other parts of India as well. *S. ligula* is, however, more prevalent in the dry weather than in the rainy season.

Relationship to hosts : Chiggers are widespread parasites of a wide range of reptile, bird and mammal hosts, but rodents and shrews are the most commonly infested. Goff (1979c) confirms the accepted concept that trombiculids are habitat-specific rather than host-specific. He reported a chigger species from 14 different host species in similar habitats of Papua New Guinea. He also noted that host species were commonly infested by several species of chiggers, with an average of four chigger species per host species. The maximum number of species recorded for a given host in his collection was 13 for the Variable Spiny rat, *Rattus*

ruber. In peninsular Malaysia, a single forest rat, *Rattus bowersi*, harboured 18 species of chiggers. The burrow of a rodent in the ground yielded 8 species of unfed chiggers. In comparison, the maximum number of chigger species found on a single Malaysian field rat, *Rattus argentiventer*, caught in open grassland was 3 (Nadchatram, 1970b). Kulkarni (1979) observed that all 36 species recorded in the Pune District collection were found to parasitize the House shrew *Suncus murinus*.

Chiggers are known to have specific sites of attachment on small mammals (Sasa, 1961). For a particular trombiculid species, the site on one host species may differ markedly and regularly from that of another. The commonly encountered parasitopes are the ear, the thighs, the intranasal region and the perianal area. Traub and Wisseman (1968) suggested that the choice of the attachment site of *L. deliense* varies with the grooming habits of the host species. *L. deliense* is found in the ears of rats, the belly and inguinal regions of tree shrews, and on the thighs of soricid shrews. Kulkarni (1979) reported seven parasitopes in his study, with the ear as the most frequent site of attachment on rodents. On *S. murinus*, however, the outer side of the thighs proved to be the choice parasitope. Goff (1979c) noted that while an average of five host species was exploited by a given species, a much narrower range of parasitopes was used.

PRESENTATION OF MATERIALS

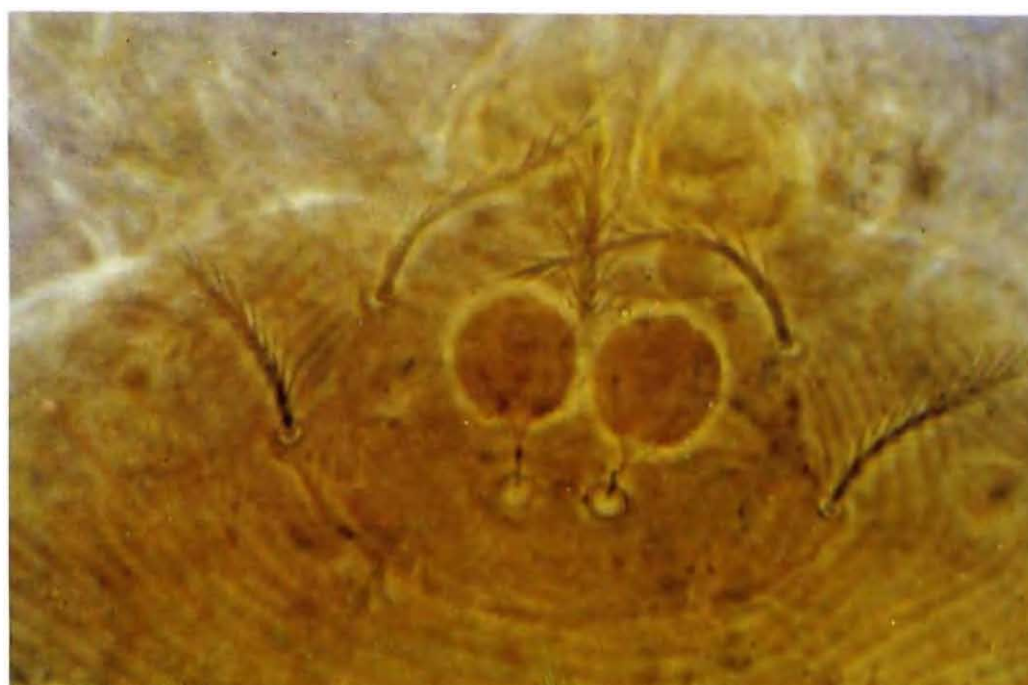
Terminology : The terminology used in the descriptions of species primarily follows Goff *et al.* (1982), who have explained the specialized terms which were developed independently from other acarine terminology as a result of the almost exclusive preoccupation with the parasitic larval stage found on vertebrates and the emphasis placed on the descriptions and identifications of medically important species. Certain other terms used follow Nadchatram and Dohany (1974), Vercammen-Grandjean (1968b), Vercammen-Grandjean *et al.* (1973), Vercammen-Grandjean and Langston (1976), and Wen (1978).

Descriptions : Figure 3 presents photomicrographs of a trombiculid mite and a scutum bearing globose sensillae. Figures 4-6 detail the various structures of a chigger and the method of measurements followed in the determination of standard data. Illustrations prepared from camera lucida drawings are presented for the Indian species available in the NIV collection or accessible from type depositories in museums and collections of acarologists. The morphological structures figured for the species include details of the scutum, the dorsal view of the gnathosome, the ventral aspect of the palpal tibia and tarsus, and the terminal leg segments. The drawings focus on the diagnostic characters, and preclude repetitious or less important features. Thus, the palpal claw is not presented in the illustration of the ventral aspect of the palpal tibia and tarsus, nor are the bases of the ordinary branched setae indicated on the legs. All standard measurements are given in micrometres.

Abbreviations The abbreviations used in the standard measurements (Fig. 6) follow



A



B

Fig. 3. Photomicrographs of trombiculid mite :
A. *Walchia lupella* (idiosoma 335x232);
B. Scutum of *Helenicula nadchatrami* (AW 56, PW 75) with globose sensillae.

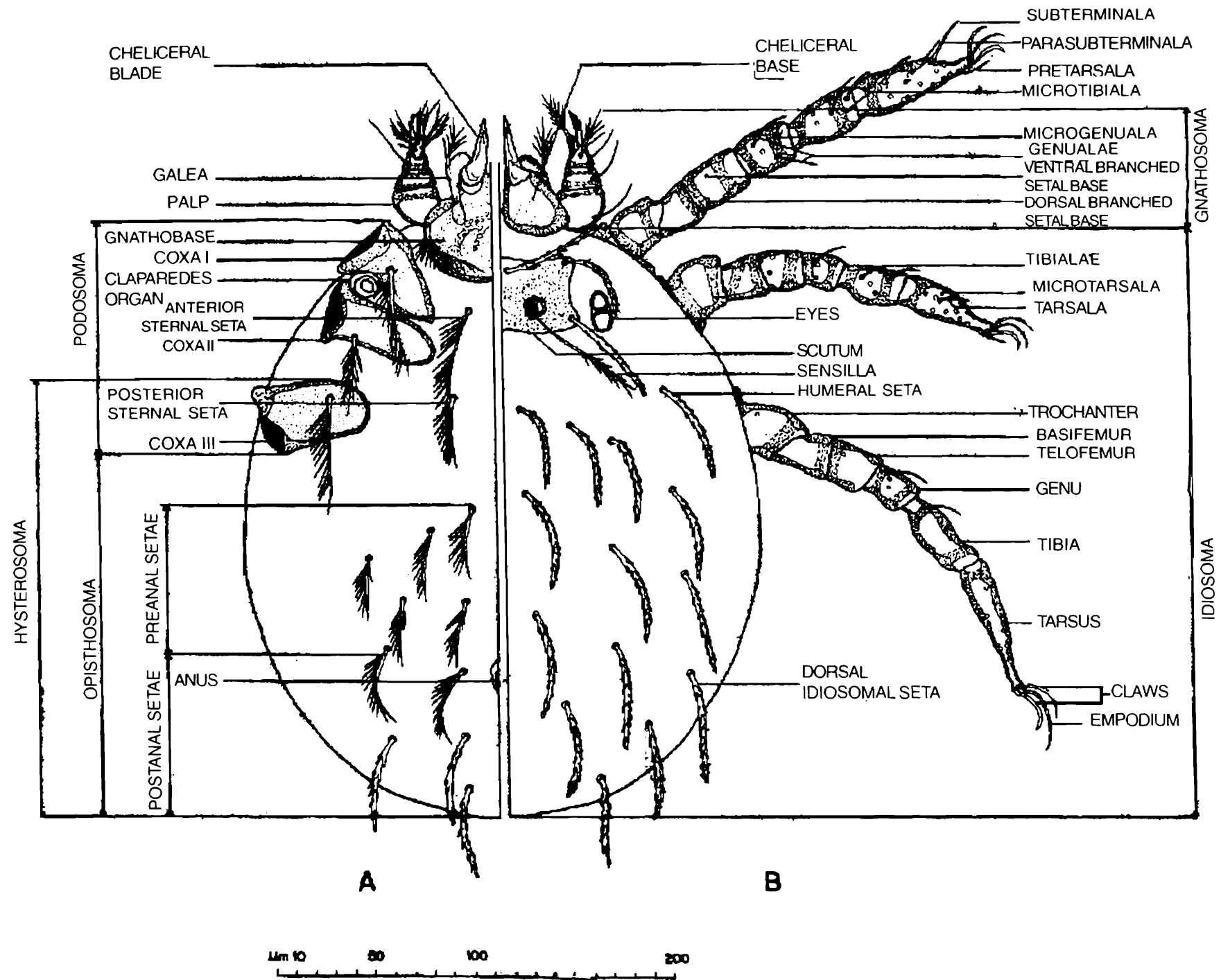


Fig. 4. Idiosoma and gnathosoma of a trombiculid mite (*Leptotrombidium deliense*)
A. ventral aspect; B. dorsal.

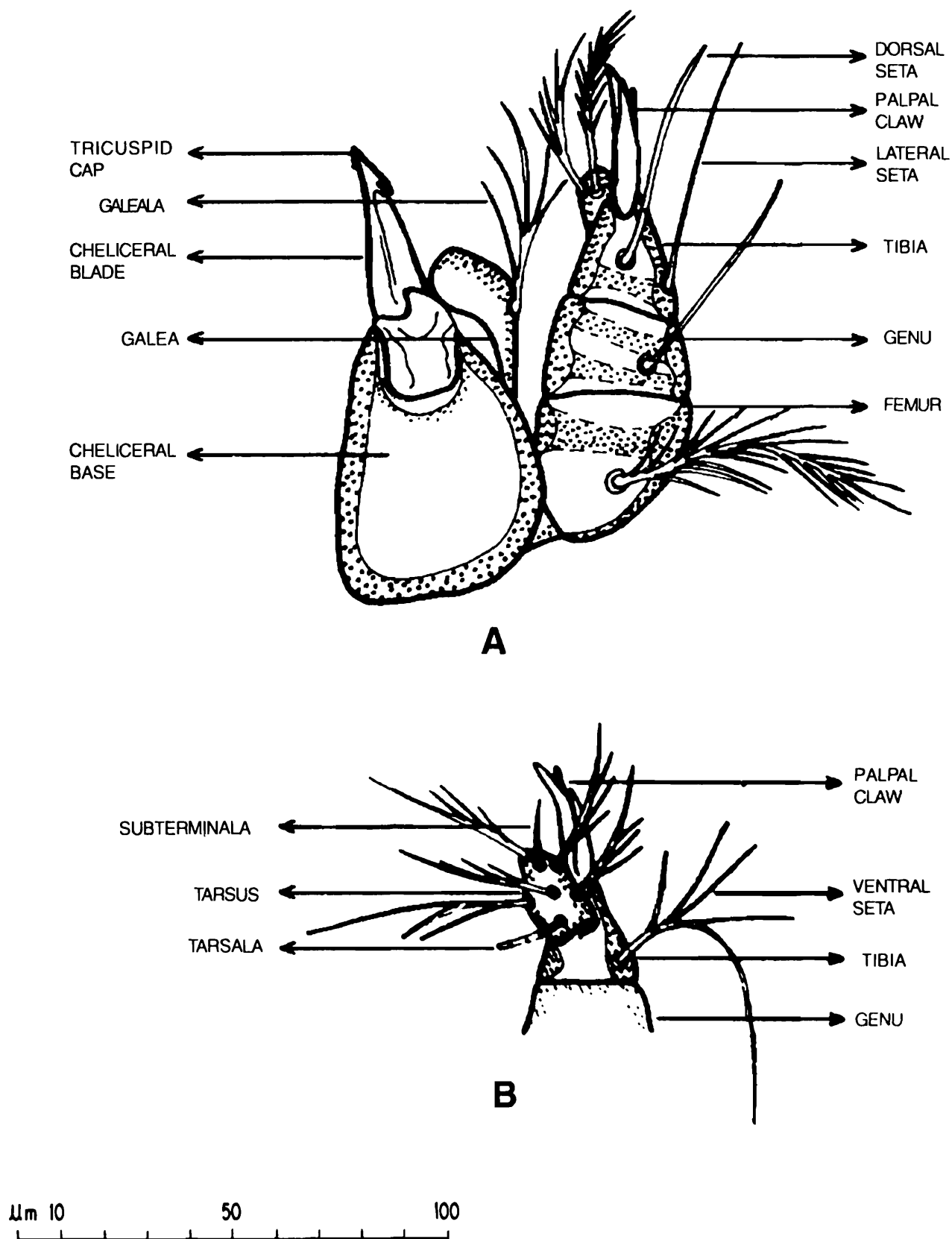


Fig. 5. Gnathosoma of *Leptotrombidium vietzi*: A. dorsal aspect;
B. ventral aspect of palpotibia and tarsus.

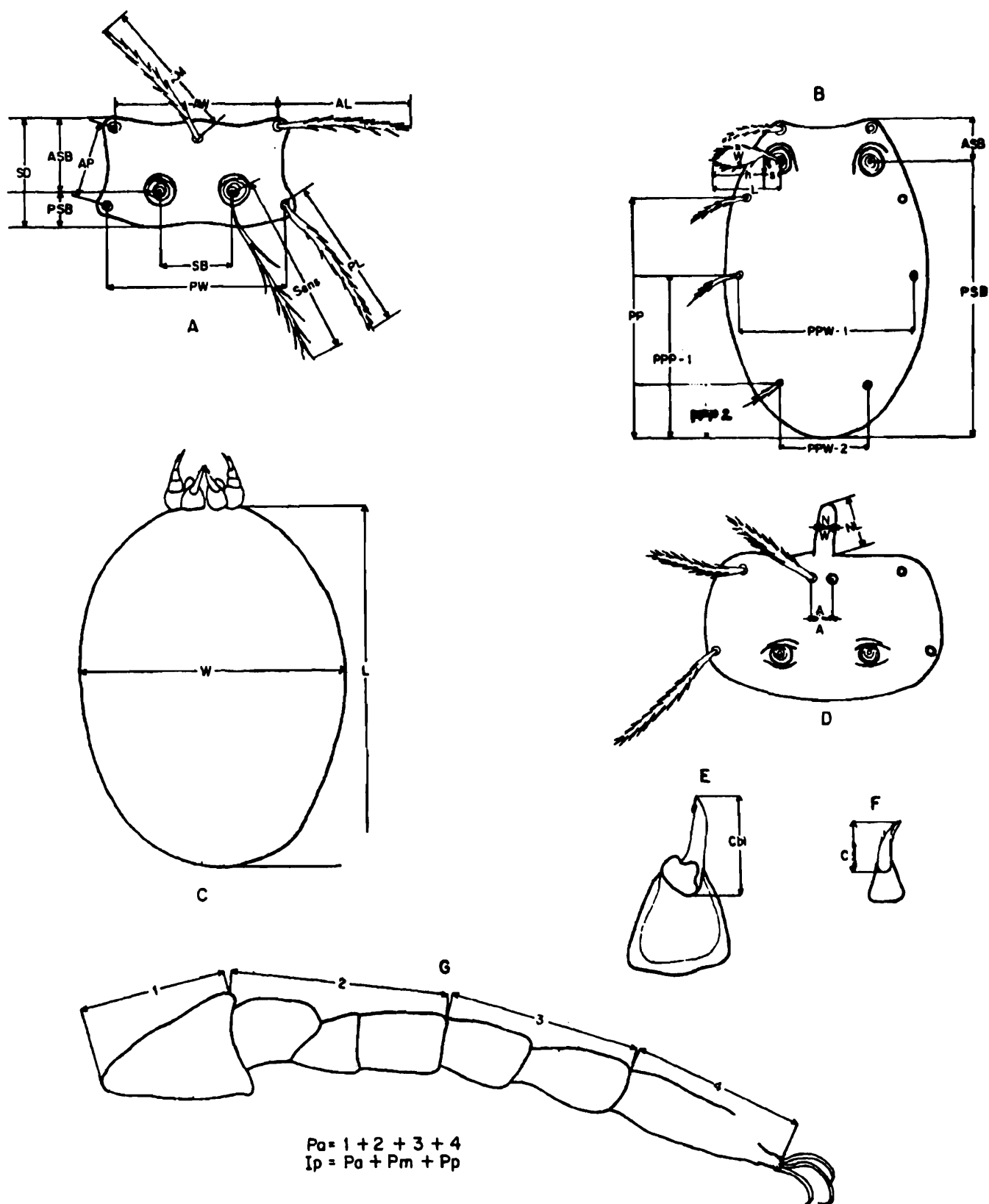


Fig. 6. Method of standard measurements : A. dimensions of scutum of Trombiculini and Schoengastiini; B. Gahrlepiini as above; C. dimensions of idiosoma; D. dimensions of scutum of Leeuwenhoeikiinae; E. length of cheliceral blade; F. length of palpal claw; G. length of leg I (anterior leg).



A



B

Fig. 7. Collection of trombiculid mites :
A. setting of baited Sherman traps for rodent hosts;
B. removal of chiggers for preservation and study.

Goff *et al.* (1982), Nadchatram and Dohany (1974), and Vercammen-Grandjean (1968b). The following abbreviations have been used for selected idiosomal setae in the legends of the illustrations : **cs**, posterior opisthosomal seta; **ds**, dorsal seta; **dsam**, anteromedian dorsal seta; **dsl**, dorsolateral seta; **dsm**, dorsomedian seta; **dsp**, posterior dorsal seta; **hs**, humeral seta; **prs**, preanal seta; **prsa**, anterior preanal seta; **prsl**, lateral preanal seta; **prsm**, median preanal seta; **prsp**, posterior preanal seta; **ps**, postanal seta; **psa**, anterior postanal seta; **psl**, lateral postanal seta; **psp**, posterior postanal seta. The following abbreviations have been used in the listing of the type depositories and field collection teams : **BM(NH)**, British Museum (National History); **BPBM**, Bernice P. Bishop Museum; **CNHM**, Chicago Natural History Museum; **CORU**, Colonial Office (Scrub Typhus) Research Unit, Kuala Lumpur; **GWHF**, George Williams Hooper Foundation; **IA**, Institute of Acarology, Ohio State University, Columbus; **IM**, Indian Museum, Calcutta; **IMR**, Institute of Medical Research, Kuala Lumpur; **KECM**, King Edward VII College of Medicine, Singapore (Presently, the only depository at Singapore is the Zoological Reference Collection, **ZRC**, at the National University of Singapore); **LSTHM**, London School of Tropical and Hygiene and Medicine; **MI**, Molteno Institute, Cambridge; **NICD**, National Institute of Communicable Diseases, Delhi; **NIV**, National Institute of Virology (known prior to 1978 as **VRC**, Virus Research Centre); **PMRC**, Pakistan Medical Research Centre, Lahore; **RMNH**, Rijks Museum of Natural History, Leiden; **SAM**, South Australian Museum; **STRU**, Scrub Typhus Research Unit, Imphal; **UM**, University of Maryland, Baltimore; **USNM**, United States National Museum, Washington (chigger collection presently at University of Hawaii at Manoa, Honolulu); **ZSI**, Zoological Survey of India, Calcutta.

Methods This study is restricted to the larval stage of the trombiculid mite as found on the host body. The NIV field collections were carried out during the period 1966 to 1988. The trapping of hosts and the collection of chiggers (Fig. 7) was done following the method of Rao *et al.* (1973); preservation and mounting of chiggers follows Kulkarni *et al.* (1979). The number of chiggers taken on a single host varied widely, ranging from none to over 2000. When the specimens collected from a host exceeded 25, usually only 25 randomly selected individuals were mounted for study. The identification of chiggers was done with the help of keys by Vercammen-Grandjean (1968b), Nadchatram and Dohany (1974) and other recent taxonomical publications. The species described earlier have been compared with type and representative specimens whenever accessible, and the identity of several species further confirmed by Goff and Nadchatram. The holotypes of the new species are deposited in the NIV chigger collection, and paratypes (as available) are deposited there and will be deposited in due course in the collections of BPBM, IMR, USNM, ZRC and ZSI.

Study area The study area is restricted to the political boundaries of India. The Indian collection records are cited with reference to the States and Union territories (Fig. 8). The complete type data is presented for each species, but the additional records given are only for collections within India. Several species earlier reported from Pakistan by Traub and Nadchatram (1966a, 1966b, 1967a) and Vercammen-Grandjean and Langston (1976) have been collected in localities falling within the State of JAMMU and KASHMIR. These records have been correctly ascribed here to India.

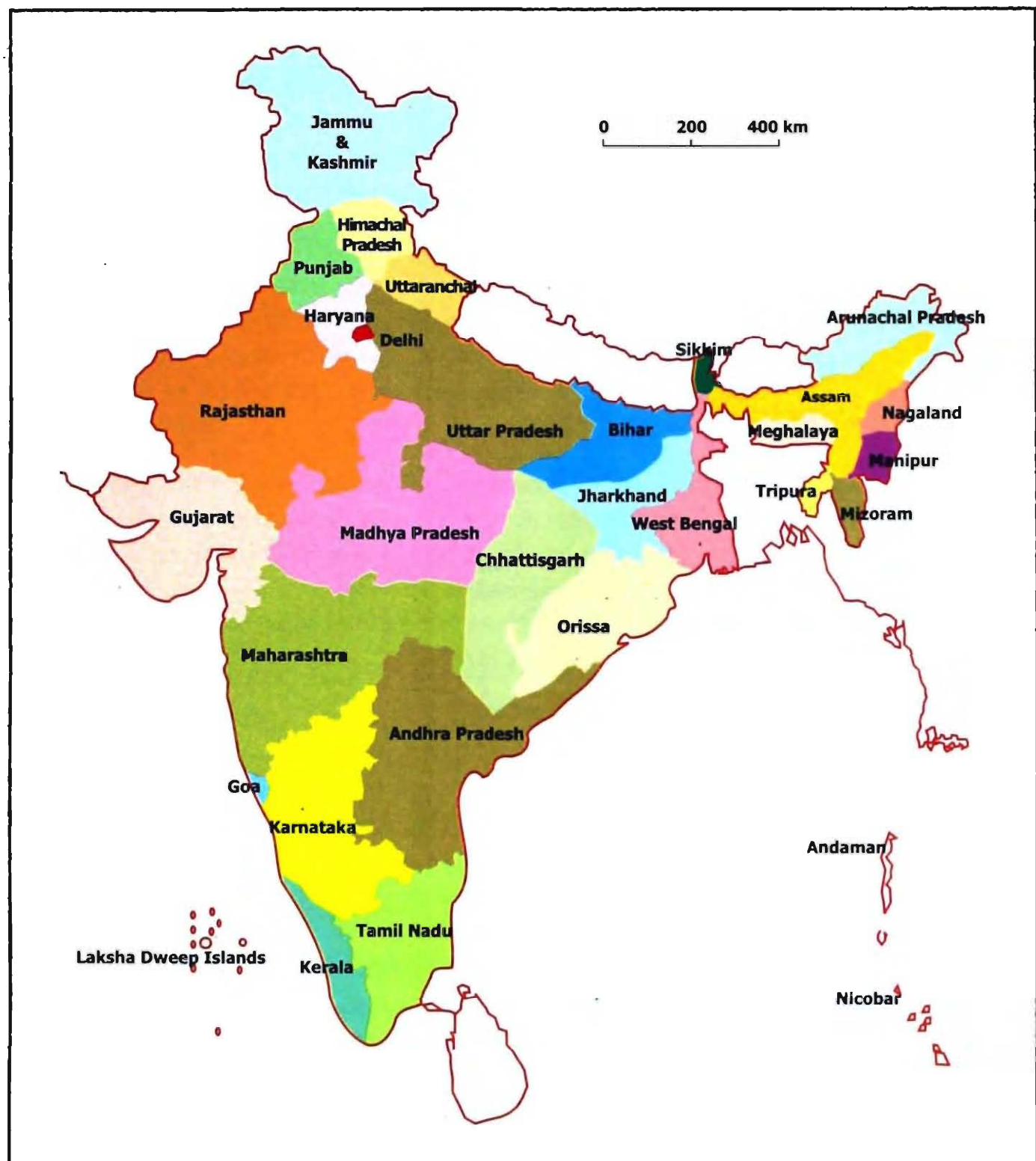


Fig. 8. Map of India showing States and Union Territories.

CLASSIFICATION OF TROMBICULIDAE

Family TROMBICULIDAE Ewing

Trombiculidae Ewing, 1944, 101.

Type genus : *Trombicula* Berlese, 1905.

The taxonomic arrangement accepted here follows Krantz (1978) to the family level and Nadchatram and Dohany (1974) to the tribe level, taking into consideration the revision of Goff *et al.* (1982) for Apoloniinae :

Phylum **ARTHROPODA**

Subphylum **CHELICERATA**

Class **ARACHNIDA**

Subclass **ACARI** (Acarina)

Order **ACARIFORMES**

Suborder **ACTINEDIDA**

Supercohort **PROMATIDES**

Phalanx **TROMBIDIDA**

Superfamily **TROMBIDIOIDEA**

Family **TROMBICULIDAE**

Subfamily **LEEUVENHOEKIINAE**

Subfamily **APOLONIINAE**

Subfamily **TROMBICULINAE**

Tribe **Trombiculini**

Tribe **Schoengastiini**

Tribe **Gahrlepiini**

The trombiculid classification is based on larval characters, termed “nepophylogeny” by Vercammen-Grandjean *et al.* (1973). Nadchatram and Dohany (1974) regard this basis as inadequate since they consider a clearer understanding of postlarval stages essential for a valid, natural classification of the family especially at the generic level. But, Nadchatram and Fernandes (1989) contend that the recognition of the larval stage alone as the basis is the popular trend being followed for practical reasons, and seems to be the only logical solution to this problem for years to come.

The Indian trombiculid taxa conform to the following :

Gnathosoma normally developed, non-retractile. Palps 6-segmented : gnathobase (fused coxae) with 2 barbed setae; nondescript trochanter without seta; femur with dorsal seta; genu with dorsal seta; tibia with dorsal, lateral and ventral setae, and with terminal claw having axial and one or more accessory prongs; tarsus having 4B-7B barbed setae with basal tarsala and sometimes with subterminala (a nude seta). Chelicerae with broad unfused base and curved blade, variously toothed in certain taxa, with apical tricuspid cap. Galea, with galeal seta, sheathing chelicera ventrally.

Scutum with pair of sensillae (flagelliform or expanded) and variable number of setae present on anterodorsal idiosoma. Scutum punctate, pittings variable, sparse to dense, from simple light to scrobiculate. Eyes free on cuticle or on sclerotized ocular plate, 2/2, 1/1, reduced or absent.

Idiosoma with superficial annulate cuticular foldings, more pronounced in unengorged chiggers. Humeral setae one or more pairs on either side of scutum, not distinguishable in hirsute species. Dorsal and to some extent ventral idiosomal setae arranged in definite rows, except in hirsute species. Ventral setae differentiated as preanal and postanal, inserted anterior and posterior to anus (uropore). Sternal setae usually 2 pairs, one to multiple pairs in certain taxa.

Three pairs of legs, 7-segmented (6-segmented, if femoral segments are fused), with coxae attached to idiosoma; coxa I and II contiguous, with urstigma (Claparede's organ) at apical corner; tarsus with terminal pair of claws and clawlike empodium, bearing onychotriches (tenant hairs) in some taxa. In the bird-infesting genus *Mackiena*, there is a caruncle instead of empodium. As noted in several studies beginning with Walch (1922), Audy (1954b), Sasa (1958) and more recently Vercammen-Grandjean *et al.* (1973), Goff *et al.* (1982) and Domrow and Lester (1985), the distribution of barbed ordinary setae and nude sensory setae on the leg segments follows a definite pattern in generic / subgeneric groups. The distribution of barbed setae is detailed in the generic diagnoses of the taxa. The type and number of nude setae are of diagnostic importance. The normal distribution of nude setae on the leg segments as given by Nadchatram and Dohany (1974) is as follows : Leg I - Genu with 1-3 genualae and microgenuala; tibia with 1-2 tibialae and microtibiala; tarsus with tarsala, microtarsala, subterminala, fine parasubterminala (forked or barbed in certain taxa), and pretarsala. Leg II - Genu with genuala (and microgenuala in subfamily Leeuwenhoeekiinae); tibia with 2 tibialae; tarsus with tarsala, microtarsala and pretarsala. Leg III - Genu with genuala (2 genualae in *Chiroptella*); tibia with tibiala (lacking in Gahrlepiini and *Schoutedenichia*); certain taxa with one or more mastitarsalae, mastitibialae, or mastifemoralae (long whiplike setae).

CHECKLIST OF INDIAN TROMBICULIDAE

Subfamily LEEUWENHOEKIINAE

Multisetosa himalayensis **new species**

Odontacarus (Leogonius) audyi (Radford, 1946)

Odontacarus (Leogonius) gymnodactyli (Ewing, 1925)

Odontacarus (Leogonius) indica Nadchatram and Joshee, 1966

Odontacarus (Leogonius) joshii **new species**

Shunsennia wissemanni Traub and Nadchatram, 1966

Whartonia (Fascutonia) brennani Hiregaudar and Bal, 1956

Whartonia (Fascutonia) indica Hiregaudar and Bal, 1956

Whartonia (Fascutonia) kumaonensis Bhat, 1971

Subfamily TROMBICULINAE

Tribe Trombiculini

Trombicula hampii Hiregaudar and Bal, 1955

Trombicula (Trombicula) hypodermata Nadchatram and Traub, 1966

Trombicula schmitzi (Oudemans, 1914)

Blankaartia (Blankaartia) acuscutellaris (Walch, 1922)

Blankaartia (Blankaartia) nilotica (Tragardh, 1904)

Chiroptella (Chiroptella) bandupi (Hiregaudar and Bal, 1956)

Chiroptella (Chiroptella) hiregaudari **new species**

Eutrombicula hirsti (Sambon, 1927)

Fonsecia (Fonsecia) coluberina Radford, 1946

Fonsecia (Fonsecia) pyasi Rao and Hiregaudar, 1955

Leptotrombidium (Leptotrombidium) baltalense Vercammen-Grandjean and Langston, 1976

Leptotrombidium (Leptotrombidium) bhimtalense (Womersley, 1952)

Leptotrombidium (Leptotrombidium) burmense (Ewing, 1945)

Leptotrombidium (Leptotrombidium) dehradunense **new species**

Leptotrombidium (Leptotrombidium) deliense (Walch, 1922)

Leptotrombidium (Leptotrombidium) delimushi Vercammen-Grandjean and Langston, 1976

Leptotrombidium (Leptotrombidium) dihumeralae Traub and Nadchatram, 1967

Leptotrombidium (Leptotrombidium) discrepans **new species**

Leptotrombidium (Leptotrombidium) dooleyi Nadchatram, 1970

Leptotrombidium (Leptotrombidium) dux (Womersley, 1952)

Leptotrombidium (Leptotrombidium) fulleri (Ewing, 1945)

Leptotrombidium (Leptotrombidium) fulmentum Vercammen-Grandjean and Langston, 1976

Leptotrombidium (Leptotrombidium) imphalum Vercammen-Grandjean and Langston, 1976

Leptotrombidium (Leptotrombidium) insigne **new species**

Leptotrombidium (Leptotrombidium) irregulare Traub and Nadchatram, 1967

Leptotrombidium (Leptotrombidium) jayewickremei (Womersley, 1952)

Leptotrombidium (Leptotrombidium) kalrai (Radford, 1953)

- Leptotrombidium* (*Leptotrombidium*) *keukenschrijveri* (Walch, 1923)
Leptotrombidium (*Leptotrombidium*) *kulkarnii* Vercammen-Grandjean and Langston, 1976, **full species**
Leptotrombidium (*Leptotrombidium*) *lagone* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *longisetum* (Womersley, 1952)
Leptotrombidium (*Leptotrombidium*) *macacum* (Womersley, 1952)
Leptotrombidium (*Leptotrombidium*) *mirum* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *mittelli* Nadchatram, 1970
Leptotrombidium (*Leptotrombidium*) *multisetosum* (Joshee, 1964)
Leptotrombidium (*Leptotrombidium*) *oreophilum* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *pakistanum* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *paradox* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *parapalpale* (Womersley, 1952)
Leptotrombidium (*Leptotrombidium*) *parviscutum* Mitchell and Nadchatram, 1966
Leptotrombidium (*Leptotrombidium*) *peniscutum* Vercammen-Grandjean, Nadchatram and Traub 1966
Leptotrombidium (*Leptotrombidium*) *pseudofulmentum* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Leptotrombidium*) *puta* (Womersley, 1952)
Leptotrombidium (*Leptotrombidium*) *radfordi* (Sinha, 1954)
Leptotrombidium (*Leptotrombidium*) *rupestre* Traub and Nadchatram, 1967
Leptotrombidium (*Leptotrombidium*) *russicum* (Oudemans, 1902)
Leptotrombidium (*Leptotrombidium*) *siligorensis* **new species**
Leptotrombidium (*Leptotrombidium*) *sinhgarhensis* Kulkarni, 1973
Leptotrombidium (*Leptotrombidium*) *solitarium* **new species**
Leptotrombidium (*Leptotrombidium*) *spilletti* Mitchell and Nadchatram, 1966
Leptotrombidium (*Leptotrombidium*) *subintermedium* Jameson and Toshioka, 1954
Leptotrombidium (*Leptotrombidium*) *subrussicum* Kolebinova, 1970
Leptotrombidium (*Leptotrombidium*) *tithwalense* (Womersley, 1952)
Leptotrombidium (*Ericotrombidium*) *bhattipadense* (Joshee, 1964), **new combination**
Leptotrombidium (*Ericotrombidium*) *eximium* **new species**
Leptotrombidium (*Ericotrombidium*) *gliricolens* (Hirst, 1915)
Leptotrombidium (*Ericotrombidium*) *indicum* **new species**
Leptotrombidium (*Ericotrombidium*) *lepidum* **new species**
Leptotrombidium (*Ericotrombidium*) *murphyi* Nadchatram, 1970
Leptotrombidium (*Ericotrombidium*) *pseudogliricolens* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Ericotrombidium*) *rajaniae* Kulkarni, 1981
Leptotrombidium (*Ericotrombidium*) *rajasthanensis* **new species**
Leptotrombidium (*Ericotrombidium*) *uriense* Vercammen-Grandjean and Langston, 1976
Leptotrombidium (*Ericotrombidium*) *vietzi* (Womersley, 1952)
Leptotrombidium (*Ericotrombidium*) *wallacei* Mitchell and Nadchatram, 1966, **new combination**
Microtrombicula (*Microtrombicula*) *alpicula* Traub and Nadchatram, 1966
Microtrombicula (*Microtrombicula*) *altensis* **new species**
Microtrombicula (*Microtrombicula*) *buxtoni* (Womersley, 1952)
Microtrombicula (*Microtrombicula*) *cotrivensa* **new species**
Microtrombicula (*Microtrombicula*) *kajutekrii* (Joshee, 1964)

- Microtrombicula (Microtrombicula) khurdangencosa* **new species**
Microtrombicula (Microtrombicula) khurdangensis (Womersley, 1952)
Microtrombicula (Microtrombicula) latens Traub and Nadchatram, 1966
Microtrmbicula (Microtrombicula) munda (Gater, 1932)
Microtrombicula (Microtrombicula) palicula **new species**
Microtrombicula (Microtrombicula) perissochaeta Traub and Nadchatram. 1966
Microtrombicula (Microtrombicula) pseudoperissochaeta **new species**
Microtrombicula (Microtrombicula) rajoriensis (Womersley, 1952)
Microtrombicula (Microtrombicula) spicea (Gater, 1932)
Microtrombicula (Microtrombicula) talens **new species**
Microtrombicula (Microtrombicula) unigenuala **new species**
Microtrombicula (Microtrombicula) vacillata **new species**
Microtrombicula (Microtrombicula) vencotrisa **new species**
Microtrombicula (Microtrombicula) ventricosa Traub and Nadchatram, 1966
Miyatrombicula cooli (Domrow, 1962), **new combination**
Miyatrombicula najai (Hiregaudar, 1958), **new combination**
Myotrombicula (Myotrombicula) kauli **new species**
Neotrombicula anax Audy and Womersley, 1957
Neotrombicula autumnalis (Shaw, 1790)
Neotrombicula cervulicola (Ewing, 1931)
Neotrombicula fujigmo (Philip and Fuller, 1950)
Neotrombicula gayanoi **new species**
Neotrombicula guptai Nadchatram, 1979
Neotrombicula inflata Mitchell and Nadchatram, 1966
Neotrombicula kanzalwanensis (Womersley, 1952)
Neotrombicula kashmirensis (Womersley, 1952)
Neotrombicula microti (Ewing, 1928)
Neotrombicula nagayoi Sasa, Hayashi, Sato, Miura and Asahina, 1950
Neotrombicula nivalis Kudryashova, 1977
Trombiculindus aetherius **new species**
Trombiculindus cuneatus Traub and Evans, 1951
Trombiculindus deccanensis (Mitchell and Nadchatram, 1966)
Trombiculindus foliaceus Traub and Evans, 1951
Trombiculindus fordi (Womersley, 1952)
Trombiculindus mehtai **new species**
Trombiculindus pruthi Sinha, 1954
Trombiculindus squamiferus (Womersley, 1952)
Trombiculindus squamosus Radford, 1948
Trombiculindus traubi (Womersley, 1952)
Trombiculindus varifolius **new species**
Trombigastia abdita **new species**
Trombigastia tristernala **new species**

Tribe **Schoengastiini**

- Schoengastia kanhaensis* Mitchell and Nadchatram, 1966
Schoengastia propria Audy and Womersley, 1957
Schoengastia pseudoschuffneri (Walch, 1922)
Schoengastia tuberculatae **new species**
Ascoschoengastia guptai Kulkarni, 1974
Ascoschoengastia indica (Hirst, 1915)
Ascoschoengastia katarmalensis **new species**
Ascoschoengastia leechi Domrow, 1962
Ascoschoengastia roluis (Traub and Audy, 1954)
Doloisia (Doloisia) bhati **new species**
Doloisia (Doloisia) manipurensis (Radford, 1946)
Helenicula comata (Womersley, 1952)
Helenicula globularis (Walch, 1927)
Helenicula kohlsi (Philip and Woodward, 1946)
Helenicula lanius (Radford, 1946)
Helenicula mattei **new species**
Helenicula miyagawai (Sasa, Kumada and Miura, 1951)
Helenicula nadchatrami **new species**
Herpetacarus (Herpetacarus) longisetosa (Hiregaudar, 1958)
Herpetacarus (Herpetacarus) schlugeri (Radford, 1953), **new combination**
Neoschoengastia (Neoschoengastia) thomasi (Radford, 1946)
Reidlinia coeca Oudemans, 1914
Schoutedenichia (Schoutedenichia) capillata (Radford, 1953), **new combination**
Schoutedenichia (Schoutedenichia) gangutriani **new species**
Schoutedenichia (Schoutedenichia) goffi **new species**
Schoutedenichia (Schoutedenichia) jubbulporensis (Womersley, 1952)
Schoutedenichia (Schoutedenichia) nagpurensis Srivastva and Wattal, 1975
Schoutedenichia (Schoutedenichia) nausheraensis (Womersley, 1952)
Schoutedenichia (Schoutedenichia) schalleri Mitchell and Nadchatram, 1966
Walchiella lewthwaitei (Womersley, 1952)
Walchiella oudemansi (Walch, 1922)

Tribe **Gahrlepiini**

- Gahrlepiea armata* **new species**
Gahrlepiea armigera **new species**
Gahrlepiea barbiger Traub and Morrow, 1957
Gahrlepiea crassiscuti **new species**
Gahrlepiea crocidura (Radford, 1946)
Gahrlepiea darita Traub and Morrow, 1957
Gahrlepiea dhandai **new species**
Gahrlepiea dupliseta Traub and Morrow, 1955
Gahrlepiea fletcheri Gater, 1932

- Gahrliepia hirsuta* (Radford, 1946)
Gahrliepia inconstans **new species**
Gahrliepia khandalaensis Kulkarni, 1974
Gahrliepia longipili (Radford, 1946)
Gahrliepia murini **new species**
Gahrliepia plurisetae Traub and Morrow, 1955
Gahrliepia punensis **new species**
Gahrliepia uttaranchalensis **new species**
Gahrliepia usitata **new species**
Schoengastiella argalea (Traub and Morrow, 1957)
Schoengastiella bengalensis Hirst, 1915
Schoengastiella brevis Radford, 1946
Schoengastiella ceylonica (Womersley, 1952)
Schoengastiella chirbatiensis **new species**
Schoengastiella dalhousiensis **new species**
Schoengastiella darjeelingensis **new species**
Schoengastiella galarea **new species**
Schoengastiella gammonsi (Traub and Evans, 1954)
Schoengastiella helata (Traub and Evans, 1954)
Schoengastiella herulata **new species**
Schoengastiella homunguis (Abdussalam, 1939)
Schoengastiella kalrata (Traub and Evans, 1954)
Schoengastiella kumaonensis (Womersley, 1952)
Schoengastiella ligula Radford, 1946
Schoengastiella liota (Traub and Evans, 1954)
Schoengastiella minuta **new species**
Schoengastiella praecipua **new species**
Schoengastiella punctata Radford, 1946
Schoengastiella ralagea **new species**
Schoengastiella ramachandrai Kulkarni, 1973
Schoengastiella shrivastavi Srivastva and Wattal, 1975
Schoengastiella sicata **new species**
Schoengastiella singularis **new species**
Schoengastiella tarsala **new species**
Schoengastiella uttarkashiensis **new species**
Walchia (*Walchia*) *enode* Gater, 1932
Walchia (*Walchia*) *ewingi* Fuller, 1949
Walchia (*Walchia*) *gujaratensis* **new species**
Walchia (*Walchia*) *lupella* (Traub and Evans, 1957)
Walchia (*Walchia*) *manipurensis* Sinha, 1954
Walchia (*Walchia*) *rustica* (Gater, 1932)
Walchia (*Walchia*) *soricicola* (Traub and Evans, 1957)
Walchia (*Walchia*) *turmalis* (Gater, 1932)

Key to the Subfamilies, Tribes, Genera and Species of Indian TROMBICULIDAE

1. Scutum with single AM seta, or AM seta absent Trombiculinae 6
 Scutum with 2 AM setae.....2
2. Leg segmentation 7.7.7 Apoloniinae (not recorded in INDIA)
 Leg segmentation 6.6.6 Leeuwenhoeekiinae3
3. Scutum with anteromedian extension (nasus) 4
 Scutum without nasus 5
4. Scutal setal formula : 2AM + 2AL + 2PL *Odontacarus*
 Scutal setal formula : 2AM + 2AL + 2PL + 6-10 PPL *Multisetosa*
5. Cheliceral blade long with large, recurved ventral row of teeth and denticulate cap
 *Whartonia*
 Cheliceral blade with tricuspid cap or minute ventral tooth row *Shunsennia*
6. AM seta absent Gahrlepiini 7
 AM seta present 9
7. Scutal setal formula : 2AL + 2PL *Walchia*
 Scutal setal formula : 2AL + 2PL + (2-n) PPL 8
8. Scutal setal formula : 2AL + 2PL + 2PPL *Schoengastiella*
 Scutal setal formula : 2AL + 2PL + (4 or > 4) PPL *Gahrlepieia*
9. Sensilla expanded (lanceolate to globose) Schoengastiini 10
 Sensilla filamentous or occasionally thickened Trombiculini 19
 (if sensillae are missing, both tribes are to be keyed)
10. Sensillary bases (SB) contiguous, i.e.< diameter of SB apart *Helenicula*
 Sensillary bases = or > diameter of SB apart (Fig. 114A) 11
11. Tibiala III absent 12
 Tibiala III present 13
12. Coxa II always, and coxa I sometimes multisetose *Doloisia*
 Coxa I and II unisetose *Schoutedenichia*
13. Scutum with anterolateral shoulders (Fig. 109A) 14
 Scutum without shoulders (Fig. 105A) 15

14. Unpleated scutal surface (Fig. 109A); parasubterminala present (Fig. 109D).....
..... *Ascoschoengastia*
Posterior scutal surface overlapped by cuticular pleats; lacking parasubterminala
..... *Neoschoengastia*
15. Scutum with extensive posterior projection 16
Trapezoidal scutum with little or no posterior projection 17
16. Cheliceral blade with row of dorsal teeth; AL>PL; sensilla pyriform *Schoengastia*
Cheliceral blade with apical tricuspid cap; PL>AL; sensilla fusiform to globose
..... *Herpetacarus*
17. Scutal posteromargin straight; AM>>PL *Walchiella*
Scutal posteromargin concave; PL>AM *Reidlinia*
18. Scutal setae not normal, modified 19
Scutal setae not modified 20
19. AL and, sometimes, PL setae stumpy or peglike; scutum trapezoidal, with anterolateral shoulders *Fonsecia*
PL setae and some or most dorsal body setae flattened, sometimes foliate; scutum subrectangular, without anterolateral shoulders *Trombiculindus*
20. Leg III with 2 genualae *Chiroptella*
Leg III with single genuala 21
21. Palpal claw 2-pronged, accessory prong inner and ventral *Eutrombicula*
Palpal claw usually 3-pronged; if 2-pronged, accessory prong outer and axial prong inner 22
22. Scutum with anterolateral shoulders 23
Scutum without shoulders 25
23. Gnathobase and coxae with conspicuous cuticular striations *Blankaartia*
Gnathobase and coxae without striations 24
24. Trapezoidal scutum with straight posteromargin; palpal tarsal setation 7B; leg III without mastitarsala *Myotrombicula*
Subpentagonal scutum with convex posteromargin; palpal tarsal setation 6B; leg III with or without mastitarsala *Microtrombicula*

25. Scutum with scrobiculate punctations; palpal tarsal setation 5B *Trombicula*
 Scutum with simple punctae; palpal tarsal setation 7B or 7B. S 26
26. Scutum subrectangular or subquadrate; posterior margin at most broadly convex, never angulate 27
 Scutum subpentagonal; posterior margin angulate or broadly rounded 28
27. Scutum subrectangular; Leg I with 2 genualae *Leptotrombidium*
 Scutum subquadrate; Leg I with 3 genualae *Trombigastia*
28. Leg III with 1 or more mastisetae *Neotrombicula*
 Leg III without mastisetae *Miyatrombicula*
- I. *Multisetosa* species :
- Approximately 200 dorsal body setae; Ip 1044 *himalayensis* n. sp.
- II. *Odontacarus* species :
1. >30 dorsal body setae *gymnodactyli*
 <30 dorsal body setae 2
2. Ventrolateral setae present between coxae II and III *joshii*
 Ventrolateral setae absent 3
3. 40-42 dorsal body setae *indica*
 62-90 dorsal body setae *audyi*
- III. *Shunsennia* species :
- AM seta with accessory branch; cheliceral blade with ventral row of minute
 teeth *wissemani*
- IV. *Whartonia* species :
1. Sternal setae indistinguishable, transverse band of 24-31 ventral setae between coxae II and III *kumaonensis*
 One pair of sternal setae, 5-7 pairs of ventrolateral setae between coxae II and III 2
2. Approximately 40 dorsal body setae; leg III with 5 genualae *brennani*
 >50 dorsal body setae; leg III with 1-2 genualae *indica*

V. *Trombicula* species :

1. Palpo setal formula B/B/BB(b)B 2
 Palpo setal formula B/B/NNN *schmitzi*
2. Legs 7-segmented; scutum micropunctate *hampii*
 Legs 6-segmented; scutum scrobiculate *hypodermata*

VI. *Blankaartia* species :

- 24 dorsal body setae; galeala N *acuscutellaris*
 28 dorsal body setae; galeala b *nilotica*

VII. *Chiroptella* species :

- Larger scutum : AW 50-52, PW 70-76 *bandupi*
 Smaller scutum : AW 45, PW 59 *hiregaudari* n. sp.

VIII. *Eutrombicula* species :

- 18 dorsal body setae, arranged : 6-6-4-2; palpal pilous formula B/N/NNB *hirsti*

IX. *Fonsecia* species :

- Cheliceral blade with large, blunt subapical tooth and tricuspid cap; Ip 870
 *coluberina*
 Cheliceral blade with simple apical tricuspid cap; Ip 915 *ptyasi*

X. *Leptotrombidium* species :

- 1 Palpal tarsal setation 7B, scutal punctae always fine, numerous and somewhat evenly distributed subgenus *Leptotrombidium* 2
 Palpal tarsal setation 7 B. S, scutal punctae usually coarse, sparse and irregularly distributed subgenus *Ericotrombidium* 44
2. 4 palpal setae branched, excluding tarsal setae 3
 1-3 palpal setae branched 4
3. Palpo-setal formula B/B/NBB *parviscutum*
 Palpo setal formula N/B/BBB *solitarium* n. sp.
4. 3 branched and 2 nude palpal setae 5
 1-2 palpal setae branched 6

5.	Palpo setal formula B/B/BNN	<i>burmense</i>
	Palpo setal formula B/B/NNB	<i>jayewickremei</i>
6.	2 branched and 3 nude palpal setae	7
	1 branched and 4 nude palpal setae	21
7.	Palpo setal formula B/N/BNN	<i>insigne</i> n. sp.
	Palpo setal formula N/N/BNB	8
8.	270-310 total body setae	<i>multisetosum</i>
	<200 total body setae	9
9.	Posterior scutal margin convex	10
	Posterior scutal margin biconvex	13
10.	Peditarsal setation : 33-19-17	<i>baltalense</i>
	Peditarsal setation : 22-16-15	11
11.	96-102 total body setae; Ip 740-790	<i>dehradunense</i> n. sp.
	>110 total body setae; Ip >800	12
12.	PL > AM	<i>dihumerale</i>
	AM >> PL	<i>spilletti</i>
13.	Ip 958-980	<i>lagone</i>
	Ip <950	14
14.	>40 dorsal body setae	15
	<38 dorsal body setae	19
15.	PW/AP = 2.13-2.78	16
	PW/AP = 3.1-4.2	17
16.	PW/AP = 2.66-2.78; Ip 674-747	<i>macacum</i>
	PW/AP = 2.13-2.64; Ip 761	<i>radfordi</i>
17.	70-82 total body setae; Ip 761-780	<i>tithwalense</i>
	>90 total body setae; Ip >800	18
18.	PL = AM; HS measuring 56-61	<i>irregulare</i>
	PL > AM; HS measuring 72-85	<i>parapalpale</i>
19.	Dorsal setal arrangement commencing : 10-8-6	<i>bhimtalense</i>
	Dorsal setal arrangement commencing : 8-6-6	20

20. PL> AM> AL; Ip 789-810 *pseudofulmentum*
 AM> PL = AL; Ip 630-705 *mittelli*
21. Palpo setal formula N/N/NNB *puta*
 Palpo setal formula N/N/BNN 22
22. Parasitic exclusively on bats 23
 Parasitic on other mammals, rare on birds and reptiles 24
23. 54-58 dorsal body setae; Ip 676-771 *russicum*
 78-83 dorsal body setae; Ip 773-812 *siligorensis* n. sp.
24. PL setae extrascutal *peniscutum*
 PL setae inserted on scutum 25
25. 218-264 total body setae *kalrai*
 <120 total body setae 26
26. 182-202 total body setae *dux*
 <180 total body setae 27
27. 120-140 total body setae 28
 <120 total body setae 29
28. 121-140 total body setae; AM> PL> AL *dooleyi*
 120 total body setae; PL> AM> AL *paradox*
29. 108-118 total body setae; AM>> PL *keukenschrijveri*
 <108 total body setae; AM< PL 30
30. 80-100 total body setae 31
 <80 total body setae 34
31. 32 dorsal body setae, arrangement commencing : 8-6-6 *subintermedium*
 >32 dorsal body setae, arrangement commencing : (10-18)-(8-13)-(2-10) 32
32. Dorsal setal arrangement commencing : 10-10-10(8); AM>> AL *sinharhense*
 Dorsal setal arrangement irregular; AM> AL 33
33. Palpal pilous formula N(f)/N/BNN; posterior scutal margin not deeply extended
 *discrepans* n. sp.
 Palpal pilous formula N/N/BN(b)N(b); posterior scutal margin deeply extended
 *rupestre*
34. AL> AM 35
 AM> AL 36

35. 34 dorsal body setae; Ip 810 *mirum*
 <34 dorsal body setae; Ip <810 *longisetum*
36. Dorsal setal arrangement commencing : 8-6-8 37
 Dorsal setal arrangement commencing : 8-6-6 38
37. PL> AM> AL; PL 47-57, AM 47-60 *delimushi*
 PL>> AM> AL; PL 65-75, AM 52-62 *kulkarnii* f. sp.
38. PL>> AM *fulmentum*
 PL \geq AM 39
39. PL = AM *deliense*
 PL> AM 40
40. PL> AM>> AL 41
 PL> AM> AL 42
41. 30 dorsal body setae; Ip 814-864 *pakistanum*
 26 dorsal body setae; Ip 702-781 *subrussicum*
42. SB anterior to level of PL bases *imphalum*
 SB level with or posterior to level of PL bases 43
43. Posterior scutal margin markedly biconvex; sensilla branched on distal 1/2 *fulleri*
 Posterior scutal margin shallowly biconvex; sensilla with basal barbs and branches on distal 2/3 *oreophilum*
44. 1 branched and 4 nude palpal setae *eximium* n. sp.
 2-4 palpal setae branched 45
45. 2 branched and 3 nude palpal setae 46
 3-4 palpal setae branched 50
46. Scutum small with PW 48-59, SD 29-32 *vietzi*
 Scutum medium to large 47
47. PL>> AL> AM *rajaniae*
 PL> AL> AM 48
48. 58-68 total body setae; dorsal setal arrangement commencing : 8-6-6
 *bhattipadense* n. comb.
 76-92 total body setae; dorsal setal arrangement commencing : (8-10)-8-(8-10) ... 49

49. Posterior scutal margin lightly biconvex; dorsal setal arrangement commencing : 8-8-8 *gliricolens*
 Posterior scutal margin markedly biconvex; dorsal setal arrangement usually commencing : 10-8-10 *wallacei* n. comb.
50. 3 branched and 2 nude palpal setae 51
 4 palpal setae branched 54
51. >82 total body setae 52
 <82 total body setae 53
52. 131-143 total body setae *indicum* n. sp.
 88-112 total body setae *murphyi*
53. 36-38 dorsal body setae, arrangement commencing : 10(8)-8-8 *pseudogliricolens*
 26 dorsal body setae, arrangement commencing : 8-6-6 *rajasthanense* n. sp.
54. 68 total body setae *lepidum* n. sp.
 142-148 total body setae *uriense*

XI. *Microtrombicula* species :

1. Coxa I-III unisetose 2
 Either coxa II or III bisetose 10
2. 2 genualae I 3
 3 genualae I 5
3. Pedigenualae I-III : 2-0-0 *cotrivensa* n. sp.
 Pedigenualae I-III : 2-1-1 4
4. Mastitarsala III absent *khurdangencosa* n. sp.
 Mastitarsala III present *ventricosa*
5. Mastitarsala III absent *khurdangensis*
 Mastitarsala III present 6
6. 3 mastitarsalae III *kajutekrii*
 1 mastitarsala III 7
7. 22-28 dorsal body setae 8
 38-44 dorsal body setae 9
8. Palpal claw 3-pronged; sensilla flagelliform with few distal branches *munda*
 Palpal claw 2-pronged; sensilla slightly expanded with basal barbs and branches on distal $\frac{1}{2}$ *spicea*

9. PL> AM> AL; Ip 601-648 *alpicula*
 PL>> AM> AL; Ip 833-847 *palicula* n. sp.
10. Coxa II bisetose 11
 Coxa III bisetose 12
11. Pedigenuale I-III : 2-1-1 *perissochaeta*
 Pedigenuale I-III : 1-0-0 *pseudoperissochaeta* n. sp.
12. Mastitarsala III present 13
 Mastitarsala III absent 18
13. Pedigenuale I-III : 1-0-0 *unigenuala* n. sp.
 2-3 genualae I 14
14. Pedigenuale I-III : 2-0-0 *vencotrisa* n. sp.
 Genualae II and III present 15
15. 90-102 total body setae *vacillata* n. sp.
 <90 total body setae 16
16. 2 pairs of humeral setae *altens* n. sp.
 1 pair of humeral setae 17
17. Dorsal setal arrangement commencing : 6-6 *buxtoni*
 Dorsal setal arrangement commencing : 8-6 (8) *latens*
18. 84-106 total body setae *rajoriensis*
 64-76 total body setae *talens* n. sp.

XII. *Miyatrombicula* species :

- Palpal tarsal setation 4B, 3N *cooli* n. comb.
 Palpal tarsal setation 5B, 2N. S *najai* n. comb.

XIII. *Myotrombicula* species :

- 150 total body setae; Ip 654 *kauli* n. sp.

XIV. *Neotrombicula* species :

(As the number of genualae I has not been reported for *kashmirensis*, this species has been keyed following the routes for both 2 and 3 genualae I)

1. 1 mastitarsala III 2
 2-4 mastitarsalae III 12

2.	2 genualae I	3
	3 genualae I	6
3.	Dorsal body setae expanded, dagger-like	<i>inflata</i>
	Dorsal body setae not modified	4
4.	30-36 dorsal body setae	<i>anax</i>
	>40 dorsal body setae	5
5.	50 dorsal body setae	<i>kanzalwanensis</i>
	42 dorsal body setae	<i>kashmirensis</i>
6.	2 pairs of humeral setae	7
	1 pair of humeral setae	8
7.	PW/SD ratio 1.26; palpal tarsal setae NbB	<i>cervulicola</i>
	PW/SD ratio 1.41-1.67; palpal tarsal setae NNB	<i>guptai</i>
8.	28-34 dorsal body setae	9
	38-46 dorsal body setae	10
9.	PL > AL = AM	<i>autumnalis</i>
	PL >> AL > AM	<i>nivalis</i>
10.	Palpo setal formula B/B/NNB	11
	Palpo setal formula B/B/bbB	<i>gayanoi</i> n. sp.
11.	PL >> AL > AM; Ip 936	<i>kashmirensis</i>
	PL >> AM > AL; Ip 770-820	<i>nagayoi</i>
12.	4 mastitarsalae III	<i>fujigmo</i>
	2 mastitarsalae III	<i>microti</i>

XV. *Trombiculindus* species :

1	1 genuala I	2
	2 genualae I	6
2.	Palpo setal formula N/N/NNN	3
	Palpo setal formula N/N/NNB	<i>mehtai</i> n. sp.
3.	Posterior scutal margin shallowly biconvex	4
	Posterior scutal margin convex, medially truncate	5
4.	PL foliate setae with basal attachment	<i>squamiferus</i>
	PL foliate setae with medial attachment	<i>squamosus</i>
5.	PW/SD ratio 1.74-1.88	<i>aetherius</i> n. sp.
	PW/SD ratio 1.58	<i>varifolius</i> n. sp.

6. >110 total body setae 7
 <110 total body setae 8
7. PL> AL; Ip 750-768 *deccanensis*
 AL> PL; Ip 718-724 *traubi*
8. 24-30 dorsal body setae 9
 40-50 dorsal body setae 10
9. AM> PL>> AL *cuneatus*
 PL> AM>> AL *foliaceus*
10. PL> AM; AP 20-21 *fordi*
 AM> PL; AP 14-16 *pruthi*

XVI. *Trombigastia* species :

- 2 pairs of sternal setae *abdita* n. sp.
- 3 pairs of sternal setae *tristernala* n. sp.

XVII. *Schoengastia* species:

1. Palpal femoral seta branched 2
 Palpal femoral seta nude, 30-34 dorsal body setae *kanhaensis*
2. 3 genualae I 3
 4 genualae I *propria*
3. 32 dorsal body setae *pseudoschuffneri*
 26-28 dorsal body setae *tuberculatae* n. sp.

XVIII. *Ascoschoengastia* species :

1. Mastitarsala III absent *roluis*
 Mastitarsala III present 2
2. Palpal claw 2-pronged; submedian setae of 1st posthumeral row displaced, level with humeral setae *indica*
 Palpal claw 3-pronged; submedian setae of 1st post- humeral row in usual position 3
3. Sensilla elongate, fusiform *guptai*
 Sensilla clavate 4
4. >50 dorsal body setae *katarmalensis* n.sp.
 <44 dorsal body setae *leechi*

XIX. *Doloisia* species :

- Sensilla clavate; coxa I unisetose *manipurensis*
 Sensilla abruptly capitate; coxa I multisetose *bhati* n. sp.

XX. *Helenicula* species :

- 1 Coxa III unisetose 2
 Coxa III multisetose 5
2. PL and dorsal body setae modified *mattei* n. sp.
 PL and dorsal body setae not modified, setiform 3
3. Palpal tarsal setation 5B *nadchatrami* n. sp.
 Palpal tarsal setation 4B 4
4. <90 dorsal body setae; dorsal palpotibial seta N/b *kohlsi*
 >100 dorsal body setae; dorsal palpotibial seta always barbed *comata*
5. Coxa III bisetose 6
 Coxa III with 3 (or 4) branched setae *globularis*
6. 34-40 dorsal body setae; Ip 675-740 *lanius*
 42-48 dorsal body setae; Ip 835-855 *miyagawai*

XXI. *Herpetacarus* species :

- Sensilla filiform; galeala N; Ip 806-827 *longisetosa*
 Sensilla narrowly clavate; galeala b; Ip 750-818 *schlugeri* n. comb.

XXII. *Neoschoengastia* species :

- 22 dorsal body setae, arranged : 6-6-6-2(4)-(2); palpal pilous formula B/B/BbB
 *thomasi*

XXIII. *Riedlinia* species :

- 24 dorsal body setae, arranged : 6-8-6-2-2; Palpo setal formula B/N/NNB *coeca*

XXIV. *Schoutedenicchia* species :

- 1 PL setae extrascutal 2
 PL setae inserted on scutum 3
2. Palpal pilous formula B/B/NNN *capillata* n. comb.
 Palpal pilous formula B/B/NNB *nagpurensis*
3. Palpal tarsal setation 4B 4
 Palpal tarsal setation 4B.S 6

4. Dorsal body setae inserted directly on cuticle 5
Dorsal body setae inserted on sclerotized platelets *gangutriani* n. sp.
5. AL > PL > AM *goffi* n. sp.
AM > PL > AL *schalleri*
6. Coxa III unisetose *jubbulporensis*
Coxa III trisetose *nausheraensis*

XXV. *Walchiella* species :

- 36 dorsal body setae; cheliceral blade simple *lewthwaiti*
28 dorsal body setae; cheliceral blade serrate *oudemansi*

XXVI. *Gahrlepiea* species :

1. Scutum with large scrobiculae, in addition to the usual micropunctae 2
Scutum with micropunctae only, or occasionally with secondary punctae not larger than setal bases 3
2. Scutum with evenly distributed scrobiculae; 2 pairs of sternal setae *khandalaensis*
Scutum with anteromedian cluster of scrobiculae; 1 pair of sternal setae
..... *punensis* n. sp.
3. Scutal and dorsal body setae modified 4
Scutal and dorsal body setae not modified 5
4. PL setae anteriorly displaced *armigera* n. sp.
PL setae not displaced *armata* n. sp.
5. Scutum with cuticular thickening of anterior and anterolateral margins
..... *crassiscuti* n. sp.
Scutum lacking such thickening 6
6. 1 pair of sternal setae 7
2 pairs of sternal setae 8
7. Scutum caudally rounded, with 6-11 usurped setae *inconstans* n. sp.
Scutum caudally subacuminate, with 4 (rarely 5) usurped setae
..... *uttaranchalensis* n. sp.
8. PL setae anteriorly displaced 9
PL setae not displaced as in above 11
9. Scutum caudally subacuminate, with 8-10 usurped setae *hirsuta*
Scutum caudally rounded, with 4-6 usurped setae 10
10. With 4 usurped setae, all submedian *dupliseta*
With 6 usurped setae, 1st pair submarginal *plurisetae*

11. Coxa III multisetose	12
Coxa III unisetose	14
12. 1 pair of humeral setae	<i>murini</i> n. sp.
2 pairs of humeral setae	13
13. Scutum with 13-23 usurped setae	<i>barbigera</i>
Scutum with 5-6 usurped setae	<i>usitata</i> n. sp.
14. Scutum with 6 usurped setae	15
Scutum with 9-20 usurped setae	16
15. Scutum caudally truncate	<i>dhandai</i> n. sp.
Scutum caudally rounded	<i>crocidura</i>
16. Scutum caudally subacuminate	<i>longipili</i>
Scutum caudally rounded	17
17. Scutum uniformly micropunctate, 1-3 usurped setae inserted level with PL bases ...	
.....	<i>darita</i>
Scutum with micropunctae and scattered secondary punctae, usurped setae inserted posterior to level of PL bases	<i>fletcheri</i>

XXVII. *Schoengastiella* species :

1 Pedigenuale I-III : 1-0-0	2
Pedigenuale I-III : 2-1-1	3
2. Coxa III bisetose	<i>brevis</i>
Coxa III unisetose	<i>singularis</i> n. sp.
3. 2 pairs of sternal setae	4
1 pair of sternal setae	<i>praecipua</i> n. sp.
4. Coxa III multisetose	5
Coxa III unisetose	19
5. Coxa III with 4-6 branched setae	6
Coxa III with 2-3 branched setae	8

6. Palpal femoral seta nude	7
Palpal femoral seta branched	<i>kalrata</i>
7. Ip 409-522	<i>ceylonica</i>
Ip 636	<i>kumaonensis</i>
8. Dorsal body setae modified	<i>sicata</i> n. sp.
Dorsal body setae not modified	9
9. 2 pairs of humeral setae	10
1 pair of humeral setae	11
10. Scutum caudally truncate	<i>dalhousiensis</i> n. sp.
Scutum caudally subacuminate	<i>galarea</i> n. sp.
11. Tarsala I measuring 24-27	<i>tarsala</i> n. sp.
Tarsala I not so elongate	12
12. Scutum with micropunctae only	13
Scutum micropunctate with scattered scrobiculae	<i>shrivastavi</i>
13. Coxa III bisetose	14
Coxa III trisetose	<i>chirbatiensis</i> n. sp.
14. 42-50 dorsal body setae	<i>darjeelingensis</i> n. sp.
<40 dorsal body setae	15
15. Mean PPW 21-27	16
Mean PPW 42-62	18
16. PW/SD = 0.58-0.67	17
PW/SD = 0.50	<i>gammonsi</i>
17. Mean PPW 29, APP 67	<i>helata</i>
Mean PPW 21, APP 56	<i>liota</i>
18. Mean PPW 62, APP 106	<i>herulata</i> n. sp.
Mean PPW 42, APP 86	<i>punctata</i>
19. Dorsal body setae inserted directly on cuticle	20
Dorsal body setae inserted on sclerotized platelets	<i>ramachandrai</i>

20. 1 pair of humeral setae	21
2 pairs of humeral setae	<i>ralagea</i> n. sp.
21. PW/SD ratio 0.44-0.85	22
PW/SD ratio 0.28-0.30	<i>minuta</i> n. sp.
22. Mean PW 48-56, AP 35-38	23
Mean PW 70, AP 44	<i>uttarkashiensis</i> n. sp.
23. Scutum ligulate, tapering sharply beyond PL bases	24
Scutum non-ligulate	25
24. Mean PW 56, PPW 20, APP 59; sensilla subglobose	<i>homunguis</i>
Mean PW 48, PPW 15, APP 65; sensilla clavate	<i>ligula</i>
25. PL = AL; 1 pair of eyes	<i>argalea</i>
PL > AL; 2 pairs of eyes	<i>bengalensis</i>

XXVIII. *Walchia* species :

1. Coxa III unisetose	2
Coxa III multisetose	5
2. AL < PL	3
AL >> PL	<i>soricicola</i>
3. PW/SD ratio 0.56-0.86	4
PW/SD ratio 0.48-0.52	<i>manipurensis</i>
4. Posterolateral scutal margins sinuate beyond PL bases; scutum caudally papillate	<i>rustica</i>
Posterolateral scutal margins fairly straight beyond PL bases; scutum caudally subacute	<i>turmalis</i>
5. Coxa III bisetose	6
Coxa III with 3 or more branched setae	7
6. Anterolateral scutal margins sinuate between AL and PL bases	<i>gujaratensis</i> n. sp.
Anterolateral scutal margins fairly straight between AL and PL bases	<i>lupella</i>
7. Coxa III with 4 branched setae; Ip 523-551	<i>enode</i>
Coxa III with 3 branched setae; Ip 484-501	<i>ewingi</i>

DESCRIPTIONS OF INDIAN TROMBICULID SPECIES

Subfamily LEEUWENHOEKIINAE Womersley

Leeuwenhoekiinae, Womersley, 1944, 102; Wharton, 1947, 381; Fuller, 1952, 227; Nadchatram and Dohany, 1974, 5; Goff *et al.*, 1982, 221; Goff and Webb, 1989, 77.

Leeuwenhoekiidae, Womersley, 1945, 96; Vercammen-Grandjean, 1968b, 119; Vercammen-Grandjean *et al.*, 1973, 49; Wen, 1978, 309; Goff *et al.*, 1986b, 1.

Leeuwenhoekinae, sic! Hsu and Wen, 1963, 49; Reed and Brennan, 1975, 1.

Type genus : *Leeuwenhoekia* Oudemans, 1910a, by original designation.

Diagnosis : Trombiculid larvae parasitic on small mammals, reptiles and occasionally birds. Legs all 6-segmented (leg femurs undivided), terminating in a pair of claws and clawlike empodium, onychotriches present or absent; anterior sternal setae on base of coxae I (coxa I bisetose); parasubterminala I absent; microgenuala II present. Palpal tarsus lacking subterminala. Scutum with 2 anterior submedian setae; nasus present or absent; sensillae flagelliform, nude or branched. Eyes present. Tracheae and spiracles present or absent.

Remarks : Womersley (1945) elevated the subfamily to full familial rank on the basis of presence of tracheae and spiracles. Wharton (1947) considered the group as a trombiculid subfamily only. At present there is a difference of opinion as to whether the group merits a separate family status and includes the Apoloniinae, or is only a subfamily alongside the Apoloniinae in the Trombiculidae. This latter view has been supported by Reed and Brennan (1975) in their revision of the Neotropical representatives of this subfamily, and by Goff and Webb (1989) who have presented a key to the New World genera of this subfamily. Their taxonomic arrangement is followed here. Nine species in 4 genera have been recorded from this subfamily in India.

Genus *Multisetosa* Hsu and Wen

Multisetosa Hsu and Wen, 1963, 49; Schluger and Amanguliev, 1972b, 534; Wen and Liu, 1973, 189; Wen, 1981, 155; Zhou *et al.*, 1987, 141.

Sasacarus (*Multisetosa*), Vercammen-Grandjean, 1968b, 123; Vercammen-Grandjean *et al.*, 1970, 773; 1973, 55; Kudryashova *et al.*, 1976, 62.

Type species : *Leeuwenhoekia major* Schluger, 1955, by original designation.

Diagnosis : Leeuwenhoekiine larvae parasitic on rodents. Ip = 650-1300. Legs all 6-segmented (femoral segment undivided), terminating in a pair of claws and claw-like empodium, onychotriches present; coxa I bisetose, coxae II and III unisetose; 2 genualae I, and genuala II; genuala III present or absent; microgenuala II; tibala III; subterminala, pretarsala I and II; parasubterminala I lacking. Palpal tarsus 7B; palpal claw 4- to 7-pronged; cheliceral blade with rows of dorsal and ventral teeth; galeala B. Eyes 2/2, on ocular plate. Scutum with

anteromedian nasus and anterolateral shoulders, 2 AM setae, 2 AL setae, 2 PL setae, 6-10 PPL setae, posterior scutal margin convex; scutal punctae simple; sensillae flagelliform; 1-4 pairs of oculoscutal setae (between scutum and eyes). Spiracles and tracheae present. Dorsal and ventral idiosomal setae approximately 200-450 in number; ventral intercoxal setae between coxae II and III, 10-20 pairs; anterior sternal setae lacking; 1-4 pairs of posterior sternal setae present.

Remarks : In their revision of the subfamily Leeuwenhoeekiinae, Hsu and Wen (1963) proposed the genus *Multisetosa* characterized by the presence of numerous setae both on the scutum and idiosoma. Vercammen-Grandjean (1968b) regarded it as a subgenus of *Sasacarus* Brennan and Jones 1959. Wen (1981) reinstated the genus, presenting a revision of the distinguishing characters of *Multisetosa* and *Sasacarus*. The generic status of *Multisetosa* is accepted here. Six species have been recorded previously in this genus from China, Iran and U.S.S.R. A new species is described here, the first record of this genus from India.

1. *Multisetosa himalayensis* new species (Fig. 9)

not *Multisetosa major* (Schluger, 1955) : Fernandes *et al.*, 1988, 108.

Description of species : Larva.

Idiosoma : Measuring 500 x 320 in partially engorged specimen. Eyes 2/2, subequal, on ocular plate. Humeral setae not distinguishable; approximately 200 dorsal idiosomal setae, measuring 41-46, anterior setae longest, arrangement commencing : 6-9-10-6-10-6-9-8-11-12, the rest irregular; 3 oculoscutal setae (between scutum and eyes), measuring 40-42; 1 pair of sternal setae at level of coxae III, 43; 13 pairs of ventrolateral setae between coxae II and III, 35-42; approximately 60 preanal setae, 23-35; approximately 40 postanal setae, 48-51; total idiosomal setae approximately 300. Spiracles and tracheae present.

Gnathosoma : Palpal setal formula B/B/BBB/7B; palpal claw 4-pronged; galeala B; cheliceral blade (52) with 5 dorsal and 5 ventral teeth; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, with slight anterolateral shoulders; posterior margin convex, rounded; anteromedian nasus, measuring 21x8 at base; AM bases slightly posterior to level of AL bases; PL setae anteriorly displaced; 3 pairs of PPL setae along lateral scutal margins; AM>PL=AL; sensillary bases closer to posterior scutal margin, far posterior to level of PL bases; sensillae flagelliform with short branches on distal half; PW/SD = 1.55. Scutal measurements of holotype : AW 79; PW 96; SB 31; AA 10; ASB 39; PSB 23; AP 12; AM 56; AL 42; PL 44; sens. 90.

Legs : All 6-segmented, terminating in a pair of claws and clawlike empodium; onychotriches present. Ip = 1044. Leg I : 358; coxa with 2 barbed setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (29x24) 34B,

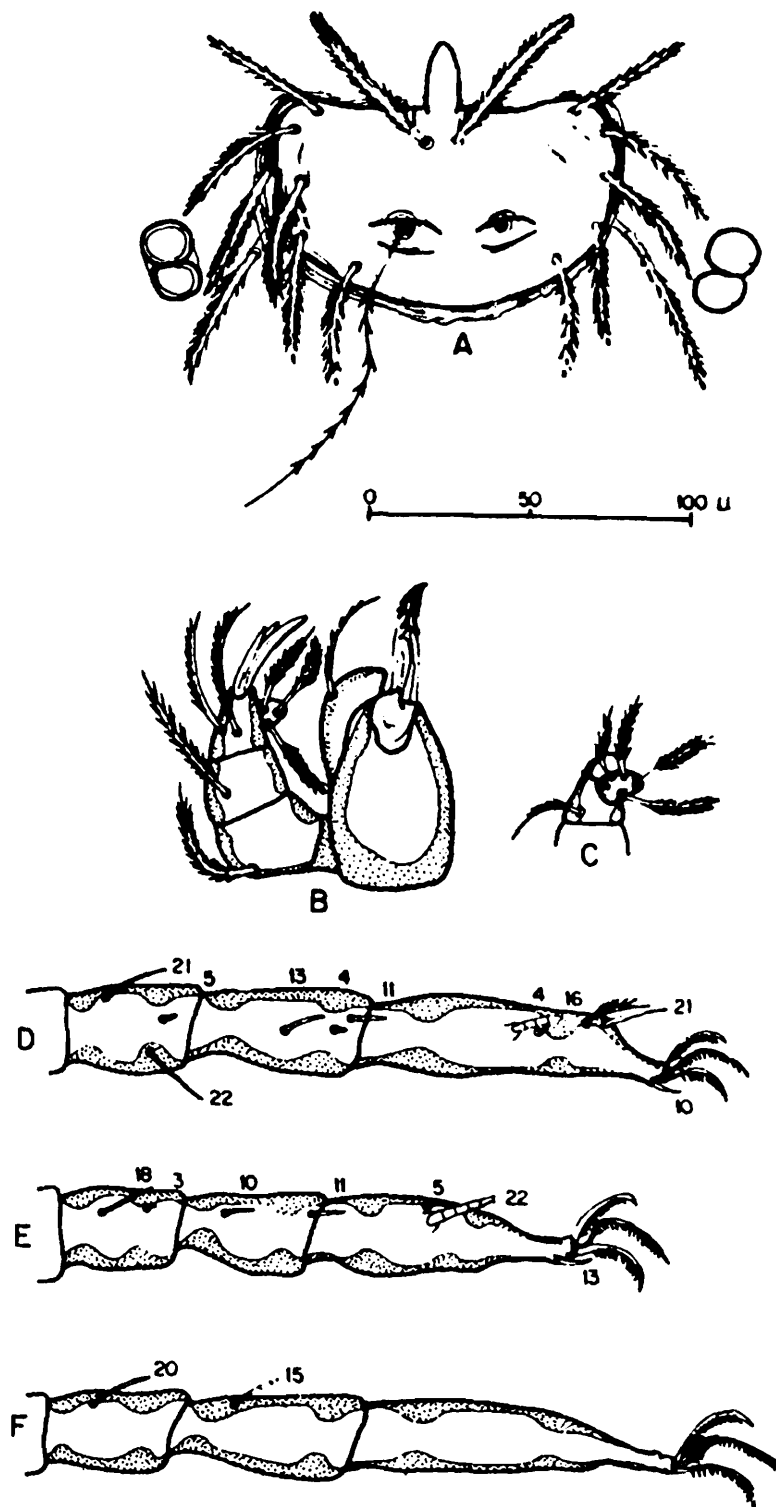


Fig. 9. *Multisetosa himalayensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

tarsala (16), microtarsala, subterminala, pretarsala. Leg II : 326; coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala, microgenuala; tibia 6B, 2 tibialae; tarsus (77x22) 17B, tarsala (22), microtarsala, pretarsala. Leg III : 360; coxa 1B; trochanter 1B; femur 4B; genu 4B, genuala; tibia 6B, tibiala; tarsus (94x21) 16B.

Type data : Holotype (NIV A83744.17), HIMACHAL PRADESH, Mahasu District, Sarhan, 1300-2140m, ex *Rattus rattoides*, 5.V.1968, NIV coll.

Remarks : Among the species of *Multisetosa*, *M. himalayensis* is close to *M. pinguis* Schluger and Amanguliev, 1972b, and *M. persicus* (Vercammen-Grandjean *et al.*, 1970). *M. himalayensis* may be separated from them in having a higher Ip (713 in *M. pinguis* and 821-916 in *M. persicus*). It may be further distinguished from *M. persicus* in having a greater number of dorsal idiosomal setae (140-166 in *M. persicus*), 4-pronged palpal claw (3-pronged in *M. persicus*), dimensions of nasus, AW and PW higher (measuring 16x7, 59-69 and 70-81 respectively in *M. persicus*). Fernandes *et al.* (1988) identified this specimen as *Multisetosa major* (Schluger, 1955). A more critical examination, however, has revealed that the Indian specimen differs in several important aspects: much higher Ip (750 in *M. major*); greater number of dorsal body setae (122 in *M. major*); fewer preanal and postanal setae (148 in *M. major*); and tarsala I<II (subequal in *M. major*). Hence, the Indian specimen is considered a new species.

Wen (1978) has proposed a list of abbreviations of morphological characters of the "shaman" or sand mites (chiggers). He considers the formula of scutal setae in *Multisetosa* species as : 2 AM + 4 AL + 6-10 PL. Vercammen-Grandjean *et al.* (1970) and Kudryashova *et al.* (1976) consider the PL setae anteriorly displaced, and the formula of scutal setae as: 2 AM + 2 AL + 2 PL + 6-10 PPL. The latter view is followed here.

This is the first record of the genus *Multisetosa* from India. The species name is derived from the general collection locality. This species is dedicated with gratitude to the NIV field teams that conducted the extensive survey of the haematophagous arthropods in the Himalayan region of India from 1966 to 1970.

Genus *Odontacarus* Ewing

Odontacarus Ewing, 1929b, 188; Wharton and Fuller, 1952, 103; Brennan, 1959, 1, **in part**; Brennan and Goff, 1977, 565; Vercammen-Grandjean, 1968b, 120; Vercammen-Grandjean *et al.*, 1973, 64, **in part**; Vercammen-Grandjean and Langston, 1976, 78, **in part**; Nadchatram and Dohany, 1974, 47, **in part**; Reed and Brennan, 1975, 6, **in part**; Goff, 1979a, 143; Goff and Webb, 1989, 77.

Type species : *Trombicula dentata* Ewing, 1925a, original designation.

Diagnosis : Leeuwenhoekiine larvae parasitic on mammals, reptiles and birds. Legs all 6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches present; parasubterminala absent; usually mastitarsala III or tarsala III present. Palpal tarsus 7B, subterminala absent; palpal claw 2- to 4-pronged; cheliceral blade with ventral row of teeth, dorsal row present or absent; galeala B. Scutum with nasus and paired AM setae; sensillae flagelliform. Eyes 2/2, on ocular plate. Tracheae and spiracles present.

Remarks : There is some controversy regarding the understanding of the diagnosis of the genus *Odontacarus* and the taxonomic status of *Acomatacarus* Ewing, 1942. Brennan (1959) synonymized *Acomatacarus* with *Odontacarus*, a view later followed by Brennan and Reed (1975), Vercammen-Grandjean *et al.* (1973) and Vercammen-Grandjean and Langston (1976). However, Brennan and Goff (1977) follow Ewing (1946b, 1949) and Vercammen-Grandjean (1968b) in according *Acomatacarus* full generic status, distinguishing it primarily in having palpal tarsus 6B (7B in *Odontacarus*). Goff and Webb (1989) concur with the latter view. The following 3 subgenera are currently recognized in genus *Odontacarus*: *Tarsalacarus* Vercammen-Grandjean, 1968b, *Leogonius* Vercammen-Grandjean, 1968b, and the nominate subgenus. *Tarsalacarus* may easily be distinguished in having tarsala III present (absent in the other 2 subgenera), and cheliceral blade having a row of ventral teeth only (dorsal and ventral rows of teeth present in the other 2 subgenera). *Leogonius* differs from the nominate subgenus by the number of branched setae on the legs : having genual setation 4.4.4 (5.5.5 in *Odontacarus* s. str.), and tibial setation 8.6.6 (9.6.6 in *Odontacarus* s. str.). Vercammen-Grandjean (1968b) proposed the subgenus *Leogonius* with type species *Leeuwenhoekia australiensis* Hirst, 1925b, for Leeuwenhoekine larvae parasitic on mammals and birds, with cheliceral blade having only dorsal row of teeth. Goff (1979a), in his revision of the subgenus, placed all the eight currently recognized species of *Odontacarus* from New Guinea in *Leogonius*. He characterized the cheliceral blade as having both dorsal and ventral teeth, as observed in the Indian species. Goff (1979a) remarks that the primary hosts for New Guinea *Odontacarus* species appear to be birds, while Brennan and Reed (1975) and Goff and Loomis (1977) indicated mammals and reptiles to be the principal hosts for the New World species. The principal hosts of the *Odontacarus* species in India appear to be reptiles and birds. Four Indian *Odontacarus* species are reported here, including a new species, all in the subgenus *Leogonius*.

2. *Odontacarus (Leogonius) audyi* (Radford) (Fig. 10)

Acomatacarus audyi Radford, 1946b, 263; Audy *et al.*, 1953, 29.

Acomatacarus (A.) audyi, Wharton and Fuller, 1952, 97.

Odontacarus audyi, Nadchatram, 1963b, 535; 1970b, 135; Lakshana, 1973, 5.

Odontacarus (Leogonius) audyi, Vercammen-Grandjean, 1968b, 121.

Redescription of species - Larva. Colour in life orange.

Idiosoma : Measuring 440-1000 x 320-680 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 58; 62-90 dorsal idiosomal setae, measuring 36-45, irregularly arranged, arrangement in holotype : 10-8-10-12-8-8-4-2, in Radford's specimen from Kanglatongbi : 18-10-16-18-12-10-4-2; one pair of sternal setae between coxae III; 20-24 preanal setae, measuring 30; 26-32 postanal setae; total idiosomal setae 100-148.

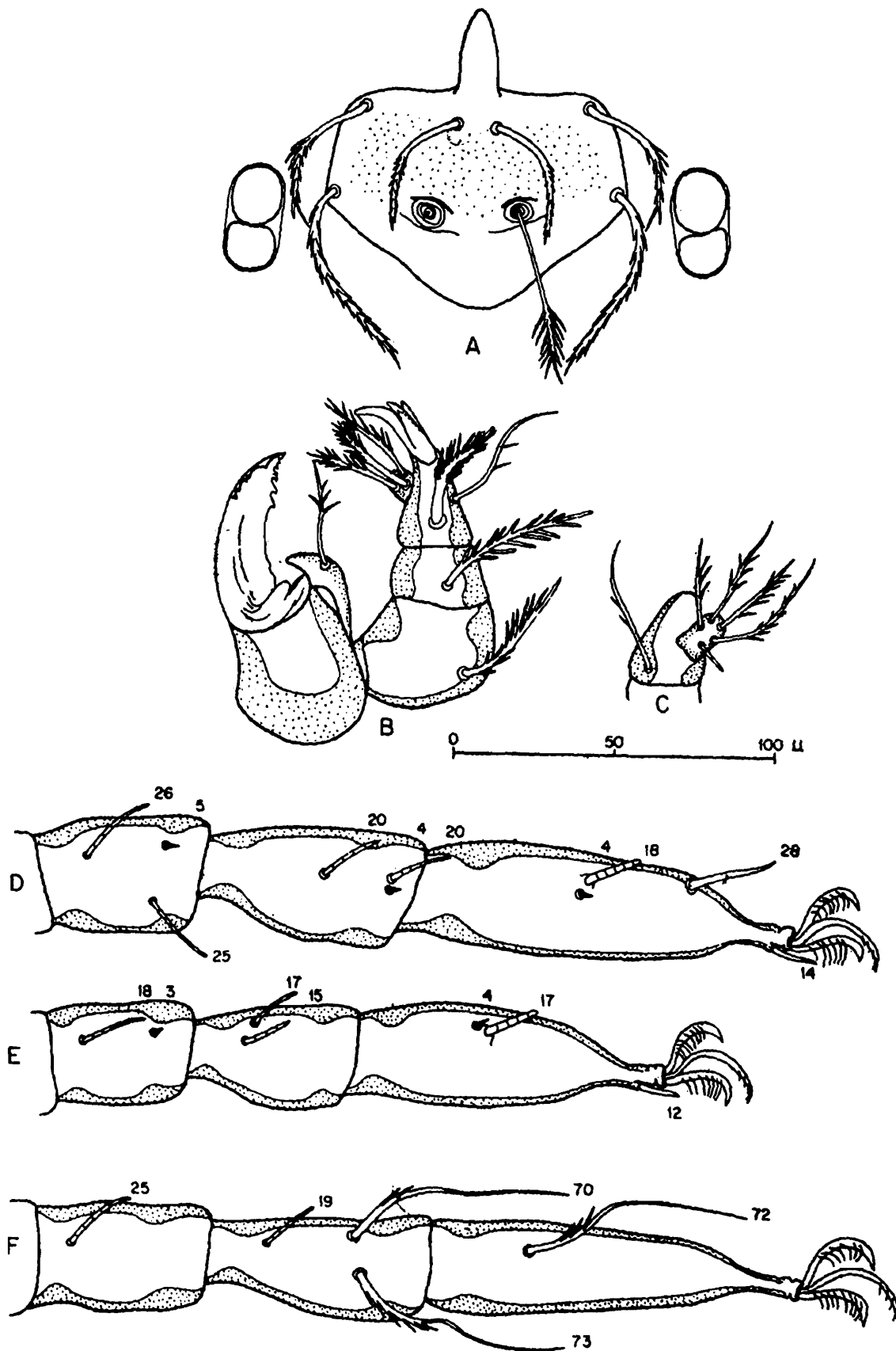


Fig. 10. *Odontacarus audyi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula B/B/Bbb/7B; palpal claw 4 (occasionally 3)-pronged; galeala B; cheliceral blade (51) with 7 dorsal and 6-8 ventral teeth; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subpentagonal with posterior margin rounded; nasus measuring 23x11 at base; AM bases slightly posterior to level of AL bases; SB level with PL bases; $PL > AL \geq AM$; sensillae flagelliform with 10-12 barbs on distal 1/3; $PW/SD = 1.23-1.31$. Scutal measurements of holotype and Radford's specimen from Kanglatongbi after original description, followed by means and ranges of 10 Thai specimens in parentheses after Nadchatram (1963b) : AW 85, 70 (65, 60-73); PW 102, 88 (80, 74-86); SB 34, 26 (26, 23-28); ASB 44, 37 (36, 33-40); PSB 34, 33 (29, 26-30); AP 34, 30 (29, 25-32); AM 51, 52 (41, 40-49); AL 51, 49 (44, 40-54); PL 68, 81 (63, 60-69); sens. 68, - (58, 55-60).

Legs : All 6-segmented, terminating in a pair of claws and a clawlike empodium; onychriches present. Ip and individual leg measurements not recorded. Leg I : coxa 2B; trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (106-116 x 28-32) 20-22B, tarsala 18-19, microtarsala, subterminala, pretarsala, parasubterminala absent. Leg II : coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala, microgenuala; tibia 6B, 2 tibialae; tarsus (88-94 x 26-31) 15-17B, tarsala 15-17, microtarsala, pretarsala. Leg III : coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala; tibia 4B, tibiala, 2 mastitibialae (70, 73) with basal barbs; tarsus (110-114 x 21-28) 15B, mastitarsla (72) with basal barbs.

Type data : Holotype, MANIPUR, Imphal, ex 'bird' (Babbler?), 7.II.1945, Sergeant J.Hake coll. 1 specimen labelled "Paratype" (#1563 USNM), MANIPUR, Kanglatongbi, ex 'bird' (Laughing Thrush?), 8.VII.1945, C.D. Radford coll.

Type depository : Type material at BM(NH), as recorded by Wharton and Fuller (1952). "Paratype" at USNM.

Material examined : 2 specimens on loan from USNM : One labelled "*Acomatacarus audyi* Radford - #1563 USNM - Manipur, Kanglatongbi - Paratype - Bird - 8 July, 1945 - C.D. Radford" The second from THAILAND labelled "*Odontacarus audyi* (Radford 1946) - SMRL # V-180 - Host *Saxicola ferrea* - Nan Ban Pahang - December 13, 1961 - Coll.Kitti Thonglongya"

Remarks : The above redescription is based on the literature, the study of Radford's "Paratype" and the Thai specimen. Audy *et al.* (1953) have recorded the collection of 3 specimens of this species from Manipur. These include the holotype, "paratype" and a third specimen ex 'bird', February 1946, STRU coll. Nadchatram (1963b) described the nymph and redescribed the larva of *O. audyi* based on the study of specimens collected from birds in Malaysia and Thailand. He has compared these with "one of Radford's specimens from the type series deposited in the London School of Hygiene and Tropical Medicine" He has also used notes made by Dr. H.S. Fuller, who had examined the type specimen in Radford's collection.

3. *Odontacarus (Leogonius) gymnodactyli* (Ewing)
(Fig. 11)

Trombicula gymnodactyli Ewing, 1925b, 145.

Odontacarus gymnodactyli, Thor and Willmann, 1947, 319; Nadchatram and Joshee, 1966, 446; Amanguliev, 1980, 95.

Acomatacarus (Acomatacarus)? gymnodactyli, Wharton and Fuller, 1952, 98.

Acomatacarus gymnodactyli, Prasad, 1974, 76.

not *Odontacarus gymnodactylus*, Amanguliev et al., 1972, 83.

Redescription of species : Larva.

Idiosoma : Measuring approximately 520 x 300 in engorged species. Eyes 2/2, anterior larger. Dorsal idiosomal setae approximately 24.

Gnathosoma : Palpal setal formula b/N/bNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) with 4 dorsal and 7 ventral teeth in addition to tricuspid cap.

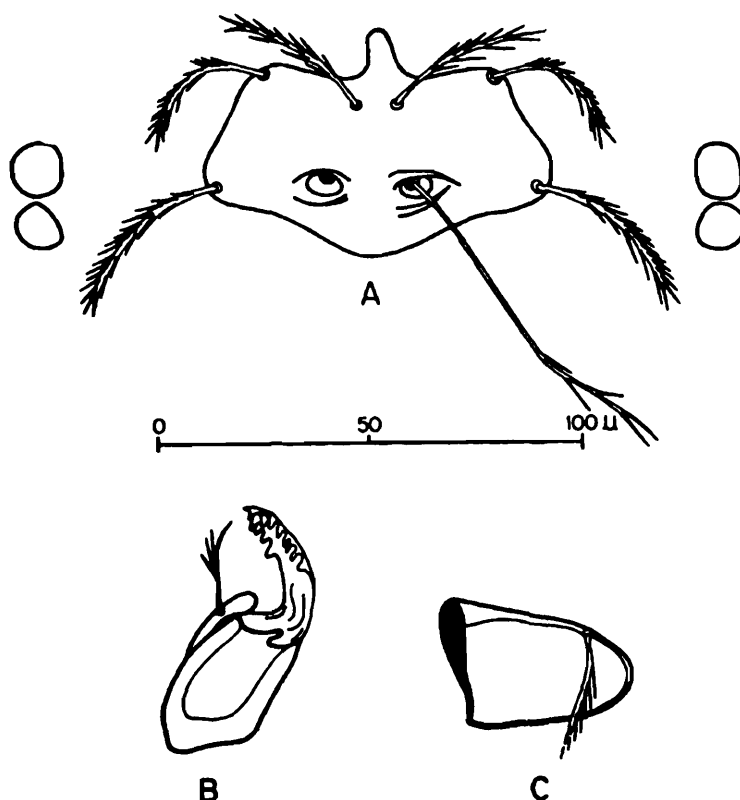


Fig. 11. *Odontacarus gymnodactyli*
A. scutum; B. dorsal aspect of chelicera and galea; C. coxa III.

Scutum : Lightly punctate, subpentagonal with posterior margin rounded; nasus measuring 12x6 at base; AM bases slightly posterior to level of AL bases; SB level with PL bases; PL>AM>AL; sensillae flagelliform with 6-8 branches on distal 1/3; PW/SD = 1.68. Scutal measurements of one cotype : AW 55; PW 76; SB 20; ASB 27; PSB 18; AP 28; AM 37; AL 35; PL 43; sens. 80.

Type data : 5 cotypes from HIMACHAL PRADESH, Kulu (Kooloo) Valley, ex gecko *Gymnodactylus lawderanus* (#4803 Museum of Comparative Zoology) from axillary pits of front legs, V.1874. These 5 formed part of many specimens collected. In the original description, Ewing states that these were sent to him for study by Joseph Bequaert of the Department of Tropical Medicine of the Harvard Medical School.

Type depository : 3 cotypes at USNM; 1 cotype at Smithsonian Institution, Washington D.C.

Material examined : 3 cotypes on loan from USNM, labelled "*Odontacarus gymnodactyli* (Ewing) - #955 USNM - Kooloo Valley, India - May 1874 - Mus. Comp. Zoo. 4803 - From Gecko *Gymnodactylus lawderensis* - Remounted IV.1948"

Remarks : The above redescription is based on the literature and the study of 3 cotypes. The original description is sketchy and without any illustration. Ewing (1925b) has compared this species with *Trombicula dentata* Ewing, 1925 (= *Odontacarus dentatus*), distinguishing it by the chelicerae having more ventral teeth (4 in *O. dentatus*) and fewer dorsal idiosomal setae (92 in *O. dentatus*). Thor and Willmann (1947) transferred this species to the genus *Odontacarus*. Nadchatram and Joshee (1966) have described *O. indica*, which they consider unrelated to *O. gymnodactyli*. They make the following comments : 'The senior author had the privilege of examining a cotype of *Odontacarus gymnodactyli*' Although the specimen was badly damaged and distorted during mounting, and deteriorated through age, it is possible to ascertain the following features in *gymnodactyli* :

Palpal tarsus with 7 barbed setae in addition to tarsala; on palpal tibia, dorsal seta barbed, lateral and ventral setae nude. Sensilla nude, 65 um long. Chelicera with a row of 7 conspicuous ventral teeth; dorsally with a row of 4 teeth in addition to tricuspid cap'

Unfortunately, this information only elucidates the details of the gnathosoma, which have been confirmed in the study of the 3 cotypes at the USNM.

Prasad (1974), while placing this species in the genus *Acomatacarus*, inadvertently reports the type locality as UTTAR PRADESH, Kumaon Hills!

Amanguliev (1980) proposed the name *O. fedtschenkoi* for *O. gymnodactylus* Amanguliev *et al.*, 1972, preoccupied.

The chigger specimens of May 1874 are probably the oldest collection from which a new chigger species has been described in India. It is unfortunate that the 3 USNM cotypes are in very poor condition; and hence, a detailed redescription of this species is not possible at

present. It has been possible to illustrate only the chelicera and the scutum that are discernable to a certain extent in one cotype specimen. Based on this study, *O. gymnodactyli* is tentatively placed in the subgenus *Leogonius*.

4. *Odontacarus (Leogonius) indica* Nadchatram and Joshee (Fig. 12)

Odontacarus indica Nadchatram and Joshee, 1966, 446; Prasad, 1974, 88; Schluger and Amanguliev, 1972b, 538.

Redescription of species : Larva.

Idiosoma : Measuring 200-600 x 160-420 in unengorged to engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 38; 40-42 dorsal idiosomal setae, measuring 26-32, arranged : 6-6-8-8-6-6-(2); one pair of sternal setae between coxae III, 30; 10-12 preanal setae, 20-24; 12-16 postanal setae, 24-30; total idiosomal setae 66-74.

Gnathosoma : Palpal setal formula B/B/Bbb/7B (6B in original description; palpal claw 3-pronged; galeala b/N; cheliceral blade (27-29) with 6-7 dorsal and the same number of smaller ventral teeth; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with nasus measuring 10-12 x 5 at base; AM bases slightly posterior to level of AL bases; SB level with PL bases; PL>AM>AL (original description: PL>AL>AM); sensillae flagelliform with 10-12 branches on distal 1/2; PW/SD = 1.33-1.5. Scutal measurements of holotype followed by means and ranges of 9 paratypes in parentheses after original description : AW 46 (49, 46-52); PW 66 (64, 60-67); SB 24 (25, 24-27); ASB 33 (35, 32-41); PSB 14 (13, 12-16); AP 18 (21, 17-25); AM 26 (27, 21-30); AL 34 (32, 30-34); PL 38 (38, 36-42); sens. 55 (56, 52-61).

Legs : Similar to *O. audyi* (Radford, 1946) in the number of ordinary and sensory setae. But, leg I with tarsus 18B and subterminala present (original description: absent); leg II with femur 6B; and leg III with tibia 6B, mastitibialae not distinguishable, and tarsus 14B, having mastitarsala with basal barbs. Measurements as follows : Ip = 800-850. Leg I : 290; tarsus (72-79 x 14-18), tarsala 16-19. Leg II : 260; tarsus (62-66 x 14-16); tarsala 15-16, spoon-tipped. Leg III : 290; tarsus (78-80 x 11-12), mastitarsala (32) with basal barbs.

Type data : Holotype (MZ 110485), MAHARASHTRA, Bombay, Vihar Bhandup Hills, ex gecko, *Hemidactylus brooki* Gray. 17.I.1960, A.K. Joshee, coll. 14 paratypes, same data as holotype.

Type depository : Holotype at BPBM; paratypes at IMR, ZSI, USNM, BM(NH), HF and RML.

Material examined : 1 paratype (MZ 110491) on loan from USNM; 1 paratype (MZ 110498) on loan from ZSI.

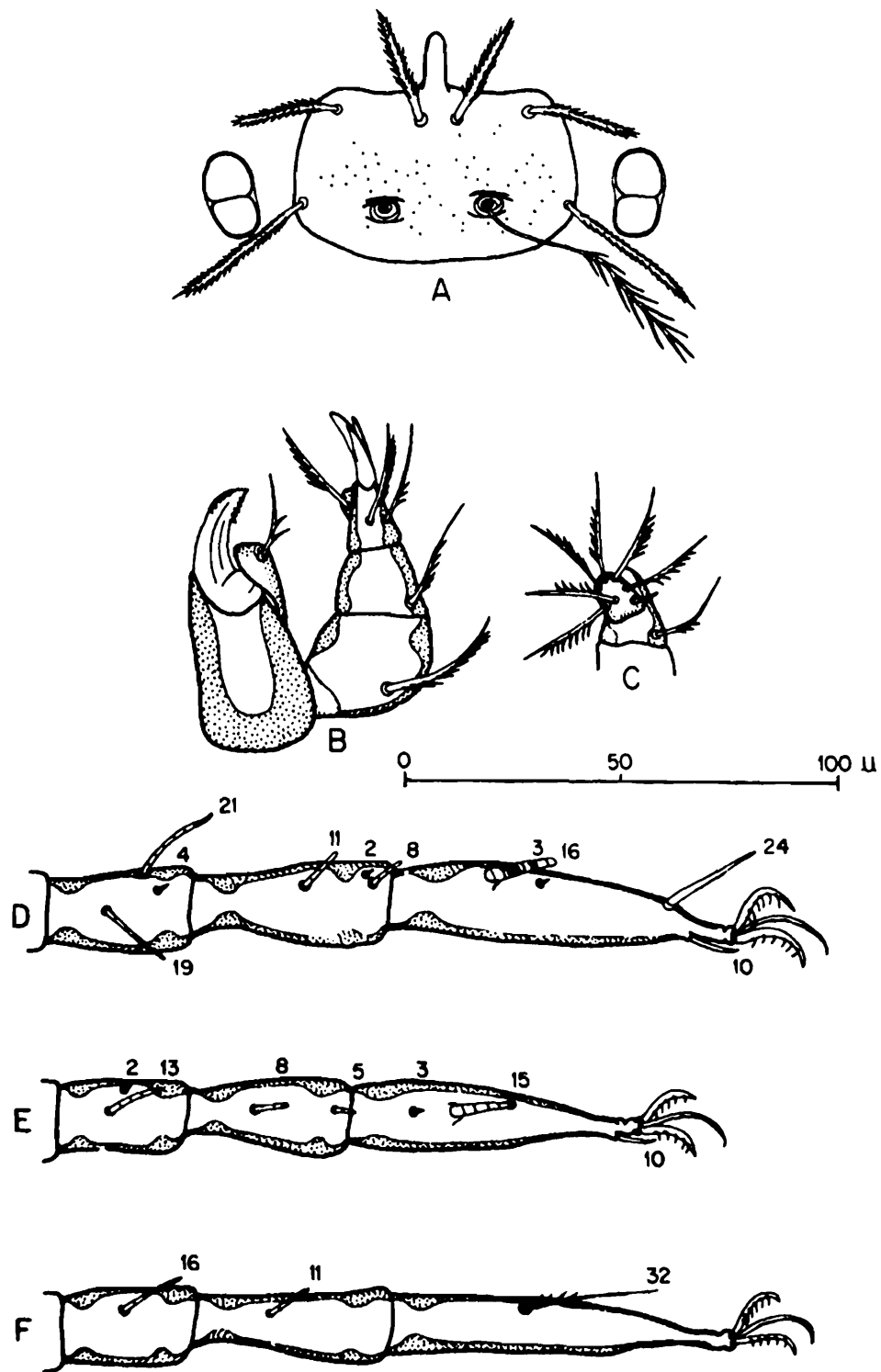


Fig. 12. *Odontacarus indica*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Remarks : The above redescription is based on the literature and the study of 2 paratypes. Nadchatram and Joshee (1966) consider *O. indica* unrelated to *O. gymnodactyli* (Ewing, 1925), and have compared it to *O. agamae* Taufflieb, 1960, and *O. ediosi* Taufflieb and Mouchet, 1962. They distinguish *O. indica* from the former in having tarsala I>II, by the absence of parasubterminala and the presence of onychotriches. They distinguish *O. indica* from the latter in having a smaller scutum, dissimilar arrangement of dorsal idiosomal setae, longer tarsala I and absence of parasubterminala. Taufflieb and Mouchet (1962) have included *O. agamae* and *O. ediosi* in the subgenus *Matacarus* Vercammen-Grandjean, 1956. Vercammen-Grandjean *et al.* (1973) have, however, raised this principally African taxon to full generic status.

Schluger and Amanguliev (1972b) have described *O. primarius* from Turkmenia, considering it close to *O. indica* in the absence of subterminala and parasubterminala. They distinguish *O. primarius* in having elongate tarsala II (spoon-tipped in *O. indica*), 58 dorsal body setae (40-42 in *O. indica*), and other characters.

5. *Odontacarus (Leogonius) joshii* new species (Fig. 13)

Odontacarus sp. A Fernandes *et al.*, 1988, 108.

Description of species : Larva.

Idiosoma : Measuring 254-257 x 194-213 in partially engorged specimens. Eyes 2/2, well defined, anterior larger, on ocular plate. One pair of humeral setae, measuring 39-42; 62-72 dorsal idiosomal setae, measuring 26-36; irregularly arranged, arrangement in holotype : 10-12-2-8-12-10-2-8-6-2; One pair of sternal setae, 27-34; 5-9 ventrolateral setae between coxae II and III; 24-30 preanal setae, 21-24; 24-30 postanal setae, 30-36; total idiosomal setae 121-141.

Gnathosoma : Palpal setal formula B/b(N)/B(b)NB(b)/7B; palpal claw 3- (occasionally 4) pronged; galeala b; cheliceral blade (44) with 5-7 dorsal and 4-6 ventral teeth; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with broadly rounded posterior margin; nasus measuring 12-15 x 6-7 at base; AM bases level with or slightly posterior to level of AL bases; SB level with PL bases; PL>AM>AL; sensillae flagelliform with 4-6 branches on distal 1/2; PW/SD = 1.5-1.7. Scutal measurements of holotype followed by means and ranges of 10 type specimens in parentheses : AW 62 (62, 60-66); PW 78 (78, 75-82); SB 26 (26, 24-26); ASB 27 (27, 25-29); PSB 19 (21, 19-22); AP 23 (24, 23-26); AM 38 (35, 32-38); AL 27 (31, 27-32); PL 39 (39, 36-42); sens. 59 + (65, 64-67).

Legs : Similar to *O. audyi* (Radford, 1946) in the number of ordinary and sensory setae. But, leg I with parasubterminala forked or weakly barbed; and leg III with tibia 6B, mastitibialae

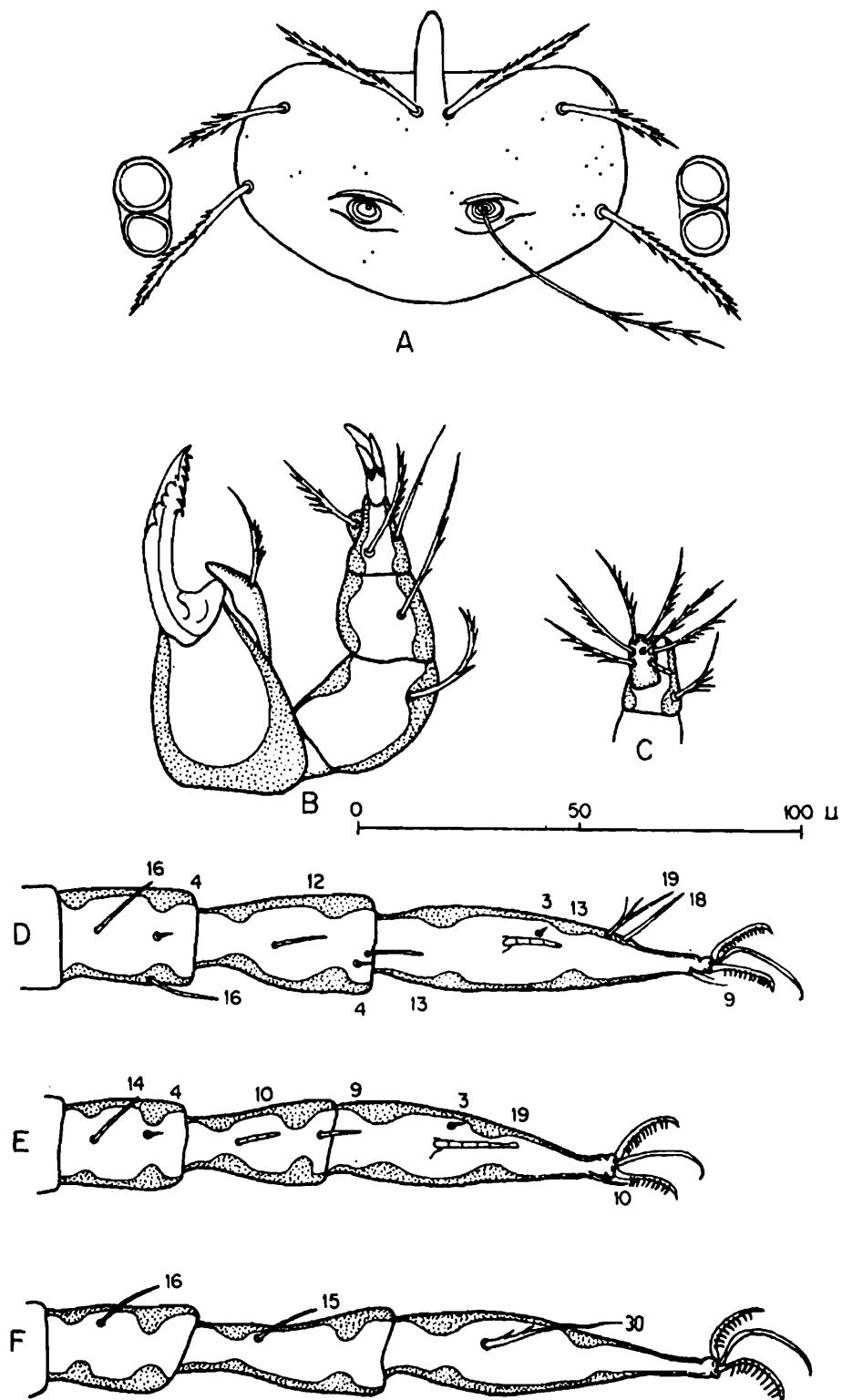


Fig. 13. *Odontacarus joshii* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

not distinguishable. Measurements as follows : Ip = 716-806. Leg I : 260-295; tarsus (74x18); tarsala 11-13. Leg II : 207-248; tarsus (64x17); tarsala 15-19, spoon-tipped. Leg III : 247-285; tarsus (74x17).

Type data : Holotype (NIV A-83011.2) and 1 paratype, UTTARANCHAL, Pithoragarh District, Dharchula, 900-1100m, ex *Agama tuberculata*, 18.V.1968, NIV, coll.; 11 paratypes, same data, but Chamoli District, Lambagarh, 2150-2450m, taken 24.VI.1968.

Additional material : 2 records of collections from the Himalayan region by NIV field teams : 2, same data as holotype. JAMMU and KASHMIR, Kargil, 2440-2740m, 30.VII.1968, 2 ex *Mus musculus*.

Remarks : *Odontacarus joshii* is similar to *O. sichuanensis* Zhao *et al.*, 1981, in having ventrolateral setae between coxae II and III, but differs in having dorsal and ventral cheliceral teeth (only ventral teeth in *O. sichuanensis*), fewer body setae (approximately 282 in *O. sichuanensis*), and PL>AM (AM>>PL in *O. sichuanensis*). *O. joshii* appears close to *O. naumovi* Kudryashova and Ribin, 1974, from which it may be separated by having ventrolateral setae between coxae II and III (lacking in *O. naumovi*) and having parasubterminala forked or weakly barbed (nude in *O. naumovi*). This species has been warmly dedicated to the late Prof. A.K. Joshi, former Head of Department of Zoology, L.U. and M.V. College, Bombay, in recognition of his contribution to chigger taxonomy in India.

Genus *Shunsennia* Jameson and Toshioka

Shunsennia Jameson and Toshioka, 1953, 89; Teller, 1956, 173; Traub *et al.*, 1958, 145; Brennan and Goff, 1977, 565; Goff and Brennan, 1980, 835; Goff and Webb, 1989, 78.

Parashunsennia, Kumada, 1956, 257.

Chatia (*Parashunsennia*), Traub and Nadchatram, 1966b, 377; Vercammen-Grandjean, 1968b, 124.

Chatia (*Shunsennia*), Traub and Nadchatram, 1966b, 377; Vercammen-Grandjean, 1968b, 124.

Chatia (*Ptilonia*), Vercammen-Grandjean and Langston, 1976, 106, new synonymy.

Type species : *Shunsennia tarsalis* Jameson and Toshioka, 1953, by original designation.

Diagnosis : Leeuwenhoekinae larvae parasitic on mammals, mostly rodents. Legs all 6-segmented terminating in a pair of claws and clawlike empodium; onychotriches absent; coxa I 2B; 1 or 2 genualae I and genuala II; microgenuala II present; genuala III present or absent; tibial setation 8-6-6 (occasionally 8-6-8, 9-6-6 or 9-7-7); microtarsala II present or absent; tarsala III present or absent; palpal tarsus 7B; Palpal claw 2 to 4-pronged; cheliceral blade with tricuspid cap or ventral row of minute subapical teeth; spiracles and tracheae absent; scutum with paired AM setae, accessory branches present or absent; nasus absent; sensillae flagelliform.

Remarks : Jameson and Toshioka (1953) proposed the genus *Shunsennia* for chiggers

collected from South Korea ex *Clethrionomys rufocanus regulus* and *Apodemus agrarius coreae*. To this genus they also transferred *Hannemania ochotona* Radford, 1942. Teller (1956) while describing *S. biplumosa*, revised the generic diagnosis to include the presence or absence of cheliceral teeth, and 2- to 4- pronged palpal claw. Traub and Nadchatram (1966b) relegated *Shunsennia* to a subgenus of *Chatia* and synonymised *Parashunsennia* Kumada, 1956, with *Shunsennia*. Vercammen-Grandjean (1968b) concurred with this revision, but considered *Parashunsennia* an independent subgenus of *Chatia*. Vercammen-Grandjean and Langston (1976) proposed a new subgenus *Ptilonia* in the genus *Chatia* for the Pakistani species *S. wissemani* (Traub and Nadchatram, 1968b) and *S. nurahmadi* (Traub and Nadchatram, 1968b). *Ptilonia* Vercammen-Grandjean and Langston (1976) is here considered a synonym of *Shunsennia*. Brennan and Goff (1977) reinstated *Shunsennia* to generic status recognizing the synonymy of *Parashunsennia* with *Shunsennia*. Goff and Brennan (1980) consider the absence of empodia in *Chatia* and difference in tibial setation (11-9-9 in *Chatia*) sufficient to warrant separate generic status for these two taxa. This arrangement has been followed here. A single species of *Shunsennia* is reported here for the first time from India.

**6. *Shunsennia wissemani* Traub and Nadchatram
(Fig. 14)**

Chatia (Shunsennia) wissemani Traub and Nadchatram, 1966b, 378; Traub *et al.*, 1967, 42.

Chatia (Ptilonia) wissemani, Vercammen-Grandjean and Langston, 1976, 106.

Shunsennia wissemani, Goff and Brennan, 1980, 835.

Shunsennia, Chatia sp. A Fernandes *et al.*, 1988, 108.

Redescription of species : Larva.

Idiosoma : Measuring 308-490 x 216-281 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Humeral setae not distinguishable; 68-78 dorsal idiosomal setae; lateral setae longer, measuring 70-99; anterior medial setae short, slender, measuring 48-60; arrangement irregular (Original description : 14-9-4-10-2-10-4-8-6-4-2); one pair of sternal setae, 48-66; 30-32 preanal setae, 25-36; 33-36 postanal setae, 54-74; total idiosomal setae 126-144.

Gnathosoma : Palpal setal formula B/B/BNb/7B; palpal claw 2-pronged, subequal, axial claw internal; galeala N/b (original description : b); cheliceral blade (38-44) with ventral row of minute teeth; gnathobase distinctly punctate, bearing a pair of branched setae.

Scutum : Subrectangular, sparsely punctate; posterior margin slightly convex with median indentation, often obscured in unengorged specimens by cuticular folds; paired AM setae with short accessory branch, inserted posterior to level of AL bases; SB slightly anterior to or level with PL bases; PL>AM=AL (all scutal setae subequal in Pakistani specimens); sensillae nude, flagelliform; PW/SD = 1.94-2.18. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses after original description : AW 95 (92,

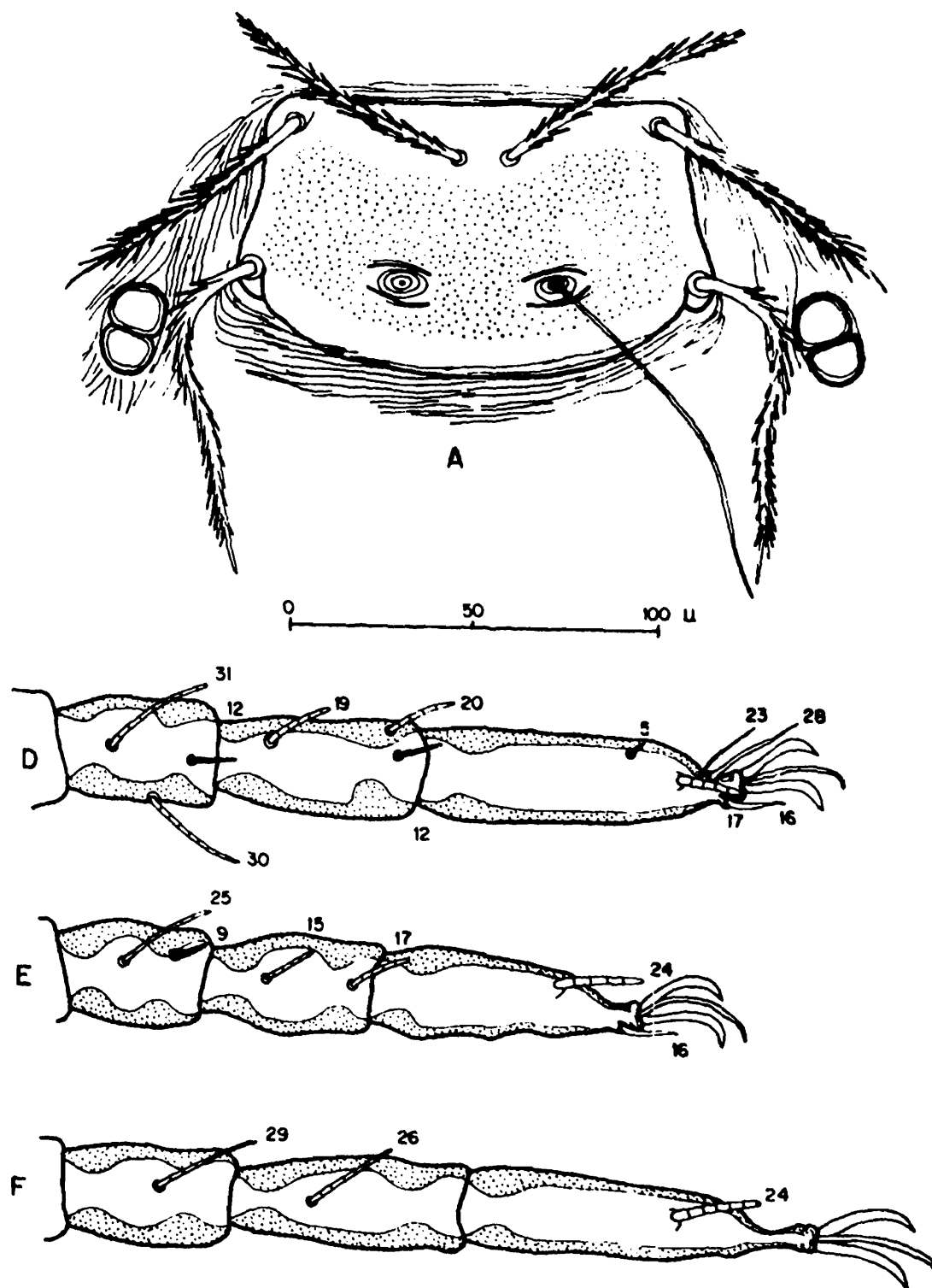


Fig. 14. *Shunsennia wissemanni*

A. scutum; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

85-98); PW 124 (114, 108-126); SB 42 (38, 35-44); ASB 41 (38, 34-41); PSB 16 (19, 16-22); AP 42 (38, 35-42); AM 71 (68, 64-72); AL 74 (71, 66-74); PL 74 (69, 65-74); sens. - (83, 80-87). Scutal measurements giving means and ranges of 10 NIV specimens : AW 84, 78-92; PW 106, 99-120; SB 35, 32-38; ASB 41, 37-43; PSB 21, 19-22; AP 36, 34-38; AM 65, 58-78; AL 63, 58-77; PL 75, 68-92; sens. 97, 93-101.

Legs : All 6-segmented terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 954-1105. Leg I : 339-383; coxa with 2 barbed setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B (9B in NIV specimens), 2 tibialae, microtibiala; tarsus (85-90 x 24) approximately 30B, tarsala (12-17), microtarsala, subterminala, pretarsala; parasubterminala absent (original description: present). Leg II : 285-329; coxa 1B; trochanter 1B; femur 7B; genu 4B, genuala, microgenuala; tibia 6B (7B in HIMACHAL PRADESH and UTTARANCHAL NIV specimens), 2 tibialae; tarsus (74-76 x 22-24) 18B; tarsala (17-24), pretarsala; microtarsala absent. Leg III : 330-394; coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala; tibia 6B (7B in HIMACHAL PRADESH and UTTARANCHAL NIV specimens), tibiala; tarsus (85-93 x 20-23) 18B, tarsala (18-24) on distal 1/3 of segment.

Type data : Holotype (B66198-16) and 1 paratype, PAKISTAN, Hazara District, Kagan Valley, Gitidas, 3600m, ex *Alticola roylei*, 17.VIII.1963, R. Traub, coll.; 4 paratypes, same data, but Besal, 3150m, ex *Hyperacrius fertilis*, taken 28.VIII.1963; 4 paratypes, same data, but ex 2 *Sorex* sp., taken 28,29.VIII.1963.

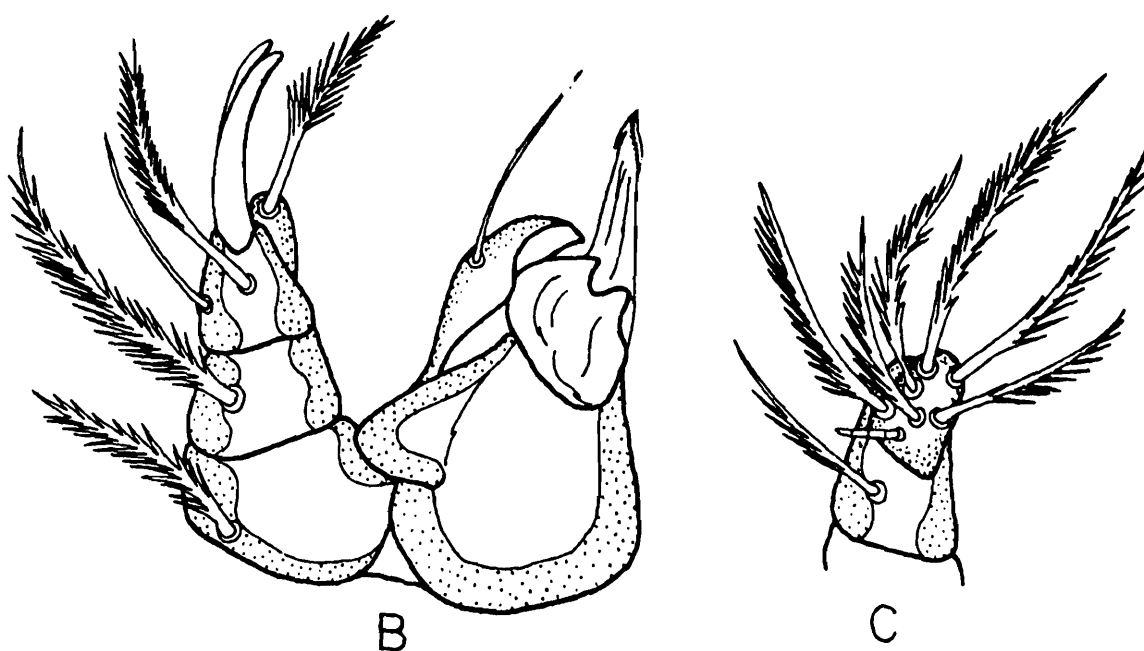


Fig. 14. *Shunsennia wissemanni*
B. dorsal aspect of gnathosoma; C. Ventral aspect of palpotibia and tarsus.

Type depository : Holotype at USNM; paratypes at BM(NH), IMR, RML, BM, HF, IA, and in Traub's collection.

New records : 31 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Kinnaur District, Rakcham, 3120m, 8 ex 4 *Apodemus flavicollis*, 19,20.VI.1970; Kulu District, Palchan, 1800-2290m, 1 ex *Mus musculus*, 1.X.1968; Mahasu District, Kotkhai, 1800-1900m, 1 ex *Mus musculus*, 14.V.1969. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 4 ex *Apodemus flavicollis*, 31.X.1969; 54 ex 3 *Rattus rattoides*, 2,3.XI.1969; 51 ex 6 *Mus musculus*, 31.X - 2.XI.1969; 37 ex *Bandicota bengalensis*, 2.XI.1969; 3 ex *Suncus murinus*, 3.XI.1969; 3 ex *Capra* sp., 1.XI.1969; Rampore, 1400m, 4 ex *R. rattoides*, 5.XI.1969; 2 ex *Rattus* sp., 8.XI.1969; 38 ex *M. musculus*, 7.XI.1969; 3 ex *S. murinus*, 5.XI.1969; Tangmarg, 600m, 1 ex *R. rattoides*, 19.X.1969; 2 ex 2 *M. musculus*, 19.X.1969; Doda District, Bhadarwah, 1700m, 14 ex *R. rattoides*, 15.XI.1969; 8 ex *M. musculus*, 15,17.XI.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 24 ex *Rattus fulvescens*, 4.X.1967.

Specimen examined : One paratype of *S. nurahmadi* Traub and Nadchatram, 1966b, on loan from M. Nadchatram: PAKISTAN, Hazara District, Kaghan Valley, Buruwai, 3000m, ex *Apodemus* sp., R.L. Amoureux, coll.

Remarks : Traub and Nadchatram (1966b) described the species *wissemani* and *nurahmadi* from material collected in the Kagan Valley of the Himalayan range, all above the timber-line in alpine-type terrain, at elevations ranging from 2400m to 7600m. They placed these species in the subgenus *Shunsennia* of the genus *Chatia* Brennan, 1946. Goff and Brennan (1980) reinstated *Shunsennia* to generic status and reported the characteristic short accessory branch arising from the paired AM setae in certain *Shunsennia* species including *wissemani*. They have also given as diagnostic of the genus the tibial setation : 8-6-6. Traub and Nadchatram (1966b) have reported the tibial setation of *wissemani* as 8-6-8. There is some variation observed in the Indian specimens : 9-6-6 in JAMMU and KASHMIR specimens; 9-7-7 in HIMACHAL PRADESH and UTTARANCHAL specimens. The NIV material has been collected at elevations ranging from 550m to 3120m in the western Himalayas. The Indian specimens do not fully conform to the original description. They are similar to *S. nurahmadi* in having galeala N, anterior scutal margin only slightly sinuate (so that the AL corners are not markedly raised), dimensions of scutal setae unequal, and lateral and medial dorsal body setae of anterior row unequal in size. Goff and Brennan (1980), in their key to *Shunsennia* species, have inadvertently characterised the galeala as N in *wissemani* and B in *nurahmadi*! The original description reports the reverse. This has been confirmed by the study of the paratype of *S. nurahmadi*. The NIV specimens are distinguishable from *S. nurahmadi* in having PL and dorsal setae well barbed (not cylindrical with only short ciliations) and in having prongs of palpal claw subequal, with axial prong internal (not axial claw external and longer). The mix of characters observed in the NIV specimens makes it difficult to place them definitively in either *wissemani* or *nurahmadi*. The differences do not merit the status of a separate species, and hence they are being tentatively considered as the species *wissemani*.

The hosts of the Indian collection are primarily rodents and insectivores, with one record from *Capra* sp.

This species has been named in honour of Prof. Charles Wisseman, Jr., who has contributed much to the knowledge of arthropod-borne infections.

Genus *Whartonia* Ewing

Whartonia Ewing, 1944, 102; Domrow, 1962d, 1; Vercammen-Grandjean, 1968b, 126; Nadchatram and Dohany, 1974, 47; Reed and Brennan, 1975, 33; Brennan and Goff, 1977, 565; Goff, 1980b, 494; Goff and Webb, 1989, 78.

Type species : *Hannemania nudesetosa* Wharton, 1938, by original designation.

Subgenus *Fascutonia* Vercammen-Grandjean *et al*

Fascutonia Vercammen-Grandjean *et al.*, 1973, 64; Vercammen-Grandjean and Langston, 1976, 99.

Type species : *Whartonia lepidopteriscuta* Vercammen-Grandjean, 1965, by original designation.

Diagnosis : Leeuwenhoekine larvae infesting bats. Colour in life yellow to orange. Ip = 1000-2550. Legs all 6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; coxa I 2B; coxa III unisetose; femoral setation 6-6-5; 2 genualae I; tarsala III absent; parasubterminala present on leg I; mastisetae present or absent. Palpal tarsus 7B; palpal claw 3-pronged; cheliceral blade long, with large, recurved ventral row of teeth and denticulate cap. Scutum narrow, band-like, twice as wide as long, with paired AM setae, without nasus, sensillae flagelliform. Tracheae and spiracles present or absent.

Remarks : Vercammen-Grandjean (1968b) proposed the subgenus *Asolentria* differentiating it from the nominate subgenus by the absence of tarsala III. Reed and Brennan (1975) further differentiated *Asolentria* by unisetose coxa III and parasubterminala on leg I (bisetose coxa III and parasubterminala absent in subgenus *Whartonia*). Vercammen-Grandjean *et al.* (1973) proposed the subgenus *Fascutonia* for the African and certain Oriental species, which they distinguished by femoral setation 6-6-5 (6-5-4 in the other subgenera). Vercammen-Grandjean (1968b) and Vercammen-Grandjean *et al.* (1973) state that the absence of scutal nasus is coincident with the lack of tracheae and spiracles in the genus *Whartonia*. Nadchatram and Dohany (1974), however, deem the spiracles and tracheae present, though the latter may not always be discernable. Reed and Brennan (1975) report the presence of spiracles and tracheae in the Neotropical species of *Whartonia*. They have not been observed in the Indian *Whartonia* species.

Three Indian species have been reported from India, taken exclusively from bats. They are placed in the subgenus *Fascutonia*.

7. *Whartonia (Fascutonia) brennani* Hiregaudar and Bal
(Fig. 15)

W. brennania sic! Hiregaudar and Bal, 1955, 221, **nomen nudum**.

Whartonia brennani Hiregaudar and Bal, 1956a, 125, original description; 1956b, 251; Domrow, 1962d, 5; Prasad, 1974, 99.

Redescription of species : Larva. Colour in life white.

Idiosoma : Measuring 1000-1400 x 700-800 in engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 86; approximately 40 dorsal idiosomal setae irregularly arranged, anterior lateral and posterior measuring 86, anterior median, 63; arrangement after original illustration : 8-12-5-10-10-6-3 = 54; one pair of sternal setae between coxae III; 6-7 pairs of ventrolateral setae between coxae II and III; 20 preanal setae, measuring 81; approximately 52 postanal setae, 63 (Original description : approximately 60 ventral setae); total idiosomal setae, after original illustration, approximately 134. Dorsal and postanal body setae appearing almost nude with minute barbs; preanal setae with long slender barbs.

Gnathosoma : Palpal setal formula B/N/BNN/6B. N (Original description : b/b/bb?/5-6B?); palpal claw 2-pronged (Original description : 3- or more pronged); galeala f; cheliceral blade (101) with 8 recurved teeth lateroventrally, larger at base, and apical cap bearing 7 lateral teeth; gnathobase moderately punctate, bearing a pair of branched setae (Original description : 4 branches at base).

Scutum : Moderately punctate, with anterior margin sinuate; posterior margin convex (medially truncate in cotype observed); AM bases slightly posterior to level of AL bases; SB posterior to level of PL bases; AM>PL>AL.; sensillae flagelliform, nude (Original description : with short branches on distal 1/2); PW/SD = 2.09. Scutal measurements of holotype after original description, followed by measurements of a cotype studied : AW 100, 107; PW 112, 118; SB 44, 46; ASB 30, 43; PSB 15, 19; AP 30, 28; AM 96, 110; AL 60, 69; PL 94, 95; sens. 98, 158.

Legs : All 6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip and individual leg measurements not recorded. Leg I : coxa with 2 barbed setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (195x21) 22B, tarsala (39), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : coxa 1B; trochanter 1B; femur 6B; genu 4B, genuala, microgenuala; tibia 6B, 2 tibialae; tarsus (177x24) 17B, tarsala (30), microtarsala, pretarsala. Leg III : coxa 1B; trochanter 1B; femur 5B; genu 4B, 5 genualae; tibia 6B, tibiala; tarsus (224x18) 15B.

Type data : About 12 specimens, MAHARASHTRA (originally Bombay State), Karla Caves near Pune, ex *Hipposideros bicolor fulvus*, 1952, L.S. Hiregaudar and D.V. Bal, coll.

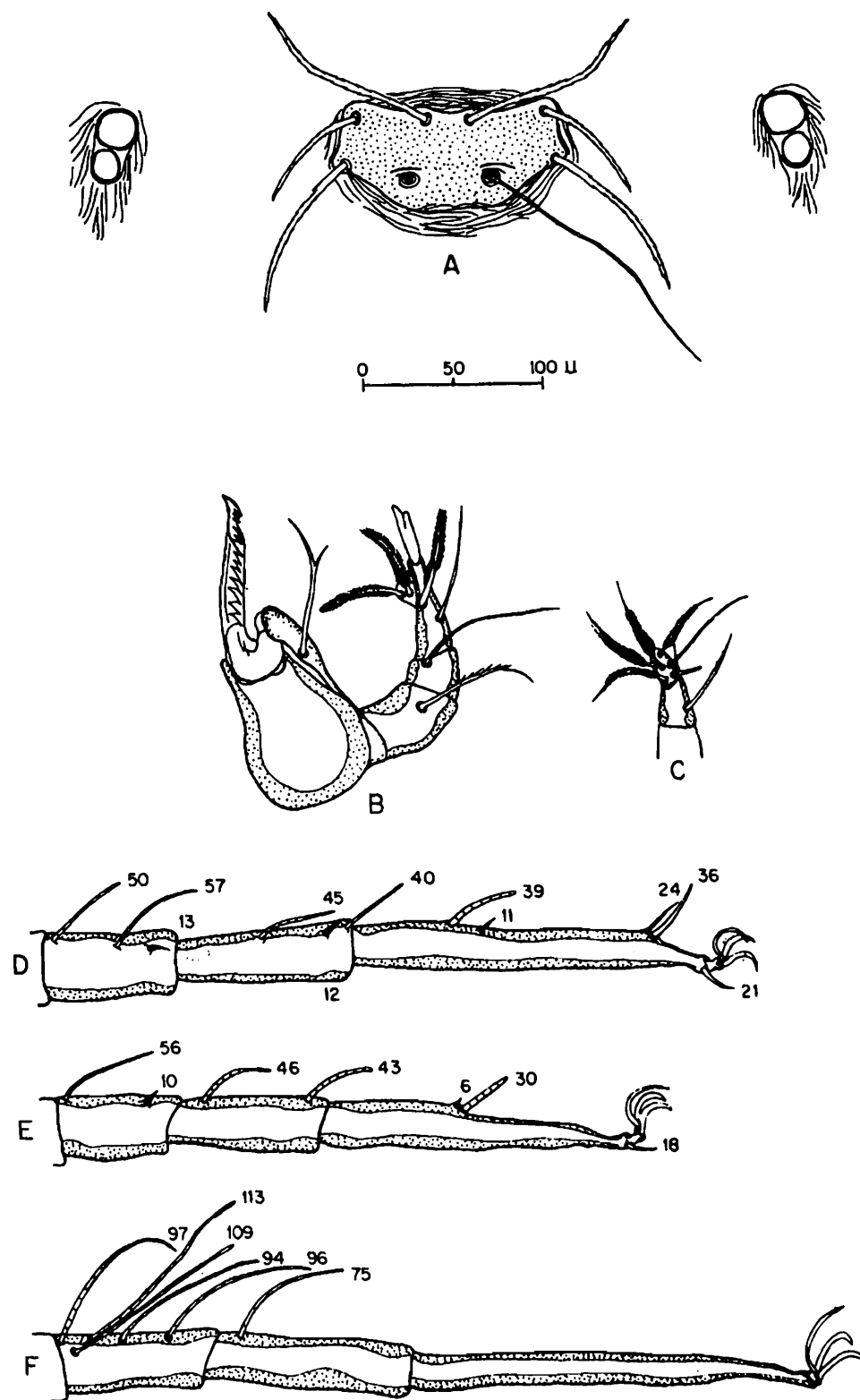


Fig. 15. *Whartonia brennani*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type depository : 6 cotypes at USNM; type depository not reported in original description. Prasad (1974) cites paratype depository as ZSI (not traceable at present).

Material examined : 6 cotypes on loan from USNM labelled: "*Whartonia brennani* Hiregaudar - #31299 USNM - *Hipposideros b. fulvus* - Karla Caves, Bombay, India - Received December 12, 1952" The cotypes are all in poor condition.

Remarks : The above redescription is based on the literature and study of the cotypes. Hiregaudar and Bal reported *Whartonia brennania* **sic!** in Current Science of July 1955 without any description, ex *Hipposideros bicolor fulvus*, Karla Caves, Bombay, 1953(?). Thus, technically, *Whartonia brennani* is to be considered a **nomen nudum!**

Hiregaudar and Bal (1956a) have compared *Whartonia brennani* to *W. perplexa* Brennan 1947, distinguishing it in having scutum much broader with concave sides and chelicerae narrow with strong recurved teeth. It can be further separated in having SB posterior to level of PL bases (anterior in *W. perplexa*), and having ventrolateral setae between coxae II and III (lacking in *W. perplexa*). They have regarded the assignment of *brennani* to the genus *Whartonia* as tentative, due to the absence of spiracles and tracheae. The current understanding does not, however, deem their presence essential in this genus. The reference to the spiracular opening between the bases of coxae I and II in the original description is rather to the urstigma or Claparede's organ. The scutal measurements recorded above for the cotype are in agreement with the original description, except for the ASB and PSB measurements. The measurements deduced from the illustration: ASB 40 and PSB 20, are closer to our measurements. This discrepancy may perhaps be explained by the difference in the earlier understanding of these terms. The palpal tarsal formula of *W. brennani* is 6B.N (7B in genus *Whartonia*). This is not considered to be of special significance, as the setal branching in the genus is generally poor.

This species is close to *W. prima* Schluger *et al.*, 1959, and *W. salifa* Schluger *et al.*, 1959, but may be separated by the number of ventrolateral setae between coxae II and III (8-10 pairs in *W. prima*, 5 pairs in *W. salifa*), and by differences in the scutal setal dimensions (AM measuring 88-114, AL 67-85, PL 98-117 in *W. prima* and AM 61-64, AL 48-57, PL 76-83 in *W. salifa*). *W. brennani* is similar to *W. angulascuta* Reed and Brennan 1975 in having multiple genualae III (7-11 in *W. angulascuta*). It may be separated by the presence of parasubterminala I (absent in *W. angulascuta*) and the absence of tarsala III (present in *W. angulascuta*). This species has been named in honour of Dr. J. M. Brennan.

8. *Whartonia (Fascutonia) indica* Hiregaudar and Bal

Whartonia indica Hiregaudar and Bal, 1956b. 253; Schluger *et al.*, 1959, 419; Domrow, 1962d, 5; Prasad, 1974, 99.

Description : Larvae. Colour in life yellowish white.

Idiosoma : Measuring 1800-2000 x 800-1000 in engorged specimens. Eyes 2/2, on ocular plate. Humeral setae not distinguishable; dorsal idiosomal setae 50 or more, measuring 80-90 (measuring 76, 73 and 75 in holotype and 2 paratypes, after table of standard measurements), arranged : 4-8-6-8-8-6-6-4; single pair of sternal setae and 5-6 pairs of ventrolateral setae between coxae II and III; approximately 75 ventral setae (approximately 32 preanal and 68 postanal setae after original illustration); total idiosomal setae approximately 164.

Gnathosoma : Palpal setal formula B/B/BBB/(7B? - palpal tarsal setation not reported in original description); gnathobase punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subtrapezoidal, anterior margin with slight median convexity; posterior margin biconvex; AM bases level with AL bases; SB posterior to level of PL bases; AM>PL>AL; sensillae flagelliform, with distal branches; PW/SD = 1.41-1.51. Scutal measurements of holotype and 2 paratypes after original description : AW 94, 94, 91; PW 112, 112, 111; SB 49, 50, 51; ASB 58, 54, 55; PSB 22, 21, 19; AP 40, 39, 38; AM 144, 142, 146; AL 79, 80, 81; PL 115, 116, 113; sens. -, -, 118(?).

Legs : All 6-segmented. Presence/ absence of onychotriches, number of ordinary and sensory setae, and leg measurements not recorded. Tarsala I>II; 1-2 long, nude genualae I-III.

Type data : Holotype and paratypes (about 12 specimens), MAHARASHTRA, Bombay, Tulsi Lake Tunnel, ex Horse-shoe bats *Rhinolophus rouxi*, 12.VIII.1955, L.S. Hiregaudar and D.V. Bal, coll.

Type depository : Holotype and paratypes in author's collection at Department of Parasitology, Bombay Veterinary College (now Haffkine Institute) - not traceable at present.

Remarks : The above redescription is based only on the literature. Hiregaudar and Bal (1956b) compare *W. indica* to *W. brennani* Hiregaudar and Bal, 1956a, distinguishing it by differences in the standard measurements and the type of branched setae on the gnathobase (barbed throughout in *W. indica*; with only 4 basal barbs in *W. brennani*). Schluger *et al.* (1959) have described *W. prima* from North Vietnam, considering it close to *W. indica*. They distinguish it in having sensilla nude (with distal branches in *W. indica*), shorter dorsal median body setae and other characters.

It is unfortunate that the type specimens of this species are not traceable. On the basis of the sketchy original description, it is placed tentatively in the subgenus *Fascutonia* with the other Indian *Whartonia* species.

9. *Whartonia (Fascutonia) kumaonensis* Bhat
(Fig. 16)

Whartonia kumaonensis Bhat, 1971, 585; Fernandes *et al.*, 1988, 107.

Redescription of species : Larva.

Idiosoma : Measuring 575-926 x 393-657 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, free on cuticle. One pair of humeral setae, measuring 70-94; 50-54 dorsal idiosomal setae, measuring 56-87, irregularly arranged, arrangement in holotype : 8-9-9-2-8-2-7-6-2, in paratypes : 8(9-1)-8(9-10)-8(9-10)-2-6(7-8)-2-6(7)-5(6)-1(2); no sternal setae distinguishable, transverse band of 24-31 setae ventrally between coxae II and III, measuring 37-80; 18-22 preanal setae, 45-52; 38-44 postanal setae, 74-84; total idiosomal setae 136-149.

Gnathosoma : Palpal setal formula b/b/BNN/7B; palpal claw 3-pronged; galeala N; cheliceral blade (81-84) with 7-9 lateroventral recurved teeth and an apical cap with 8-9 lateral denticles; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular, with shallowly biconcave anterior margin; posterior margin biconvex; anterolateral scutal angles produced anterior to AL bases; AM bases posterior to level of AL bases; SB slightly posterior to level of PL bases; scutal setae with short barbs on distal half, anteromedian setae thickest; PL > AM > AL; sensillae flagelliform, nude; PW/SD = 1.84 - 1.98 (Original description : 18.9 - lapsus!). Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 145 (141, 138-147); PW 141 (136, 129-145); SB 46 (44, 39-46); ASB 55 (54, 48-58); PSB 20 (18, 17-20); AP 41 (39, 34-43); AM 83 (77, 70-83); AL 65 (58, 53-65); PL 93 (90, 87-93); sens. - (87, no variation recorded).

Legs : All 6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 1569-1699. Leg I : 540-584; coxa with 2 barbed setae (2B); trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (139-150 x 24-27) 19-22B, tarsala 24-27, microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 457-526; coxa 1B; trochanter 1B; femur 6B; genu 4B, genuala, microgenuala; tibia 6B, 2 tibialae; tarsus (118-125 x 26-28) 17B, tarsala 23-25, microtarsala, pretarsala. Leg III : 566-618; coxa 1B; trochanter 1B; femur 5B; genu 4B, genuala; tibia 5B, tibiala, mastitibiala with basal barbs (78); tarsus (143-153 x 24-31) 15B, mastitarsala (64) with basal barbs.

Type data : Holotype (VRC A81361-3) and 7 paratypes, UTTARANCHAL, Kumaon Hills, Nainital District, Dugada, 700m, ex *Rousettus leschenaulti*, 8.IX.1967, H.R. Bhat coll. 1 paratype, same data as holotype; 1 paratype, same data, but ex *Eonycteris spelaea*, taken 25.II.1967.

Type depository : Holotype and paratypes at NIV.

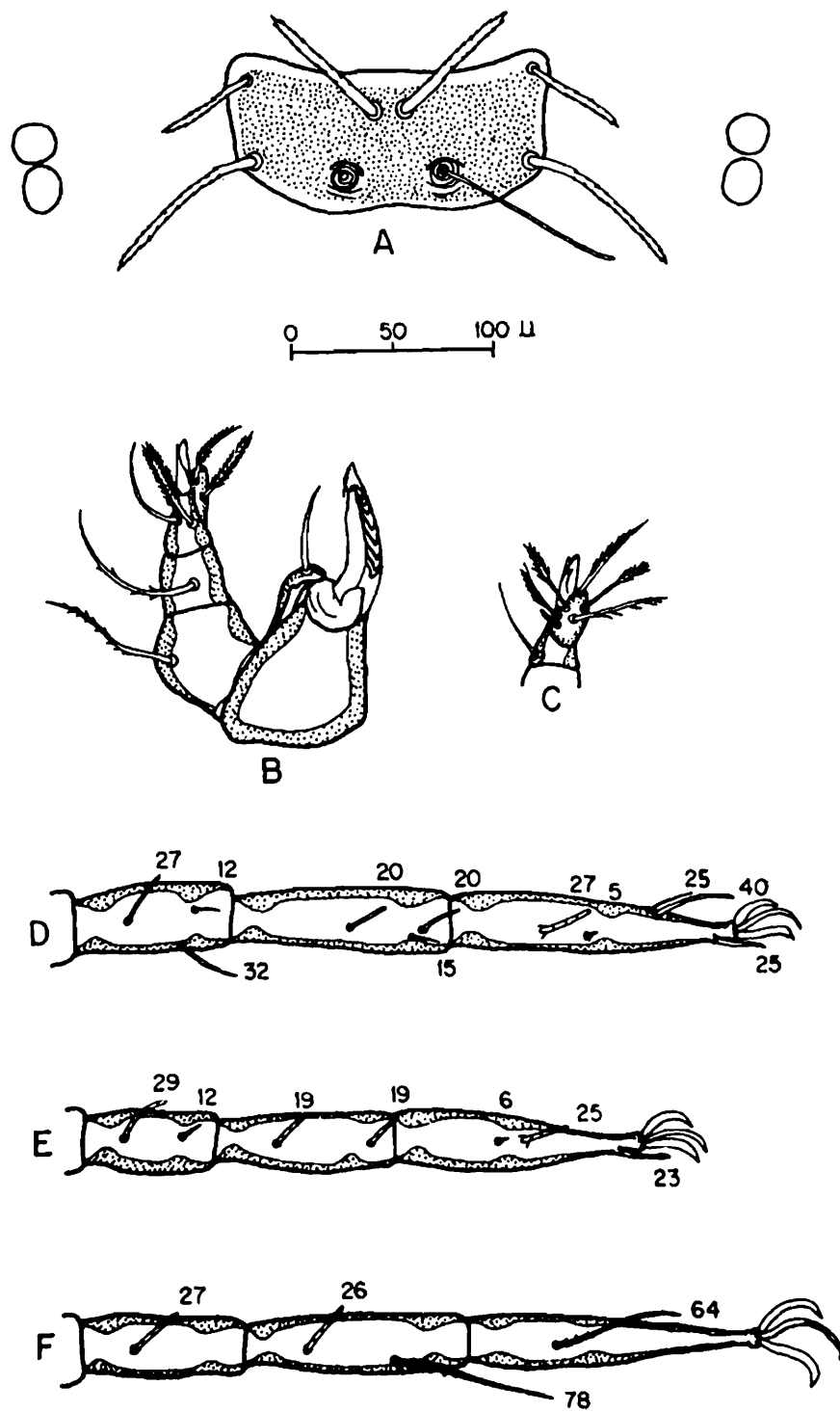


Fig. 16. *Whartonia kumaonensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Additional records : Several specimens from MAHARASHTRA, Satara District, Mahabaleshwar, ex *R. leschenaulti* and *E. spelaea*, collection dates not recorded, H.R. Bhat coll. Specimens collected on body of host or free living in bat cave.

Remarks : The above redescription is based on the literature and study of the type series. *Whartonia kumaonensis* is the first new species described from the NIV Himalayan chigger collection. Bhat (1971) considers *W. kumaonensis* close to *W. maai* Nadchatram and Wilson, 1965, from which it may be separated in having $AW > PW$ ($AW < PW$, with AW measuring 140-148 and PW 148-155 in *W. maai*); cheliceral blade (81-84) with 7-9 lateroventral recurved teeth (cheliceral blade (90) with 8-10 lateroventral teeth in *W. maai*); and leg tarsi shorter (tarsus I : 144-152 x 26-28; tarsus II : 130-132 x 26-29; tarsus III : 152-160 x 23-25 in *W. maai*). *W. kumaonensis* shows an apparent predilection for *R. leschenaulti* and *E. spelaea*. The species name is derived from the type locality, Kumaon Hills of the western Himalayas.

A long tapering mastitibiala with basal barbs, not reported in the original description, was observed on the distal 1/3 of leg tibia III. A mastitibiala III with basal barbs has also been illustrated, but not reported in the original description of *W. maai*.

Subfamily TROMBICULINAE Ewing

Trombiculinae Ewing, 1929b, 22; Wharton and Fuller, 1952, 41; Womersley, 1952, 19; Vercammen-Grandjean, 1960, 469; 1968b, 23; Nadchatram and Dohany, 1974, 16; Brennan and Goff, 1977, 557; Goff *et al.*, 1982, 221.

Walchiinae Ewing, 1946b, 436; Wharton and Fuller, 1952, 91.

Gahrlepiinae Womersley, 1952, 278; Vercammen-Grandjean, 1968b, 23; Brennan and Goff, 1977, 557.

Trombiculini Vercammen-Grandjean, 1960, 469; 1968b, 23; Nadchatram and Dohany, 1974, 18; Goff *et al.*, 1982, 221.

Schoengastiini Vercammen-Grandjean, 1960, 469; 1968b, 23; Nadchatram and Dohany, 1974, 18; Goff *et al.*, 1982, 221.

Gahrlepiini Nadchatram and Dohany, 1974, 17; Goff *et al.*, 1982, 221.

Type genus : *Trombicula* Berlese, 1905, by original designation.

Diagnosis : Trombiculid larvae parasitic on mammals, reptiles, birds and occasionally arthropods. Legs 7-7-7 or 7-6-6 segmented. Scutum with single AM seta, or AM seta absent; sensillae flagelliform to expanded.

Remarks : Following Nadchatram and Dohany (1974) and Goff *et al.* (1982), the subfamily Trombiculinae includes the tribes Trombiculini, Schoengastiini, and Gahrlepiini. 195 species in 24 genera have been recorded from this subfamily in India.

Tribe *Trombiculini* Vercammen-Grandjean, 1960
Genus *Trombicula* Berlese

Trombicula Berlese, 1905, 155; 1912, 83; Audy, Nadchatram, Loomis and Traub, 1965; Vercammen-Grandjean, 1968b, 59; Nadchatram and Dohany, 1974, 58; Domrow and Lester, 1985, 22.

Type species : *Trombicula minor* Berlese, 1905, by monotypy and subsequent designation (Berlese, 1912).

Diagnosis : Trombiculini larvae parasitic on small mammals, usually bats. Legs all 6- or 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 2 genualae I; mastitarsala III absent. Palpal tarsus 5B or 6B; palpal claw 3-pronged; galeala N or B; cheliceral blade with tricuspid cap. Eyes 2/2. Scutum subtrapezoidal with irregular pitting, scrobiculate; posterior margin convex; sensillae flagelliform with distal branches.

Remarks : Audy *et al.* (1965) briefly outline the complex history of the type species, the confusion arising from its incomplete description and the varied interpretation of the genus/subgenus *Trombicula* given by different workers. They have designated the neotype of *T. minor*, giving descriptions of the larval, nymphal and adult stages. Following Vercammen-Grandjean (1960) they have recognized 4 subgenera in the genus *Trombicula*. Of these, *Anomalapsis* Brennan, 1952, and *Sasatrombicula* Vercammen-Grandjean, 1960, are presently recognized as genera, while the taxonomic status of *Cotrombicula* Vercammen-Grandjean, 1960, is disputed. Vercammen-Grandjean (1968b) proposed *Diplectria* with palpal tarsal setation 5B and 2 pretarsalae I as a subgenus of *Trombicula*. Nadchatram and Dohany (1974) raised this taxon to generic status. The nominate subgenus is characterized by palpal tarsal setation 5B and all legs 6-segmented. Three Indian *Trombicula* species are reported here, one in the nominate subgenus. The other 2 species are tentatively assigned to this genus; their taxonomic status, however, requires confirmation.

10. *Trombicula hampii* Hiregaudar and Bal

Trombicula hampi sic! Hiregaudar and Bal, 1955, 221, **nomen nudum**.

Trombicula hampii Hiregaudar and Bal, 1956a, 128; 1956b, 251; Prasad, 1974, 96.

Redescription of species : Larva.

Idiosoma : Measuring 650-680 x 320-360 in engorged specimens. Eyes 1/1 (second pair inconspicuous?), free on cuticle (Original illustration (fig. 157) : Eyes 2/2, anterior larger, on ocular plate). Humeral setae absent; approximately 41 dorsal idiosomal setae, arrangement commencing : 8-8, measuring 30 (Original illustration (fig. 157) : One pair of humeral setae; 44 dorsal idiosomal setae, arranged : 6-8-8-8-2-6-4-2); 2 pairs of sternal setae; approximately 40 ventral setae, measuring 25 (Original illustration (fig. 158) : 18 preanal and 14 postanal setae); total idiosomal setae approximately 85 (Original illustrations (figs. 157 and 158) : 82).

Gnathosoma : Palpal setal formula B/B/BBB/(4-5B?); palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase apparently impunctate, bearing a pair of branched setae.

Scutum : Relatively small, moderately punctate, subrectangular with margins almost straight; scutal setae marginal; AM base slightly anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform, bearing 5-7 branches on distal 1/2; PW/SD = 1.88. Scutal measurements of holotype after original description : AW 60; PW 75; SB 22; ASB 32; PSB 8; AP 30; AM 30; AL 25; PL 36; sens. 56.

Legs : All 7-segmented, terminating in a pair of claws and a claw-like empodium. Number of ordinary and sensory setae not reported; but coxae I-III unisetose. Leg measurements not recorded.

Type data : Holotype and paratypes (about 12 type specimens), KARNATAKA, Hospet District, Hampi, ex *Rhinophoma hardwickei*, 1954, L.S. Hiregaudar, coll.

Type depository : Not reported; 1 paratype in ZSI.

Specimen examined : Paratype (2424/18) at ZSI labelled : *Trombicula hampii* Hiregaudar and Bal, 1955 - Hampi (Hospet) Mysore State 1954 - *Rhinopoma hardwicki* - L.S. Hiregaudar.

Remarks : The above redescription is based only on the literature. The paratype examined is in poor condition and needs to be remounted for critical observation. Hiregaudar and Bal reported *Trombicula hampi* **sic!** in Current Science of July 1955, without description, ex *Rhinopoma hardwicki* **sic!**, Hampi, Mysore State. Vercammen-Grandjean has redescribed this species, renaming it in honour of Dr. L.S. Hiregaudar (Hiregaudar, personal communication). This redescription has, unfortunately, not been published.

Nadchatram in a personal communication states that there is a species described as *Trombicula hampii* Ewing, 1945, from the Indian region. According to him, it would seem that Hiregaudar and Bal's species name is preoccupied, hence the reason for rename after Hiregaudar.

Hiregaudar and Bal (1956a) consider this species close to *T. leveri* Womersley, 1952, in scutal shape, ciliation of scutal setae and in having palpal claw 3-pronged. They distinguish *T. hampii* in having scutum punctate, SB not midway between AL and PL bases and by the standard measurements. They also distinguish this species from *T. schmitzi* (Oudemans, 1914) in having a broader scutum with concave sides, palpal claw 3-pronged instead of 2-pronged, and porous discs behind coxa III absent. As several diagnostic characters of this species are not known, its precise taxonomic status remains uncertain. It is tentatively retained in the genus *Trombicula*.

11. *Trombicula (Trombicula) hypodermata* Nadchatram and Traub
(Fig. 17)

Trombicula (Trombicula) hypodermata Nadchatram and Traub, 1966. 46; Traub *et al.*, 1967, 38; Kulkarni, 1979, 18; Kulkarni *et al.*, 1979, 10.

Redescription of species : Larva.

Idiosoma : Measuring 280-360 x 230-360 in partially engorged to engorged specimens. Eyes 2/2, anterior larger and well-defined, on ocular plate (Original description : Eyes 1/1). One pair of humeral setae, measuring 33-39; 24 dorsal idiosomal setae, measuring 30-36, arranged : 8-6-6-4; 3 pairs of sternal setae, anterior 26-28, median 21-24, posterior 21-24; 10-12 preanal setae, 19-23; 4-6 postanal setae, 28-32; total idiosomal setae 48-50.

Gnathosoma : Palpal setal formula B/B/BbB/5B; palpal claw 3-pronged; galeala B; cheliceral blade (23) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Subpentagonal with large, irregular pitting, scrobiculate; anterior margin biconcave; posterior margin convex; AM base slightly anterior to level of AL bases; SB anterior to level of PL bases; PL > AM > AL; sensillae flagelliform with 8-10 branches on distal 1/2; PW/SD = 1.73-1.92. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 48 (49, 46-53); PW 71 (73, 70-75); SB 19 (19, 18-21); ASB 22 (21, 20-22); PSB 19 (19, 18-20); AP 23 (21, 19-23); AM 28 (28, 28-30); AL 26 (25, 23-27); PL 38 (36, 34-41); sens. 52 (50, 48-57). Scutal measurements giving means and ranges of 10 NIV specimens : AW 50, 47-54; PW 72, 67-78; SB 18, 18-19; ASB 20, 19-21; PSB 19, 18-20; AP 23, 21-25; AM 30, 28-31; AL 28, 25-30; PL 38, 36-40; sens. 46, 45-49.

Legs : All 6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 611-638 (Original description : 670). Leg I : 216-230; coxa 1B; trochanter 1B; femur 6B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (52-54 x 18-19) 20B, tarsala (18-19), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 185-194; coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (45-46 x 16) 16B, tarsala (14-17), microtarsala, pretarsala. Leg III : 209-215; coxa 1B; trochanter 1B; femur 5B; genu 3B, genuala; tibia 6B, tibiala; tarsus (55-62 x 12-14) 15B.

Type data : Holotype (B66339-2), PAKISTAN, Lahore District, North West of Lulliani, ex *Tatera indica*, 30.IX.1963, R. Traub, coll.; 2 paratypes, same data, but Lahore, ex *Nesokia* sp., taken 26.IX.1962; 2 paratypes, same data, but taken 28.IX.1962; 1 paratype, same data, but 9km North West of Lulliani, taken 26.IX.1963; 2 paratypes, same data, but Rawalpindi, ex *T. indica*, X.1962; 4 paratypes, same data, but Lahore, taken 17.IX.1963.

Type depository : Holotype and 2 paratypes in USNM; paratypes in IMR, BPBM, BM(NH), ZSI, GWHF, RML, IA and Traub collection.

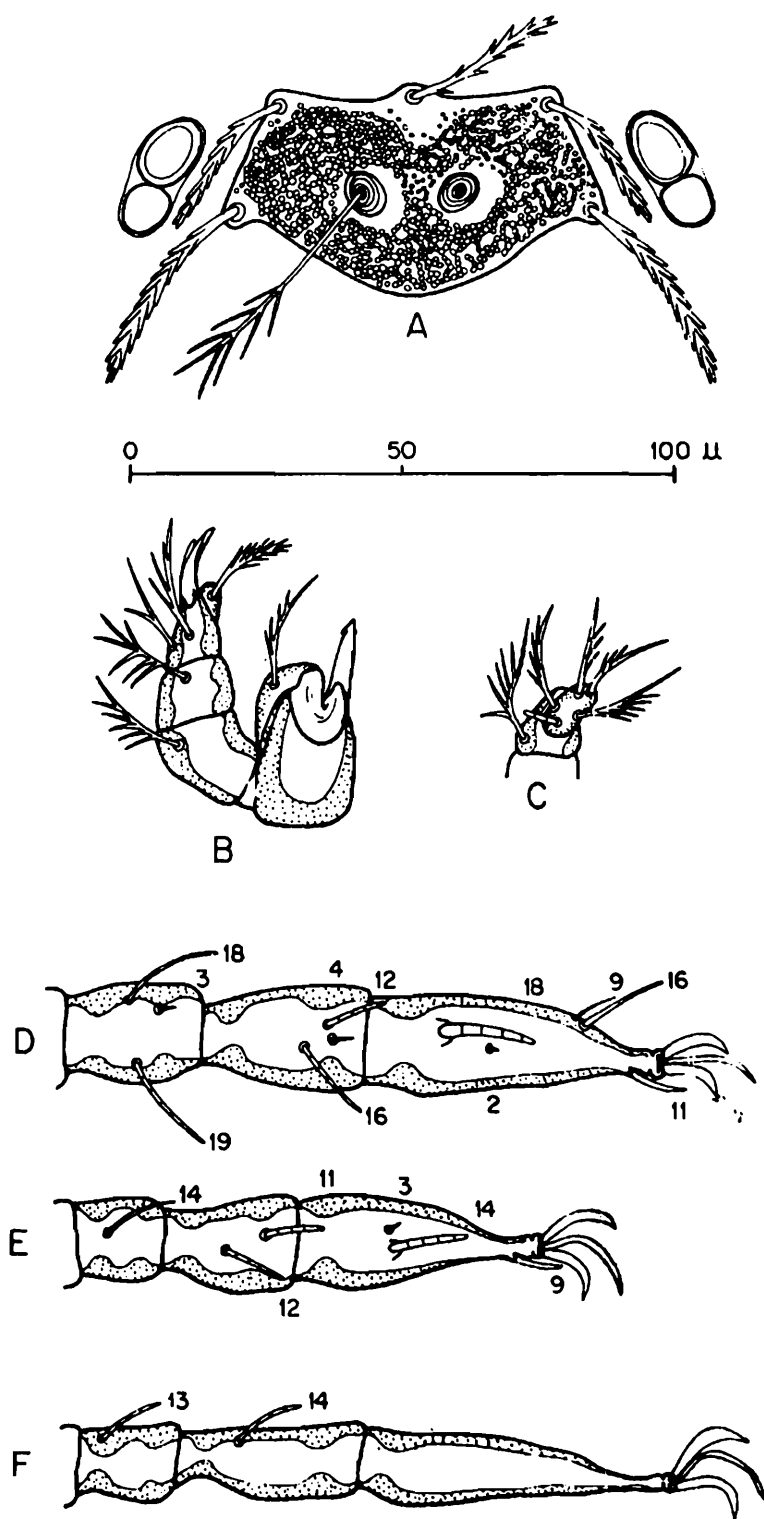


Fig. 17. *Trombicula hypodermata*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Additional records : MAHARASHTRA, Pune District, approximately 1200 ex *Suncus murinus* and *Rattus blanfordi*, 12.IV.1970 to 12.XI.1970, S.M. Kulkarni, coll.

New records : MAHARASHTRA, Akola District, Mhaispur, 2 ex *S. murinus*, 25.IX.1986, P.V. Mahadev, coll. GOA, 108 ex 8 *S. murinus*, 18.VIII.1983 to 17.II.1984, S. Fernandes, coll. GUJARAT, 1 ex *S. murinus*, 20.X.1984, S. Fernandes, coll.

Specimen examined : Paratype (B63034-11) on loan from M. Nadchatram : PAKISTAN, Lahore District, Paudoki, ex *Nesokia*, 26.IX.1962, R. Traub, coll.

Remarks : The above redescription is based on the original description, study of a paratype and the NIV specimens. Nadchatram and Traub (1966) consider this species close to *T. minor* Berlese 1905, separating it in having idiosoma of engorged specimen spherical (ovoid in *T. minor*), 8 dorsal setae in 1st posthumeral row (6 in *T. minor*), and lateral palpotibial seta lightly barbed (heavily barbed in *T. minor*). They point out that most Pakistani specimens were found embedded in the superficial layers of the dorsal skin of the hosts (invariably rodents and insectivores). They consider this an exceptionally interesting parasitope for a chigger belonging to a genus formerly considered to comprise only bat chiggers. The NIV specimens agree closely with the original description, but differ in having 2 pairs of eyes and Ip range slightly lower. The species name is based on the unusual parasitope of this chigger. The NIV specimens, however, were collected attached to, and not embedded beneath, the host skin.

12. *Trombicula schmitzi* (Oudemans)

Microtrombidium schmitzi Oudemans, 1914, 87; 1916, 18.

Trombicula schmitzi, Philip and Traub, 1950, 33; Womersley, 1952, 425; Prasad, 1974, 98.

Trombicula (T.) schmitzi, Wharton and Fuller, 1952, 70; Audy, 1954b, 147.

Redescription of species : Larva. Colour in life red.

Idiosoma : Measuring 500x530 in engorged specimen. Eyes 2/2. One pair of humeral setae; 40 dorsal idiosomal setae, measuring 50, arranged : 6-6-6-6-6-6-2-2; 2 pairs of sternal setae; 116 ventral setae; total idiosomal setae 162.

Gnathosoma : Palpal setal formula B/B/NNN/?; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Subpentagonal with anterior margin biconvex; lateral margins concave; posterior margin moderately deep beyond PL bases, caudally rounded; PL>AM>AL. Scutal measurements interpolated by Womersley (1952) after illustration (fig. 3A) of Oudemans (1916) : AW 58; PW 64; SB 21; ASB 28; PSB 24; AP 34; AM -; AL 28; PL 50; sens.-. In the illustration, AM is omitted and sensillae are broken off.

Legs : All 7-segmented, terminating in a pair of claws and a claw-like empodium. Number of ordinary and sensory setae not reported; but, coxa I-III unisetose. Leg measurements not recorded.

Type data : Holotype, MAHARASHTRA, Pune District, Khandala, 680m, ex 'bat', P. Assmuth, coll.; date of collection, and number of specimens not reported.

Type depository Holotype at RMNH.

Remarks : The above redescription is based only on the literature. Oudemans (1916) reports the presence of subcutaneous porous discs behind coxa III on each side. Womersley (1952) remarks that Oudemans (1916) does not clarify whether there is more than 1 type specimen, and adds that this species has not been recorded since the original description. Following Womersley's (1952) redescription, this species fits in the genus *Microtrombicula* (Nadchatram, personal communication). The precise taxonomic status of this species, however, remains uncertain, as several diagnostic characters have not been clarified. It is tentatively retained here in the genus *Trombicula*.

Genus *Blankaartia* Oudemans

Blankaartia Oudemans, 1911, 123; Vercammen-Grandjean, 1960, 469; 1968b, 61; Vercammen-Grandjean et al., 1973, 55; Vercammen-Grandjean and Kolebinova, 1985, 66; Nadchatram and Dohany, 1974, 59; Kolebinova and Vercammen-Grandjean, 1978, 102.

Trombicula (Tragardhula) Berlese, 1912, 4.

Trombicula (Blankaartia), Berlese, 1912, 96; Wharton and Fuller, 1952, 42.

Pentagonella Thor, 1936, 30.

Trombicula (Megatrombicula) Michener, 1946, 432.

Tragardhula, Womersley 1948, 83; 1952, 19.

Type species : *Trombidium niloticum* Tragardh, 1904 (adult, not larva), by original designation.

Diagnosis : Trombiculini larvae parasitic on birds and mammals. Gnathobase and coxae with cuticular striations. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium, onychotriches absent; 3 genualae I, genuala II and genuala III; tibiala III; mastitarsala III always present. Palpal tarsus 7B.S; palpal claw 3-pronged; strong cheliceral blade with tricuspid cap and dorsal subapical tooth; galeala N. Eyes 2/2, well developed. Scutum pentagonal with prominent acute or rounded posterior angle and anterolateral shoulders; scutal punctae simple; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; supernumerary scutal setae sometimes present; sensillae flagelliform with distal branches.

Remarks : Womersley (1948) throws some light on the complex history of the erection of this genus : Oudemans (1911) proposed the genus *Blankaartia* for *Trombidium niloticum*

Tragardh 1904 described from both larvae and adults found in association in large numbers on the leaves of an aquatic plant *Pistia stratiotes* on the White Nile. Tragardh's adult material was studied by Berlese (1912) who used the name *Tragardhula* as a subgenus of *Trombicula* (p. 4) and later in the same work (p. 96) adopted Oudemans' name *Blankaartia* also as a subgenus of *Trombicula*.

Thor (1936) raised the genus *Pentagonella* for those species of larval trombiculids with a pentagonal dorsal scutum and flagelliform sensillae. As type he designated *Trombidium ardeae* Tragardh 1904 from the White Nile.

The subgenus *Megatrombicula* was erected by Michener (1946) for 4 species of adult trombiculids from Central America. Womersley (1948) synonymized both *Pentagonella* and *Megatrombicula* with *Tragardhula*. Wharton and Fuller (1952) considered *Blankaartia* a subgenus of *Trombicula* Berlese, 1905, and *Tragardhula*, *Pentagonella* and *Megatrombicula* as synonyms of *Blankaartia*.

Vercammen-Grandjean (1960) proposed the subgenus *Megaciella* in the genus *Blankaartia* and Vercammen-Grandjean (1968b) has differentiated *Megaciella* from the nominate subgenus in having galeala B, tarsala I>>II and PL>PW (galeala N, tarsala I>II, and PL<PW in subgenus *Blankaartia*).

Vercammen-Grandjean and Kolebinova (1985) in their revision of the *Neotrombicula* complex, synonymized the subgenus *Megaciella* with the nominate subgenus *Blankaartia*. They draw attention to the similarity of *Heaslipia* Ewing, 1944, to *Blankaartia*, being distinguished by the presence of supernumerary scutal setae and a few other subgeneric differences. Hence, following Vercammen-Grandjean *et al.* (1973), they consider it only a subgenus of *Blankaartia*.

Two *Blankaartia* species are reported here from India, both in the nominate subgenus.

13. *Blankaartia (Blankaartia) nilotica* (Tragardh)

Trombidium niloticum Tragardh, 1904, 80 (adult, not larva).

Trombidium ardeae Tragardh, 1904, 83; Vercammen-Grandjean and Kolebinova, 1985, 66, synonymy.

Blankaartia nilotica, Oudemans, 1911, 123.

Trombicula (Tragardhula) nilotica, Berlese, 1912, 4.

Trombicula (Blankaartia) nilotica, Berlese, 1912, 96; Wharton and Fuller, 1952, 42.

Tragardhula nilotica, Womersley, 1948, 83; 1952, 315.

Blankaartia (Blankaartia) nilotica, Vercammen-Grandjean, 1968b, 61; 1973, 115; Vercammen-Grandjean and Kolebinova, 1985, 66.

Redescription of species : Larva.

Idiosoma : Measurements not reported. Eyes 2/2, adjacent to posterolateral angles of scutum. One pair of humeral setae; 28 dorsal idiosomal setae, measuring approximately 84, arranged : 6-4-8-6-4; 2 pairs of sternal setae; 20 ventral setae; total idiosomal setae 54.

Gnathosoma : Palpal setal formula B/B/NbB/?; palpal claw 3-pronged; galeala b; cheliceral blade with apical tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Pentagonal with PSB>ASB and SB slightly anterior to or level with PL bases; PL>>AM≥AL; sensillae flagelliform with branches on distal 1/2. Scutal measurements giving means and ranges of 4 specimens of *Trombidium ardeae* Tragardh, 1904, after Womersley (1948) : AW 74 (73-78); PW 88 (87-90); SB 32 (31-32); ASB 25, no variation recorded; PSB 42, no variation recorded; AP 28, no variation recorded; AM 62, no variation recorded; AL 61 (59-62); PL 84, no variation recorded; sens. 84 (80-89).

Legs : Similar to *B. acuscutellaris* (Walch, 1922) in the number of ordinary and sensory setae. Measurements not recorded.

Type data : Originally described from the adult : EGYPT, on the banks of the White Nile near Gebel Ahmed Aga, taken on the leaves of *Pistia stratiotes*, 20.III.1901, Swedish Zoological Expedition, coll.

Type depository : Vercammen-Grandjean (1973) reports the adult types from BM(NH) and the Stockholm Museum.

Additional records : Womersley (1948) reports the adult from India, taken on *Pistia*.

Remarks : This species was earlier known only from the adult stage. Tragardh (1904) described *Trombidium niloticum* from both larvae and adults found in apparent association and in large numbers on the leaves of an aquatic plant *Pistia stratiotes* on the White Nile. Womersley (1948) has pointed out that while the adults belong to the family Trombiculidae, the larvae do not, and the two stages described by Tragardh under this name cannot be associated. He has further suggested the possibility that *Trombidium ardeae* Tragardh, 1904, may be the larval stage of *B. nilotica*, as these larvae were collected from the legs of a heron *Ardea cinerea* from the same locality and on the same date as the *B. nilotica* adults. Womersley (1952) has redescribed the adult *B. nilotica* from the Indian specimen. Vercammen-Grandjean (1973) recounts the events related to the collection and description of this species. He confirms that the larvae earlier described as *Trombidium niloticum* by Tragardh (1904), possessing two median dorsal scuta, do not belong to the Trombiculidae, and proposes that the type species of the genus *Blankaartia* be represented by the adults of *nilotica*. Vercammen-Grandjean and Kolebinova (1985) in their revision of the *Neotrombicula* complex reiterate this proposal. On the basis of their unpublished studies of old material of Tragardh (Jagerskjöld's Nile expedition, 1901), they synonymize *Trombidium ardeae* Tragardh, 1904, with *Blankaartia nilotica*. Following this synonymy, the above redescription is tentatively presented, based only on the redescription of *ardeae* by Womersley (1948).

14. *Blankaartia (Blankaartia) acuscutellaris* (Walch)
(Fig. 18)

Trombicula acuscutellaris Walch, 1922, 536; 1923b, 78; Gater, 1932, 148; Mehta, 1937, 358; Radford, 1942, 58; 1946a, 48; Gunther, 1952, 17; Sen and Fletcher, 1962, 513.

Tragardhula acuscutellaris, Womersley, 1948, 85; 1952, 24; Prasad, 1974, 91.

Trombicula (Blankaartia) acuscutellaris, Wharton and Fuller, 1952, 43.

Blankaartia (Blankaartia) acuscutellaris, Vercammen-Grandjean, 1968b, 62.

Blankaartia acuscutellaris, Nadchatram, 1970b, 135; Nadchatram and Dohany, 1974, 59; Brown, 1992, 291.

Redescription of species : Larva. Colour in life red.

Idiosoma : Measuring 260 x 195 in unengorged specimen. Eyes 2/2, well-developed, on ocular plate. One pair of humeral setae, measuring 76-78; 24 dorsal idiosomal setae, measuring 65-76, arranged 6-6-6-4-2; 2 pairs of sternal setae, anterior 52; posterior 43; 10 preanal setae, 47-50; 10 postanal setae, 58-66; total idiosomal setae 50.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (47) with apical tricuspid cap and dorsal subapical tooth; gnathobase with cuticular striations, bearing a pair of branched setae.

Scutum : Densely punctate, pentagonal with anterolateral shoulders; anterior margin shallowly biconcave; posterior margin convex with posterior angle rounded; posterior scutal surface covered with cuticular striations; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL > AM > AL; sensillae flagelliform with distal 2/3 branched; PW/SD = 1.01-1.14. Ranges of scutal measurements of 20 specimens after Womersley (1948) : AW 70-84; PW 76-87; SB 28-34; ASB 28-31; PSB 42-45; AP 25-28; AM 50-56; AL 39-43; PL 76-85; sens. 84.

Legs : All 7-segmented, terminating in a pair of claws and a claw-like empodium; onychotriches absent. $lp' = 1177$. Leg I : 330-350; coxa with cuticular striations, bearing a branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (96x28) 21B, tarsala (22), microtarsala, subterminala, praterminala, pretarsala. Leg II : 312-392; coxa 1B, with cuticular striations; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (85x25) 16B, tarsala (15), microtarsala, petarsala. Leg III : 435; coxa 1B, with cuticular striations; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (104x20) 13B, nude mastitarsala (101).

Type data : Originally described from INDONESIA, Deli, Sumatra, ex *Rattus rattus diardi*.

Type depository : Gunther (1952) reports holotype larva deposited in BM(NH). Not traceable at present.

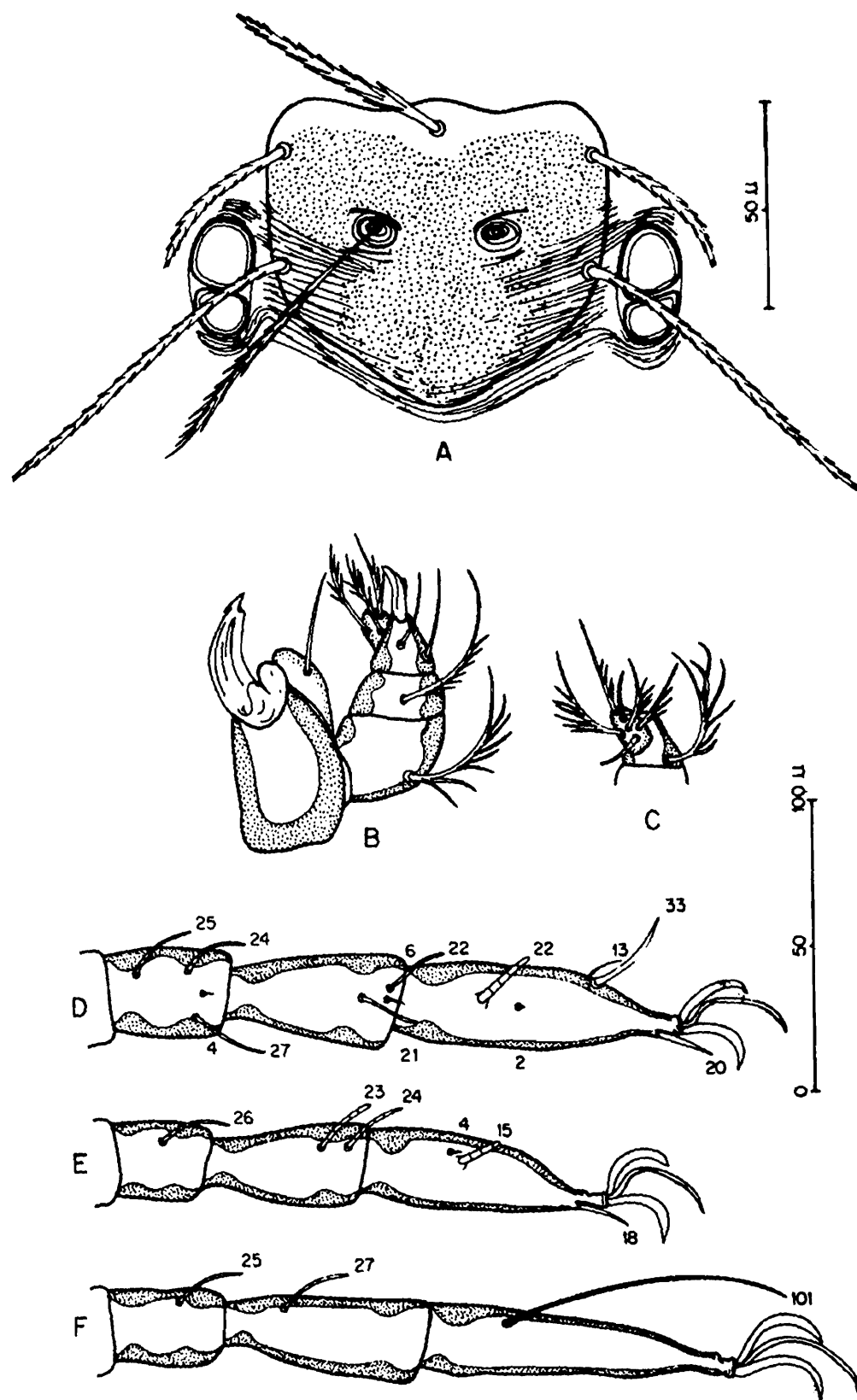


Fig. 18. *Blankaartia acuscutellaris*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Additional records : HIMACHAL PRADESH, Simla Hills, Kasauli and Sabathu, 11 ex *Rattus rattus*, XII.1935, D.R. Mehta, coll.

Material examined : A specimen (#82581) on loan from M. Nadchatram : MALAYSIA, Kuala Lumpur, Setapak, free living on water hyacinth, 2.XI.1966, IMR, coll.

Remarks : The above redescription is based on the literature and study of the Kuala Lumpur specimen. Wharton and Fuller (1952) and Womersley (1952) report this species to have a wide distribution in the Asiatic-Pacific region. It has not, however, been recorded in India since Mehta's collection in the Simla Hills (Mehta 1937). Nadchatram (personal communication) states that this larval species attacks man and causes severe dermatitis. It is a common species in Malaysia, infesting water-frequenting birds and rodents.

Genus *Chiroptella* Vercammen-Grandjean

Eltonella (*Chiroptella*) Vercammen-Grandjean, 1960, 469.

Leptotrombidium (*Chiroptella*), Vercammen-Grandjean, 1965, 35.

Chiroptella, Nadchatram, 1966, 20; Nadchatram and Dohany, 1974, 55; Vercammen-Grandjean, 1968b, 80; Vercammen-Grandjean and Langston, 1971, 447; 1976, 897.

Type species : *Trombicula insolli* Philip and Traub, 1950, by monotypy and original designation.

Diagnosis : Trombiculini larvae parasitic on bats. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; 2 genualae I, genuala II, 1 or 2 genualae III; femorala III present or absent. Palpal tarsus 7B or 7B.S; palpal claw 3-pronged; cheliceral blade broad, stout and strongly sclerotized, with tricuspid cap; galeala N, sometimes B. Eyes 2/2, or absent. Scutum subquadrate or subtrapezoidal; PL>AM and AL; sensillae flagelliform, branched on distal 1/2.

Subgenus *Chiroptella* Vercammen-Grandjean

Type species : *Trombicula insolli* Philip and Traub, 1950.

Diagnosis : 2 genualae III. Palpal tarsus 7B.S. Scutum with anterolateral shoulders; PL setae on posterolateral corners of scutum; PW> AW. Eyes 2/2. Neosomatic structure absent, or if present, poorly developed.

Remarks : Vercammen-Grandjean (1960) erected the subgenus *Chiroptella* in the genus *Eltonella* Audy, 1956, for a group of four species : *Trombicula insolli*, *Trombicula revelae* Audy, 1952, *Trombicula pierci* Ewing, 1931, and *Trombicula bandupi* Hiregaudar and Bal, 1956. He characterized this group as follows : Palpal tarsus 6B or 5B.S; subtrapezoidal scutum; galeala N; 3-pronged palpal claw; and 2 genualae I. Vercammen-Grandjean (1965) corrected the palpal tarsus to 7B and transferred the subgenus *Chiroptella* to the genus

Leptotrombidium Nagayo *et al.*, 1916. Nadchatram (1966), on the basis of his study of larval and nymphal characters, raised *Chiroptella* to generic rank. He also transferred the subgenus *Neosomia* Vercammen-Grandjean and Nadchatram, 1965, from the genus *Reidlinia* Oudemans, 1914, to *Chiroptella*, as it showed greater affinity to the latter in sharing the following characters : Palpal tarsus 7B or 7B. S; 2 genualae I and III; femorala III; and ASB/PSB ratio of scutum 3.0. Vercammen-Grandjean and Andre (1966) erroneously transferred the subgenus *Lorillatum* Nadchatram, 1963, from the genus *Leptotrombidium* to *Chiroptella*. They further proposed subgenus *Oudemansidium* in the genus *Chiroptella* characterized by palpal setal formula N/N/NNN/7B.S, and only 1 genuala III. Vercammen-Grandjean and Langston (1971) raised *Lorillatum* to generic status, redefining *Chiroptella* as comprising 3 subgenera: *Neosomia*, *Oudemansidium* and the nominate subgenus. Subsequently, Vercammen-Grandjean and Langston (1976) proposed a fourth subgenus *Willmannium*, characterized by galeala B, and femorala III absent.

Thus, there are 4 subgenera presently recognized in the genus *Chiroptella*. Two Indian species, one new to science, are reported here, both in the nominate subgenus.

15. *Chiroptella (Chiroptella) bandupi* (Hiregaudar and Bal)

Trombicula bandupi Hiregaudar and Bal, 1956b, 251; Domrow, 1962e, 44; Prasad, 1974, 92.

Leptotrombidium (Chiroptella) bandupi, Vercammen-Grandjean, 1965, 51

Chiroptella (Chiroptella) bandupi, Nadchatram, 1966, 20; Kudryashova, 1975, 1563; Vercammen-Grandjean and Langston, 1976, 898.

Redescription of species : Larva. Colour in life pale reddish white.

Idiosoma : Measuring 700-900 x 400-450 after original description. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 70 after Vercammen-Grandjean (1965); 40 dorsal idiosomal setae after original illustration and Vercammen-Grandjean (1965) (Original description : approximately 38), measuring 39-41 after table of standard measurements (but, 'in text' of original description : anterior rows measuring 58-64, posterior 48-50), arranged : 8-6-8-8-6-4 after original illustration and Vercammen-Grandjean (1965); 2 pairs of sternal setae; approximately 30 ventral setae after original description (Original illustration : 10 preanal and 20 postanal setae; Vercammen-Grandjean (1965) : 10 preanal setae, measuring 38; 30 postanal setae, measuring 47); total idiosomal setae 86 after original illustration and Vercammen-Grandjean (1965).

Gnathosoma : Palpal setal formula N/N/NNN/7B.S (Original description : palpal tarsus 5-6B); palpal claw 3-pronged; galeala N; cheliceral blade moderately long with tricuspid cap; gnathobase punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subtrapezoidal with anterolateral shoulders, posterior margin almost straight with PL corners extended; AM base slightly anterior to level of AL bases; SB slightly anterior to or level with PL bases; PL>>AM>AL; sensillae flagelliform, branched

on distal 1/2. PW/SD = 1.24-1.28. Scutal measurements of holotype and two paratypes after original description : AW 52,50,50; PW 76,70,70; SB 29,29,29; ASB 46,42,42; PSB 13,15,15; AP 43,42,41; AM 52,49,48; AL 46,43,40; PL 76,76, 73; sens. 80, 78,75. Scutal measurements after Vercammen-Grandjean (1965) : AW 51; PW 72; SB 29; ASB 43; PSB 14; AP 42; AM 50; AL 43; PL 74; sens. 80.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 930. Leg I : 330. Leg II : 300. Leg III : 300. Number of sensory setae after Vercammen-Grandjean (1965) : 2 genualae I, genuala II and 2 genualae III; femorala III and tibiala III.

Type data : Holotype and 5 paratypes, MAHARASHTRA, Bombay, Bandup, Tulsi lake tunnel, ex *Rhinolophus rouxi*, 20.X.1955, L.S. Hiregaudar and D.V. Bal, coll.

Type depository : Holotype and paratypes in author's collection at Dept. of Parasitology, Bombay Veterinary College (now Haffkine Institute) - not traceable at present.

Remarks : The above redescription is based only on the literature. Hiregaudar and Bal (1956b) compare *C. bandupi* to *C. insolli* (Philip and Traub, 1950), distinguishing it by the larger dimensions of PL setae, sensillae, AP, PW and SB (PL measuring 57-64, sens. 65-68, AP 35-36, PW 65-69 and SB 22-23 in *C. insolli*). Domrow (1962) described *C. niehoffi* from Laos, distinguishing it from *C. bandupi* in having 2 pairs of humeral and 10 dorsal body setae in the first posthumeral row.

Kudryashova (1975) has described *C. vavilovi* from Iran, separating it from *C. bandupi* by the absence of tibiala III, and the presence of mastitibiala III and mastitarsala III. *C. vavilovi* is further distinguished in having shorter setae (AL measuring 28-31, PL 62-67, dorsal body setae 31-50 and ventral setae 31-50), by the higher Ip (1058, with leg I : 372-378, leg II : 322, and leg III : 364-367), and other characters.

16. *Chiroptella (Chiroptella) hiregaudari* new species (Fig. 19)

Description of species : Larva.

Idiosoma : Measuring 508x304 in partially engorged holotype. Eyes 2/2, anterior larger, free on cuticle. One pair of humeral setae, measuring 55; 46 dorsal idiosomal setae, measuring 45-54, arranged : 8-8-2-8-8-6-4-2; 2 pairs of sternal setae, anterior 40, posterior 41; 14 preanal setae, 43; 20 postanal setae, 40-46; total idiosomal setae 86.

Gnathosoma : Palpal setal formula N/N/NNN/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade stout (tip broken off); gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Coarsely punctate, subtrapezoidal with anterolateral shoulders, posterior margin almost straight between PL bases, PL corners extended; AM base slightly anterior to level

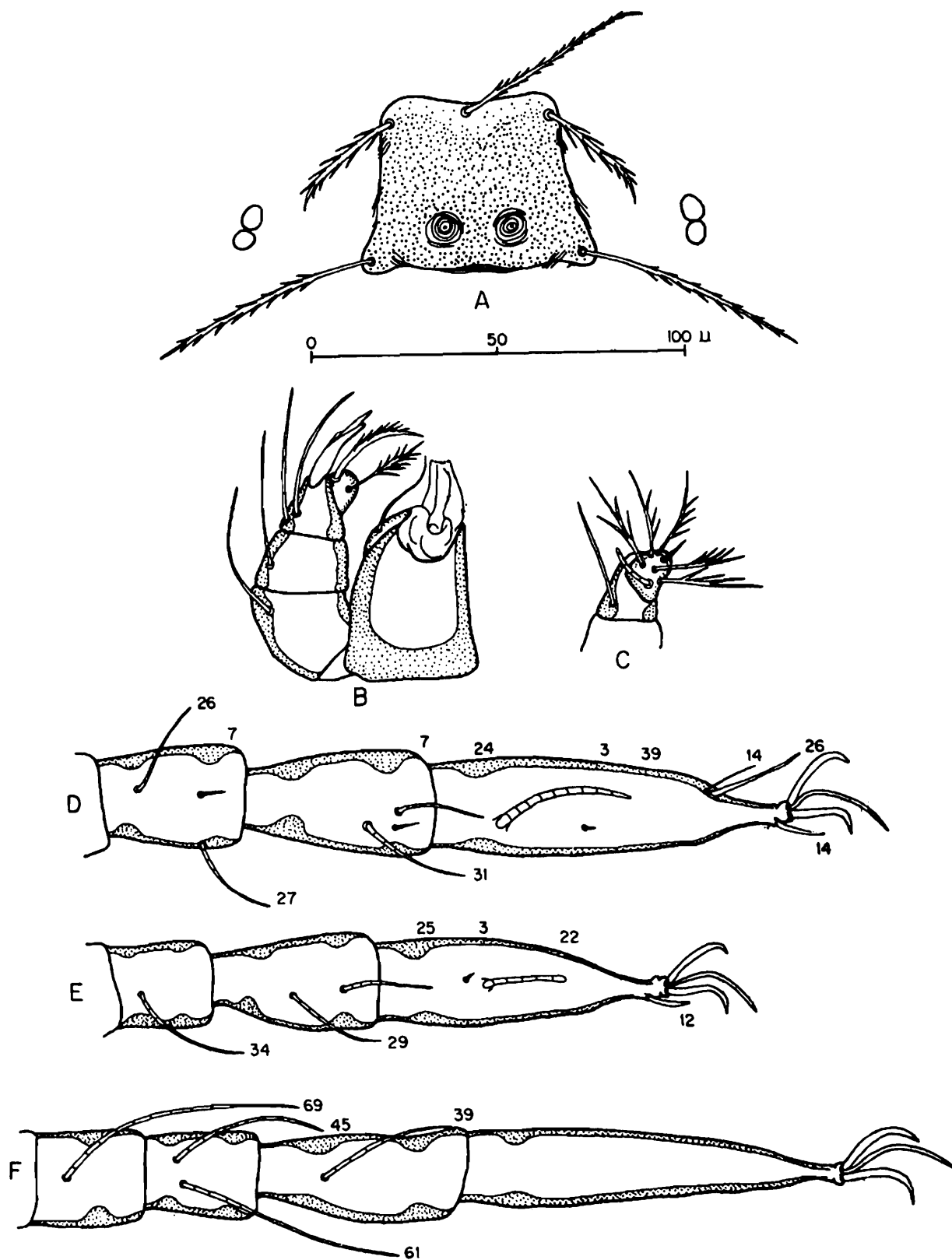


Fig. 19. *Chiroptella hiregaudari* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

of AL bases; SB anterior to level of PL bases; $PL > AM >> AL$; sensillae missing. $PW/SD = 1.31$. Scutal measurements of holotype: AW 45; PW 59; SB 19; ASB 34; PSB 11; AP 36; AM 52; AL 34; PL 65; sens. -.

Legs : All 7-segmented, terminating in a pair of claws and a claw-like empodium; onychotriches absent. $Ip = 974$. Leg I : 339; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (95x26) 21B, tarsala (39), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 301; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (78x24) 16B, tarsala (22) spoon-tipped, microtarsala, pretarsala. Leg III : 334; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B, mastifemorala (69); genu 2B, 2 mastigenualae (45, 61); tibia 6B, mastitibiala (39); tarsus (88x17) 15B (4-5 long whip-like setae).

Type data : Holotype (NIV AA57.1), ORISSA, Bhubaneshwar, Khandagiri, ex *Rhiopoma hardwickei*, 13.XI.1972, H.N. Kaul, coll.

Remarks : *C. hiregaudari* is close to *C. insolli* (Philip and Traub, 1950) and *C. vavilovi* Kudryashova, 1975. It may easily be separated from *C. insolli* in having $PL > AM >> AL$ ($PL > AM > AL$ in *C. insolli* with PL setae measuring 60, AM 45 and AL 42), fewer dorsal idiosomal setae (62 in *C. insolli*), and smaller ASB (measuring 48 in *C. insolli*). *C. hiregaudari* may be distinguished from *C. vavilovi* in having a lower Ip (1058-1067 in *C. vavilovi*), smaller PW (measuring 78 in *C. vavilovi*), and mastitarsala III absent (present in *C. vavilovi*).

C. hiregaudari is named in honour of Dr. L.S. Hiregaudar in recognition of his contribution to the study of bat chiggers in India.

Genus *Eutrombicula* Ewing

Eutrombicula Ewing, 1938, 293; Vercammen-Grandjean, 1960, 469, in part; 1968b, 64, in part; Vercammen-Grandjean and Audy, 1965, 280, in part; Vercammen-Grandjean and Langston, 1976, 943; Nadchatram and Dohany, 1974, 55; Brennan and Reed, 1974, 699; Brennan and Goff, 1977, 561; Domrow and Lester, 1985, 8, in part.

Type species : *Microthrombidium alfreddugesi* Oudemans, 1910, by original designation.

Diagnosis : Trombiculini larvae parasitic on mammals (including man), birds, and reptiles. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; 2 or 3 genualae I; mastitarsala III present. Palpal tarsus 7B.S; palpal claw 2-pronged, axial prong external; cheliceral blade long, with tricuspid cap; galeala N. Eyes 2/2, on ocular plate. Scutum subrectangular with anterolateral shoulders and convex posterior margin, sometimes with cuticular striations, SB widely set, sensillae flagelliform with distal barbs.

Remarks : Vercammen-Grandjean and Audy (1965), in a revision of the genus *Eutrombicula*

recognized the following 4 subgenera: *Eutrombicula* Ewing, 1938, *Siseca* Audy, 1956, *Novotrombicula* Womersley and Kohls, 1947, and *Blanciella* Vercammen-Grandjean, 1960. The latter 2 subgenera are currently regarded as independent genera. There are, however, conflicting opinions concerning the taxonomic status of *Siseca*. Vercammen-Grandjean (1968) and Domrow and Lester (1985) continue to regard *Siseca* as a subgenus of *Eutrombicula*. Nadchatram and Dohany (1974) and Brennan and Goff (1977), on the other hand, consider *Siseca* an independent genus, and admit no subgeneric distinction in the genus *Eutrombicula*. The latter view is followed here. Only one *Eutrombicula* species has been reported from India.

17. *Eutrombicula hirsti* (Sambon) (Fig. 20)

Trombicula hirsti Sambon, 1927, 157; 1928, 71; Hirst, 1929a, 24; 1929b, 451; Womersley, 1952, 82; Prasad, 1974, 96.

Trombicula (Eutrombicula) hirsti, Wharton and Fuller, 1952, 48; Audy *et al.*, 1953, 33; Chen and Hsu, 1957, 401.

Eutrombicula (Eutrombicula) hirsti, Womersley and Audy, 1957, 264; Vercammen-Grandjean and Audy, 1965, 283; Vercammen-Grandjean and Langston, 1976, 944.

Eutrombicula hirsti, Domrow, 1962c, 283; 1978, 76; Domrow and Lester, 1985, 9; Goff, 1979c, 340; 1982a, 552.

Trombicula hakei Radford, 1946b, 247; Womersley 1952, 84, **synonymy**.

Redescription of species : Larva.

Idiosoma : Measuring 320 x 210 in unengorged specimen. Eyes 2/2, anterior larger, on ocular plate, contiguous to posterolateral scutal margins. One pair of humeral setae, measuring 70; 18 dorsal idiosomal setae, measuring 51-59, arranged : 6-6-4-2; 2 pairs of sternal setae; 8-10 preanal setae, 31-43; 4 postanal setae, 52; total idiosomal setae 36-38.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S; palpal claw 2-pronged, axial prong external, longer; galeala N; cheliceral blade (45) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate with shallowly concave anterior margin and anterolateral shoulders; cuticular striations covering posterolateral margins; posterior margin shallowly biconvex; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.36-1.5. Scutal measurements of *T. hakei* type specimen after Radford 1946b, followed by measurements of a paratype after Womersley (1952) : AW 85, 95; PW 102, 110; SB 45, 43; ASB 34, 33; PSB 34, 48; AP 34, 39; AM 45, 58; AL 40, 55; PL 54, 70; sens. 65, 70. Scutal measurements of 12 specimens from CHINA, Kwangtung, Anpu, ex domestic fowls after Chen and Hsu (1957), giving means followed by ranges : AW

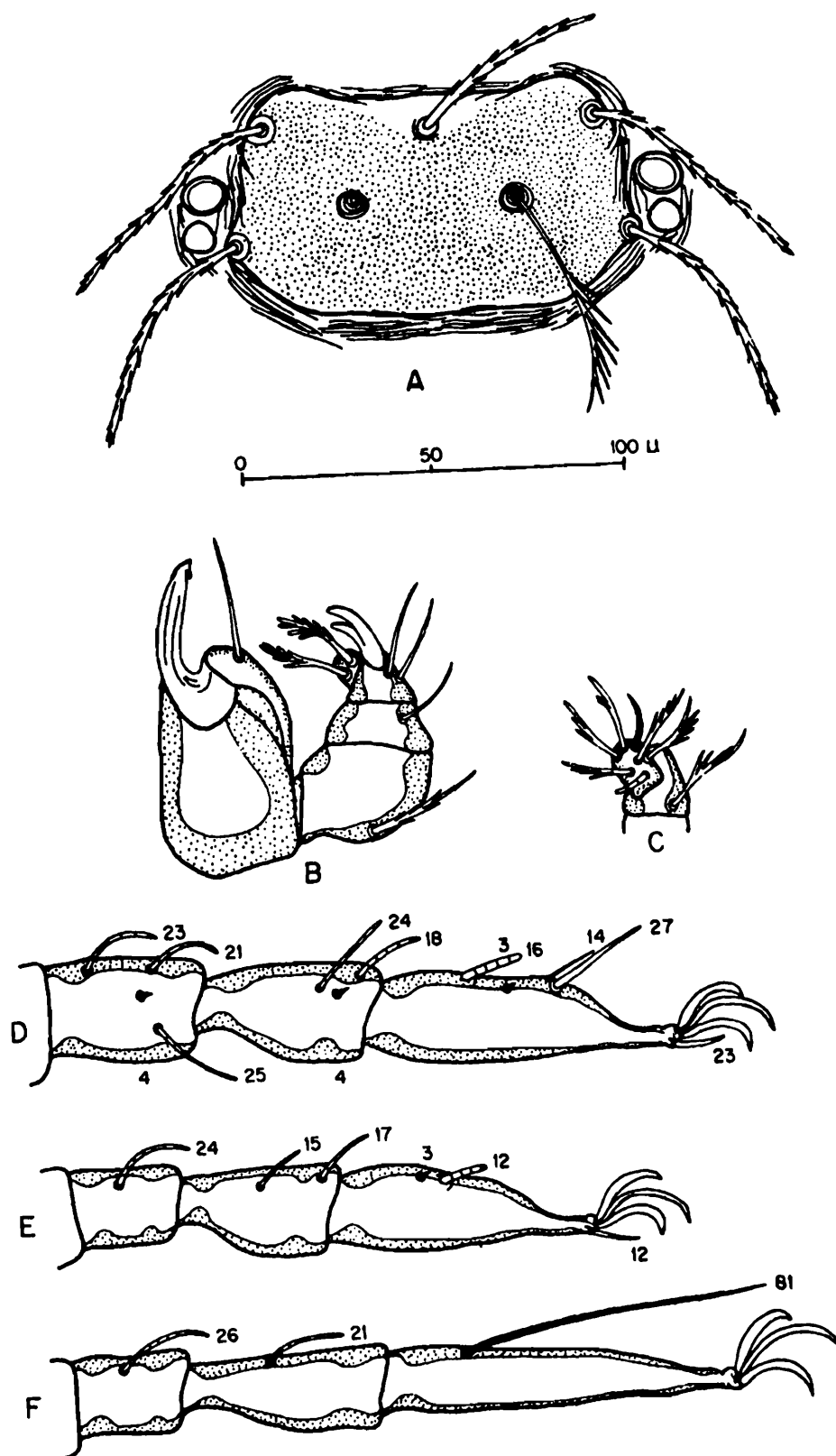


Fig. 20. *Eutrombicula hirsti*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

87, 82-92; PW 103, 98-109; SB 44, 39-47; ASB 31, 28-36; PSB 33, 31-36; AP 35, 31-40; AM 47, 43-51; AL 50, 45-56; PL 56, 51-62; sens. 56, 51-62.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip and leg measurements not recorded. Leg I : coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (76x21) 22B, tarsala (16), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : coxa 1B; trochanter 1B; basifemur B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (66x20) 16B, tarsala (12), microtarsala, pertarsala. Leg III : coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (86x15) 14B, mastitarsala (81).

Type data : Holotype and 2 paratypes, AUSTRALIA, North Queensland, Townsville, ex 'man', (collection date not reported), F.H. Taylor, coll.

Type depository : Holotype in BM(NH); paratypes in SAM.

Additional record : Radford (1946B) as *Trombicula hakei* : MANIPUR, Imphal, 3 ex *Coluber radiatus*, 10.V.1945, Sergeant J. Hake, coll.

Specimens examined : 3 specimens on loan from USNM. 2 paratypes labelled : "*Trombicula hakei* Radford - Manipur Imphal - *Coluber radiatus* - 10 May 1945 - C.D. Radford", both in poor condition. 1 specimen from PHILIPPINES labelled : "*Eutrombicula hirsti* (Sambon) - *Rattus rattus* - Mindoro, P.I. - June 8, 1945 - J.F. Cassel *et al.*"

Remarks : The above redescription is based on the literature and study of the USNM specimens. Womersley (1952) synonymized *Trombicula hakei* Radford, 1946, with *Eutrombicula hirsti*, considering it only a race or form of the latter. Audy *et al.* (1953) remark that this species may be more common in Manipur than is suggested by the solitary record, since the major hosts are birds and reptiles, and very few of these were examined in Manipur. They add, however, that this species may be here at the limit of its eastward distribution.

Eutrombicula hirsti is known to cause scrub-itch in man. Sambon (1927) considers this species very close to *E. wichmanni* (Oudemans, 1905), distinguishing it by the position of the eyes, the number and distribution of the idiosomal setae, and the branching of the palpal setae. *E. hirsti* has been named in honour of Stanley Hirst in appreciation of his excellent work as Acarologist at the BM(NH).

Genus *Fonsecia* Radford

Fonsecia Radford, 1942, 56; Audy, 1954b, 148; 1956b, 49; Brennan and Loomis, 1959, 53; Vercammen-Grandjean, 1960, 469; 1968b, 68; Vercammen-Grandjean *et al.*, 1973, 59; Nadchatram and Dohany, 1974, 54.

Trombicula, Womersley, 1952, 104.

Trombicula (Fonsecia), Wharton and Fuller, 1952, 51.

Type species : *Trombicula ewingi* Fonseca, 1932, by original designation.

Diagnosis : Trombiculini larvae parasitic on reptiles. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 3 genualae I, genuala II and III; tibiala III. Palpal tarsus 7B. S; palpal claw 2- or 3-pronged, usually stumpy; cheliceral blade with tricuspid cap; galeala N. Eyes 1/1 or 2/2. Scutum quadrate or subquadrate with anterolateral shoulders; posterior margin convex or biconvex; AL setae modified, broad and peglike; AM seta normal; PL setae modified or normal; sensillae flagelliform, with distal branches.

Remarks : The unusual modification of AL setae, led Radford (1942) to propose the genus *Fonsecia* for *Trombicula ewingi* Fonseca, 1932 and *T. travassosi* Fonseca, 1936. Womersley (1952) contended that *Fonsecia* could not be considered a valid genus till the postlarval stages were studied. Audy (1954b, 1956b) reinstated *Fonsecia* to generic status, and Rao and Hiregaudar (1955) and Brennan and Loomis (1959) concurred with this view.

Vercammen-Grandjean (1960) proposed a new subgenus *Subfonsecia* with *Eutrombicula gymnodactyla* Womersley and Kohls, 1947, as type species. Loomis (1966) erected the subgenus *Parasecia* for *Fonsecia* species of the Western hemisphere differing from the nominate subgenus in having normal AL setae, sinuous posterior scutal margin, and wide host range. Vercammen-Grandjean (1968b) makes reference to subgenus *Euneocula* (?), differing from the nominate subgenus in having sensillae branched from near the base. Vercammen-Grandjean *et al.* (1973) report seven *Fonsecia* subgenera : one with palpal tarsal setation 7B and six with 7B.S. Vercammen-Grandjean and Langston (1976) cite *Paraschoengastia* Vercammen-Grandjean, 1960, *Parasecia*, and *Fonsecula* Loomis, 1966, among the subgenera of *Fonsecia*. Brennan and Reed (1975), Brennan and Goff (1977) and Goff (1982f) have accorded *Parasecia* and *Paraschoengastia* full generic status. Two species have been reported from India, both in the nominate subgenus.

18. *Fonsecia (Fonsecia) coluberina* Radford (Fig. 21)

Fonsecia coluberina Radford, 1946b, 249; Audy *et al.*, 1953, 34; Rao and Hiregaudar, 1955, 210; Hiregaudar, 1958, 22; Brennan and Loomis, 1959, 53.

Trombicula coluberina, Womersley, 1952, 104; Prasad, 1974, 93.

Trombicula (Fonsecia) coluberina, Wharton and Fuller, 1952, 51.

Redescription of species : Larva.

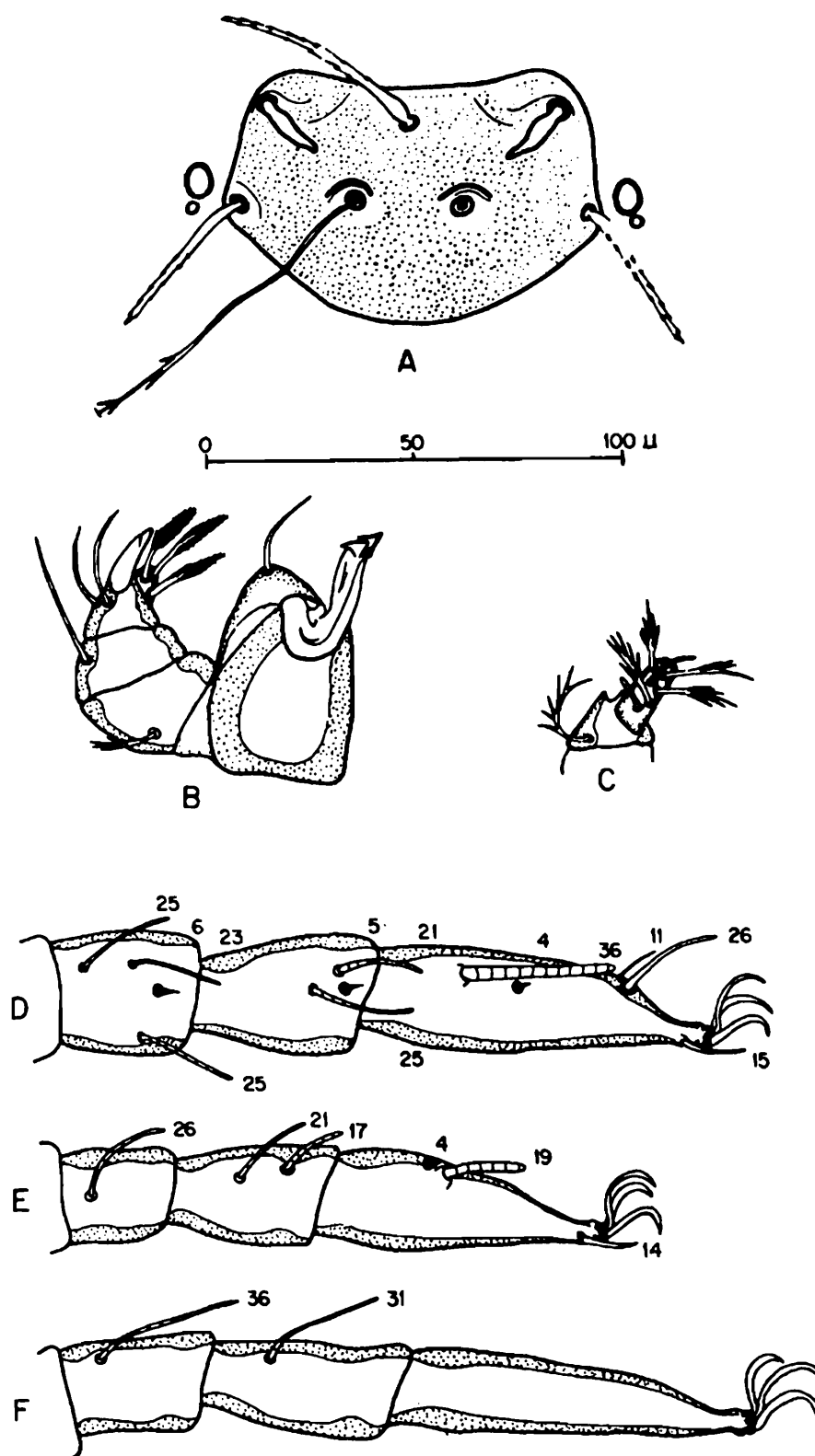


Fig. 21. *Fonsesia coluberina*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 365-475 x 260-360 in partially engorged specimens. Eyes 2/2, small, free on cuticle. Idiosomal setae with few, short barbs; one pair of humeral setae; 26-30 dorsal idiosomal setae, measuring 40-60, arranged : 6-8-6-6(4)-4(2), anterior setae with slight basal expansion; 2 pairs of sternal setae, setiform; 40 preanal setae, slightly expanded basally; 12 postanal setae, long, setiform; total idiosomal setae 84-88.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S; palpal claw stumpy, 2-pronged, axial claw internal; galeala N; cheliceral blade (36) with large blunt subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subpentagonal, with anterior margin shallowly biconcave and anterolateral shoulders; posterior margin deeply convex; AM base posterior to level of AL bases; SB anterior to level of PL bases; AL setae modified, short, peglike; AM and PL setae with slight basal expansion, having setiform stem bearing short barbs; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.30-1.38. Scutal measurements of 'holotype' after original description, followed by measurements of 'paratype' after Womersley (1952) and of 2 specimens after Brennan and Loomis (1959) : AW 68, 67, 67, 68; PW 83, 81, 86, 83; SB 26, 28, 26, 22; ASB 31, 25, 36, 35; PSB 29, 31, 30, 26; AP 26, 25, 26, 26; AM 51, 53, 48, 54; AL 20, 17, 14, 15; PL 51, 48, 44, 41; sens. 68, -, -, 84.

Legs : All 7-segmented, terminating in a pair of claw and a clawlike empodium; onychotriches absent. Ip = 870. Leg I : 300; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 6B, 2 tibialae, microtibiala; tarsus (81x24) 21B, tarsala (36), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 270; coxa 1B, with slight basal expansion; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (65x22) 16B, tarsala (19), microtarsala, pretarsala. Leg III : 300; coxa 1B, with slight basal expansion; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (81x16) 14B.

Type data : 'Holotype', MANIPUR, Imphal, ex *Elaphe radiata* (= *Coluber radiatus*), 10.V.1945, Sergeant J. Hake, coll.

Type depository : 'Holotype' in BM(NH).

Additional records : Specimens collected from type locality, ex *Naja naja* (= *Naja tripudians fasciatus*), 10.V.1945; and on type host on 3 subsequent occasions, after original description.

Specimens examined : 4 specimens on loan from USNM : 1. *Fonsecia coluberina* Paratype - Manipur, Imphal - *Coluber radiatus* - 10, May 1945 - C.D. Radford; 2. *Fonsecia coluberina* - Paratype #1573 USNM - Manipur, Imphal, 19, May 1945 - C. Radford - *Coluber radiatus*; 3. *Fonsecia coluberina* - *Naia tripudians fasciatus* - 19 May 1945 - C.D. Radford - A.P.II 24937; 4. *Fonsecia coluberina* #24937 - *Naia tripudians fasciatus* (a cobra) - Manipur, Imphal - May 19, 1945 - C.D. Radford.

Remarks : The above redescription is based on the literature and study of the USNM specimens. The original description is sketchy. Radford (1946b) has not designated a holotype, and the collection data lacks clarity. Womersley (1952) gives a more complete description based on the study of a 'paratype'. The redescription of Brennan and Loomis (1959) is based on the study of 2 specimens taken on *Naja naja* on 19.V.1945 (10.V.1945 in original description).

A single pair of eyes was observed in 'paratype' #1573 USNM, as illustrated (2 pairs, free on cuticle, have been reported in the literature). Brennan and Loomis (1959) record the position of SB as level with PL bases (anterior to PL bases in our study). They regard this species as closely related to *Fonsecia ptyasi* Rao and Hiregaudar, 1955, from which it may be separated by having eyes 2/2, and AM inserted slightly posterior to level of AL bases. The species name is derived from the type host.

19. *Fonsecia (Fonsecia) ptyasi* Rao and Hiregaudar (Fig. 22)

Fonsecia ptyasi Rao and Hiregaudar, 1955, 210; Hiregaudar, 1958, 22; Brennan and Loomis, 1959, 53; Prasad, 1974, 77.

Redescription of species : Larva.

Idiosoma : Measuring 500-660 x 380-450 in partially engorged to engorged specimens. Eyes 1/1, small, free on cuticle. Idiosomal setae with short, sparse barbs; one pair of humeral setae, measuring 47, with slight basal expansion; 30-34 dorsal idiosomal setae, measuring 40-52, arranged : (2+8)-10(8)-8(6)-4-4(2), anterior setae with slight basal expansion; 2 pairs of sternal setae, setiform; 36-40 preanal setae, 30-36, with slight basal expansion; 16-18 postanal setae, setiform, 47-52; total idiosomal setae 88-98.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S; palpal claw stumpy, 2-pronged, with accessory prong small, dorso-external, arising near tip of axial prong; galeala N; cheliceral blade (32-33) with apical tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subpentagonal, with anterior margin shallowly concave and anterolateral shoulders; posterior margin deeply convex; AM base slightly anterior to level of AL bases; SB anterior to level of PL bases; AL setae modified, short, peglike; AM and PL setae with slight basal expansion and setiform stem bearing short barbs; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.35-1.42. Scutal measurements of holotype after original description, followed by measurements of 'paratype' after Brennan and Loomis (1959) : AW 67, 74; PW 88, 92; SB 23, 25; ASB 38, 36; PSB 24, 32; AP 28, 28; AM 44, 43; AL 16, 15; PL 38, 36; sens. 68, 80.

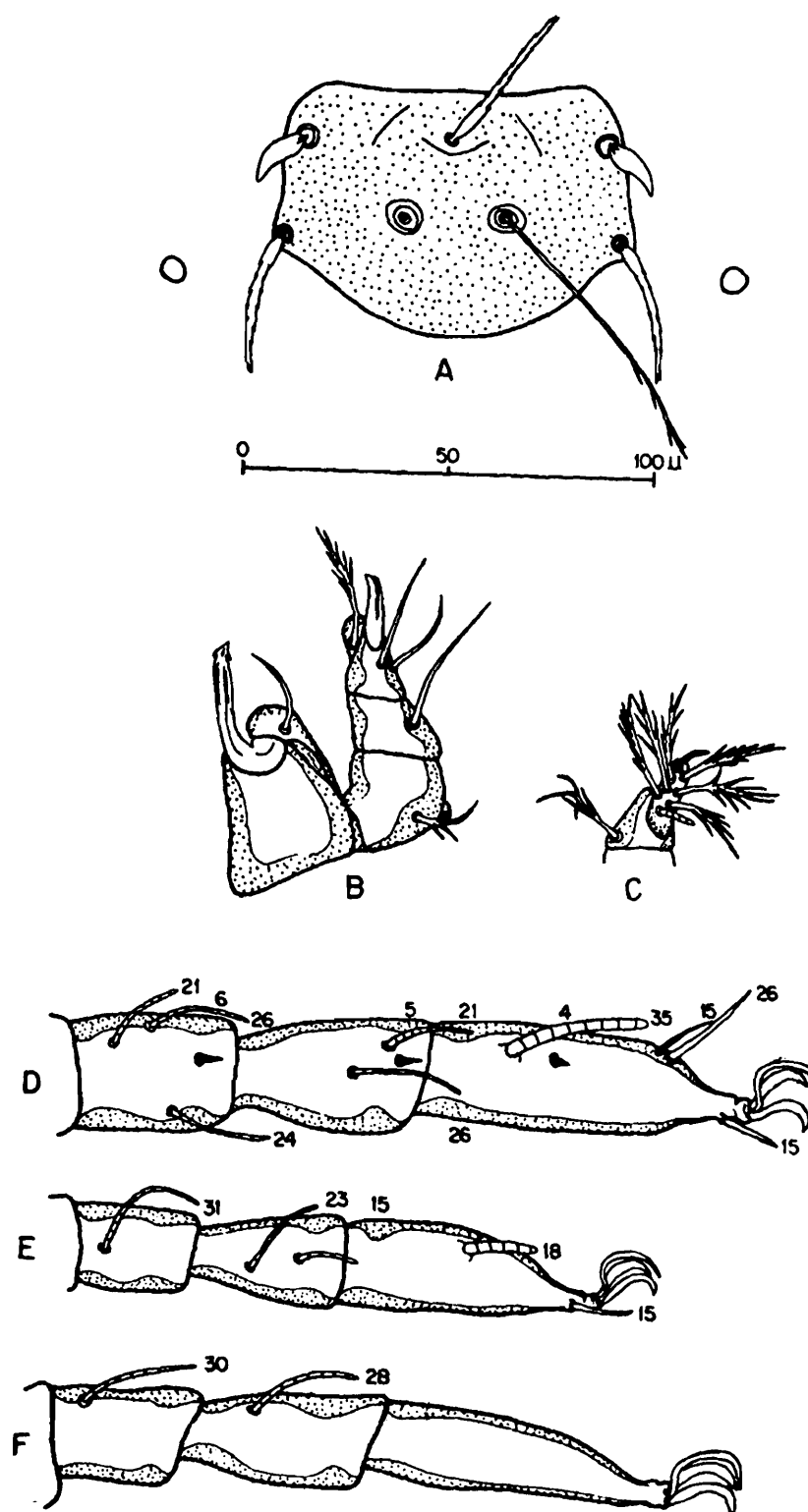


Fig. 22. *Fonsesia ptyasi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs Similar to *F. coluberina* Radford, 1946, in the number of ordinary and sensory setae. Measurements as follows : Ip = 915. Leg I : 324; tarsus (80x25), tarsala (35-40). Leg II : 266; tarsus (62x21), tarsala (18). Leg III : 325; tarsus (70x18).

Type data : Holotype, MAHARASHTRA, Bombay, Bombay Veterinary College (now Haffkine Institute) compound, ex *Ptyas mucosus*, VI.1953, S.R. Rao and L.S. Hiregaudar, coll. (10 specimens, presumably from type series, sent to Dr. Brennan; total number of type specimens not reported.)

Type depository : Holotype in Haffkine Institute - not traceable at present; 6 'paratypes' at USNM.

Material examined : 6 USNM specimens labelled : *Fonsecia ptyasi* Rao and Hiregaudar - #34516 - *Ptyas mucosus* - Bombay, India - Paratype.

Remarks : The above redescription is based on the literature and study of the 6 USNM 'paratypes' Rao and Hiregaudar (1955) distinguish *F. ptyasi* from *F. coluberina* by the single pair of eyes (2/2 in *F. coluberina*), intersensillary craters present anterior to AL setae and posterior to SB (absent in *F. coluberina*), and AM base anterior to level of AL bases (posterior in *F. coluberina*).

Brennan and Loomis (1959) separate *F. ptyasi* from *F. coluberina* by the single pair of eyes, greater number of setae in the first posthumeral row (6 in *F. coluberina*), more shallow scutum, AM seta anterior to level of AL bases, and SB anterior to level of PL bases.

In our study of *F. coluberina* ('Paratype' #1573 USNM), only a single pair of eyes has been observed. The intersensillary craters on the scutum of *F. ptyasi*, reported in the original description, have not been observed either by Brennan and Loomis (1959) or in our study. Our study has also shown that the difference in depth of PSB in the two species is not consistent. A point of distinction, not earlier cited, is the cheliceral blade with simple tricuspid cap in *F. ptyasi* (with large, blunt subapical tooth and tricuspid cap in *F. coluberina*).

The species name is derived from the type host.

Genus *Leptotrombidium* Nagayo *et al.*

Leptotrombidium Nagayo, Miyagawa, Mitamura and Imamura, 1916, 392; Vercammen-Grandjean, 1960, 469, in part; 1968b, 72, in part; Vercammen-Grandjean and Langston, 1971, 445, in part; 1976, 85, in part; Nadchatram and Dohany, 1974, 57, in part; Domrow and Lester, 1985, 26, in part.

Trombicula (*Leptotrombidium*), Audy, 1954, 141; Womersley and Audy, 1957, 254.

Mehracula Sinha, 1954, 329; 1957, 295, synonymy.

Montivagum Kudryashova, 1988, 58, new synonymy.

Leptotrombidium (*Hypotrombidium*), Vercammen-Grandjean, 1960, 469; Vercammen-Grandjean and Langston, 1976, 699; Nadchatram, 1984, 1107.

Leptotrombidium (*Ericotrombidium*), Vercammen-Grandjean and Andre, 1966, 64; Vercammen-Grandjean, 1968b, 72; Vercammen-Grandjean and Langston, 1971, 447; 1976, 737; Nadchatram, 1984, 1107.

Leptotrombidium (*Intertrombidium*), Vercammen-Grandjean and Langston, 1971, 446; 1976, 60, synonym of subgenus *Hypotrombidium* Vercammen-Grandjean, 1960.

Type species : *Trombicula akamushi* Brumpt, 1910, by monotypy and original designation.

Diagnosis : Trombiculini larvae parasitic on birds and mammals. Legs all 7-segmented; onychotriches absent; 2 genualae I; telofemur III 3B; mastisetæ absent. Palpal tarsus 7B or 7B.S; palpal claw 3 - (rarely 2-) pronged; galeala B (rarely N); cheliceral blade with tricuspid cap. Eyes 2/2. Scutum subrectangular with simple punctae; AM seta submarginal; AL setae marginal; sensillae flagelliform, branched distally.

Remarks : The genus *Leptotrombidium* is the largest single taxon of the family Trombiculidae. In a monumental work, Vercammen-Grandjean and Langston (1976) have presented a comprehensive review of the genus. Nadchatram (1984) reports 258 species and concurs in recognizing four subgenera in the genus. The distinction of subgenera, following Vercammen-Grandjean and Langston (1971), is based primarily on the variation in the palpal tarsal setation :

1. Subgenus *Leptotrombidium* Nagayo *et al.*, 1916 - comprising 174 species with type species *Trombicula akamushi* Brumpt, 1910; characterized by palpal tarsal setation 7B, branched dorsal paloptibial seta, and usually AM>AL.

2. Subgenus *Hypotrombidium* Vercammen-Grandjean, 1960 - comprising 15 species with type species *Eutrombicula subquadrata* Lawrence, 1951; characterized by palpal tarsal setation 7B, nude dorsal palpotibial and barbed palpofemoral setae, and usually AL> AM.

3. Subgenus *Ericotrombidium* Vercammen-Grandjean and Andre, 1966 - comprising 32 species with type species *Leptotrombidium galliardi* Vercammen-Grandjean and Taufflieb, 1959; characterized by palpal tarsal setation 7B.S, nude dorsal palpotibial and branched palpofemoral setae, and usually AL>AM.

4. Subgenus *Trombiculindus* Radford, 1948 - comprising 37 species with type species

Trombiculindus squamosus Radford, 1948; characterized by palpal tarsal setation 7B, branched dorsal palpotibial seta (if nude, all palpal setae nude), and shafts of PL and dorsal body setae expanded or foliate (at times, some postanal setae also modified).

Vercammen-Grandjean and Langston (1976) reported several combinations of the palpal setal formula representative of the subgenera. The study of the NIV material has revealed novel variations of this formula. One such, N/N/NNB/7B.S, reveals the inadequacy of this character as a basis for subgeneric classification in the genus. Nadchatram (1970c) deems the subgeneric distinction on the basis of palpal tarsal setation 7B or 7B.S inadvisable, as it results in an artificial separation of phylogenetically related species within the genus. Hence, there is evidently a pressing need for a revision of the subgeneric arrangement in the *Leptotrombidium*. Tentatively, 2 subgenera are recognized : *Ericotrombidium* and the nominate subgenus. The subgenus *Hypotrombidium* Vercammen-Grandjean, 1960, is considered a synonym of subgenus *Leptotrombidium*; while, *Trombiculindus*, following Goff (1987), is accorded independent generic status.

Domrow and Lester (1985) have included *Toritrombicula* Sasa, 1954, as a subgenus of *Leptotrombidium*. This taxon is of no concern in this study; and their redefinition of the genus *Leptotrombidium* is not followed here. Kudryashova (1988) has proposed the genus *Montivagum* with type species *Leptotrombidium latum* Schluger and Kudryashova, 1969, comprising seven species. The proposed genus basically constitutes the *abidi* group of Vercammen-Grandjean and Langston (1976). The diagnostic characters defining this genus do not warrant even subgeneric separation. Hence, *Montivagum* Kudryashova, 1988, is considered a synonym of subgenus *Leptotrombidium*.

The vectors of chigger-borne rickettsiosis all belong to the genus and subgenus *Leptotrombidium*. Goff (1984b) lists 11 nominal species which may be involved in the transmission of the disease to man. Of these, only *L. deliense* (Walch, 1922), the most widely distributed vector species, has been reported from India. Vercammen-Grandjean and Langston (1976) and Nadchatram (1984) confirm that the distribution of another important vector species, *L. akamushi*, is restricted to Japan. Hence, earlier records of this species from India are misidentifications. Vercammen-Grandjean and Langston (1976) have described *L. imphalum* and *L. pseudofulmentum*, which they state were previously misidentified as *L. deliense*. Thus, 13 nominal species may currently be recognized as vectors of chigger-borne rickettsiosis, three from India.

Nadchatram (1984) establishes the Oriental region as the centre of development of the subgenus *Leptotrombidium*, where 116 (approximately 67%) of the known species have been recorded. This study confirms his views. 55 *Leptotrombidium* species are reported here from India, 9 new to science: 43 in the subgenus *Leptotrombidium* with 5 new species and 3 new combinations; 12 in the subgenus *Ericotrombidium* with 4 new species and 2 new combinations. Two new synonyms have been established and 1 subspecies elevated to full species.

20. *Leptotrombidium (Leptotrombidium) baltalense* Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) baltalense Vercammen-Grandjean and Langston, 1976, 595.

Redescription of species : Larva.

Idiosoma : Measurements not reported. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 57-59; 92 dorsal idiosomal setae, measuring 34-53, arranged : (8+14+8)-12-10-14-10-8-6-2; 2 pairs of sternal setae; 46 preanal setae, 31; 18 postanal setae, 48-50; total idiosomal setae 162.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly concave, sinuate; posterior margin deeply convex, medially tuncate; AM base posterior to level of AL bases; SB level with PL bases; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.69-1.75. Scutal measurements of holotype and paratype after original description : AW 80, 82; PW 88, 91; SB 33, 35; ASB 31, 33; PSB 21, 19; AP 32, 32; AM 50, 51; AL 47, 49; PL 55, 54; sens. 90, -.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 924-942. Leg I : 313-324; coxa 1B; trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus 33B, tarsala, microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 276-286; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 19B, tarsala, microtarala, pretarsala. Leg III : 332-335; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus 17B.

Type data : Holotype (#23766), JAMMU and KASHMIR, Baltal, ex *Alticola roylei*, X.1949, S.L. Kalra, coll.; 1 paratype (#10130), same data, but ex 'mouse', taken IX.1948.

Type depository : Holotype and paratype in SAM.

Remarks : The above redescription is based only on the original description. *L. baltalense* runs to couplet 21 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They distinguish *L. baltalense* from all other species of the subgenus in having peditarsal setation : 33-19-17, instead of the usual 21(22)-16-15. Vercammen-Grandjean and Langston describe *L. baltalense* as a very large species with Ip 924-942 and body setae numbering 160-166. They consider its scutum similar to that of *L. abidi* Traub and Nadchatam, 1967, but larger and more densely punctate. The body setae are strongly barbed, giving the species a very different appearance from others in the *abidi* group. The type specimens of *L. baltalense* were among Womersley's material labelled *Trombicula tithwalensis* Womersley, 1952. The species name has been derived from the type locality.

21. *Leptotrombidium (Leptotrombidium) bhimtalense* (Womersley)

Trombicula (?*Leptotrombidium*) *bhimtalensis* Womersley, 1952, 60.

Leptotrombidium bhimtalensis, Radford, 1954, 260.

Trombicula (Leptotrombidium) bhimtalensis, Womersley and Audy, 1957, 296.

Trombicula bhimtalensis, Prasad, 1974, 92.

Leptotrombidium (Leptotrombidium) bhimtalense, Vercammen-Grandjean and Langston, 1976, 407.

Redescription of species : Larva.

Idiosoma : Measuring 665x560 in engorged holotype. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 63; 30 dorsal idiosomal setae, measuring 48-52, arranged : 10-8-6-4-2; 2 pairs of sternal setae, missing, but represented by setal bases in holotype; approximately 20 ventral setae, 35; (Vercammen-Grandjean and Langston (1976) : 24 preanal setae, 33; 10 postanal setae, 48-61); total idiosomal setae approximately 56.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged (Original description : 2-pronged); galeala B; cheliceral blades broken off in holotype; gnathobase moderately punctate, setae missing in holotype, represented by a pair of setal bases.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex, medial concavity pronounced. AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; PL>AL>AM; sensillae missing in holotype; PW/SD = 1.86-1.93. Scutal measurements of unique holotype after original description, followed by measurements after Vercammen-Grandjean and Langston (1976) : AW 70, 71; PW 83, 82; SB 35, 34; ASB 30, 31; PSB 13, 13; AP 29, 28; AM 32, 33; AL 42, 48; PL 48, 63; sens. -, -.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description, followed by measurements after Vercammen-Grandjean and Langston (1976) : Ip = 750, 754. Leg I : 240, 260. Leg II : 240, 232. Leg III : 270, 262.

Type data : Holotype, UTTARANCHAL, Kumaon Hills, Bhimtal, ex 'shrew', 10.X.1946, S.L. Kalra, coll.

Type depository : Holotype at SAM.

Remarks : The above redescription is based only on the literature. *L. bhimtalense* falls out at couplet 40 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. peromysci*, a new species they have described. They distinguish *L. bhimtalense* in having posterior scutal margin with deep medial concavity (less marked concavity in *L. peromysci*), higher Ip (698-720 in *L. peromysci*), and greater number of body setae (58-60 in *L. peromysci*). Womersley (1952) and Womersley and Audy

(1957) mention a unique type specimen of *L. bhimtalense*. Vercammen-Grandjean and Langston apparently contradict this in reporting that the original description by Womersley involved three slides with the same date of collection and locality data, collected by S.L. Kalra : 1. the slide marked "Type", which they have used in their redescription; 2. a slide marked "Paratype A" containing 2 specimens collected from a rat which they consider a new subspecies *L. delimushi kumaoense*; 3. a slide marked "Paratype B" containing a specimen collected from a shrew, which they have described as a new species *L. mirum*. They describe the humeral, dorsolateral and postanal setae as having 3 rows of 7-8 strong spikelike barbs; the other dorsal setae as having 5-7 barbs; and the preanal, 2 rows of 5 of the same kind of barbs. The species name has been derived from the type locality.

22. *Leptotrombidium (Leptotrombidium) burmense* (Ewing)

Trombicula burmensis Ewing, 1945b, 63; Prasad, 1974, 93.

Trombicula (Leptotrombidium) burmensis, Womersley, 1952, 74; Audy *et al.*, 1953, 27; Womersley and Audy, 1957, 255.

Trombicula (Trombicula) burmensis, Wharton and Fuller, 1952, 63.

Leptotrombidium burmensis, Radford, 1954, 260.

Leptotrombidium (Leptotrombidium) burmense, Traub and Lakshana, 1966, 288; Upham and Nadchatram, 1968, 199; Vercammen-Grandjean, 1968b, 74; Vercammen-Grandjean and Langston, 1976, 486; Nadchatram, 1970b, 134.

Trombicula burmansis, sic! Davis *et al.*, 1947, 275.

Redescription of species : Larva.

Idiosoma : Measuring 290-400 x 227-340 in unengorged to partially engorged specimens (Original description : 830 x 440 in engorged specimen). Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 75-78; 26-28 dorsal idiosomal setae, measuring 58-78, arranged : 8-6-6-4(6)-2; 2 pairs of sternal setae; 26-30 preanal setae, 36-37, 4-6 postanal setae, 56-61; total idiosomal setae 64-68.

Gnathosoma : Palpal setal formula B/B/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (38) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly convex, medially truncate; AM base posterior to level of AL setae; SB level with or slightly posterior to level of PL bases; PL > AM >> AL; sensillae flagelliform with basal barbs and branches on distal 4/5; PW/SD = 1.58-1.68. Scutal measurements giving means of 5 Imphal specimens after Womersley (1952) : AW 70; PW 79; SB 34; ASB 31; PSB 15; AP 27; AM 60; AL 47; PL 71; sens. 70. Scutal measurements giving means and ranges of holotype and 4 topotypes after Traub and Lakshana (1966), followed by measurements of

holotype and means of 3 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 70, 67-73 (69, 71); PW 79, 76-82 (79, 79); SB 34, 32-36 (33, 33); ASB 34, 33-35 (31, 31); PSB 15, 14-16 (16, 16); AM 62, 61-63 (62, 62); AL 49, 48-50 (50, 48); PL 74, 73-75 (71-73); sens. 74, 72-76 (-, 79).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after Traub and Lakshana (1966) : Tarsus I (59x26), tarsala (22). Tarsus II (50x25), tarsala (15). Tarsus III (60x23). Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 810, 816. Leg I : 281, 287; tarsala (26). Leg II : 246, 246; tarsala (17). Leg III : 283, 283.

Type data : Holotype (USNM #1484) and 8 paratypes, BURMA, Ting Kawk, ex *Rattus rattus brunneusculus*, 14,18,29.VI.1944, H.S. Fuller, coll.

Type depository : Holotype at USNM; paratypes at USNM and H.S. Fuller collection.

Additional records : MANIPUR, Imphal, 5 ex *Rattus rattus bullocki*, 26.X.1945, STRU, coll.; 1, same data, but ex 'unknown host', taken 16.IX.1945. ASSAM, Stilwell Road, 12 mile mark, 2 ex *Rattus rattus*, 1946, USATC, coll.

Remarks : The above redescription is based only on the literature. *L. burmense* runs to couplet 5 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976), along with *L. muridium* (Womersley, 1952) in having palpal formula B/B/BN. They distinguish *L. burmense* in having microtarsala I proximal to tarsala I (distal in *L. muridium*), Ip = 798-822 (651-659 in *L. muridium*), and total body setae numbering 64-70 (58-62 in *L. muridium*). Traub and Lakshana (1966) have described a new species *L. elisbergi*, which they consider close to *L. burmense*. They distinguish *L. burmense* in having lateral palpotibial seta nude (barbed in *L. elisbergi*), preanal setae approximately 28 in number (< 20 in *L. elisbergi*), and PL > AM (PL > AM in *L. elisbergi*). Upham and Nadchatram (1968) separate *L. burmense* from *L. muridium* by the scutal shape and dimensions. The species name has been derived from the type locality.

23. *Leptotrombidium* (*Leptotrombidium*) *dehradunense* new species (Fig. 23)

Leptotrombidium (*Ericotrombidium*) sp. E Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 276x198 in partially engorged holotype. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 50-52; 46-52 dorsal idiosomal setae, measuring 40-43, arranged : 8-6(4)-10-10(8)-10(8)-6-2; 2 pairs of sternal setae, anterior 32-44, posterior 29-31; 30-32 preanal setae, 26-30; 12-14 postanal setae, 32-44; total idiosomal setae 96-102.

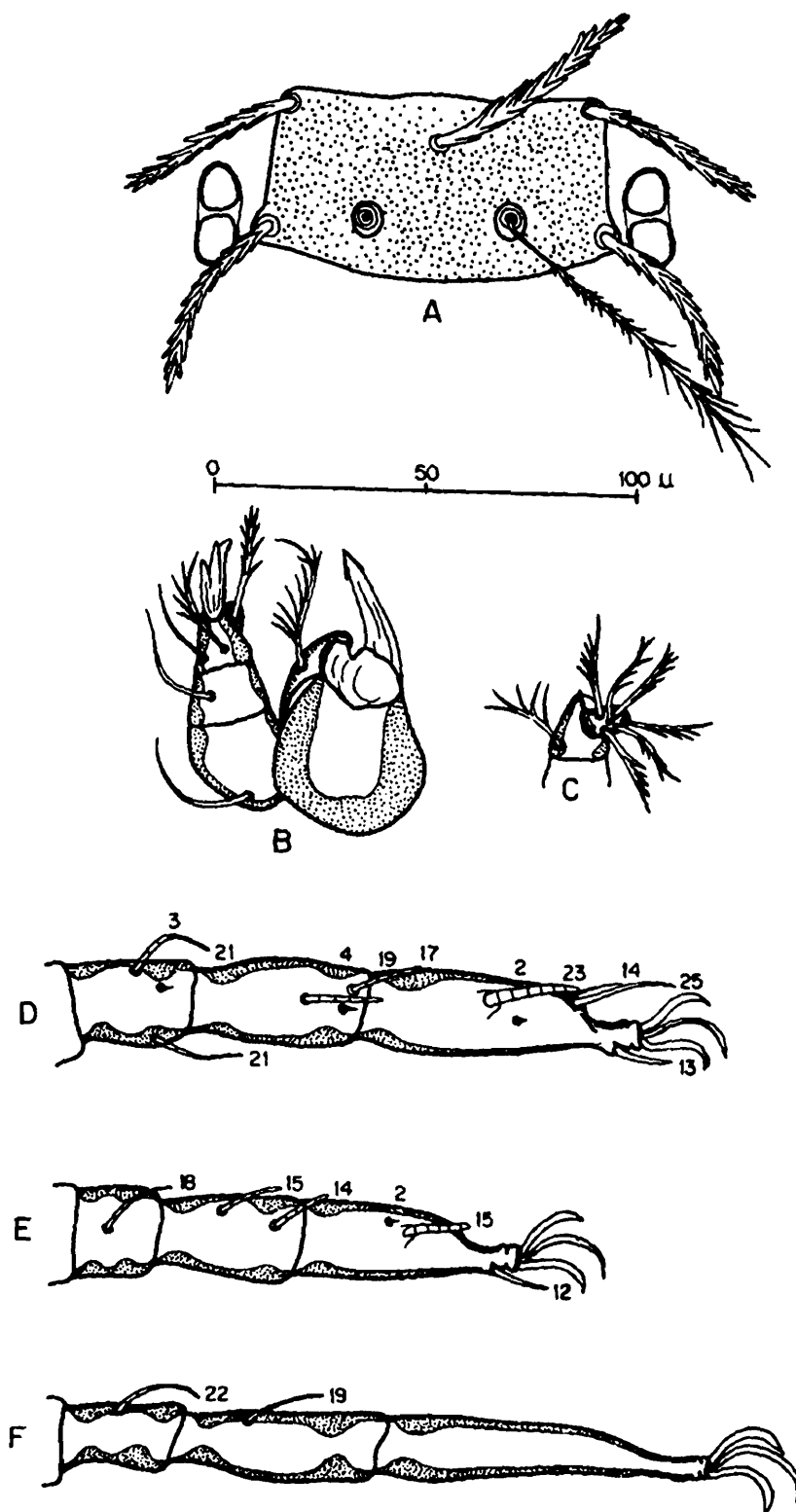


Fig. 23. *Leptotrombidium dehradunense* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula N(f)/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (37) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly convex; AM base posterior to level of AL bases; SB anterior to level of PL bases; AM>PL>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.92-2.12. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 73 (76, 69-83); PW 82 (90, 79-105); SB 35 (34, 32-38); ASB 29 (29, 27-30); PSB 17 (17, 15-19); AP 30 (30, 29-32); AM 53 (54, 53-55); AL 45 (43, 39-45); PL 48 (48, 47-50); sens. 75 (75, 71-80).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation: 22-16-15. Measurements as follows : Ip = 740-790. Leg I : 254-274; tarsus (64x20), tarsala (23). Leg II : 216-232; tarsus (51x18), tarsala (15). Leg III : 270-291; tarsus (78x14).

Type data : Holotype (NIV A81599.21) and 9 paratypes, UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, ex *Rattus gangutrianus*, 28.X.1967, NIV, coll.

Additional records : 6 records from the Himalayan region by NIV field teams : 12, same data as holotype; 15, same data, but ex 4 *R. gangutrianus*, taken 28,29.X.1967; 1, same data, but ex *Bandicota bengalensis*, taken 28.X.1967.

Remarks : *L. dehradunense* will fall out at couplet 25 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976), along with *L. abidi* Traub and Nadchatram, 1967, and *L. latum* Schluger and Kudryashova, 1969. *L. dehradunense* may easily be separated in having AM>PL>AL (PL>AL>AM in other 2 species), and greater number of body setae (72-74 in *L. abidi* and 82-88 in *L. latum*). *L. dehradunense* may further be distinguished from *L. abidi* in having posterior scutal margin shallowly convex (deeply convex in *L. abidi*), and from *L. latum* in having 1 pair of humeral setae (2 pairs in *L. latum*). Fernandes *et al.* (1988) inadvertently reported this species in the subgenus *Ericotrombidium*. The species has been named after the type locality.

24. *Leptotrombidium (Leptotrombidium) deliense* (Walch)

(Fig. 24)

Trombicula deliensis Walch, 1922, 554; Mehta, 1937, 353; 1948, 159; Krishnan *et al.*, 1949a, 39; 1949b, 41; 1949c, 63; Kalra, 1952, 569; Kalra and Rao, 1949, 378; 1951, 297; Traub, 1949, 361; Audy and Harrison, 1954, 21; Ramachandran, 1954, 184; Sen and Fletcher, 1962, 553; Prasad, 1974, 94.

Trombicula (Leptotrombidium) deliensis, Womersley, 1952, 62; Wharton and Fuller, 1952, 52; Audy *et al.*, 1953, 27; Womersley and Audy, 1957, 255.

Leptotrombidium (Leptotrombidium) deliense, Vercammen-Grandjean, 1968b, 74; Vercammen-Grandjean and Langston, 1976, 239; Traub and Nadchatram, 1967a, 1; Traub *et al.*, 1967, 38; Wattal *et al.*, 1967a,

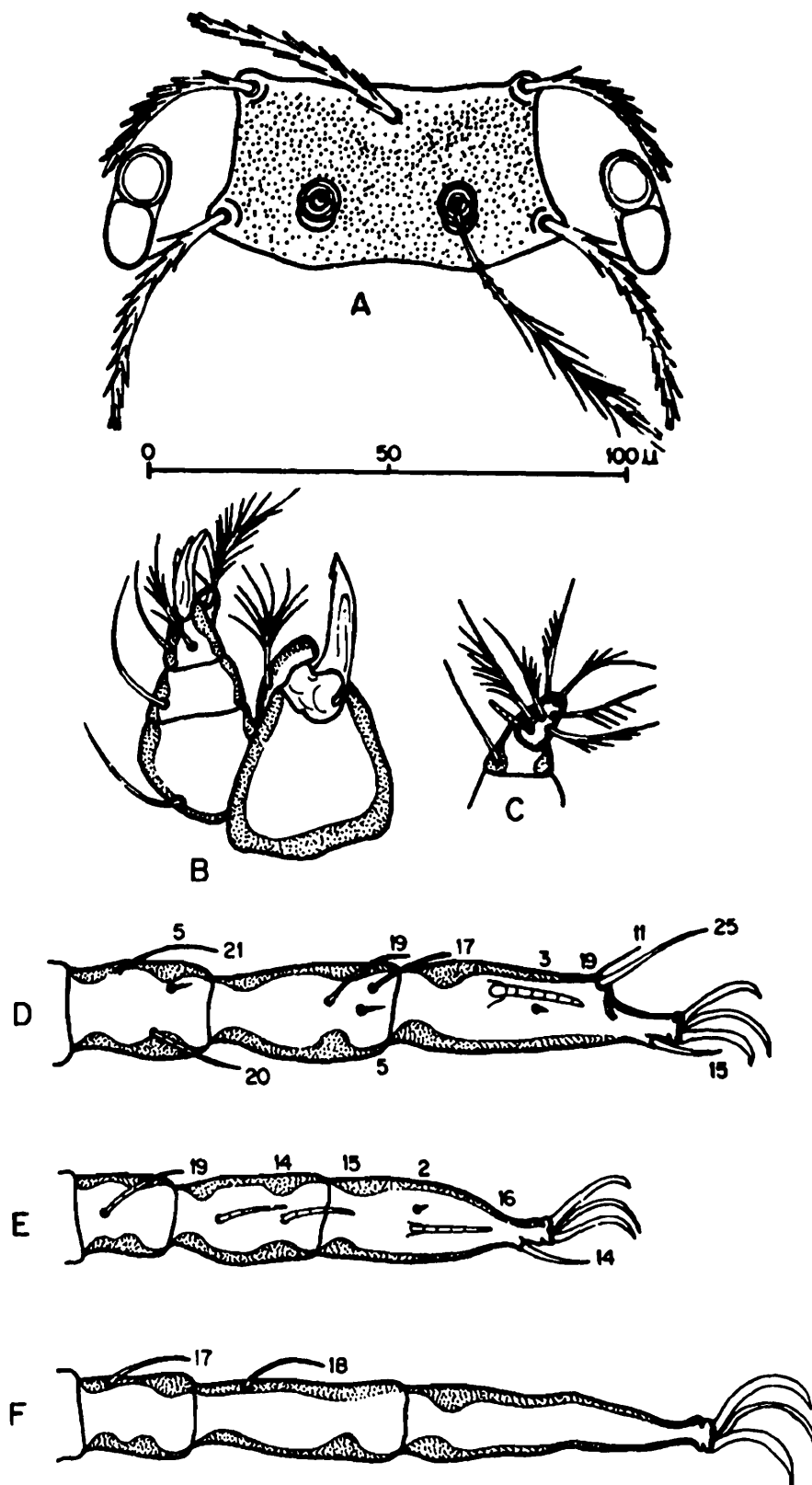


Fig. 24. *Leptotrombidium deliense*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

352; 1967b, 366; Nadchatram, 1970c, 148; Varma and Mahadevan, 1971, 817; 1972a, 211; 1972b, 635; Kochhar, 1972, 137; Kaul *et al.*, 1978, 22; not Kulkarni, 1979, 18; not Kulkarni *et al.*, 1979, 10; Saxena, 1983, 290; Domrow and Lester, 1985, 27.

Leptotrombidium deliense, Varma, 1969b, 1228.

Redescription of species : Larva.

Idiosoma : Measuring 232-290 x 184-230 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 46-58; 26 dorsal idiosomal setae, measuring 38-58, arranged : 8-6-6-6-4-2; 2 pairs of sternal setae, anterior 46-51, posterior 34-37; 14-16 preanal setae, 27-33; 6-8 postanal setae, 34-52; total idiosomal setae 52-54.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex, posterolateral corners rounded; AM base posterior to level of AL base; SB anterior to level of PL bases; PL = AM > AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.62-1.75. Scutal measurements of lectotype and mean of 4 paralectotypes followed by means and ranges of 100 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 58, 58 (60, 55-66); PW 68, 70 (70, 64-78); SB 27, 29 (28, 26-31); ASB 28, 28 (26, 24-30); PSB 14, 14 (14, 12-15); AP 27, 31 (27, 24-30); AM 50, 50 (50, 44-59); AL 44, 40 (39, 34-46); PL 50, 50 (51, 44-58); sens. -, 68 (70, 62-80). Scutal measurements giving means and ranges of 10 NIV specimens : 60, 56-66; PW 71, 66-76; SB 28, 26-32; ASB 27, 24-28; PSB 14, 12-15; AP 26, 26-29; AM 52, 49-56; AL 38, 34-43; PL 54, 50-57; sens. 60, 58-62.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 626-719. Leg I : 220-255. Leg II : 186-215. Leg III : 215-255. Measurements of NIV specimens: Tarsus I (62x18), tarsala (19). Tarsus II (49x16), tarsala (16). Tarsus III (66x14).

Type data : Lectotype and 3 paralectotypes (#3206), SUMATRA, Medan, Deli, ex *Rattus rattus*, 14.III.1922, E.W. Walch, coll. (corrections after Domrow and Lester 1985).

Type depository : Lectotypes and paralectotypes in RMNH.

Additional records : HIMACHAL PRADESH, Simla Hills, Kasauli and Sabathu, ex *R. rattus*, *Suncus murinus*, *Silenus (Macacus) rhesus*, VI.1935 to V.1936, D.R. Mehta, coll. ASSAM, Ledo area, and N. BURMA, ex *R. rattus*, *Suncus* sp., *Anourosorex* sp., X.1944 to IX.1945, USATC, coll. ASSAM, Ledo, Stilwell Road, 21 mile mark, ex *R. rattus*, 6.IX.1945 (Womersley and Audy, 1957 : 9.VI.1945), R. Traub, coll. MANIPUR, ex *Rattus* sp., 9.VI.1945, R. Traub, coll. MANIPUR, ex *Callosciurus erythraeus erythrogaster*, *Callosciurus pygerythrus*

lokrides, *Dremomys lokriah*, *Hadromys humei*, *Rattus rattus bullocki*, *Rattus bowersi*, *Rattus niviventer mentosus*, *Rattus manipulus*, *Mus* spp., *Bandicota bengalensis*, *Tupaia glis*, *S. murinus*, *Anourosorex squamipes*, *Macaca assamensis*, *Muntiacus muntjak*, *Herpsetes* sp., *Mustela* sp., 'domestic cat', IV.1945 to III.1946, STRU, coll. MANIPUR, Imphal, 2 ex 'unknown' host, date and coll. not known. MADHYA PRADESH, Chindwara forest and Jabalpur, 300-900m, ex 'rats', *Mus platythrix*, *S. murinus*, XI.1946 to IV.1947, S.L. Kalra and K.N.A. Rao, coll. WEST BENGAL, Calcutta area, *R. rattus*, *Gunomys varius*, *Bandicota indica*, *Crocidura coerlea* (sic!), 1947-1948, K.V. Krishnan, coll. JAMMU and KASHMIR, Tanghdhar, Chaukibal, Kanzalwan, Gurais, Uri, ex *Rattus rattoides*, VI.1948 to VIII.1949, S.L. Kalra and K.N.A. Rao, coll. JAMMU and KASHMIR, Mehandar, 1 ex 'rat?', IX.1950, coll. not known. NICOBAR ISLANDS, Car Nicobar, 444 ex *R. rattus*, X.1950, Dr.C.A. Gibson-Hill, coll. DELHI, Badli village, 111 ex *Millardia meltada*, *M. platythrix*, *S. murinus*, *Tatera indica*, XII.1964-XII.1966, NICD, coll. SIKKIM, and Darjeeling and Jalpaiguri Districts of WEST BENGAL, ex *Rattus rattus brunneusculus*, *Rattus rattus rufescens*, *Rattus rattus tistae*, *B. indica*, *B. bengalensis*, *Mus musculus*, *Mus pahari*, *S. murinus*, *Millardia meltada*, 1966-1967, R.N. Varma, coll. UTTARANCHAL, Nainital District, 210-1938m, 105 ex *R. rattus*, *B. bengalensis*, *S. murinus*, VIII.1967, NICD, coll. ARUNACHAL PRADESH and N. ASSAM, ex *R. r. tistae*, *B. bengalensis*, *B. indica*, *R. r. rufescens*, *R. r. brunneusculus*, *Rattus rattus sikkimensis*, *M. pahari*, *M. meltada*, *S. murinus*, 1968-1969, AFMC, coll. RAJASTHAN, Kota District, 10 ex 4 *S. murinus* and 2 *R.r. rufescens*, 28,30.X.1971, H.N. Kaul, coll.

New records : ORISSA, Puri District, Konark, and Nandan Kanan Park, 36 ex 4 *Rattus rattus arboreus*, 15,17.XI.1972, H.N. Kaul, coll. MAHARASHTRA, Akola District, Mhaispur, 120 ex *S. murinus*, 25.IX.1986, P.V. Mahadev, coll. 11 records of collections from the Himalayan region by NIV teams : JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 9 ex *A. flavicollis*, 31.X.1969; Tangmarg, 600m, 1 ex *Alticola roylei*, 20.X.1969; 26, same data, but ex *A. flavicollis*; 32, same data, but ex 2 *M. musculus*, taken 19,20.X.1969; Rajouri District, Naoshera, 750m, 1 ex *M. musculus*, 8.XII.1969. UTTARANCHAL, Nainital District, Ramnagar, 350m, 188 ex *R. rufescens*, 29.VIII.1970; 377, same data, but ex 4 *S. murinus*.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. deliense* falls out at couplet 142 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976), along with a new subspecies they have described *L. imphalum ceylonicum*. They distinguish *L. deliense* in having Ip 631-724 with mean 682 (729-768 with mean 738 in *L. i. ceylonicum*), scutum subrectangular with posterior margin gently rounded, medially slightly concave (trapezoidal with posterior margin more angular in *L. i. ceylonicum*). Vercammen-Grandjean and Langston draw attention to the numerous earlier misidentifications of *L. deliense*, this taxon being freely used to designate material without proper comparison with reference specimens. In the preface to their work, R. Traub cites one such instance, with reference apparently to Varma (1969) who claims that *L. deliense* occurs in subarctic terrain in the Himalayas. Vercammen-Grandjean and Langston further describe a specimen labelled *L. deliense* from

the Pune District NIV collection as a new subspecies *L. delimushi kulkarnii*, and consider the Assam and Imphal specimens in Womersley's collection as a new species *L. imphalum*. They characterize *L. deliense* by: 1. the subrectangular scutum with laterally rounded posterior margin and the 5 well-barbed setae, the AL being 20% shorter than the almost subequal AM and PL setae; 2. a minimal number of total body setae, 52-54; 3. an Ip close to a mean of 680. We concur with this specific diagnosis and have amended earlier NIV records ascribed to *L. deliense*. The NIV records from the Himalayan region are restricted to the submontane and temperate zones of the Western Himalayas only, confirming doubts of the occurrence of this species in subarctic terrain. The above records suggest a wide-ranging distribution of this important vector species of chigger-borne rickettsiosis in India. Other earlier Indian collections, however, need to be re-examined and verified in the light of our present knowledge of this species. The species name has been derived from the type locality (Deli, North Sumatra, Indonesia).

25. *Leptotrombidium (Leptotrombidium) delimushi* Vercammen-Grandjean and Langston (Fig. 25)

Leptotrombidium (Leptotrombidium) delimushi delimushi Vercammen-Grandjean and Langston, 1976, 268.

Leptotrombidium (Leptotrombidium) delimushi kumaoense Vercammen-Grandjean and Langston, 1976, 271, new synonymy.

As *Leptotrombidium (Leptotrombidium) akamushi* (Brumpt, 1910) : Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 290-465 x 205-349 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 51-58; 30-34 dorsal idiosomal setae, measuring 41-58, arranged : 8-6-8-6-(4)-2; 2 pairs of sternal setae, anterior 45-50, posterior 35-39; 14-18 preanal setae, 29-35; 6-12 postanal setae, 38-53; total idiosomal setae 56-66.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin sinuate; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL (Original description AM>PL>AL in *L. d. delimushi*, and PL>AM>AL in *L. d. kumaoense*); sensillae flagelliform with branches on distal 3/4; PW/SD = 1.67-1.78. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 65 (63, 58-65); PW 73 (72, 70-75); SB 31 (29, 26-31); ASB 27 (28, 27-29); PSB 14 (14, 13-14); AP 28 (28, 26-30); AM 58 (57, 51-60); AL 38 (40, 38-45); PL 52 (53, 50-55); sens. 70 (73, 70-76). Scutal measurements of holotype and paratype of *L. d. kumaoense* after original description, followed by means and ranges of 10 NIV

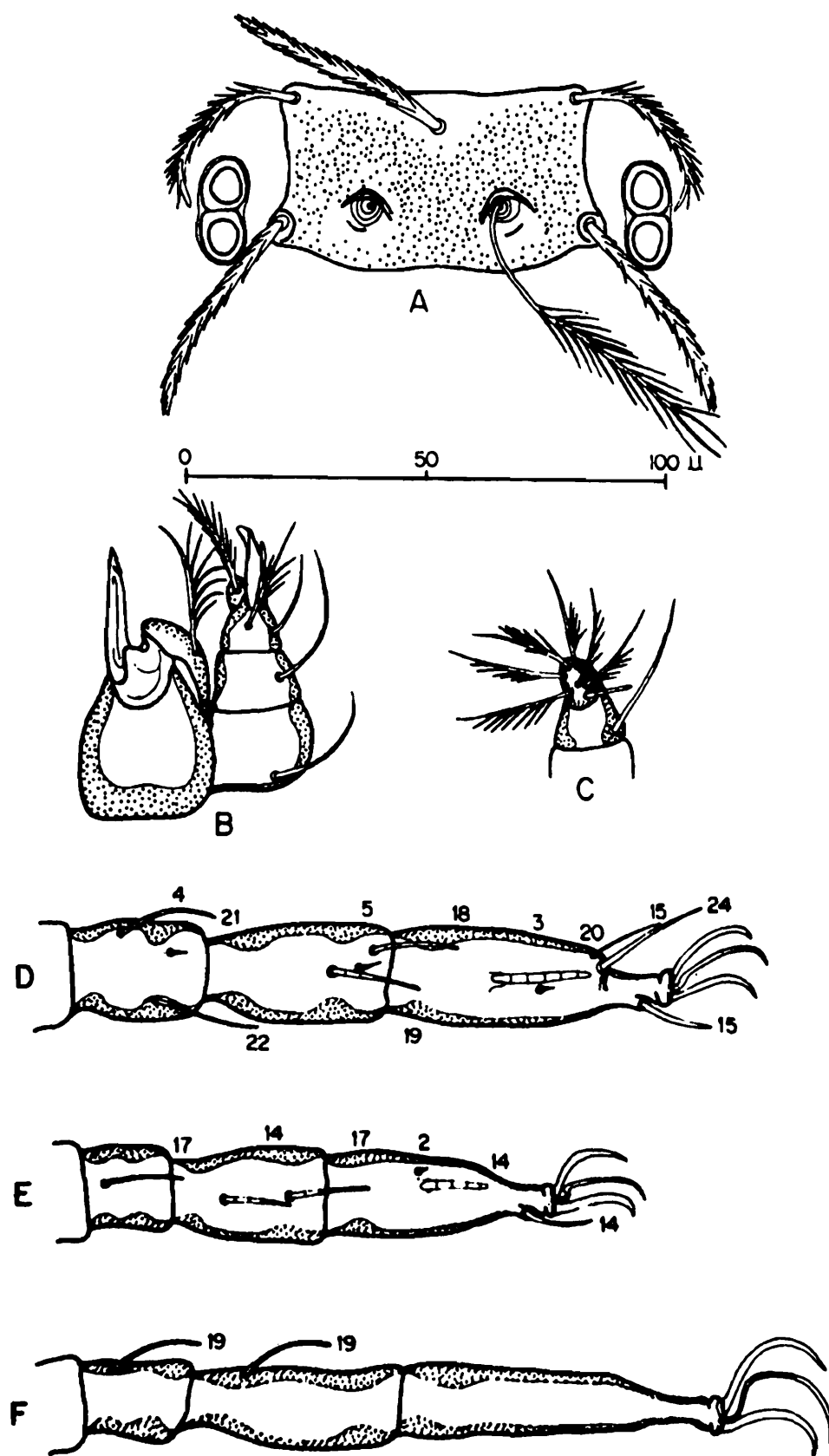


Fig. 25. *Leptotrombidium delimushi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

specimens in parentheses : AW 69, 62 (61, 56-69); PW 74, 71 (70, 66-79); SB 31, 31 (28, 27-30); ASB 27, 27 (28, 26-29); PSB 15, 15 (14, 13-15); AP 28, 29 (28, 26-31); AM 51, - (51, 47-54); AL 43, 46 (40, 38-43); PL 57, 57 (52, 47-55); sens. -, - (65, 62-70).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description, followed by measurements of holotype and paratype of *L. d. kumaoense* after original description : Ip = 702-730; 782, 774. Leg I : 244-256; 273, 272. Leg II : 208-219; 237, 232. Leg III : 249-258; 272, 270. Measurements of NIV specimens : Ip = 739-768. Leg I : 248-264; tarsus (62x20), tarsala (20). Leg II : 218-232; tarsus (50x18), tarsala (14). Leg III : 267-278; tarsus (69x13).

Type data : Holotype (#23848/1) and 4 paratypes, JAMMU and KASHMIR, Jhanghar, ex 'rat', 23.VIII.1948, S.L. Kalra, coll.; 1 paratype, Tithwal, ex *Rattus* sp., 8.VIII.1948, coll. not known; 1 paratype, NEPAL, Pokhara, 910m, ex *Rattus rattus brunneus*, 23.IX.1965, L.W. Quate, coll.; 1 paratype, Eastern Terai, Jhapa, 200m, ex *Bandicota bengalensis*, 30.XI.1965, M. Nadchatram, coll.

Type depository : Holotype at SAM; paratypes at SAM and IMR.

Additional records : Holotype and paratype of *L. d. kumaoense* : UTTARANCHAL, Kumaon Hills, Bhimtal, ex 'rat', 10.VIII.1946, S.L. Kalra, coll.

New records : 20 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Chamba District, Surkhigali, 1600-1620m, 2 ex *Rattus rattoides*, 8.IX.1967; Kangra District, Dadh, 1080-1110m, 133 ex *Rattus rattus gangutrianus*, 14.IX.1967; Lahul District, Keylong, 3110-3170m, 1 ex *Apodemus flavicollis*, 28.IX.1967; Mandi District, Mandi, 1070m, 57 ex 2 *R. r. gangutrianus*, 19.IX.1967. UTTARANCHAL, Chamoli District, Kailbinayak, 2100-4400m, 7 ex *R. r. gangutrianus*, 14.X.1967; Dehra Dun District, Asarodi, 600-750m, 3 ex *R. r. gangutrianus*, 5.VI.1970; Dehra Dun, 600-800m, 25.VIII.1970; Pithoragarh District, Goucher, 750-1500m, 69 ex 2 *R. r. gangutrianus*, 6.VIII.1970; Pithoragarh, 1500-2600m, 26 ex 3 *R. r. gangutrianus*, 12.VIII.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. delimushi* runs to couplet 152 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. akamushi* (Brumpt, 1910). They distinguish *L. delimushi* in having Ip 714 (737-767 in *L. akamushi*), dorsal body setae 30, arranged : 8-6-8-6-2 (34-36, arranged : 8-6-8-(2)-6-4-2 in *L. akamushi*), and total body setae 66 (numbering 70-74 in *L. akamushi*). They consider *L. delimushi* close to *L. akamushi* in having similar body setal structure and distribution, as well as corners of posterior scutal margin sigmoid. However, it resembles *L. deliense* in having SB only slightly anterior to level of PL bases. *L. d. kumaoense* runs to couplet 151 of the above-mentioned key, being separated from *L. d. delimushi* and *L. akamushi* in having dorsal body setae with numerous strong barbs (moderately barbed in other 2 taxa), PL>AM (AM>PL in other 2 taxa), and galeala with 5 branches (7-10 branches in other 2 taxa). The types of *L. d.*

kumaoense have been recorded from Bhimtal in Nainital District. The above new records include collections from Nainital and Pithoragarh Districts of the Kumaon Hills. These NIV specimens show characters linking the subspecies *delimushi* and *kumaoense*, and hence the subspecific distinction proposed by Vercammen-Grandjean and Langston (1976) for these 2 taxa is not accepted. The species name is a combination of *deliense* and *akamushi*, to which species *L. delimushi* is similar.

26. *Leptotrombidium (L.) dihumale* Traub and Nadchatram (Fig. 26)

Leptotrombidium (Leptotrombidium) dihumale Traub and Nadchatram, 1967a, 1; Traub and Wisseman, 1968, 219; Nadchatram, 1970c, 147; Fernandes *et al.*, 1988, 109.

Leptotrombidium dihumale, Schluger and Kudryashova, 1969, 115; Kudryashova, 1973, 3.

Leptotrombidium (Leptotrombidium) dihumale dihumale, Vercammen-Grandjean and Langston, 1976, 591.

Leptotrombidium (Leptotrombidium) dihumale khurdangense, Vercammen-Grandjean and Langston, 1976, 594, new synonymy.

L. (L.) dehumale, sic! Wang, 1981, 462.

Montivagum dihumale, Kudryashova, 1988, 63.

Redescription of species : Larva.

Idiosoma : Measuring 265-420 x 225-350 in unengorged to partially engorged specimens. Eyes 2/2, subequal, on ocular plate. 2 (occasionally 3) pairs of humeral setae, measuring 47-60; 50-82 dorsal idiosomal setae (Original description : 66-76; Schluger and Kudryashova (1969) : 53-79; Vercammen-Grandjean and Langston (1976) : 76 for *dihumale dihumale*, 64 for *dihumale khurdangense*; Kudryashova (1988) : 55-81, measuring 36-55, irregularly arranged, arrangement usually commencing : (10-14)-(2-4)-(10-16)-(4-8); 2 pairs of sternal setae, anterior 41-52, posterior 34-41; 38-54 preanal setae, 28-34; 10-18 postanal setae, 37-54; total idiosomal setae 112-158.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (38-44) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate with anterior margin shallowly biconcave; posterior margin broadly convex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; PL > AM > AL; sensillae flagelliform with branches on distal 2/3; PW/SD = 1.65-1.92. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses after original description : AW 79 (77, 75-82); PW 85 (85, 82-91); SB 34 (32, 30-34); ASB 32 (31, 29-32); PSB 15 (17, 15-20); AP 33 (31, 28-34); AM 49 (48, 46-52); AL 44 (44, 42-46); PL 55 (56, 50-60); sens. 76 (73, 71-76). Scutal measurements of holotype followed by means and ranges of type series of *L. d. khurdangense* after original description : AW 83 (79, 77-83); PW 92 (89, 84-93); SB 32 (31, 30-33); ASB 32 (31, 30-32); PSB 16

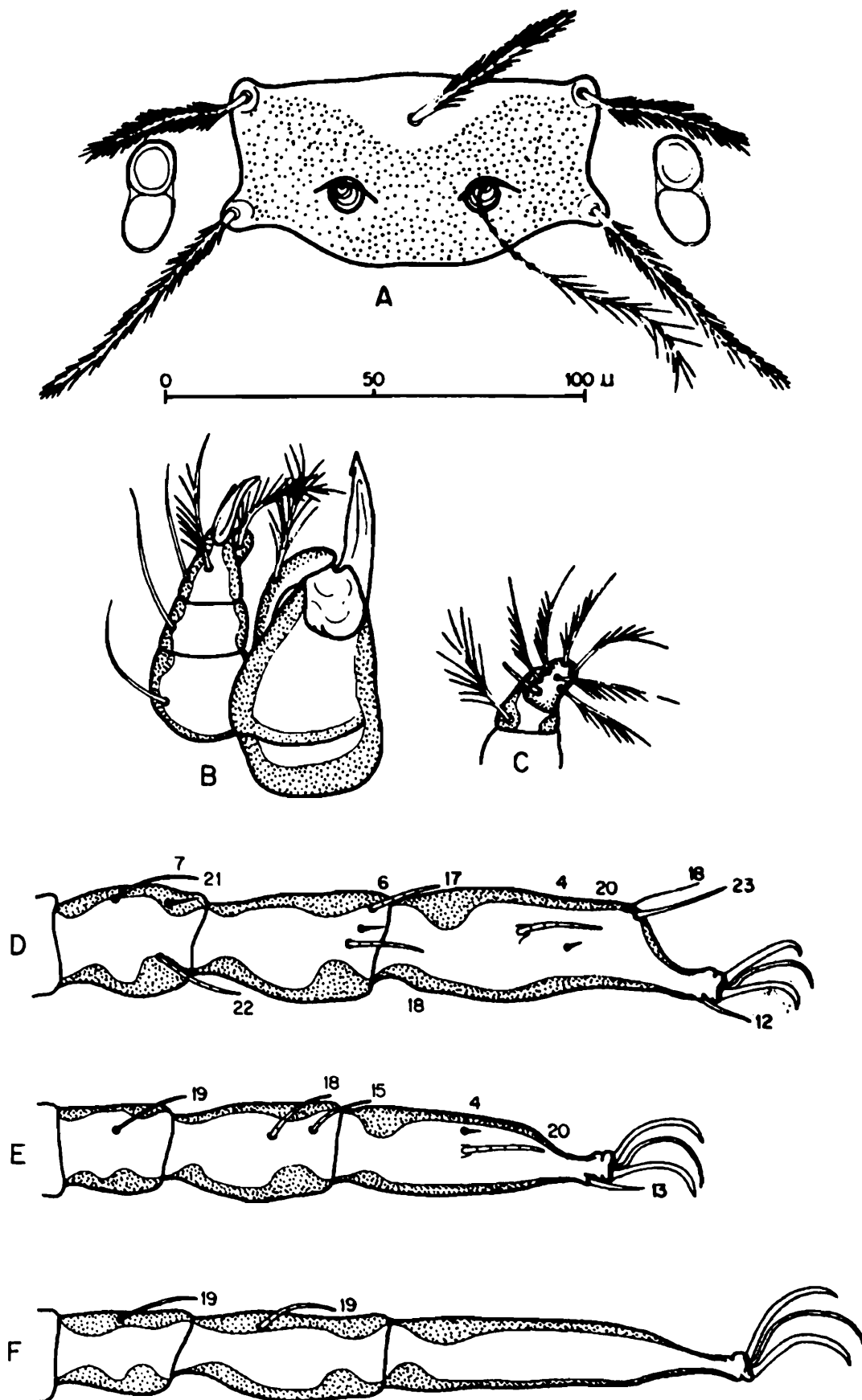


Fig. 26. *Leptotrombidium dihumale*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

(16, 15-18); AP 30 (29, 26-31); AM 50 (49, 45-52); AL 52 (46, 41-52); PL 64 (58, 52-64); sens. 76 (75, 72-80). Scutal measurements giving means and ranges of 10 NIV specimens : AW 78, 71-84; PW 85, 80-90; SB 32, 30-35; ASB 30, 27-33; PSB 18, 16-20; AP 29, 26-33; AM 47, 44-51; AL 44, 40-48; PL 57, 51-64; sens. 70, 66-76.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 880-921 (Original description : 856-874; Vercammen-Grandjean and Langston (1976) : 865-913 in *dihumerale dihumerele*, 845-910 in *dihumerale khurdangense*; Kudryashova (1988) : 893-981). Leg I : 304-326; tarsus (72-81 x 24-25), tarsala (19-20). Leg II : 262-278; tarsus (61-66 x 21-23), tarsala (17-20). Leg III : 314-322; tarsus (72-86 x 16-18).

Type data : Holotype (B66198-40), PAKISTAN, Hazara District, Kaghan Valley, Gitidas, 3690m, ex *Alticola roylei*, 17.VIII.1963, R. Traub, coll.; 29 paratypes : 9, same data as holotype; 12, same data, but taken 16.VIII.1963; 5, same data, but taken 17.VIII.1963; 3, same data, but ex *Hyperacrius fertilis*, taken 19.VI.1963.

Type depository : Holotype at USNM; paratypes at IMR, BM(NH), BPBM, RML, IA, GWHF, USPHS, and in collections of R. Traub and other acarologists.

Additional records : JAMMU and KASHMIR, Gilgit Agency, Kohighizar, Phandar, 3075m, and Naltar, 2925-3290m, ex *Cricetulus migratorius*, 1962-1964, R. Traub, coll. Type series of *L. dihumerele khurdangense* : JAMMU and KASHMIR, Ladakh District, Khurdang, 12 ex 'rat', 28.X.1949, S.L. Kalra, coll.; 3, same data, but unknown host, taken VII.1949.

New records : 10 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 104 ex *A. roylei*, 19.IX.1968; 2, same data, but ex *Ochotona roylei*, taken 20.IX.1968; Lahul District, Chhetru, 300m, 3 ex *Apodemus flavicollis*, 31.VII.1970; Kiriting, 2680-3250m, 3 ex *A. roylei*, 23.IX.1968; 2, same data, but ex *A. flavicollis*; 1 same data, but ex *Rattus rattus rufescens*. JAMMU and KASHMIR, Ladakh District, Bodhkhharbu, 3200-3500m, 2 ex 2 *A. roylei*, 22.VIII.1967; 7, same data, but ex *A. flavicollis*, taken 13.VIII.1968; Drass, 3200m, 1 ex *Mus musculus*, 21.VII.1968.

Specimen examined : 1 specimen (B67392-ET) on loan from M. Nadchatram : WEST PAKISTAN, Hazara District, Kaghan Valley, Besal, 3030m, ex 'long tailed vole', 24.VIII.1963, R. Traub, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. dihumerele* runs to couplet 23 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) and is distinguished from *L. hirsutum* (Schluger, 1955) in having coxae III 1B (3B in *L. hirsutum*), PW measuring 83-93 (65-70 in *L. hirsutum*), and total body setae 118-164 (numbering 104-144 in *L. hirsutum*). They distinguish subspecies *L. d. dihumerele* from *L. d. khurdangense* in having 2 pairs of humeral setae (1 pair in *L. d. khurdangense*), total body setae > 142 (numbering 130

in *L. d. khurdangense*), PW/AP ratio 2.4-2.7 (2.9-3.4 in *L. d. khurdangense*), and SB level with PL bases (slightly anterior to level of PL bases in *L. d. khurdangense*). As noted by Vercammen-Grandjean and Langston, the differences between the subspecies are small. Study of the NIV material which includes specimens from Ladakh District of JAMMU and KASHMIR, has shown that the differences characterizing the subspecies are not consistent. Hence, *L. dihumerae khurdangense* is regarded as a synonym of *L. dihumerae*. The original record from Gilgit Agency, PAKISTAN, has been corrected above to JAMMU and KASHMIR in India. The species name draws attention to the 2 pairs of humeral setae characteristic of this species.

27. *Leptotrombidium (Leptotrombidium) discrepans* new species
(Fig. 27)

Leptotrombidium (Leptotrombidium) sp. D Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 253-260 x 187-197 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 53-58; 38-42 dorsal idiosomal setae, measuring 49-52, irregularly arranged, arrangement in holotype : (8+2)-8-(8+2)-6-6-2; 2 pairs of sternal setae, anterior 46-51, posterior 38; 24-30 preanal setae, 30-33; 12-16 postanal setae, 41-46; total idiosomal setae 84-90.

Gnathosoma : Palpal setal formula N(f)/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex, medially truncate; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.73-1.98. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 69 (68, 66-71); PW 76 (80, 74-85); SB 33 (34, 31-35); ASB 29 (27, 26-29); PSB 15 (15, 14-16); AP 27 (27, 26-28); AM 54 (56, 54-59); AL 39 (41, 37-46); PL 55 (57, 55-60); sens. 65 (68, 65-71).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 735-771. Leg I : 251-265; tarsus (59-61 x 21-23), tarsala (16-18). Leg II : 222-234; tarsus (48 x 19), tarsala (14-15). Leg III : 262-276; tarsus (67 x 15).

Type data : Holotype (NIV A81537.5) and 6 paratypes, UTTARANCHAL, Chamoli District, Kailbinayak, 2100-4400m, ex *Bandicota bengalensis*, 15.X.1967, NIV, coll.

Remarks : *L. discrepans* will fall out at couplet 138 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L.*

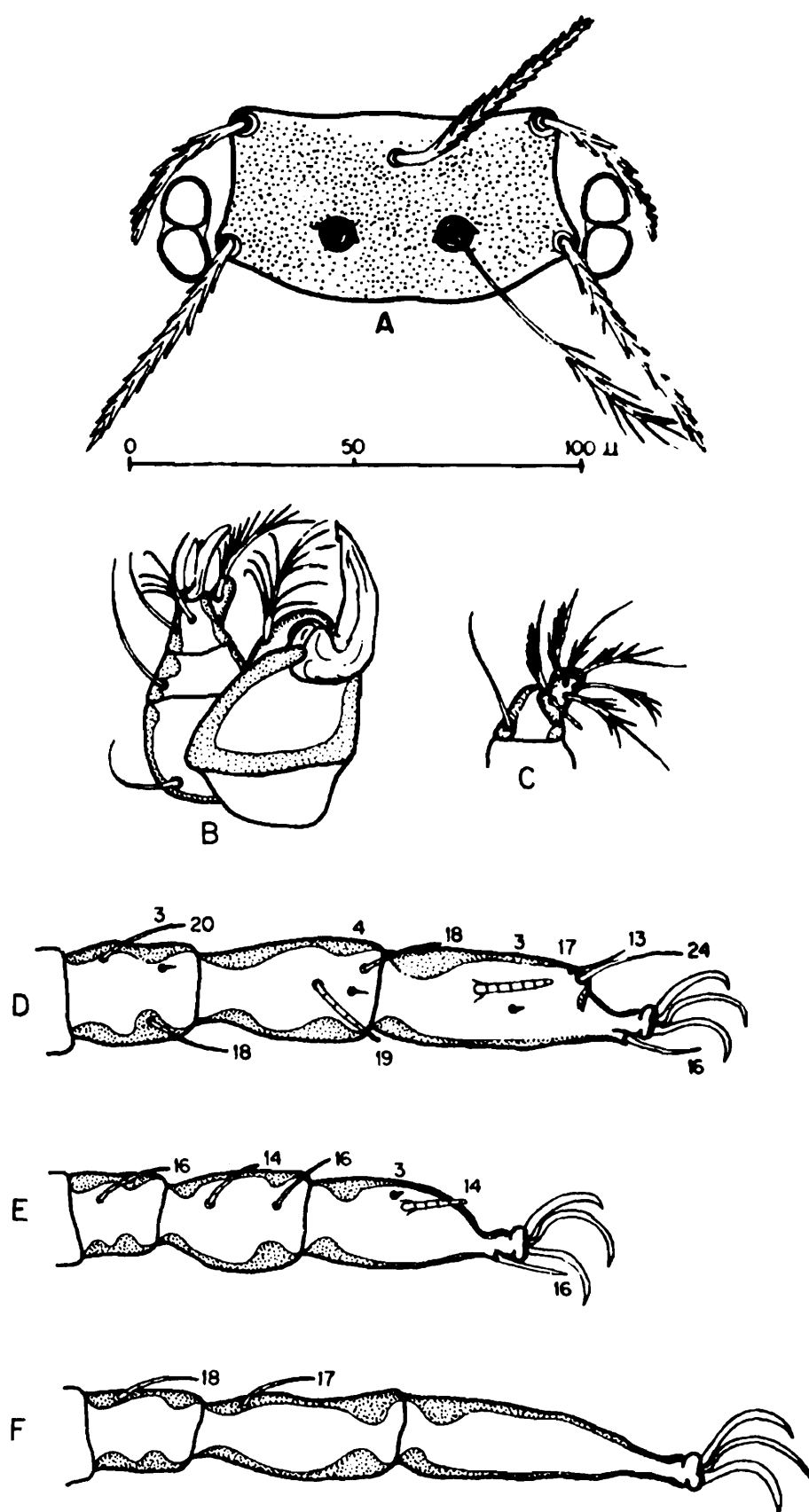


Fig. 27. *Leptotrombidium discrepans* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

crassipilum Vercammen-Grandjean, 1976 (synonym of *L. sinhgarihense* Kulkarni, 1973) and *L. cebephium* Vercammen-Grandjean and Langston, 1976. *L. discrepans* may be distinguished from *L. sinhgarihense* by the arrangement of dorsal body setae (usually arranged : 10-10-10-2-6-4 in *L. sinhgarihense*), in having SB anterior to level of PL bases (slightly anterior or level with SB in *L. sinhgarihense*), and larger number of preanal setae (18-22 in *L. sinhgarihense*). *L. discrepans* may be separated from *L. cebephium* in having fewer dorsal body setae (48 in *L. cebephium*), larger number of preanal setae (14 in *L. cebephium*), and medially truncate posterior scutal margin (medially concave in *L. cebephium*). The species name has been derived from the Latin meaning 'to be unlike'

28. *Leptotrombidium* (*L.*) *dooleyi* Nadchatram (Fig. 28)

Leptotrombidium (*Leptotrombidium*) *dooleyi* Nadchatram, 1970c, 150; Vercammen-Grandjean and Langston, 1976, 338.

As *Leptotrombidium* (*Leptotrombidium*) *magnum* (Schluger *et al.*, 1960c) : Fernandes *et al.*, 1988, 109.

Redescription of species : Larva. Colour in life orange.

Idiosoma : Measuring 235-470 x 178-320 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate (Original description : ocular plate lacking). One pair of humeral setae, measuring 58-66; 55-66 dorsal idiosomal setae, measuring 37-62, arrangement variable : (13-15)-(11-14)-(13-15)-(9-10)-(4-6)-2-2; 2 pairs of sternal setae, anterior 56-70, posterior 44-58; 44-52 preanal setae, 33-46; 16-20 postanal setae, 37-58; total idiosomal setae 121-140.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (40) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; AM>PL>AM; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.48-1.62. Scutal measurements of holotype and 2 paratypes after original description, followed by measurements of 1 paratype in parentheses after Vercammen-Grandjean and Langston (1976) : AW 74, 69, 70 (67); PW 84, 80, 79 (77); SB 32, 32, 31 (31); ASB 38, 38, 39 (37); PSB 14, 16, 14 (14); AP 30, 34, 33 (33); AM 72, -, 66 (64); AL 44, 46, 44 (43); PL 62, 64, 59 (57); sens. 78, -, 87 (94). Scutal measurements of 2 NIV SIKKIM specimens, followed by means and ranges of 8 NIV specimens from other regions in parentheses : AW 80, 82 (67, 64-69); PW 89, 89 (77, 74-80); SB 35, 38 (30, 28-32); ASB 40, 38 (35-37); PSB 18, 18 (16, 16-17); AP 37, 33 (31, 29-33); AM 85, 80 (64, 62-66); AL 58, 54 (45, 44-47); PL 82, 73 (60, 55-66); sens. 84, 90 (90, 79-99).

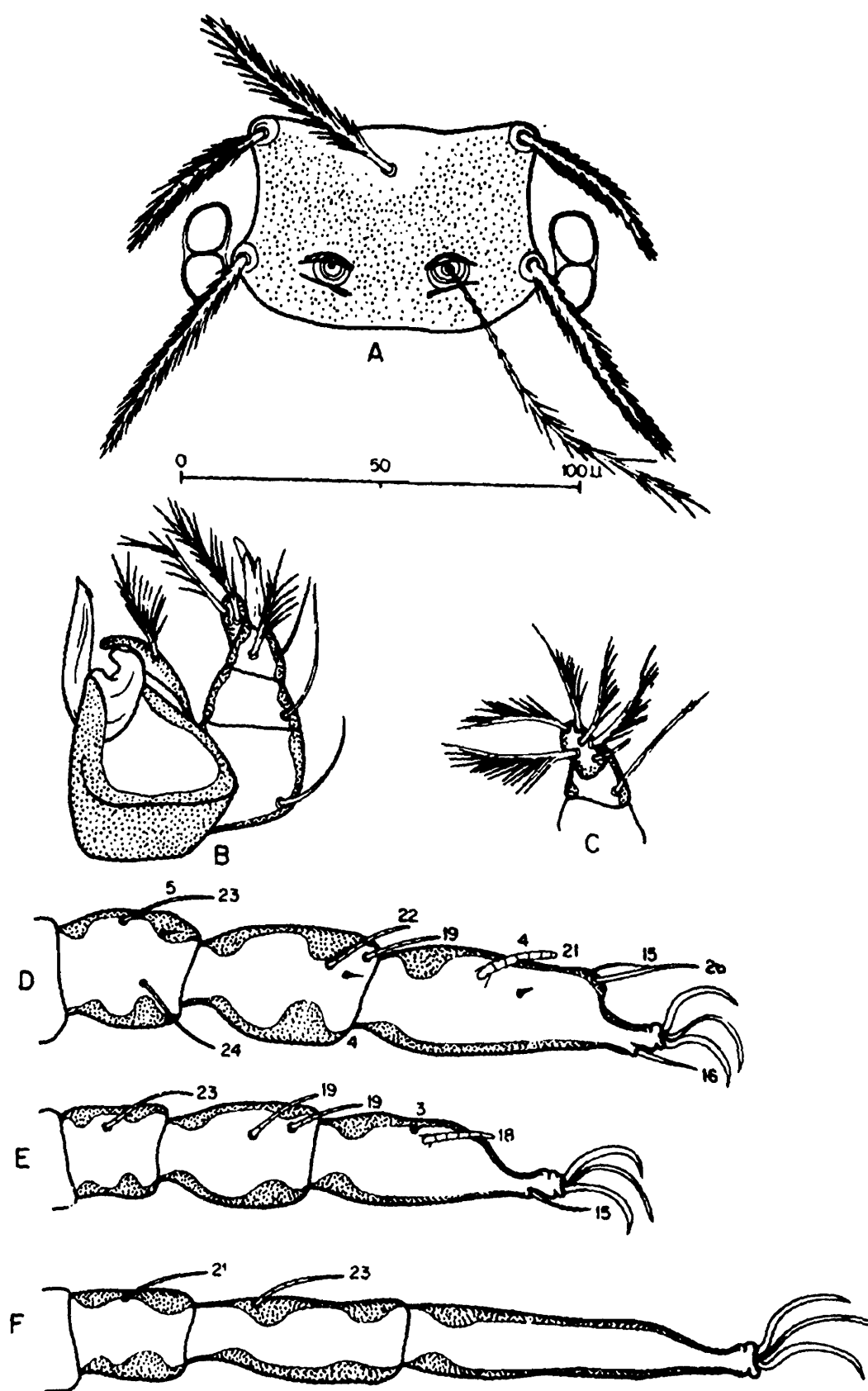


Fig. 28. *Leptotrombidium dooleyi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 865-935. Leg I : 285-315; tarsus (73-75 x 25-26), tarsala (19-20). Leg II : 265-285; tarsus (62-65 x 22-23), tarsala (17-18). Leg III : 315-335; tarsus (92 x 16-17). Measurements of NIV specimens : Ip = 845-928. Leg I : 295-325; tarsus (74 x 25), tarsala (21). Leg II : 243-281; tarsus (62 x 21), tarsala (18). Leg III : 301-322; tarsus (90 x 14).

Type data : Holotype (BBM-NP 30587-3), NEPAL, Daman, Conifer forest, 2310m, ex 'field mouse', 15.I.1966, M. Nadchatram, coll.; 2 paratypes, NEPAL, Bokaikunde, 23km NE Trisuli, forest, 1900m, ex 2 *Rattus nitidus*, 15,16.XI.1965, L.W. Quate, coll.

Type depository : Holotype and 1 paratype at BPBM; 1 paratype at IMR.

New records : 8 records of collections from the Himalayan region by NIV field teams: SIKKIM, Kyangnosla, 3200-3800m, 18 ex *Pitymys sikimensis*, 15.IV.1969. WEST BENGAL, Darjeeling District, Jorepokhri, 1200-2300m, 77 ex 4 *Rattus fulvescens*, 10,11.III.1969; 11, same data, but ex 2 *Rattus eha*, 12.III.1969; Jalpaiguri District, Chunabhatti, 150-200m, 1 ex *Rattus rattus brunneusculus*, 25.III.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. dooleyi* falls out at couplet 87 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. magnum* Schluger *et al.*, 1960. *L. dooleyi* is distinguished in having PL and body setae with thin numerous barbs (with fewer but stronger barbs in *L. magnum*). Vercammen-Grandjean and Langston characterize this species by its scutal shape, the number and arrangement of body setae, and the Ip matched only by *L. kalrai* (Radford, 1953). In the original description, Nadchatram considers *L. dooleyi* close to *L. dux* (Womersley, 1952), *L. spilletti* Mitchell and Nadchatram, 1966, and *L. rupestre* Traub and Nadchatram, 1967. He separates *L. dooleyi* from these species by the combination of its characters. The standard data of the SIKKIM specimens are proportionately larger than that of the NIV material from other regions, and are hence regarded as the same species. This is the first record of the species from India. This species has been dedicated to the late Dr. Thomas A. Dooley, the well-known medical missionary who established hospitals in remote areas of South-East Asia for the benefit of the rural people.

29. *Leptotrombidium (Leptotrombidium) dux* (Womersley) (Fig. 29)

Trombicula (?*Leptotrombidium*) *dux* Womersley, 1952, 57.

Trombicula (Leptotrombidium) dux, Womersley and Audy, 1957, 255.

Leptotrombidium dux, Radford, 1954, 260; Mitchell and Nadchatram, 1966, 68.

Trombicula dux, Prasad, 1974, 95.

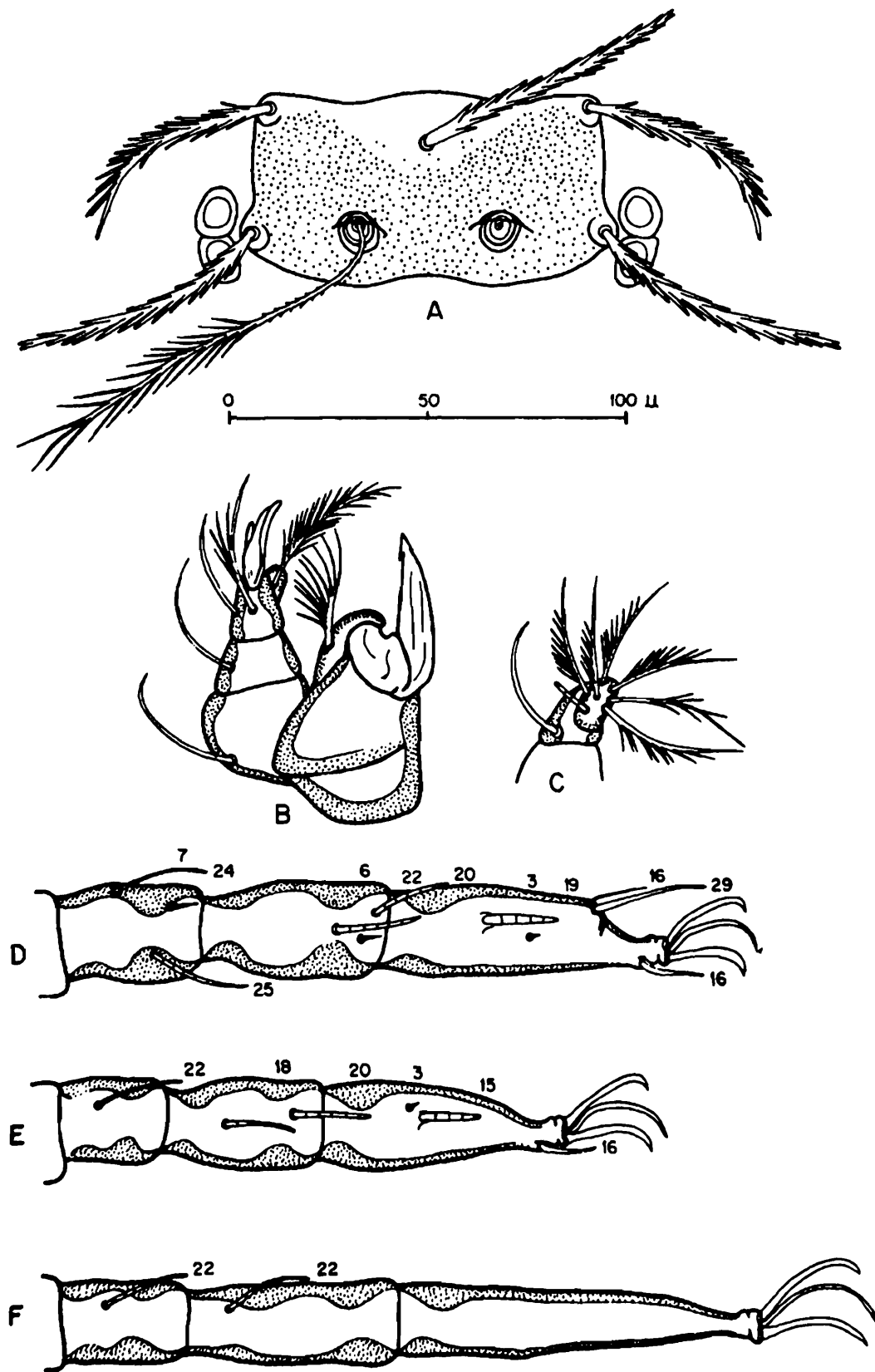


Fig. 29. *Leptotrombidium dux*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Leptotrombidium (Leptotrombidium) dux, Vercammen-Grandjean and Langston, 1976, 571; Xiang and Wen, 1986, 450; Fernandes *et al.*, 1988, 109.

Trombicula (?Leptotrombidium) villosa Womersley, 1952, 60; Vercammen-Grandjean and Langston 1976, 571, synonymy.

Trombicula (Leptotrombidium) villosa, Audy, 1954b, 142; Womersley and Audy, 1957, 257.

Leptotrombidium villosa, Radford, 1954, 260; Mitchell and Nadchatram, 1966, 68.

Leptotrombidium (Leptotrombidium) villosum, Nadchatram, 1970c, 161.

Trombicula villosa, Prasad, 1974, 99.

Redescription of species : Larva.

Idiosoma : Measuring 325-890 x 208-780 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. Two pairs of humeral setae, measuring 70-78 (Vercammen-Grandjean and Langston (1976) : One pair, measuring 76-82); 94-116 dorsal idiosomal setae, measuring 38-74, arrangement variable, arrangement in holotype : (12+6+12)-12-12-12-12-10-8-6-4-2; 2 pairs of sternal setae, anterior 58-65, posterior 44-47; 38-48 preanal setae, 38-42; 20-40 postanal setae, 46-65; total idiosomal setae 182-202.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (42) with tricuspid cap; gnathobase densely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; AM>PL>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.82-2.16. Scutal measurements of holotype followed by means of holotype and 3 paratypes of *T. villosa* after Womersley (1952) : AW 99, 89; PW 122, 103; SB 51, 41; ASB 42, 36; PSB 16, 13; AP 35, 35; AM -, 76; AL 56, 62; PL 70, 72; sens. 96, -. Scutal measurements of holotype followed by means and ranges of 5 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 92 (87, 82-92); PW 110 (101, 94-110); SB 44 (40, 37-44); ASB 36 (37, 36-37); PSB 15 (13, 12-15); AP 32 (33, 32-34); AM - (77, 74-80); AL 68 (63, 61-68); PL 72 (73, 71-74); sens. 112 (112, -). Scutal measurements giving means and ranges of 10 NIV specimens : AW 80, 76-85; PW 93, 88-96; SB 35, 32-40; ASB 35, 33-36; PSB 14, 13-16; AP 31, 28-36; AM 74, 67-81; AL 56, 52-60; PL 68, 65-73; sens. 98, 91-112.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 970-1046. Leg I : 324-360. Leg II : 289-305. Leg III : 354-381. Measurements of NIV specimens : Ip = 892-966. Leg I : 306-321; tarsus (73 x 22), tarsala (19). Leg II : 265-297; tarsus (62 x 20), tarsala (15). leg III : 320-361; tarsus (19 x 16).

Type data : Holotype, UTTARANCHAL, Kumaon Hills, Almora District, Ranikhet, ex

'brown rat', 20.X.1946, S.L. Kalra, coll.

Type depository : Holotype at SAM.

Additional records : 4 specimens (type series of *T. villosa*), same data as holotype.

New records : 20 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Mahasu District, Sarhan, 1300-2140m, 115 ex 3 *Rattus rattoides*, 5.7.V.1968; Simla District, Simla, 1700-2200m, 410 ex 6 *R. rattoides*, 29.X.1967 and 4.XI.1967. SIKKIM, Kyangnosla, 3200-3800m, 7 ex *Pitymys sikimensis*, 15.V.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 2 ex *R. rattoides*, 7.X.1967; Chamoli District, Kailbinayak, 2100-4400m, 11 ex 2 *Rattus rattus gangutrianus*, 20.X.1967; Dehra Dun District, Mussoorie 1400-2300m, 1 ex *R. rattoides*, 8.XI.1967; Pauri Garhwal District, Dogadda, 700-900m, 20 ex 4 *R. r. gangutrianus*, 11,12.XI.1967; 2, same data, but ex *Suncus murinus*, taken 12.XI.1967; Pithoragarh District, Goucher (Thal), 750-1200m, 1 ex *S. murinus*, 30.III.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. dux* falls out at couplet 78 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. halidays* Traub *et al.*, 1958, in having body setae >156 and AM>PL. They distinguish *L. dux* in having Ip>920 (<890 in *L. halidays*), humeral setae measuring >72 with thin shafts and barbs (<64 with thick shafts and strong barbs in *L. halidays*). Vercammen-Grandjean and Langston synonymized *T. villosa* Womersley, 1952, with *L. dux* and recognized 11 specimens of the original series of *L. dux*, taken from JAMMU and KASHMIR, Baltal, as a new species *L. paradux*. They draw attention to the body setae and the high Ip characteristic of *L. dux*. Xiang and Wen (1986) have described *L. orestes* from China which they consider close to *L. dux*. They distinguish *L. orestes* in having palpal formula N/N/BNB, mean scutal measurements : ASB 32 PSB 24 and AP 28, number of body setae 85, and Ip 838. The NIV specimens agree closely with the description in the literature; the scutal measurements and Ip range are, however, slightly lower, but proportional, and there are 2 pairs of humeral setae (as in original illustration, plate 5-G), not 1 pair as reported by Vercammen-Grandjean and Langston (1976). The NIV records include Almora District in the Kumaon Hills, but not the type locality of this species.

30. *Leptotrombidium (Leptotrombidium) fulleri* (Ewing) (Fig. 30)

Trombicula fulleri Ewing, 1945b, 64; Traub, 1949, 361; Prasad, 1974, 95.

Trombicula (Leptotrombidium) fulleri, Womersley, 1952, 69; Audy *et al.*, 1953, 27; Womersley and Audy, 1957, 255; Varma and Mahadevan, 1971, 821.

Leptotrombidium fulleri, Radford, 1954, 260; Schluger and Amanguliev, 1972a, 42.

Leptotrombidium (Leptotrombidium) fulleri, Traub and Lakshana, 1966, 276; Vercammen-Grandjean, 1968b,

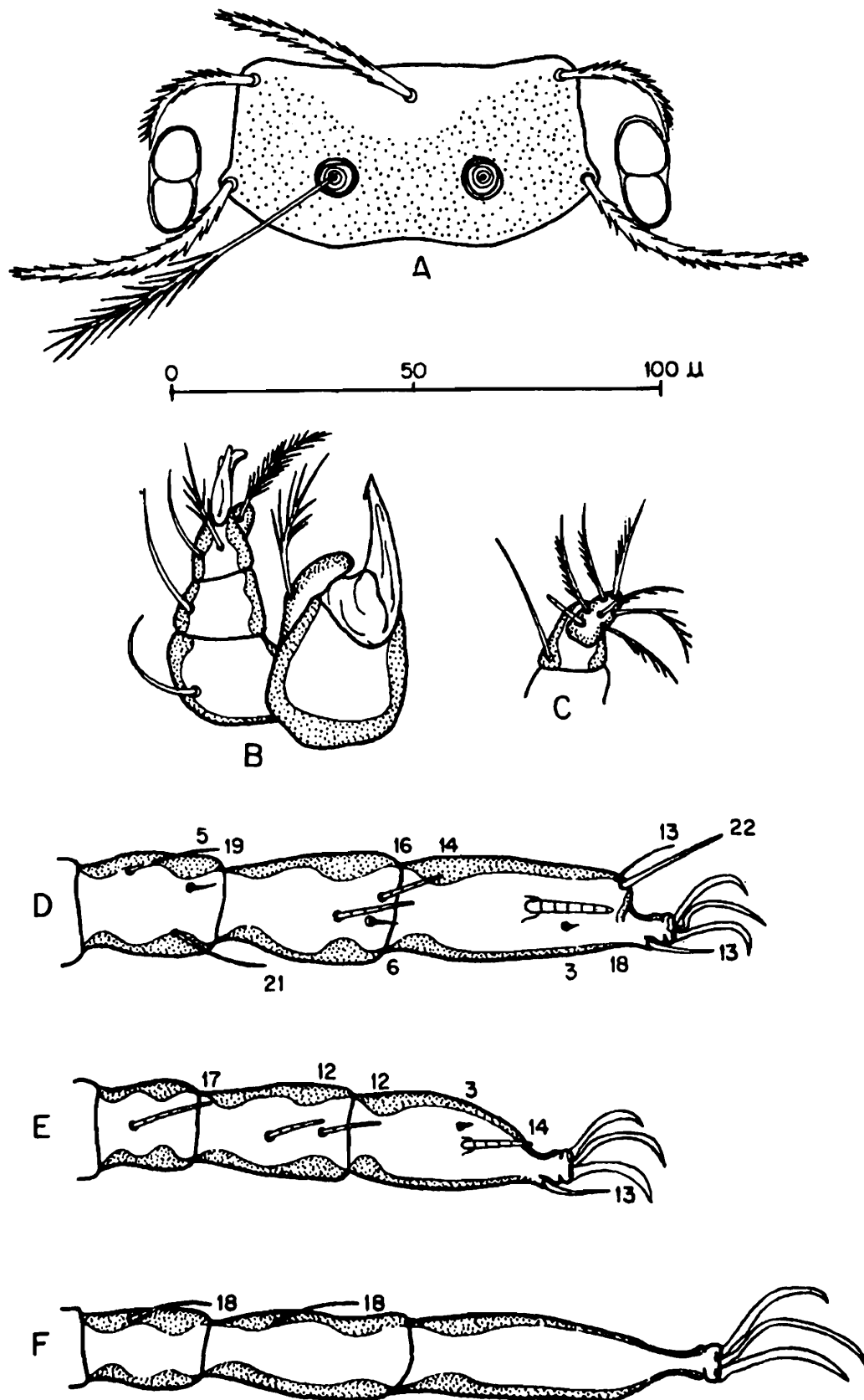


Fig. 30. *Leptotrombidium fulleri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

74; Vercammen-Grandjean and Langston, 1976, 415; Nadchatram, 1970c, 148, **in part**; Kochhar, 1972, 138.

Trombicula (Leptotrombidium) deliensis, Wharton and Fuller, 1952, 53. **in part**.

Trombicula (Leptotrombidium) pumilis Traub *et al.*, 1958, 153; Nadchatram, 1970c, 161, **synonymy**.

Redescription of species : Larva.

Idiosoma : Measuring 320x220 in partially engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 48-59; 26-28 dorsal idiosomal setae, measuring 39-56, arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 46, posterior 32; 12-18 preanal setae, 31-34; 4-8 postanal setae, 39-51; total idiosomal setae 52-58.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (32-34) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin markedly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.71-2.08. Scutal measurements giving means and ranges of 11 Imphal specimens after Womersley (1952) : AW 57, 54-58; PW 65, 64-67; SB 26, 26-29; ASB 27, 22-29; PSB 11, 10-13; AP 23, 19-26; AM 42, 42-45; AL 36, 35-38; PL 63, 58-66; sens. 55, 51-58. Scutal measurements of lectotype followed by means and ranges of 7 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 62 (64, 62-66); PW 75 (73, 70-75); SB 30 (30, 28-32); ASB 23 (25, 23-27); PSB 12 (12, 10-14); AP 23 (22, 20-23); AM 52 (51, 47-56); AL 38 (37, 34-39); PL 59 (58, 55-60); sens. 68 (68, 66-70). Scutal measurements giving means and ranges of 10 NIV specimens : AW 64, 58-68; PW 74, 69-79; SB 28, 26-30; ASB 25, 23-26; PSB 14, 12-15; AP 23, 21-25; AM 47, 45-49; AL 36, 32-41; PL 52, 48-57; sens. 63, no variation recorded.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 715-752. Leg I : 247-263; tarsus (57 x 21-23), tarsala (18-20). Leg II : 216-227; tarsus (46-50 x 19-20), tarsala (14-16). Leg III : 243-273; tarsus (64-65 x 16-17).

Type data : Lectotype and 2 paralectotypes (USNM 1485), BURMA, Shaduzup, ex 'shrews', 7.VII.1944, H.S. Fuller, coll.; 1 paralectotype, BURMA, Ting Kawk, ex 'rat', 14.VI.1944, H.S. Fuller, coll.

Type depository : Lectotype at USNM; paralectotypes at USNM and H.S. Fuller collection.

Additional records : ASSAM, Stilwell Road, 4.6-22 mile mark near Ledo, 821 ex *Rattus rattus* subsp., VI-VIII.1945, USATC, coll.; Stilwell Road and BURMA, Shinbuiyang, Primary jungle, 434 ex 'rats', X.1945, USATC, coll. MANIPUR, Imphal, 11 ex *Rattus rattus bullocki*, 1945, K.L. Cockings, coll. WEST BENGAL, Darjeeling and Jalpaiguri Districts, and SIKKIM,

ex 'rodents and insectivores', 1966-1967, R.N. Varma, coll. ARUNACHAL PRADESH and North ASSAM, ex *Bandicota bengalensis*, 'other rodents', and *Suncus murinus* (hosts not specified), 1968-1969, AFMC, coll.

New records : 4 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Mandi District, Mandi, 1070m, 24 ex *Rattus rattus gangutrianus*, 19.IX.1967; 10 ex *S. murinus*, 31.VIII.1970. UTTARANCHAL, Nainital District, Garjia, 400-500m, 1 ex *R. r. gangutrianus*, 18.XI.1967; Tehri District, Chirbatia, 1800-3200m, 5 ex *Parus monticolus monticolus*, 26.V.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. fulleri* falls out at couplet 130 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. fulmentum* Vercammen-Grandjean and Langston, 1976. They distinguish *L. fulleri* in having shorter PL setae (measuring 60-70 in *L. fulmentum*), AL and body setae with short barbs applied to the shaft (AL setae with rather long barbs and body setae with medium-sized barbs in *L. fulmentum*), sensillae with 6-18 branches (8-10 long branches in *L. fulmentum*). Traub and Lakshana (1966) distinguish *L. fulleri* from *L. arvina* (Schluger, 1960) by the characteristic biconvex posterior scutal margin (shallowly biconvex in *L. arvina*), in having PL setae measuring 1.35x AM setae (1.1x AM setae in *L. arvina*), and with mean PW 65 and AW 55-58 (9 and 55 in *L. arvina*). The NIV specimens agree closely with the description in the literature and the scutal measurements are well within the ranges given by Vercammen-Grandjean and Langston. Fernandes (1992) regarded the 10 NIV specimens taken from *S. murinus* in Mandi as the first record of *L. flureli* Vercammen-Grandjean and Langston, 1976, from India. On careful re-examination, these are here reported as an additional NIV record of *L. fulleri*. The number of Indian trombiculid mites thus drops to 204, from the 205 species recorded in India by Fernandes (1992). Audy *et al.* (1953) record *L. fulleri* from rats in IMPHAL, Kanglatongbi and report this species also from North BURMA and KASHMIR. There are no known records of this species from KASHMIR in the literature; hence, their report is apparently a *lapsus*! This species has been named in honour of the noted acarologist Dr. H.S. Fuller.

31 *Leptotrombidium (Leptotrombidium) fulmentum* Vercammen-Grandjean and Langston (Fig. 31)

Leptotrombidium (Leptotrombidium) fulmentum Vercammen-Grandjean and Langston, 1976, 393; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 284-376 x 232-256 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 44-69; 26 dorsal idiosomal setae, measuring 39-64, arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 48-60, posterior 37-43; 14-22 preanal setae, 28-38; 6 postanal setae, 39-56; total idiosomal setae 52-60.

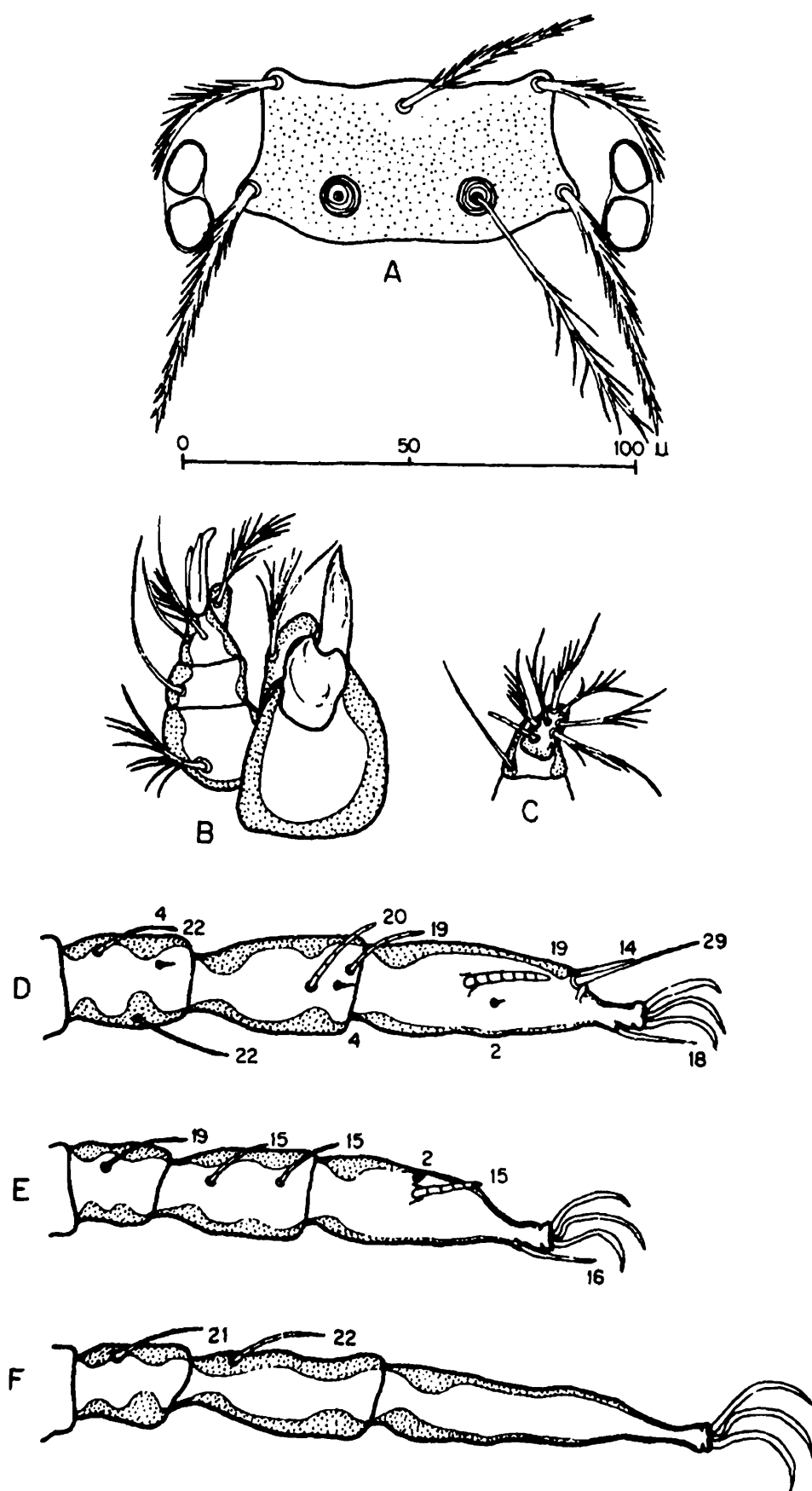


Fig. 31. *Leptotrombidium fulmentum*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to PL bases; PL >> AM > AL; sensillae flagelliform with basal barbs and 9-10 branches on distal 2/3; PW/SD = 1.76-1.81. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 54 (57, 53-62); PW 67 (67, 64-70); SB 25 (26, 24-31); ASB 26 (26, 23-31); PSB 11 (11, 9-12); AP 24 (23, 21-25); AM 42 (44, 40-47); AL 45 (42, 37-53); PL 69 (66, 60-70); sens. - (69, 64-72). Scutal measurements giving means and ranges of 10 NIV specimens : AW 59, 55-62; PW 67, 62-73; SB 26, 23-29; ASB 26, 23-28; PSB 12, 11-14; AP 26, 24-28; AM 47, 43-51; AL 39, 36-43; PL 61, 55-66; sens. 63, 56-71.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 729-774. Leg I : 250-272. Leg II : 220-235. Leg III : 249-272. Measurements of NIV specimens : Ip = 696-767. Leg I : 232-267; tarsus (64 x 20), tarsala (22). Leg II : 206-236; tarsus (55 x 18); tarsala (17). Leg III : 250-273; tarsus (72 x 16).

Type data : Holotype (3568/1) and 2 paratypes, North BURMA, Shingbuiyang, Stilwell Road, ex *Suncus murinus*, 28.VIII.1945, USATC, coll. 1 paratype, ASSAM, Ledo, Stilwell Road, ex *Suncus* sp., 29.VIII.1945, Army Medical Centre - Dept. of Parasitology, coll. 2 paratypes, MANIPUR, Imphal, ex 'unknown' host, 16.IX.1945, R. Traub, coll.; 1 paratype, same data, but taken 28.IX.1945, collector not known. 2 paratypes, W. MALAYSIA, Selangor, Kepong Forest Reserve, ex *Rattus muelleri*, 29.XI.1949, J.R. Audy, coll. 6 paratypes, MALAYSIA, host and collection data not known. 12 paratypes, BURMA, host and collection dates not known, R. Traub, coll. Type depository - Holotype at IMR; 26 paratypes at IMR and SAM.

New records : 43 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 1 ex *Rattus rattus gangutrianus*, 8.IV.1968. UTTARANCHAL, Almora District, Sukhidang, 17 ex 4 *S. murinus*, 2,4.III.1967; Chamoli District, Dogalbita, 2300-2650m, 2 ex *Rattus rattoides*, 8.VII.1970; Dehra Dun District, Dehra Dun, 600-800m, 2 ex *R. r. gangutrianus*, 28.X.1967; 6, same data, but ex 2 *S. murinus*, taken 1.X.1967; Mussoorie, 1400-2300m, 2 ex *R. rattoides*, 8.XI.1967; Satyanarayan, 300m, 5 ex 2 *R. r. gangutrianus*, 30.VI,2.VII.1970; 10, same data, but ex *S. murinus*, taken 4.VII.1970; Pauri Garhwal District, Dogadda, 700-900m, 55 ex 10 *R. r. gangutrianus*, 11-13.XI.1967; 45, same data, but ex 2 *S. murinus*, taken 12.XI.1967; Nainital District, Bhimtal, 1200-1700m, 45 ex 5 *S. murinus*, 20,27.XI.1966; 4 same data, but ex *R. r. gangutrianus*, taken 23.XI.1967; Garjia, 400-500m, 12 ex *R. r. gangutrianus*, 15,16.XI.1967; 5, same data, but ex *S. murinus*, taken 19.XI.1967; Haldwani, 400-1100m, 45 ex 2 *R. r. gangutrianus*, 23.II.1967; 31, same data, but ex 4 *S. murinus*, taken 1,3.XII.1966; Pithoragarh District, Goucher (Thal), 750-1200m, 2 ex *S. murinus*, 6.VIII.1970; Tehri District, Ghansali, 900-1100m, 2 ex *S. murinus*, 19.V.1969.

Remarks : The above redescription is based on the original description and study of the NIV specimens. *L. fulmentum* runs to couplet 130 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. fulleri* (Ewing, 1945). *L. fulmentum* is close to *L. fulleri* in having the same number of body setae and similar Ip range. They distinguish *L. fulmentum* in having scutal ratio PW/AP = 2.9 (3.32 in *L. fulleri*), PL>>AM>AL (PL>AM>>AL in *L. fulleri*), and sensillae with 9-10 long apical branches (16-18 branches in *L. fulleri*). They consider the scutum of *L. fulmentum* similar to that of *L. imphalum* Vercammen-Grandjean and Langston, 1976, in having a bilobate posterior margin. They draw attention to the strongly barbed PL and dorsal body setae, and the characteristic PL>>AM. The species name signifies 'one that corroborates' Vercammen-Grandjean and Langston contend that Womersley misidentified this species as *L. fulleri* and their description of *L. fulmentum* from a number of specimens in his collection labelled *L. fulleri* corroborates their proposition.

32. *Leptotrombidium (Leptotrombidium) imphalum* Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) imphalum imphalum, Vercammen-Grandjean and Langston, 1976, 255; Kolebinova, 1980, 70.

Leptotrombidium (Leptotrombidium) imphalum ceylonicum, Vercammen-Grandjean and Langston, 1976, 258.

Leptotrombidium (Leptotrombidium) imphalum, Wen *et al.*, 1982, 467; Tanskul and Linthicum, 1997, 370; 1999, 88.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of humeral setae, measuring 50-65; 26-28 dorsal idiosomal setae, measuring 40-66, arranged : 8-6-6-4(6)-2; 2 pairs of sternal setae; 14-18 preanal setae, 30-38; 6-10 postanal setae, 40-56; total idiosomal setae 54-62.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex with lateral corners sigmoid as in *L. akamushi* (Brumpt, 1910); AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.65-2.00. Scutal measurements of holotype followed by means and ranges of 40 *L. i. imphalum* specimens in parentheses after original description : AW 58 (58, 53-62); PW 66 (68, 62-73); SB 25 (27, 24-30); ASB 26 (27, 25-28); PSB 14 (13, 12-14); AP 27 (29, 27-31); AM 50 (52, 49-56); AL 45 (45, 40-48); PL 52 (53, 50-57); sens. 74 (71, 64-75). Scutal measurements of holotype followed by means and ranges of 9 specimens (type series) of *L. i. ceylonicum* in parentheses after original description : AW 66 (63, 60-66); PW 82 (74, 69-82) SB 32 (29, 27-32); ASB 27 (27, 26-28); PSB 14 (14, 13-14); AP 29 (28, 27-30); AM 53 (54, 51-60); AL 44 (42, 38-46); PL 55 (55, 49-66); sens. 74 (75, 74-84).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements of *L. i. imphalum* followed by *L. i. ceylonicum* after original descriptions : Ip = 740-796, 729-768. Leg I : 260-282, 252-272. Leg II : 218-239, 220-230. Leg III : 260-282, 251-266.

Type data : Holotype (No.3548) and 1 paratype, ASSAM, Stilwell Road, 21 mile mark, ex 'unknown' host, 27.VIII.1945, USATC, coll.; 10 paratypes, same data, but ex *Rattus rattus* subsp., taken 27.V.1945, R. Traub, coll.; 7 paratypes, same data, but taken 6.IX.1945; 5 paratypes, same data, but from Ledo, taken 26.IX.1945. 4 paratypes, MANIPUR, Imphal, ex 'unknown' host, ?1945, K.L. Cockings, coll.; 2 paratypes, same data, but taken 28.IX.1945; 12 paratypes, same data, but taken 10,12-14.X.1945. 18 paratypes, BURMA, ex 'unknown' host, collection date not known, R. Traub, coll.

Type depository : Holotype and 1 paratype at BM(NH); 58 paratypes at SAM and IMR. Tanskul and Linthicum (1999) report that they were unable to locate the type specimens in BM(NH) or IMR.

Additional records : Records of original type series of *L. i. ceylonicum* : KARNATAKA, Bangalore, 1 ex *Bandicota* sp., XII.1947, collector not known. MANIPUR, 3 ex *Rattus* sp., 9.VI.1945, collector not known. JAMMU and KASHMIR, Mehandar, 1 ex 'rat'(?), IX.1950, collector not known; Tithwal, ex 'rats', IX.1946, S.L. Kalra, coll.

Remarks : The above redescription is based only on the literature. *L. i. imphalum* falls out in couplet 143 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. subrussicum* Kolenova, 1970. They distinguish *L. i. imphalum* in having PW/AP ratio <2.7 (>3.3 in *L. subrussicum*), Ip range 722-792 (702-981 in *L. subrussicum*), and 24-28 ventral setae (numbering 24 in *L. subrussicum*). *L. i. ceylonicum* falls out in couplet 142 of the same key along with *L. deliense* (Walch, 1922). They distinguish *L. i. ceylonicum* in having Ip range 729-768 with mean 738 (631-724 with mean 682 in *L. deliense*), scutum trapezoidal with posterior margin more angular (subrectangular with posterior margin gently rounded, slightly concave medially in *L. deliense*). Vercammen-Grandjean and Langston distinguish the subspecies *ceylonicum* in having subtrapezoidal scutum with posterior margin shallowly biconvex (subrectangular with posterior margin markedly biconvex in *imphalum* s. str.), body setae generally thinner and longer, and higher Ip range. This subspecific distinction is not recognized here. *L. imphalum* has been redescribed by Tanskul and Linthicum (1999) from collections in Thailand. It has not been encountered in the extensive NIV collections. The species name is derived from the type locality.

33. *Leptotrombidium (Leptotrombidium) insigne* new species (Fig. 32)

Leptotrombidium sp. A Fernandes et al., 1988, 109.

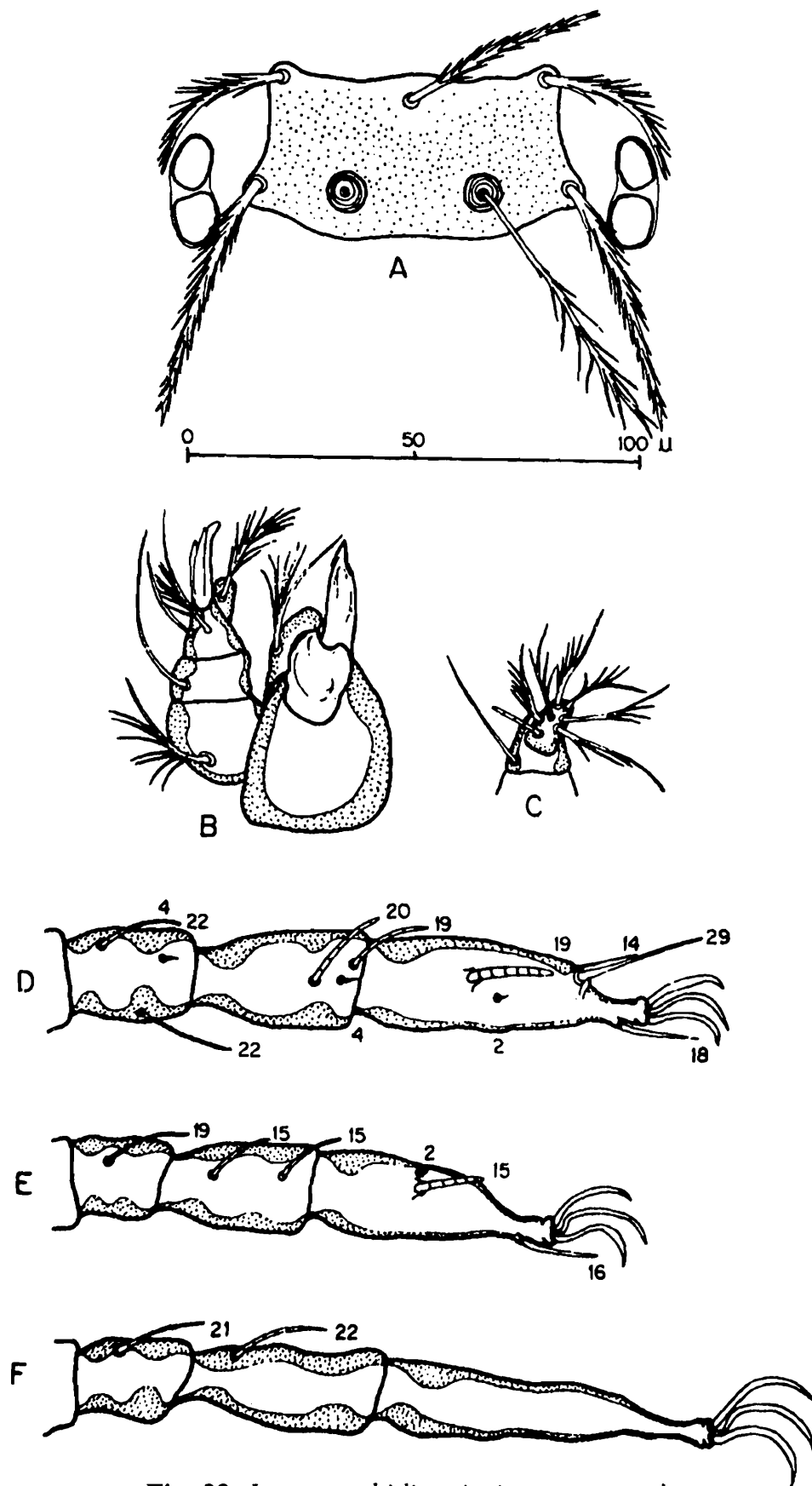


Fig. 32. *Leptotrombidium insigne* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Description of species : Larva.

Idiosoma : Measuring 342x245 in partially engorged holotype. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 52; 26 dorsal idiosomal setae, measuring 46-47, arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 46, posterior 42; 20 preanal setae, 29; 6 postanal setae, 44-46; total idiosomal setae 60.

Gnathosoma : Palpal setal formula B/N/BNN/7B; palpal claw 3-pronged, galeala B; cheliceral blade (36) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.89. Scutal measurements of holotype : AW 60; PW 70; SB 28; ASB 26; PSB 11; AP 24; AM 46; AL 39; PL 58; sens. 66.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal : 22-16-15. Measurements as follows : Ip = 749. Leg I : 256; tarsus (65 x 19), tarsala (19). Leg II : 233; tarsus (54 x 18), tarsala (15). Leg III : 260; tarsus (74 x 14).

Type data : Holotype (NIV A81746.17), UTTARANCHAL, Nainital District, Garjia, 400-500m, ex *Suncus murinus*, 19.XI.1967, NIV, coll.

Remarks : *L. insigne* will run to couplet 10 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) in having palpo-setal formula with 2 barbed and 3 nude setae. *L. insigne* may, however, easily be distinguished from all other species of the subgenus by its palpo-setal formula : B/N/BNN. The species name derived from the Latin for 'remarkable', draws attention to this unique palpo-setal formula.

34. *Leptotrombidium (Leptotrombidium) irregulare* Traub and Nadchatram (Fig 33)

Leptotrombidium (Leptotrombidium) irregulare Traub and Nadchatram, 1967a, 8; Vercammen-Grandjean and Langston, 1976, 502; Srivastava and Wattal, 1981, 124.

Redescription of species : Larva.

Idiosoma : Measuring 450-595 x 290-407 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 56-61; 58-85 dorsal idiosomal setae, measuring 40-52, arranged : (18-24)-(2-4)-(10-16)-(6-11)-(4-8)-(2-4); 2 pairs of sternal setae, anterior 55-58, posterior 40-47; 28-34 preanal setae, 32-35; 14-22 postanal setae, 37-46; total idiosomal setae 112-142.

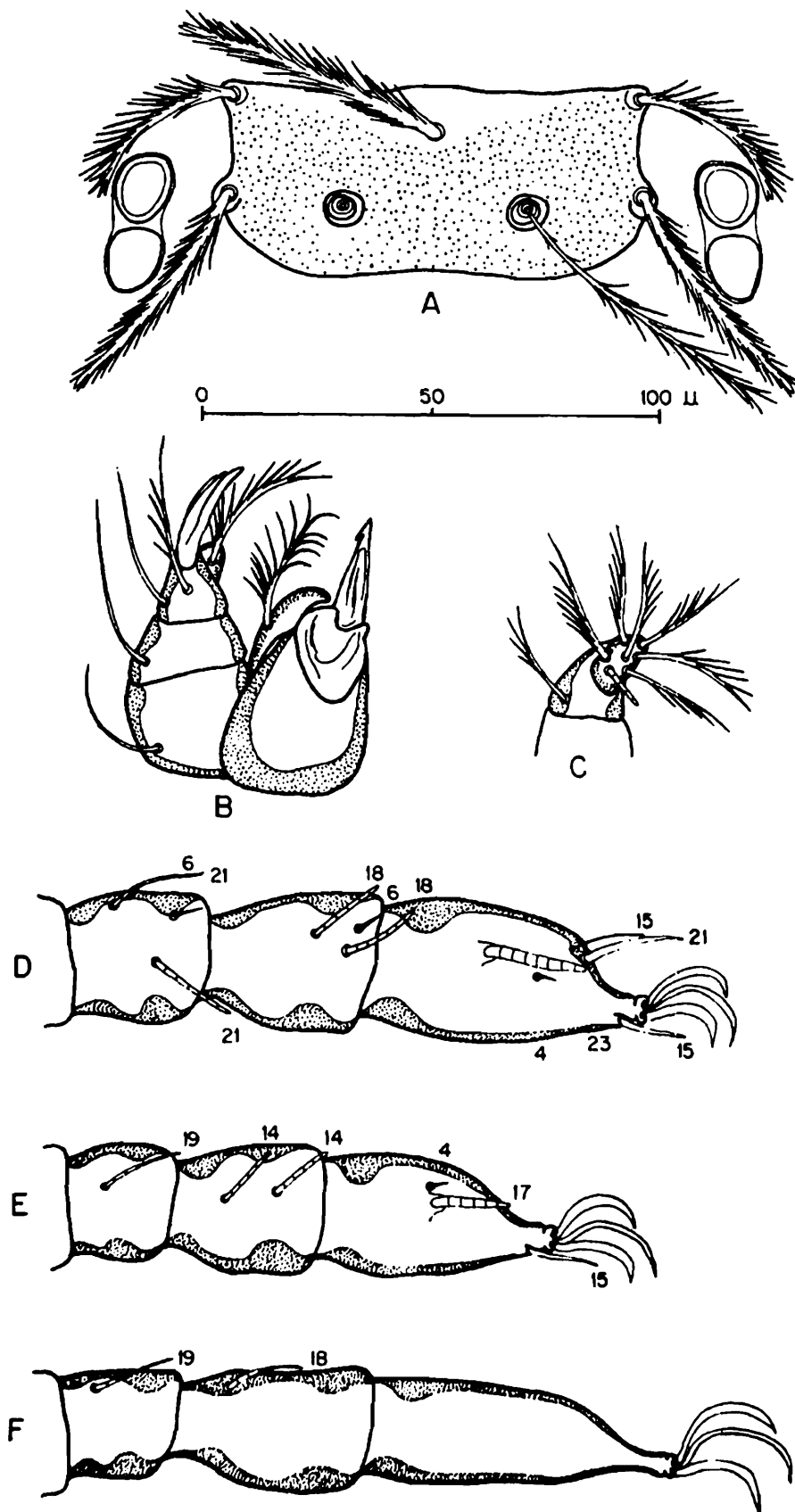


Fig. 33. *Leptotrombidium irregulare*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula N/N/BNB(b/N)/7B; palpal claw 3-pronged; galeala B; cheliceral blade (42) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL = AM > AL; sensillae flagelliform with branches on distal 2/3; PW/SD = 1.91-2.04. Scutal measurements of holotype followed by means and ranges of 15 specimens in parentheses after original description : AW 82 (80, 76-85); PW 94 (92, 88-96); SB 40 (38, 36-40); ASB 28 (30, 28-32); PSB 18 (18, 17-19); AP 25 (25, 23-27); AM 62 (57, 56-62); AL 48 (44, 43-48); PL 62 (57, 56-62); sens. 74 (72, 71-74). Scutal measurements giving means and ranges of 10 NIV specimens : AW 86, 75-96; PW 94, 86-104; SB 38, 34-42; ASB 28, 27-29; PSB 17, 15-18; AP 25, 23-26; AM 56, 47-61; AL 39, 37-43; PL 57, 48-60; sens. 75, 72-79.

Legs Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 822-866. Leg I : 277-293; tarsus (60-70 x 24-30), tarsala (20-23). leg II : 253-286; tarsus (51-54 x 20-26), tarsala (15-17). Leg III : 284-324; tarsus (66-73 x 20-22).

Type data : Holotype (B66467-2), PAKISTAN, Hazara District, Kaghan Valley, Lulu Sar, 3385m, 9.5km South of Gitidas, ex *Hyperacrius fertilis*, 28.VII.1964, R. Traub, coll. 22 paratypes, R. Traub and J.J. O'Keefe, coll. : 1, same data as holotype; 5, same host, but Soch, 2615m, 24km N of Naran, taken 22.VII.1964; 7, same host, but Besal, 3290m, taken 28.VII-1.IX.1963; 4 same host, but Gitidas, 3630m, taken 16.VIII.1963; 1, same host, but Shogran, 2385-2925m, 31.VII.1964; 3, same locality, but ex *Apodemus* sp., taken 26.VI, 29.VII.1963; 1, Battakudi, 2740m, ex *Alticola roylei*, 10.VIII.1963.

Type depository : Holotype at USNM; 22 paratypes at IMR, BM(NH), BPBM, IA, RML, and in collections of R. Traub and others.

Additional records : JAMMU and KASHMIR, Gulmarg, 2730m, 159 ex *A. roylei* and *Rattus rattus*, IX.1970, NICD, coll.

New records : 5 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 1 ex *Ochotona roylei*, 20.IX.968; Kinnaur District, Kalpa, 2590-2740m, 1 ex *Mus musculus*, 14.V.1968; Lahul District, Chetru, 3450m, 14 ex 3 *Alticola roylei*, 8.IX.1968.

Material examined : 1 paratype (B6744-2) on loan from M. Nadchatram : WEST PAKISTAN, Hazara District, Kaghan Valley, Besal, ex *H. fertilis*, 29.VIII.1963, R. Traub and J.J. O'Keefe, coll.

Remarks : The above redescription is based on the literature, the study of the Pakistan specimen, and the NIV specimens. *L. irregulare* falls out at couplet 80 of the key to species

of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. miyazakii* Sasa *et al.*, 1951. They distinguish *L. irregulare* in having humeral setae measuring 66 with thin shafts and thick barbs (70 with thicker shafts and thin barbs in *L. miyazakii*). Vercammen-Grandjean and Langston have further described a new species *L. lagone* from among specimens labelled *L. irregulare* in the IMR collection. They distinguish *L. irregulare* by the more pronounced protrusion of its scutal posterior margin (less pronounced in *L. lagone*), in having PL = AM (PL > AM in *L. lagone*), Ip 833 (975 in *L. lagone*), palpo-setal formula : N/N/BNN (N/N/BNB in *L. lagone*), and microtid host (lagomorph host in *L. lagone*). In the original description, Traub and Nadchatram (1967a) consider *L. irregulare* close to another new species they describe *L. rupestre*. They distinguish *L. irregulare* in having greater number of dorsal body setae (50 in *L. rupestre*), dorsal body setae shorter (measuring 58 in *L. rupestre*), and PL and AM setae subequal (PL > AM in *L. rupestre*). The NIV specimens agree closely with the original description, but the ventrotibial palpal seta has 2-5 barbs (Original description : nude or with 1-2 barbs). The species name draws attention to the variation in the number and arrangement of dorsal body setae, and the uneven curves formed by their bases.

35. *Leptotrombidium (Leptotrombidium) jayewickremei* (Womersley)
(Fig. 34)

Trombicula (Neotrombicula) jayewickremei Womersley, 1952, 138; Joshee, 1964, 47.

Trombicula (Leptotrombidium) jayewickremei, Audy, 1954b, 146; Womersley and Audy, 1957, 256.

Neotrombicula jayewickremei, Radford, 1954, 259.

Leptotrombidium (Leptotrombidium) jayewickremei, Traub and Nadchatram, 1967a, 1; Traub *et al.*, 1967, 37; Traub and Wisseman, 1968, 228; Vercammen-Grandjean, 1968b, 74; Nadchatram, 1970c, 146.

Leptotrombidium jayewickremei, Mitchell and Nadchatram, 1969, 123; Kudryashova, 1973, 3.

Leptotrombidium (Hypotrombidium) jayewickremei, Vercammen-Grandjean and Langston, 1976, 729.

Leptotrombidium (Ericotrombidium) jayewickremei, Kudryashova, 1976b, 33.

Redescription of species : Larva.

Idiosoma : Measuring 366-450 x 267-350 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 42-43; 26-32 dorsal idiosomal setae, measuring 34-50, arranged : 8-6-6-4-(4)-2-(2); 2 pairs of sternal setae, anterior 38-41, posterior 28-33; 14-18 preanal setae, 28-30; 4-10 postanal setae, 34-42; total idiosomal setae 52-64.

Gnathosoma : Palpal setal formula B/B/NNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (31) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with PL bases;

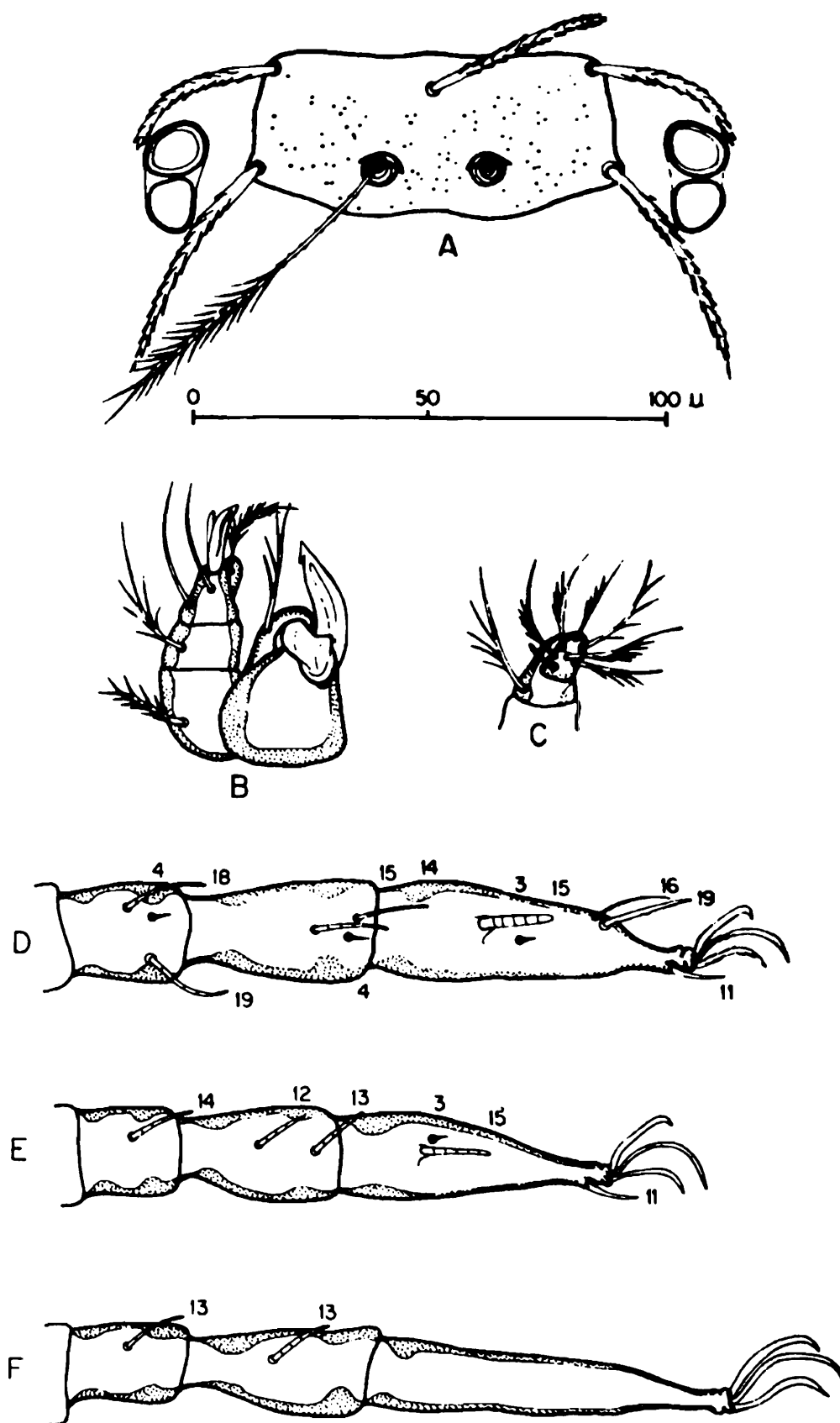


Fig. 34. *Leptotrombidium jayewickremei*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

PL>AM>AL (Original description : PL=AM>AL; Vercammen-Grandjean and Langston (1976) : PL>AL>AM); sensillae with basal barbs and branches on distal 1/2; PW/SD = 1.78-2.25. Scutal measurements of type after original description followed by means of 3 cotypes and 2 Pakistani specimens after Vercammen-Grandjean and Langston (1976) : AW 67, 64, 65; PW 81, 74, 73; SB 28, 24, 25; ASB 25, 26, 28; PSB 11, 11, 13; AP 25, 25, 27; AM 50, 33, 33; AL 45, 40, 40; PL 50, 44, 48; sens. 56, 69, 70. Scutal measurements giving means and ranges of 10 NIV specimens : AW 65, 62-67; PW 76, 73-79; SB 23, 21-25; ASB 25, 24-26; PSB 13, 12-15; AP 22, 21-24; AM 41, 37-44; AL 37, 33-40; PL 46, 44-49; sens. 64, 64-65.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 727-741 (Original description : 697; Vercammen-Grandjean and Langston (1976) : 899, 883). Leg I : 245-256 (227; 319, 310); tarsus (67 x 20), tarsala (15). Leg II : 222-230 (210; 266, 261); tarsus (58 x 18), tarsala (15). Leg III : 255-260 (260; 314, 312); tarsus (76 x 13).

Type data : 3 cotypes, SRI LANKA, Nalanda, ex *Rattus rattus kandiyanus*, IX.1944, S.H. Jayewickremei, coll.; 4 cotypes, same data, but Embilipitiya, taken XI.1944.

Type depository : Cotypes at SAM.

Additional records : KARNATAKA, Bangalore, 1 ex *Rattus*?, 19.VI.1947, S.L. Kalra, coll. JAMMU and KASHMIR, Gilgit Agency, 1540-3050m, ex *Rattus rattoides*, *Cricetulus migratorius*, *Mus* sp. and *Crocidura* sp., 1962-1965, UM and PMRC field teams, coll.

New records : 3 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Simla District, Nalagarh, 500-600m, 5 ex *Rattus rattus rufescens*, 6.IV.1969; 10, same data, but ex 2 *Suncus murinus*, taken 8,9.IV.1969.

Material examined : 2 specimens (B66665-17, B66669-5) on loan from M. Nadchatram : JAMMU and KASHMIR, Gilgit Agency, ex *R. rattoides*, 22.VIII.1964, UM and PMRC field teams, coll.

Remarks : The above redescription is based on the literature, the study of the specimens from Gilgit Agency and the NIV specimens. Vercammen-Grandjean and Langston (1976) place *L. jayewickremei* in the subgenus *Hypotrombidium* which is here regarded as a synonym of the nominate subgenus. In their key to species of the subgenus *Hypotrombidium*, *L. jayewickremei* falls out at couplet 16 along with *L. felinum* Vercammen-Grandjean and Langston, 1976. They distinguish *L. jayewickremei* in having 30 dorsal and 62 total body setae (numbering 26 and 56 in *L. felinum*), 3 tarsal bars on each leg (only one on each leg in *L. felinum*), coxa III with 1 barbed seta (2 in *L. felinum*), and Ip 890-912 (838-890 in *L. felinum*). The NIV specimens agree closely with the original description, but PL>AM>AL as in the specimen examined from Gilgit Agency. The Ip range is closer to the measurements given for the type in the original description than the measurements given by Vercammen-

Grandjean and Langston (1976) for the cotypes and Pakistani specimens. Traub *et al.* (1967) have recorded this species from Gilgit Agency, which falls within JAMMU and KASHMIR, India, and not Pakistan as they have reported. The species has been named in honour of S.H. Jayewickreme of the Medical Department, Sri Lanka.

36. *Leptotrombidium (Leptotrombidium) kalrai* (Radford)

Trombicula kalrai Radford, 1953a, 231; 1954, 257.

Trombicula (Leptotrombidium) kalrai, Audy, 1957, 229.

Leptotrombidium kalrai, Mitchell and Nadchatram, 1966, 68.

Leptotrombidium (Leptotrombidium) kalrai, Traub and Nadchatram, 1967a, 3; Vercammen-Grandjean and Langston, 1976, 340.

Trombicula kalrae, sic! Audy, 1954b, 148.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. Two pairs of humeral setae; 112 dorsal idiosomal setae, measuring 54; sternal setae : 2,6; 90 ventral setae; total idiosomal setae 218. Vercammen-Grandjean and Langston (1976) : One pair of humeral setae, measuring 74; 154 dorsal idiosomal setae, measuring 36-66, arranged : 10-14-12-14-14-14-16-16-16-12-10-6; 2 pairs of sternal setae; 50 preanal setae, 40; 54 postanal setae, 40-56; total idiosomal setae 264.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin broadly convex (Vercammen-Grandjean and Langston (1976), fig. 57 : posterior margin biconvex!); AM base posterior to level of AL bases; SB level with PL bases; AM seta and sensillae missing in holotype; PL > AL; PW/SD = 1.98 (Vercammen-Grandjean and Langston (1976) : 1.77). Scutal measurements of holotype after original description followed by measurements after Vercammen-Grandjean and Langston (1976) : AW 60, 76; PW 79, 94; SB 28, 34; ASB 28, 37; PSB 12, 16; AP 40, 53; AM -, -; AL 44, 56; PL 54, 66; sens. -, -.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of sensory setae. Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 930. Leg I : 310. Leg II : 274. Leg III : 346.

Type data : Holotype, UTTAR PRADESH (now UTTARANCHAL), Kumaon Hills, ex *Rattus* sp., X.1946, S.L. Kalra, coll.

Type depository : Holotype in C.D. Radford collection. Probably in BM(NH) : Nadchatram (personal communication).

Remarks : The above redescription is based only on the literature. *L. kalrai* falls out in couplet 85 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. besali* Vercammen-Grandjean and Langston, 1976. They distinguish *L. kalrai* in having a greater number of body setae (94-110 in *L. besali*). Mitchell and Nadchatram (1966) describe *L. spilletti*, which they consider close to *L. kalrai* in the shape of the scutum. Traub and Nadchatram (1967a) describe *L. dihumerae* which they consider close to *L. kalrai* in having more than 1 pair of humeral setae and similar scutal shape, but distinguished in having ventrotibial palpal seta barbed, dorsal body setae <80, and larger scutal dimensions (AW measuring 79 and PW 85). The redescription of Vercammen-Grandjean and Langston (1976) differs significantly from the original description. There is need of re-examination and clarification of several diagnostic features for a better understanding of this species. The species has been named in honour of Lt. Col. S.L. Kalra for his pioneering contributions to the knowledge of the Indian trombiculid fauna.

37. *Leptotrombidium (Leptotrombidium) keukenschrijveri* (Walch)
(Fig. 35)

Trombicula keukenschrijveri Walch, 1923, 585; Womersley and Heaslip, 1943, 75; Prasad, 1974, 96.

Trombicula (?Leptotrombidium) keukenschrijveri, Womersley, 1952, 49.

Trombicula (Leptotrombidium) keukenschrijveri, Wharton and Fuller, 1952, 53; Womersley and Audy, 1957, 256.

Leptotrombidium keukenschrijveri, Radford, 1954, 260.

Leptotrombidium (Leptotrombidium) keukenschrijveri, Nadchatram and Upham, 1966, 101; Nadchatram, 1970b, 133; Vercammen-Grandjean, 1968b, 74; Vercammen-Grandjean and Langston, 1976, 333; Lakshana, 1973, 2.

Redescription of species : Larva.

Idiosoma : Measuring 421-495 x 342-420 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 58-63; 52-62 dorsal idiosomal setae, measuring 37-59, arranged : 12-4-10-4-10-8-4-(6)-(4); 2 pairs of sternal setae, anterior 52-57, posterior 36-40; 28 preanal setae, 29-30; 22 postanal setae, 38-43; total idiosomal setae 108-118.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (41) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB posterior to level of PL bases; Womersley and Heaslip (1943) and Womersly (1952) : PL>AM>AL; Vercammen-Grandjean and Langston (1976) and in Malaysian specimen examined : AM>PL>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.76-1.82. Scutal

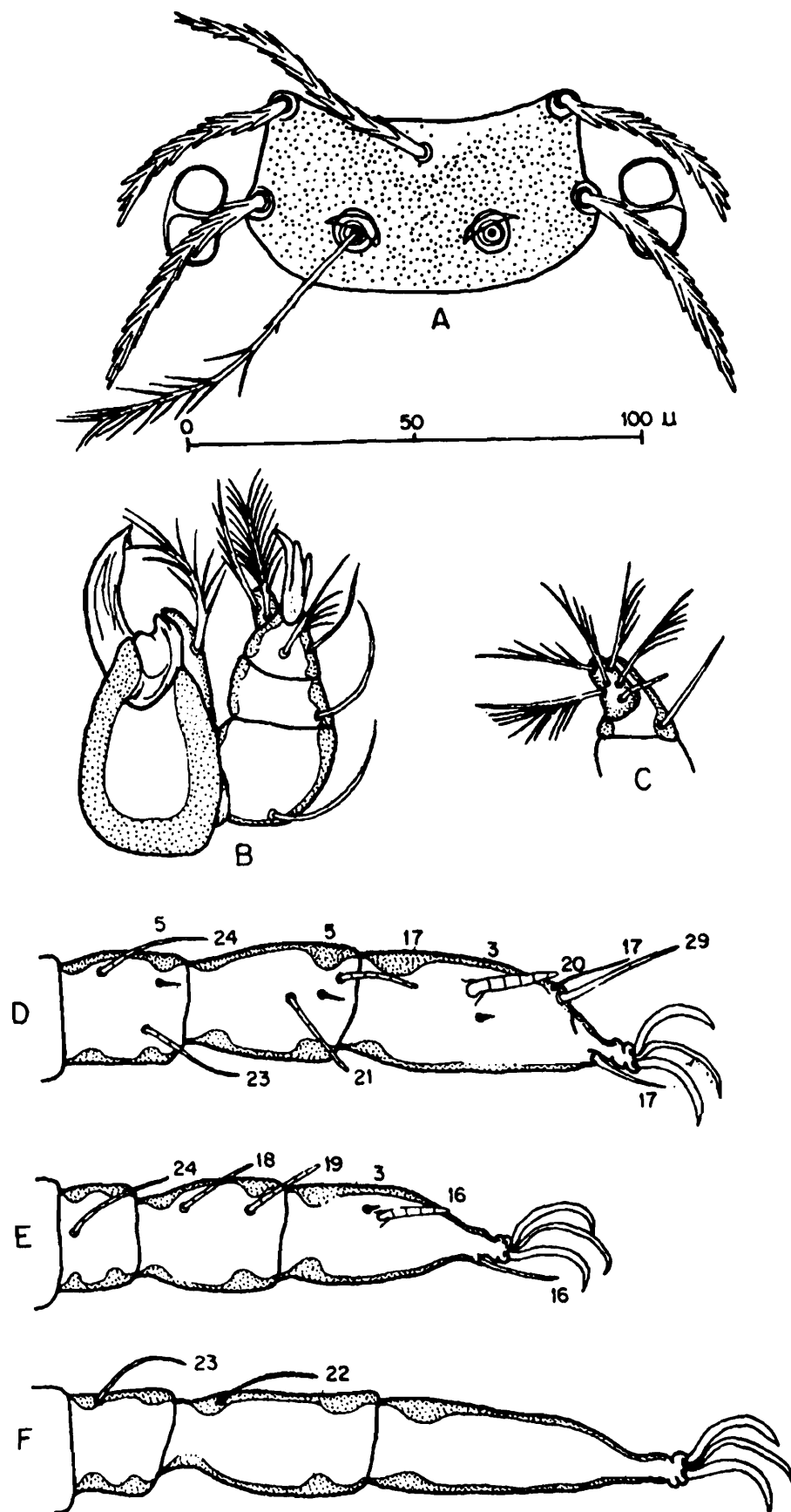


Fig. 35. *Leptotrombidium keukenschrijveri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

measurements after Womersley and Heaslip (1943) derived from Walch's description and figures : AW 64; PW 70; SB 32; ASB 24; PSB 14; AP 20; AM 48; AL 44; PL 50; sens. -. Scutal measurements giving means of 6 specimens after Womersley (1952) followed by means of 3 Malaysian specimens after Vercammen-Grandjean and Langston (1976) : AW 59, 61; PW 69, 72; SB 29, 29; ASB 27, 29; PSB 11, 12; AP 23, 26; AM 52, 66; AL 45, 48; PL 55, 54; sens. 62, 85.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 702-738. Leg I : 234-257; tarsus (62 x 26), tarsala (20). Leg II : 208-220; tarsus (49 x 22), tarsala (16). Leg III : 260-261; tarsus (67 x 18).

Type data : Holotype, SUMATRA, Deli, ex *Homo sapiens*, collection date not recorded, N.C. Keukenschrijver, coll.

Type depository : Not reported in the literature.

Additional records : Wharton and Fuller (1952) record this species from India with no mention of host, collection and precise locality data.

Material examined : 1 specimen (IMR 26) on loan from M. Nadchatram : MALAYSIA, Pahang, Mt. Brichang, ex *Dremomys rufigenis*, 19.IV.1979, IMR, coll.

Remarks : The above redescription is based on the literature and study of the Malaysian specimen. *L. keukenschrijveri* falls out in couplet 136 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. globosum* (Schluger *et al.*, 1960c). They distinguish *L. keukenschrijveri* in having fewer body setae (numbering 126-128 in *L. globosum*), SB posterior to level of PL bases (anterior in *L. globosum*), and AM >> PL (AM = PL in *L. globosum*). Wharton and Fuller (1952) have reported *L. keukenschrijveri* from India, Malaysia and Indonesia, taken on man and *Rattus edwardsi ciliatus*. In the above additional records, *L. keukenschrijveri* is reported from unknown host after Vercammen-Grandjean and Langston (1976) rather than from rat after Prasad (1974), as there is no confirmation of the latter record in the literature. This species has been named in honour of the collector, N.C. Keukenschrijver.

**38. *Leptotrombidium (Leptotrombidium) kulkarnii* Vercammen-Grandjean
and Langston, full species
(Fig. 36)**

Leptotrombidium (Leptotrombidium) delimushi kulkarnii Vercammen-Grandjean and Langston, 1976, 270.

As *Leptotrombidium (Leptotrombidium) akamushi* (Brumpt, 1910): Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 17; Kulkarni and Mahadev, 1973, 356.

As *Leptotrombidium (Leptotrombidium) deliense* (Walch, 1922): Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 17; Kulkarni and Mahadev, 1973, 355.

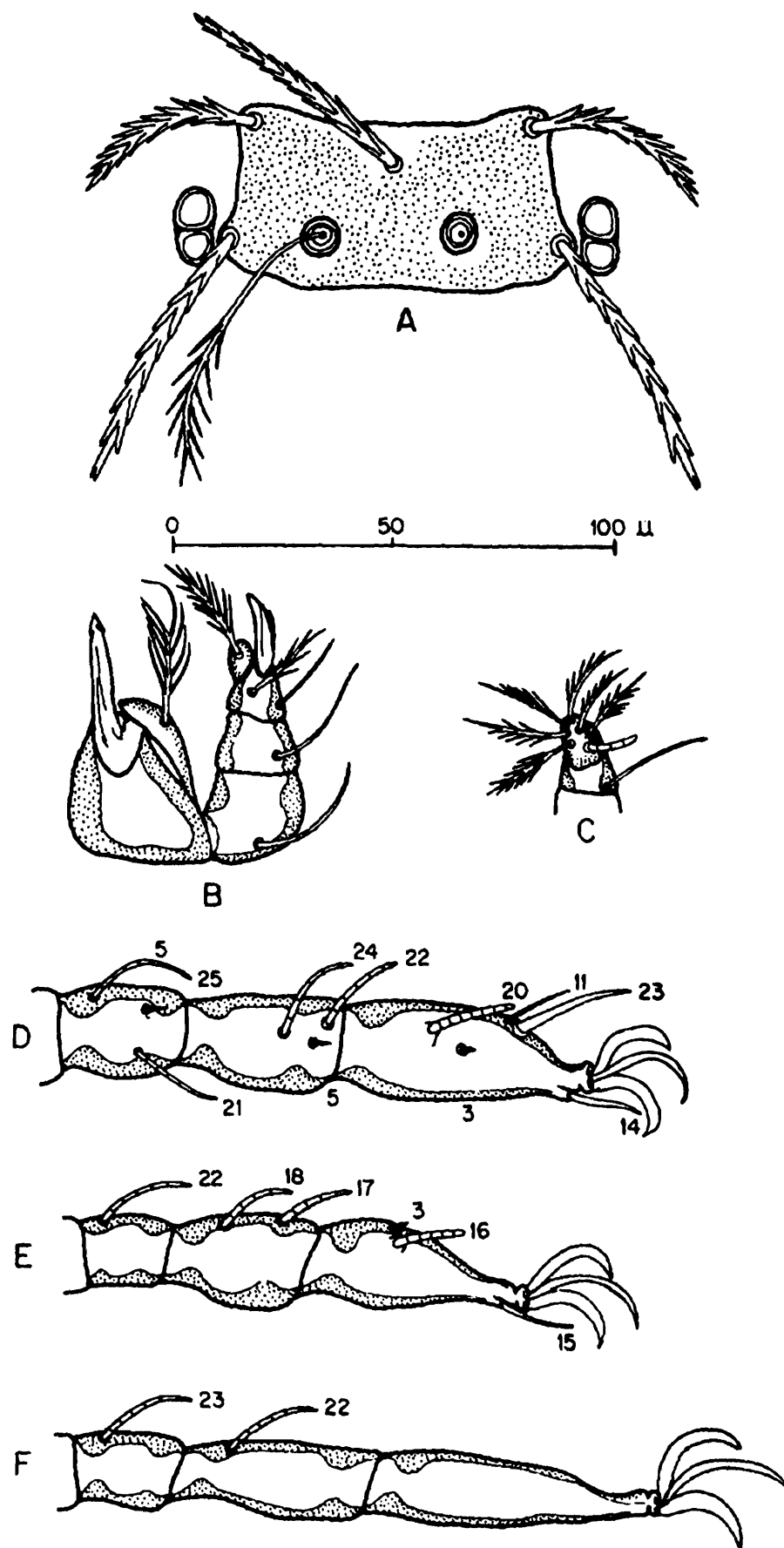


Fig. 36. *Leptotrombidium kulkarnii*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Redescription of species : Larva.

Idiosoma : Measuring 290-349 x 183-267 in unengorged to partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 57-68; 30-36 dorsal idiosomal setae, measuring 42-66, arranged : 8(10)-6-8(6)-6-4; 2 pairs of sternal setae, anterior 50-56, posterior 41-47; 16-21 preanal setae, 31-37; 6 postanal setae, 42-58; total idiosomal setae 60-66.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (35) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly biconvex; AM base posterior to level to AL bases; SB slightly anterior to level of PL bases; PL >> AM > AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.76-1.94. Scutal measurements of holotype after original description followed by means and ranges of 10 NIV specimens in parentheses : AW 65 (65, 62-70); PW 76 (77, 72-79); SB 31 (31, 26-34); ASB 28 (30, 28-32); PSB 14 (14, 13-14); AP 27 (30, 28-31); AM 52 (58, 53-65); AL 41 (44, 41-48); PL 65 (69, 66-75); sens. 74 (65, 62-66).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation: 22-16-15. Measurements as follows : Ip = 733-805. Leg I : 250-278; tarsus (58 x 21), tarsala (20). Leg II : 226-241; tarsus (47 x 19), tarsala (16). Leg III : 254-288; tarsus (63 x 15).

Type data : Holotype (NIV A92686-TMC-2), MAHARASHTRA, Pune District, Khandala, 680m, ex *Suncus murinus*, 10.I.1970, S.M. Kulkarni, coll.

Type depository : Holotype at IMR.

New records : MAHARASHTRA, Pune District, approximately 13,000 ex *S. murinus*, *Funambulus tristriatus*, *Milladia kondana*, *Rattus rattus rufescens*, *Rattus rattus satarae*, *Golunda ellioti*, *Rattus blanfordi*, *Bandicota bengalensis*, *Mus musculus*, and *Mus booduga*, I.1970-IX.1971, S.M. Kulkarni, coll.; Satara District, Mahabaleshwar, 44 ex *S. murinus*, 12.XII.1984, P.K. Deshmukh, coll. KARNATAKA, Shimoga District, Hennagere and North Kanara District, Mavingundi, 398 ex *Rattus rattus wroughtoni* and *S. murinus*, 29.IX-2.XI.1966, NIV, coll. GOA, approximately 10,000 specimens ex *S. murinus*, *R. r. rufescens*, *R. r. wroughtoni*, *R. blanfordi*, and *B. bengalensis*, VIII.1983-II.1984, S. Fernandes, coll.

Material examined : Series of specimens from the trombiculid colonies started at NIV by Kulkarni and Mahadev (1973) : *L. (L.) deliense*, (TMC-2) and (TMC-5), and *L. (L.) akamushi*, (S1).

Remarks : The above redescription is based on the original description and study of the NIV specimens. *L. delimushi kulkarnii* runs to couplet 150 of the key to species of the

subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this subspecies as having scutal and dorsal setae with thick shafts and few, relatively short barbs; 32 dorsal body setae, arranged : 8-6-8-6-4; Ip = 733; PL > AM; and galeala with 4 branches. *L. kulkarnii* is here raised to full species. A critical reexamination of the NIV collection from the Pune District, including the specimens from the trombiculid colonies (TMC-2), (TMC-5) and (S1), labelled *L. (L.) deliense* and *L. (L.) akamushi* reveals that these specimens are *L. kulkarnii*. This species has been named in honour of Dr. S.M. Kulkarni, retired Sr. Grade, Deputy Director.

39. *Leptotrombidium (Leptotrombidium) lagone* Vercammen-Grandjean and Langston (Fig. 37)

Leptotrombidium (Leptotrombidium) lagone Vercammen-Grandjean and Langston, 1976, 504; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 467x318 in partially engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 62-69; 55-64 dorsal idiosomal setae, measuring 50-62, irregularly arranged, arrangement in holotype : (7+10)-(6+6)-(10+6)-7-4-2-4; 2 pairs of sternal setae, anterior 62-67, posterior 45-50; 38 preanal setae, 31-38; 18 postanal setae, 52-55; total idiosomal setae 117-126.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (46) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; PL > AM > AL; sensillae flagelliform with few branches on distal 2/3; PW/SD = 1.80-1.94. Scutal measurements of holotype after original description, followed by means and ranges of 8 NIV specimens in parentheses : AW 82 (81, 78-90); PW 97 (98, 90-102); SB 42 (38, 36-41); ASB 37 (33, 30-36); PSB 13 (16, 14-18); AP 32 (28, 26-31); AM 65 (68, 58-73); AL 53 (50, 46-52); PL 70 (73, 71-75); sens. 106 (broken off in specimens extant).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 958-980. Leg I : 317-338; tarsus (78 x 26), tarsala (22). leg II : 284-299; tarsus (64 x 22), tarsala (18). Leg III : 340-358; tarsus (84 x 18).

Type data : Holotype (B66877-6), PAKISTAN, Hazara District, Kaghan Valley, Naran, 2430m, *Ochotona* sp., 17.IX.1964, UM and PMRC field teams, coll.

Type depository : Holotype at IMR.

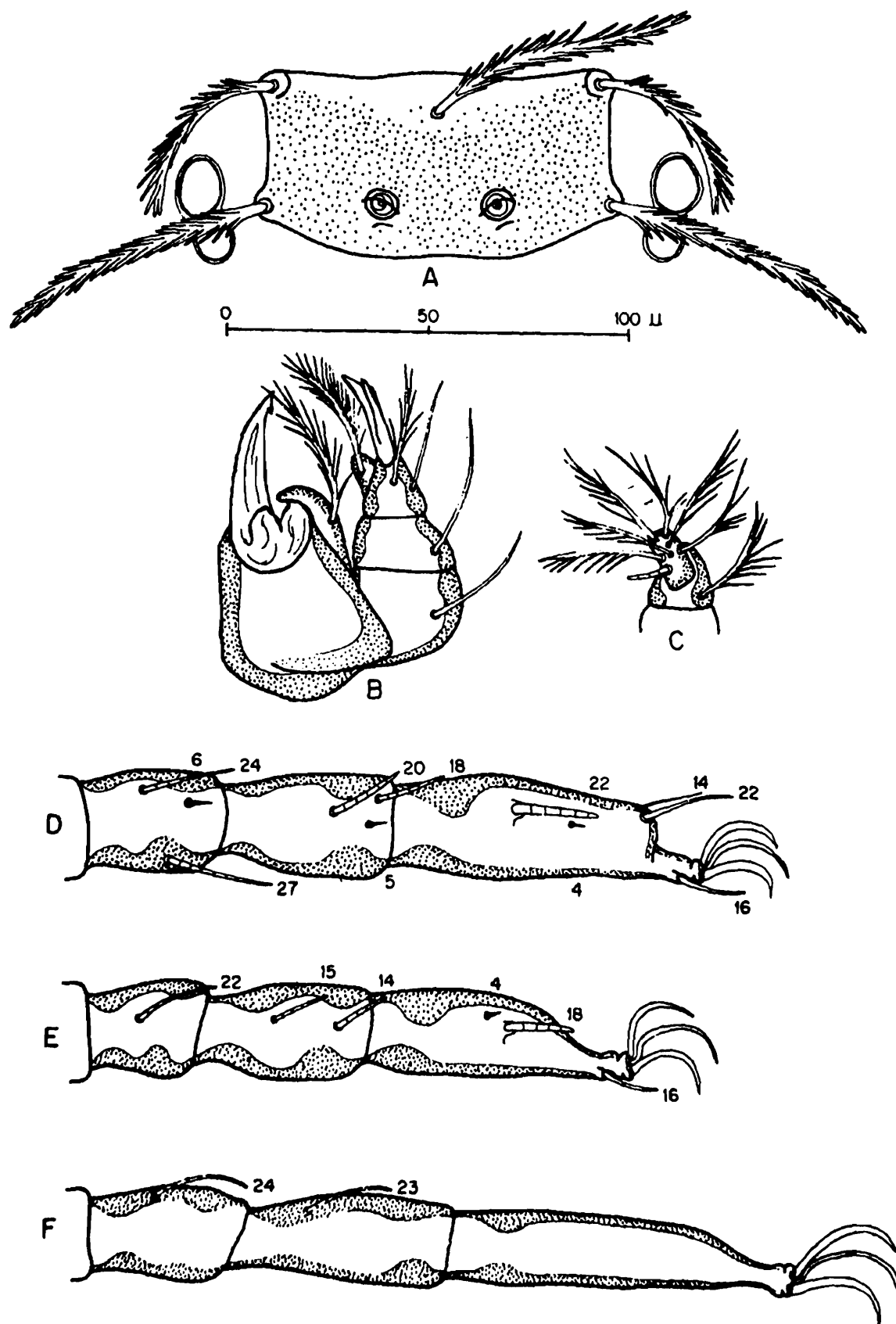


Fig. 37. *Leptotrombidium lagone*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

New records : UTTARANCHAL, Pithoragarh District, Tejam, 1100-1200m, 8 ex *Alticola roylei*, 19.IX.1967, NIV, coll.

Remarks : The above redescription is based on the original description and study of the NIV specimens. *L. lagone* falls out in couplet 13 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. rowanae* Nadchatram, 1970. They distinguish *L. lagone* in having lower Ip (990-1120 in *L. rowanae*), wide, trapezoidal scutum (subquadrate scutum in *L. rowanae*), and larger number of total body setae (66-74 in *L. rowanae*). The NIV specimens agree closely with the original description. The species name is based on the type host, a lagomorph.

40. *Leptotrombidium (Leptotrombidium) longisetum* (Womersley)

Trombicula (Leptotrombidium) longiseta Womersley, 1952, 61; Womersley and Audy, 1957, 256; Audy *et al.*, 1953, 27; Audy, 1957, 230.

Trombicula longiseta, Prasad, 1974, 96.

Leptotrombidium longiseta, Radford, 1954, 260.

Leptotrombidium (Leptotrombidium) longisetum, Vercammen-Grandjean and Langston, 1976, 391.

Redescription of species : Larva.

Idiosoma : Measuring 285x185 in unengorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 73-78; 26 dorsal idiosomal setae, measuring 51-71, arranged : 8-6-6-4-2; 2 pairs of sternal setae; 19-22 preanal setae, 29-33; 6 postanal setae, 51-54; total idiosomal setae 57-60.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged (Original description : 2-pronged); galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL >> AL > AM; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.69-1.78. Scutal measurements giving means of 14 type specimens after original description : AW 60; PW 72; SB 27; ASB 32; PSB 10; AP 26; AM 56; AL 5; PL 108; sens. 70. Scutal measurements of lectotype followed by means and ranges of 5 type specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 59 (60, 59-62); PW 71 (73, 71-75); SB 23 (26, 23-27); ASB 32 (32, 32-32); PSB 10 (10, 9-10); AP 26 (27, 26-28); AM 55 (56, 54-58); AL 58 (59, 58-60); PL 104 (108, 102-116); sens. 78 (79, 78-80).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation: 22-16-15. Measurements after original

description followed by ranges given by Vercammen-Grandjean and Langston (1976) : Ip = 695; 743-772. Leg I : 227; 258-270. Leg II : 227; 227-236. Leg III : 241; 256-266.

Type data : Lectotype (#740-1), NORTH BURMA, Myitkyina, ex 'rodent', 1945, G.M. Kohls, coll. MANIPUR, Kanglatongbi near Imphal, 3 larvae and 10 larval pelts ex *Rattus rattus bullocki*, 25.IX.1945, T.J. Lawrence and K.L. Cockings, coll.

Type depository : Lectotype at SAM; paralectotypes at SAM and IMR.

Additional records : MANIPUR, Kanglatongbi near Imphal, 1 ex *Callosciurus* sp., 26.IX.1945, STRU, coll.

Remarks : The above redescription is based only on the literature. *L. longisetum* runs to couplet 108 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having a moderate-sized scutum with PL measuring >100 and AL > AM; Ip 743-777; and dorsal body setae 26, arranged : 8-6-6-4-2. Womersley (1952) regards this species as a variant of *L. deliense* (Walch, 1922) with very long PL setae. Vercammen-Grandjean and Langston (1976) report 2 larvae ex 'rodent' from Myitkyina, whereas other sources record only 1 specimen! The species name draws attention to the outstanding PL setae, which are almost 2x AM setae in length.

41. *Leptotrombidium (Leptotrombidium) macacum* (Womersley)

Trombicula (?*Leptotrombidium*) *macacus* Womersley, 1952, 56.

Leptotrombidium macacus, Radford, 1954, 260.

Trombicula (Leptotrombidium) macacus, Audy *et al.*, 1953, 27; Womersley and Audy, 1957, 256.

Leptotrombidium (Leptotrombidium) macacus, Lakshana, 1973, 2.

Leptotrombidium (Leptotrombidium) macacum, Traub and Lakshana, 1966, 282; Nadchatram, 1970c, 145; Vercammen-Grandjean and Langston, 1976, 607.

Trombicula macacus, Prasad, 1974, 97.

Mehracula roonwali Sinha, 1954, 329; Vercammen-Grandjean and Langston, 1976, 607, **synonymy**.

Trombicula (Leptotrombidium) roonwali, Sinha, 1957, 295; Audy, 1957, 232.

Leptotrombidium roonwali, Schluger and Amanguliev, 1972a, 48.

Redescription of species : Larva. Colour in life orange(?).

Idiosoma : Measuring 260x182 in partially engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 45-50; 36-48 dorsal idiosomal setae, measuring 34-45, irregularly arranged, arrangement in holotype : 10-(8+2)-10-8-6-4; 2 pairs of sternal setae, anterior 48-50, posterior 35-40; 22-26 preanal setae, 26-28; 12-18 postanal setae, 34-39; total idiosomal setae 76-98.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (36-38) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; $AM > PL > AL$; sensillae flagelliform with basal barbs and branches on distal 2/3; $PW/SD = 1.88-1.97$. Scutal measurements of holotype after original description followed by measurements of holotypes of *L. macacum* and *L. roonwali* in parentheses after Vercammen-Grandjean and Langston (1976) : AW 64 (63, 60); PW 76 (75, 72); SB 31 (31, 30); ASB 28 (27, 26); PSB 11 (13, 12); AP 26 (27, 27); AM 48 (48, 48); AL 40 (40, 42); PL 50 (42, 44); sens. 62 (72, -). Scutal measurements giving means and ranges of 6 Nepali specimens after Nadchatram (1970c) : AW 67, 64-70; PW 80, 77-85; SB 33, 32-34; ASB 28, 26-29; PSB 14, 12-15; AP 27, 26-29; AM 52, 48-57; AL 40, 35-42; PL 45, 42-46; sens. 70, 70-74.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : $Ip = 674-747$. Leg I : 227-255; tarsus (53-56 x 24-26), tarsala (19-20). Leg II : 200-228; tarsus (43-45 x 20-21), tarsala (15-16). Leg III : 240-264; tarsus (61-62 x 16).

Type data : Holotype, MANIPUR, Imphal, ex *Macaca assamensis*, 8.XII.1945, T.J. Lawrence, coll.

Type depository : Holotype at SAM.

Additional records : Type series of *L. roonwali* : MANIPUR, Manipur-Tamu road, MS 34, near Palel, over 54 ex *Tupaia glis*, 14.IX.1945, M.L. Roonwal, coll.

Material examined : 1 paratype of *L. roonwali* (CORU 100844) at ZSI.

Remarks : The above redescription is based only on the literature. The specimen examined at ZSI is in poor condition. *L. macacum* falls out in couplet 34 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. radfordi* (Sinha, 1954). They distinguish *L. macacum* in having trapezoidal scutum (rectangular in *L. radfordi*), scutal ratio $PW/AP = 2.66-2.78$ (2.13-2.64 in *L. radfordi*), 96-104 total body setae (numbering 84-94 in *L. radfordi*) and lower Ip (761 in *L. radfordi*). They consider this species close to *L. binbium* Traub and Lakshana, 1966, but with a less prominent scutal posterior margin and greater number of total body setae (80 in *L. binbium*). Nadchatram (1970c) has based his redescription of *L. macacum* on 23 specimens from Nepal. After study of the holotypes, Vercammen-Grandjean and Langston (1976) have established the synonymy of *L. roonwali* with *L. macacum*, and based their redescription on these 2 specimens. The species name has been derived from the type host.

42. *Leptotrombidium (Leptotrombidium) mirum* Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) mirum Vercammen-Grandjean and Langston, 1976, 399.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 54; 34 dorsal idiosomal setae, measuring 36-49, arranged : 8-8-8-6-4; 2 pairs of sternal setae; 18 preanal setae, 33; 6 postanal setae 36-53; total idiosomal setae 64.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin markedly bilobed; AM base posterior to level of AL bases; SB slightly posterior to level of PL bases; PL >> AL > AM; sensillae missing in holotype; PW/SD = 1.67. Scutal measurements of holotype after original description : AW 62; PW 72; SB 29; ASB 31; PSB 12; AP 25; AM 38; AL 42; PL 64; sens. -.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 810. Leg I : 282. Leg II : 248. Leg III : 280.

Type data : Holotype, UTTARANCHAL, Kumaon Hills, Bhimtal, ex 'shrew', 10.VIII.1946, S.L. Kalra, coll.

Type depository : Holotype at SAM.

Remarks : The above redescription is based only on the original description. *L. mirum* runs to couplet 110 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having SD>2AP, AL>AM, Ip = 800-820 and 34 dorsal body setae, arranged : 8-8-8-6-4. They consider *L. mirum* very similar to *L. bhimtalense* (Womersley, 1952) in having pronounced posterior scutal margin and short AM seta. They distinguish *L. mirum* in having higher Ip (754 in *L. bhimtalense*), arrangement of dorsal body setae commencing : 8-8-8 (10-8-6 in *L. bhimtalense*), ventrotibial palpal seta nude (barbed in *L. bhimtalense*), and SB slightly posterior to level of PL bases (anterior in *L. bhimtalense*). Womersley (1952) described *T. bhimtalensis* from a single specimen taken on a shrew from Bhimtal, Kumaon Hills, 10.X.1946. Vercammen-Grandjean and Langston (1976) have described *L. mirum* from a specimen labelled *T. bhimtalensis* with the same data, but taken 10.XII.1946. There is no confirmation of their record in the literature! The species name has been derived from the Latin meaning 'wonderful' or 'extraordinary'

43. *Leptotrombidium (Leptotrombidium) mitchelli* Nadchatram
(Fig. 38)

Leptotrombidium (Leptotrombidium) mitchelli Nadchatram, 1970c, 153; Vercammen-Grandjean and Langston, 1976, 601.

Redescription of species : Larva. Colour in life orange.

Idiosoma : Measuring 430-465 x 315-349 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 36-40 (Original description : 47-53); 26 dorsal idiosomal setae, measuring 34-38, arranged : 8-6-6-4-2 (Original description : 30, measuring 36-43, usually arranged : 8-6-6-6-4); 2 pairs of sternal setae, anterior 48-52, posterior 34-36; 18-24 peranal setae, 22-30; 6-12 postanal setae, 33-40; total idiosomal setae 56-72.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (28-33) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin very shallowly biconvex; AM base posterior to level of AL bases; SB anterior to or level with PL bases; AM>PL=AL; sensillae flagelliform with basal barbs and branches on distal 3/4; PW/SD = 2.02-2.07. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 74 (74, 70-76); PW 85 (85, 82-88); SB 34 (35, 34-35); ASB 27 (28, 26-30); PSB 14 (14, 14-15); AP 25 (25, 24-28); AM 55 (53, 50-55); AL 43 (44, 43-46); PL 44 (45, 42-47); sens. 75 (72, 70-75). Scutal measurements giving means and ranges of 5 NIV specimens : AW 68, 66-71; PW 83, 79-87; SB 31, 29-34; ASB 26, 24-28; PSB 13, 13-14; AP 26, 24-27; AM 46, 45-50; AL 36, 34-39; PL 39, 36-41; sens. 55, 53-60.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 700-705. Leg I : 235-240; tarsus (56 x 25-26), tarsala (20). Leg II : 210-220; tarsus (48 x 22-23), tarsala (15-16). Leg III : 250; tarsus (66-67 x 18-19). Measurements of NIV specimens : Ip = 630-647. Leg I : 217-226; tarsus (50x19), tarsala (19). Leg II : 184-194; tarsus (42x16), tarsala (14). Leg III : 223-232; tarsus (55x14).

Type data : Holotype (BBM-NP 30414-13) and 1 paratype, NEPAL, Jhapa, 200m, ex *Rattus nitidus*, 30.XI.1965, M. Nadchatram and R.M. Mitchell, coll.; 2 paratypes, same data, but ex *Suncus murinus*, taken 30.XI,2.XII.1965.

Type depository : Holotype at BPBM; paratypes at BPBM, IMR and USNM.

New records : 4 records of collections from the Himalayan region by NIV field teams: UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, 6 ex 4 *Rattus rattus gangutrianus*, 28,29.X.1967.

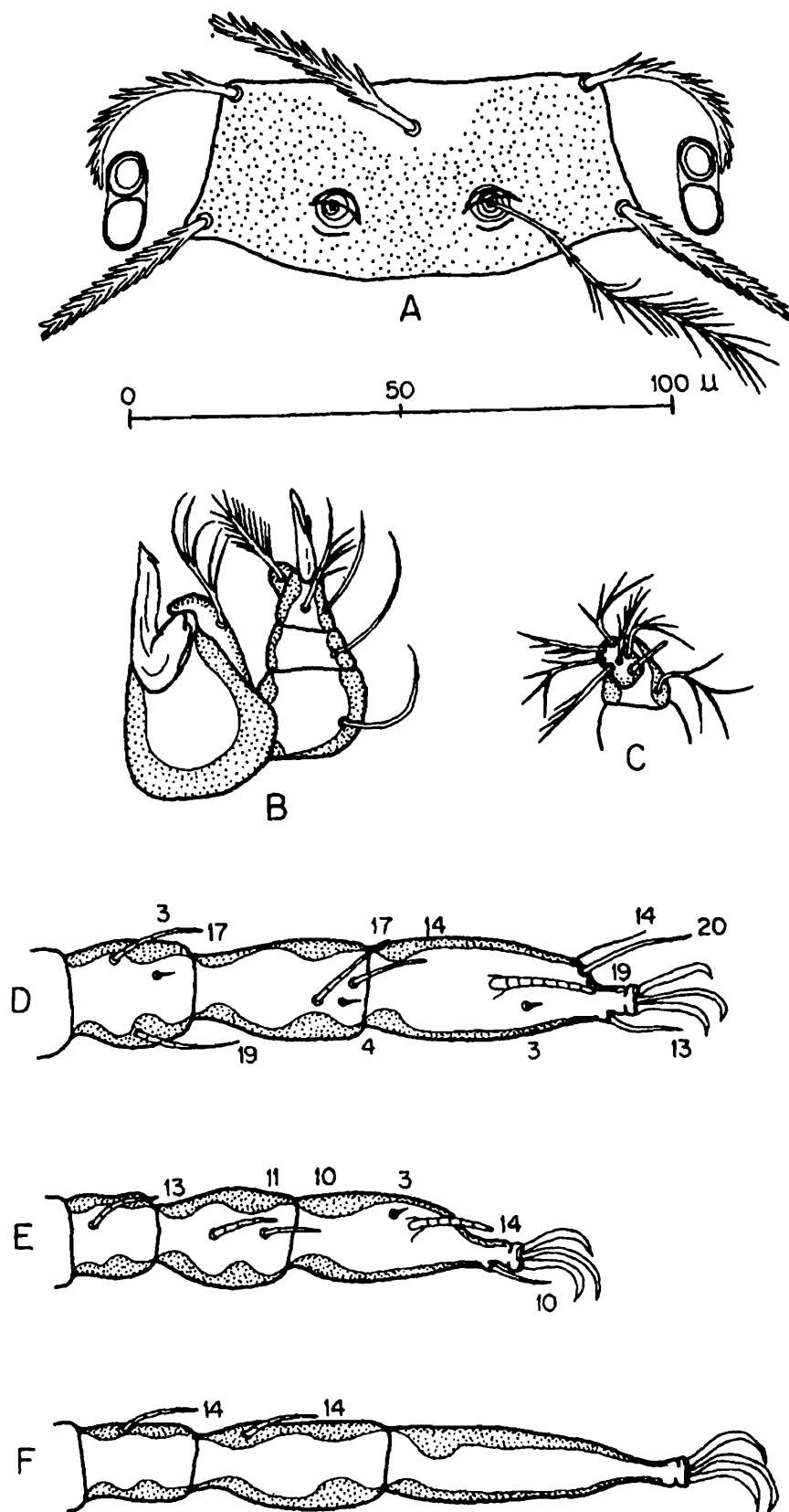


Fig. 38. *Leptotrombidium mitchelli*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. mitchelli* falls out in couplet 44 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. binbium* Traub and Lakshana, 1966. They distinguish *L. mitchelli* in having wider PW (73-76 in *L. binbium*), PW/AP ratio 2.95-3.42 (2.70-2.78 in *L. binbium*), and fewer total body setae (80-82 in *L. binbium*). Nadchatram (1970) considers this species closest to *L. hanseni* Traub and Lakshana, 1966. He distinguishes *L. mitchelli* in having scutal posterolateral margin behind PL bases angulate (very broadly rounded in *L. hanseni*), AL and PL setae subequal (PL > AL in *L. hanseni*), shorter dorsal body setae (measuring >50 in *L. hanseni*), and sensillae with basal barbs (nude basally in *L. hanseni*). He also separates *L. mitchelli* from *L. macacum* (Womersley, 1952) in having fewer dorsal body setae (numbering 36-48 in *L. macacum*). The NIV specimens have fewer body setae, shorter dorsal body setae, lower scutal and Ip measurements. The differences in scutal measurements are, however, proportional; hence, the NIV specimens are regarded as *L. mitchelli*. The species has been named for Richard M. Mitchell, a volunteer member of the Nepal Health Survey team, who also assisted in the collection of animals and ectoparasites.

44. *Leptotrombidium (Leptotrombidium) multisetosum* (Joshee)
(Fig. 39)

Trombicula multisetosa Joshee, 1964, 47.

Leptotrombidium multisetosa, Mitchell and Nadchatram, 1966, 68; Prasad, 1974, 84.

Leptotrombidium (Leptotrombidium) multisetosa, Mitchell *et al.*, 1966, 120.

Leptotrombidium (Leptotrombidium) multisetosum, Nadchatram and Joshee, 1966, 443; Vercammen-Grandjean and Langston, 1976, 610; Kulkarni, 1979, 18.

Redescription of species : Larva. Colour in life orange-red.

Idiosoma : Measuring 290-560 x 228-500 in unengorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 53-54; 168-188 dorsal idiosomal setae, measuring 34-53, arrangement after Vercammen-Grandjean and Langston (1976), commencing: (16+6)-(16+6)-14-14; 2 pairs of sternal setae, anterior 54-58, posterior 40-44; 60 preanal setae, 30-32; 40 postanal setae, 42-46; total idiosomal setae 272-292.

Gnathosoma : Palpal setal formula N/N/BN(b)B/7B; palpal claw 3-pronged; galeala B; cheliceral blade (48) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin very shallowly biconcave; posterior margin very shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; AM > AL >> PL; sensillae flagelliform with branches on distal 2/3; PW/SD = 2.04-2.15. Scutal measurements of holotype followed by means and ranges of 6 paratypes in parentheses after Nadchatram and Joshee (1966) : AW

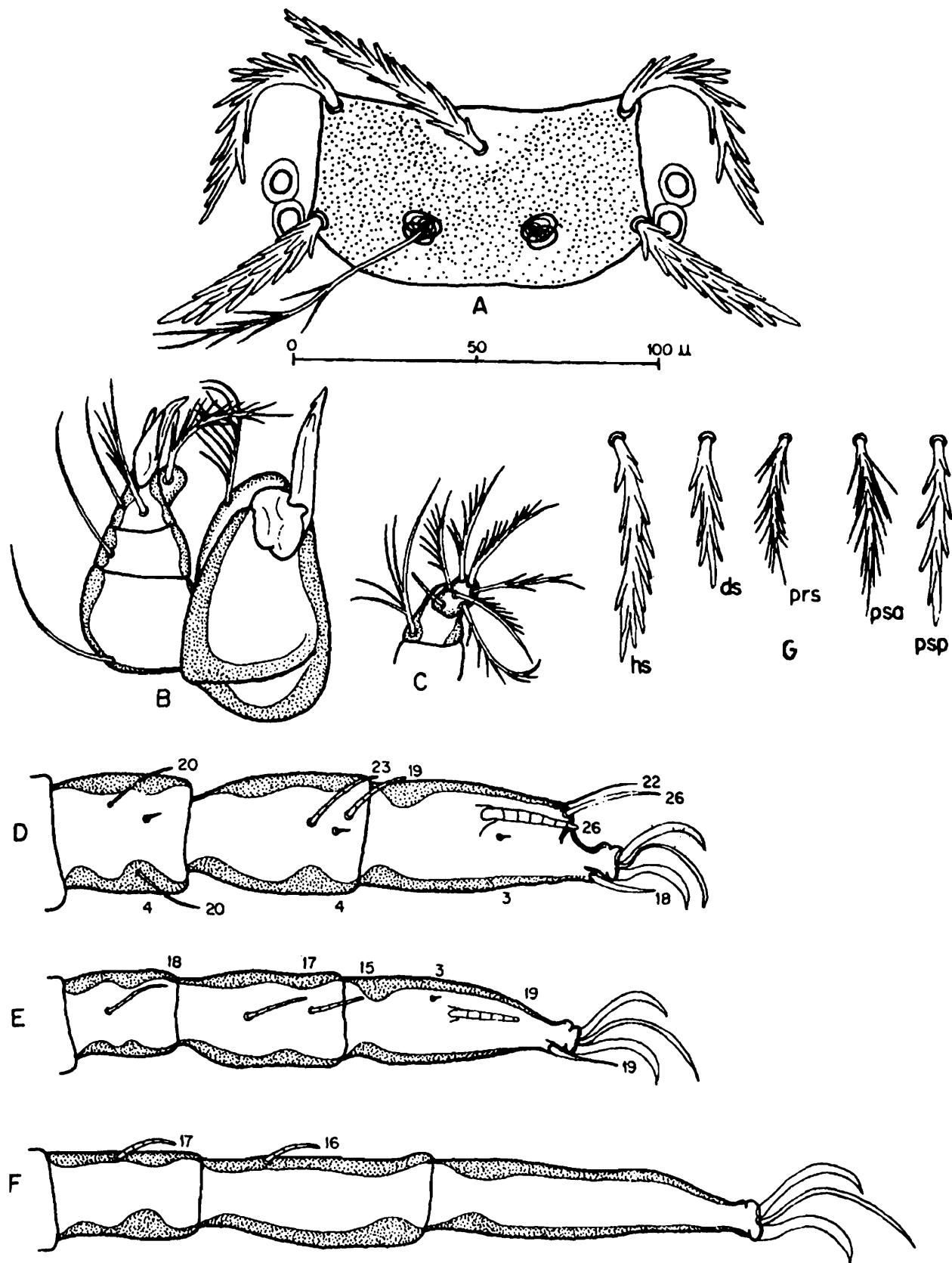


Fig. 39. *Leptotrombidium multisetosum*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above;
G. selected idiosomal setae.

78 (80, 74-85); PW 94 (94, 86-100); SB 34 (33, 30-36); ASB 35 (33, 28-37); PSB 11 (12, 11-13); AP 30 (33, 30-34); AM 63 (59, 56-63); AL 57 (58, 53-60); PL 43 (47, 43-49); sens. 70 (78, 70-78). Scutal measurements giving means and ranges of 10 NIV specimens : AW 83, 77-92; PW 104, 94-117; SB 38, 35-40; ASB 39, 35-42; PSB 15, 13-15; AP 35, 32-40; AM 64, 57-71; AL 57, 53-73; PL 54, 48-63; sens. 80, 74-84.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 900-933. Leg I : 295-317; tarsus (64-70 x 23-30), tarsala (25-26). Leg II : 277-280; tarsus (56-64 x 22-24), tarsala (16-19). Leg III : 330-340; tarsus (78-88 x 18-21).

Type data : Holotype (MZ 110447) and 6 paratypes, MAHARASHTRA, Bombay, Bhandup area, ex *Rattus rattus*, 16.IX.1959, Haffkine Institute, coll.

Type depository : Holotype at BPBM; paratypes at IMR, ZSI, USNM, BM(NH), and RML.

Additional records : MADHYA PRADESH, Kanha National Park, 533-791m, 262 ex 4 *Suncus stoliczkanus*, 21,23,27.XII.1964, C.J. Mitchell, G.B. Schaller, and J. Spillett, coll. MAHARASHTRA, Pune District, appoximately 1200 ex *Suncus murinus*, *Millardia kondana*, *Rattus rattus rufescens*, *Rattus blanfordi*, *Mus platythrix*, VIII-XI.1970 and IX.1971, S.M. Kulkarni, coll.

Specimen examined : 1 specimen (3 211264) on loan from M. Nadchatram: MADHYA PRADESH, Kanha National Park, ex *S. stoliczkanus*, 21.XII.1964, C.J. Mitchell, J. Spillett, and G.B. Schaller, coll.

Remarks : The above redescription is based on the literature, the study of the Kanha specimen (3 211264) and the NIV specimens. *L. multisetosum* runs to couplet 11 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having 274-314 total body setae, AM = AL > PL, and Ip = 905-933. They compare *L. multisetosum* with *L. spilletti* Mitchell and Nadchatram, 1966, distinguishing it in having higher Ip range (834-910 in *L. spilletti*), and greater number of body setae (142-162 in *L. spilletti*). The species name draws attention to the extraordinarily multisetose idiosoma of this most hirsute *Leptotrombidium* species.

45. *Leptotrombidium (Leptotrombidium) oreophilum* Vercammen-Grandjean and Langston (Fig. 40)

Leptotrombidium (Leptotrombidium) oreophilum Vercammen-Grandjean and Langston, 1976, 482.

Leptotrombidium (L.) langati Audy and Womersley, 1957 : Fernandes *et al.*, 1988, 109.

Leptotrombidium sp. B Fernandes *et al.*, 1988, 109.

Leptotrombidium sp. C Fernandes *et al.*, 1988, 109.

Redescription of species - Larva.

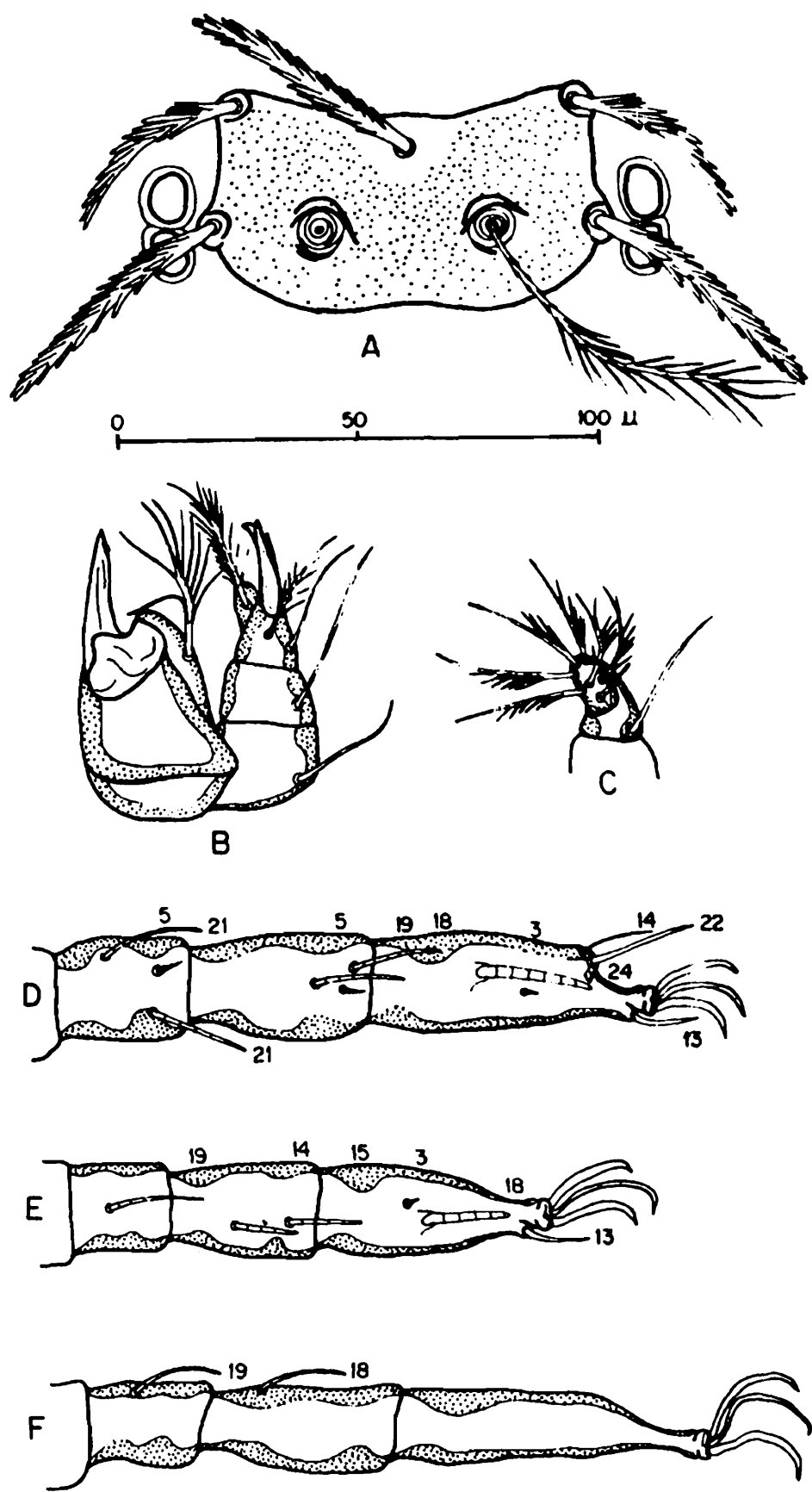


Fig. 40. *Leptotrombidium oreophilum*
A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 290-407 x 250-254 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 49-63; 26-32 dorsal idiosomal setae, measuring 40-60, arranged : 8-6-6-4(6)-2(4)-(2); 2 pairs of sternal setae, anterior 43-55, posterior 38-44; 14-18 preanal setae, 32-39; 8-10 postanal setae, 40-52; total idiosomal setae 58-64.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; PL > AM > AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.64-1.93. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 66 (71, 66-75); PW 77 (81, 77-85); SB 32 (32, 30-34); ASB 31 (30, 28-31); PSB 16 (17, 16-18); AP 24 (25, 24-27); AM 51 (53, 48-58); AL 38 (41, 38-44); PL 56 (56, 51-59); sens. 76 (79, 76-82). Scutal measurements giving means and ranges of 10 NIV specimens : AW 71, 66-80; PW 79, 74-84; SB 31, 29-33; ASB 25, 22-31; PSB 16, 14-19; AP 22, 19-26; AM 51, 45-56; AL 36, 33-38; PL 55, 50-61; sens. 66, 62-74.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 691-818 (Original description : 780-810). Leg I : 228-279 (274-282); tarsus (60 x 20), tarsala (24). Leg II : 211-251 (232-248); tarsus (49 x 18), tarsala (18). Leg III : 252-288 (269-280); tarsus (64 x 15).

Type data : Holotype (Sl. No. 7204), and 4 paratypes, JAMMU and KASHMIR, Chaukibal, ex 'unknown' host, collection date not recorded, S.L. Kalra, coll.; 1 paratype, same data, but Jhanghar, ex 'rat', 23.VIII.1948; 4 paratypes, same data, but Gurais, ex 'unknown' host, taken 1949 (?); 2 paratypes, same data, but Kanzalwan, ex 'unknown' host, VI.1949; 1 paratype, same data, but UTTARANCHAL, Kumaon Hills, Ranikhet, ex 'rat', 8.X.1946.

Type depository : Holotype and 12 paratypes at SAM.

New records : 42 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Bharmaur, 1980-2440m, 4 ex 2 *Mus musculus*, 29.30.V.1969; Tindi, 2440-2590m, 3 ex *Apodemus flavicollis*, 17.IX.1968; 1, same data, but ex *Rattus rattus gangutrianus*; Kinnaur District, Sangla, 2700m, 3 ex *A. flavicollis*, 8.VI.1970; 15, same data, but ex 3 *Rattus rattoides*; Mahasu District, Sarhan, 1360-2140m, 2 ex *Mus* sp., 23.V.1968; Sungri, 2650-2750m, 1 ex *R. r. gangutrianus*, 16.VII.1970; 23, same data, but ex 2 *M. musculus*; Kulu District, Kothi, 2440m, 1 ex *R. rattoides*, 4.X.1967; Manali, 1820-1860m, 11 ex same host, .9.VIII.1970; Palchan, 200-2290m, 3 ex same host, 27.VIII.1970; Lahul District, Thiro, 2850m, 1 ex *A. flavicollis*, 11.IX.1968. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 77 ex 5 *R. rattoides*, 6,7.XI.1969; 4, same

data, but ex *M. musculus*, taken 6.XI.1969; Doda District, Bhadarwah, 1700m, 2 ex 2 *M. musculus*, 17.XI.1969; Srinagar District, Sonmarg, 2740m, 50 ex 3 *M. musculus*, 24.VIII.1968; Udhampur District, Kulwanda, 1700-1800m, 7 ex *R. rattoides*, 3.XI.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 2 ex 2 *R. rattoides*, 3.X.1967; Chamoli District, Dogalbita, 2300-3800m, 158 ex 4 *R. rattoides*, 10,11.V.1969; 34, same data, but ex *Ochotona roylei*, taken 12.V.1969; 9, same data, but ex *R. rattoides*, taken 8.VII.1970; Gwaldam, 1500-2100m, 1 ex *Rattus niviventer*, 9.IV.1967; 9, same data, but ex *Rattus fulvescens*, taken 10.IV.1967; Dehra Dun District, Kanasar, 1800-2300m, 5 ex *R. rattoides*, 29.III.1968; Nainital District, Mukteshwar, 1400-2300m, 3 ex *R. niviventer*, 14.XI.1966; 14, same data, but ex *R. fulvescens*, 30.IV.1967; Pithoragarh District, Dharchula, 750-1100m, 1 ex *S. murinus*, 18.III.1967.

Remarks : The above redescription is based on the original description and study of the NIV specimens. *L. oreophilum* falls out in couplet 103 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. scanloni* Traub and Lakshana, 1966. They distinguish *L. oreophilum* in having a higher Ip range (680-720 in *L. scanloni*), and PL > AM with PL 35% longer than AL (AM > PL with PL only 15% longer than AL in *L. scanloni*). The NIV specimens show a wide range of variation in standard measurements, which led Fernandes *et al.* (1988) to identify this material as comprising 3 independent taxa. Further critical examination, however, indicates a close agreement with the diagnostic characters of *L. oreophilum*; and hence, they are regarded as this species.

46. *Leptotrombidium (Leptotrombidium) pakistanum* Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) pakistanum Vercammen-Grandjean and Langston, 1976, 397.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 58-70; 30 dorsal idiosomal setae, measuring 44-65, arranged : 8-6-6-6-4; 2 pairs of sternal setae; 18 preanal setae, 36-37; 12 postanal setae, 44-54; total idiosomal setae 66.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL > AM >> AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.67-1.74. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 74 (73, 71-74); PW 82 (84, 80-87); SB 35 (35, 33-38); ASB 31 (31, 30-33); PSB 18 (18, 17-18); AP 28 (28, 27-30); AM 57 (55, 54-57); AL 40 (39, 38-40); PL 67 (61, 52-67); sens. 94 (86, 80-94).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 814-864. Leg I : 280-299. Leg II : 249-265. Leg III : 285-300.

Type data : Holotype (B66728-2), JAMMU and KASHMIR, Gilgit Agency, Kohighizar, Phandar, 2985m, ex *Apodemus* sp., 30.VIII.1964, UM and PMRC field teams, coll.; 1 paratype, same data, but taken 2.IX.1964; 1 paratype, same data, but ex *Crocidura* sp., taken 30.VIII.1964; 1 paratype, same data, but PAKISTAN, Hazara District, Kaghan Valley, Naran, 2460m, ex *Mus* sp., taken 3.VIII.1963.

Type depository : Holotype at USNM; depository of paratypes not reported.

Remarks : The above redescription is based only on the original description. *L. pakistanum* falls out in couplet 98 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. silvaticum* Huscha and Schluger, 1967. They distinguish *L. pakistanum* in having thin humeral setae, measuring 66 with numerous short and acuminate barbs (thicker, measuring 61 with thick blunted barbs in *L. silvaticum*), and 30 dorsal body setae, arranged : 8-6-6-6-4 (30, arranged : 8-6-6-4-4-2 in *L. silvaticum*). The holotype and 2 paratypes from Phandar, Gilgit Agency, reported earlier from Pakistan, fall within Jammu and Kashmir, India, as recorded here. Hence, the species name, based on the type locality, is practically a misnomer - only a single paratype being taken in Pakistan!

47. *Leptotrombidium (Leptotrombidium) paradux* Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) paradux Vercammen-Grandjean and Langston, 1976, 575.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 61-71; 64 dorsal idiosomal setae, measuring 42-66, arranged : (10+8)-12-10-10-8-4-2; 2 pairs of sternal setae; 32 preanal setae, 33-40; 18 postanal setae, 42-56; total idiosomal setae 120.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase densely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL > AM > AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.96-2.09. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 85 (86, 84-88); PW 96 (96, 90-98); SB 42 (42, 40-42); ASB 30 (31, 30-32); PSB 16 (18, 16-19); AP 26 (28, 26-30); AM 62 (58, 50-63); AL 48 (47, 42-51); PL 72 (66, 63-72); sens. - (87, 82-90). Scutal measurements giving means of the 11 paratypes of *L. dux* after Womersley (1952) : AW 96; PW 107; SB 44; ASB 34; PSB 19; AP 31; AM 62; AL 48; PL 68; sens. 81.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 892-960. Leg I : 308-330. Leg II : 262-296. Leg III : 316-334.

Type data : Holotype (#10131) and 10 paratypes, JAMMU and KASHMIR, Baltal, ex 'mouse', 28.X.1945, S.L. Kalra, coll.

Type depository : Holotype and paratypes at SAM.

Remarks : The above redescription is based only on the original description. *L. paradux* runs to couplet 79 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having Ip = 892-960, and 110-130 body setae with thin shafts. They consider *L. paradux* close to *L. dux* (Womersley, 1952), from which it may be distinguished in having lower Ip (970-1046 in *L. dux*), fewer body setae (numbering 186 in *L. dux*), and PL>AM (AM>PL in *L. dux*). Vercammen-Grandjean and Langston have described *L. paradux* from 11 specimens of the original type series of *L. dux* which they recognized as different from the holotype taken at Ranikhet, Kumaon Hills. The species name draws attention to its relationship and similarity to *L. dux*.

48. *Leptotrombidium (Leptotrombidium) parapalpale* (Womersley) (Fig. 41)

Trombicula (Leptotrombidium) parapalpalis Womersley, 1952, 55; Womersley and Audy, 1957, 257.

Leptotrombidium parapalpalis, Radford, 1954, 260; Mitchell and Nadchatram, 1966, 68.

Leptotrombidium (Leptotrombidium) parapalpale, Traub and Nadchatram, 1967a, 7; Traub *et al.*, 1967, 36; Vercammen-Grandjean and Langston, 1976, 496; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 286-494 x 182-368 in unengorged to engorged specimens. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of humeral setae, measuring 72-85; 48-60 dorsal idiosomal setae, measuring 53-80, irregularly arranged; 2 pairs of sternal setae, anterior 58-65; posterior 47-56; 36-52 preanal setae, 34-38; 10-20 postanal setae, 46-52; total idiosomal setae 116-122. Original description: 50 dorsal idiosomal setae, measuring approximately 56, arranged: 13-12-12-8-4-2; approximately 40 ventral setae; total idiosomal setae approximately 96. Vercammen-Grandjean and Langston (1976) : Humeral setae measuring 64-66; 48 dorsal idiosomal setae, measuring 47-61, arranged : 14-10-10-8-4-2; 30 preanal setae, 34; 10-20 postanal setae, 47-52; total idiosomal setae 100.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (43) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave;

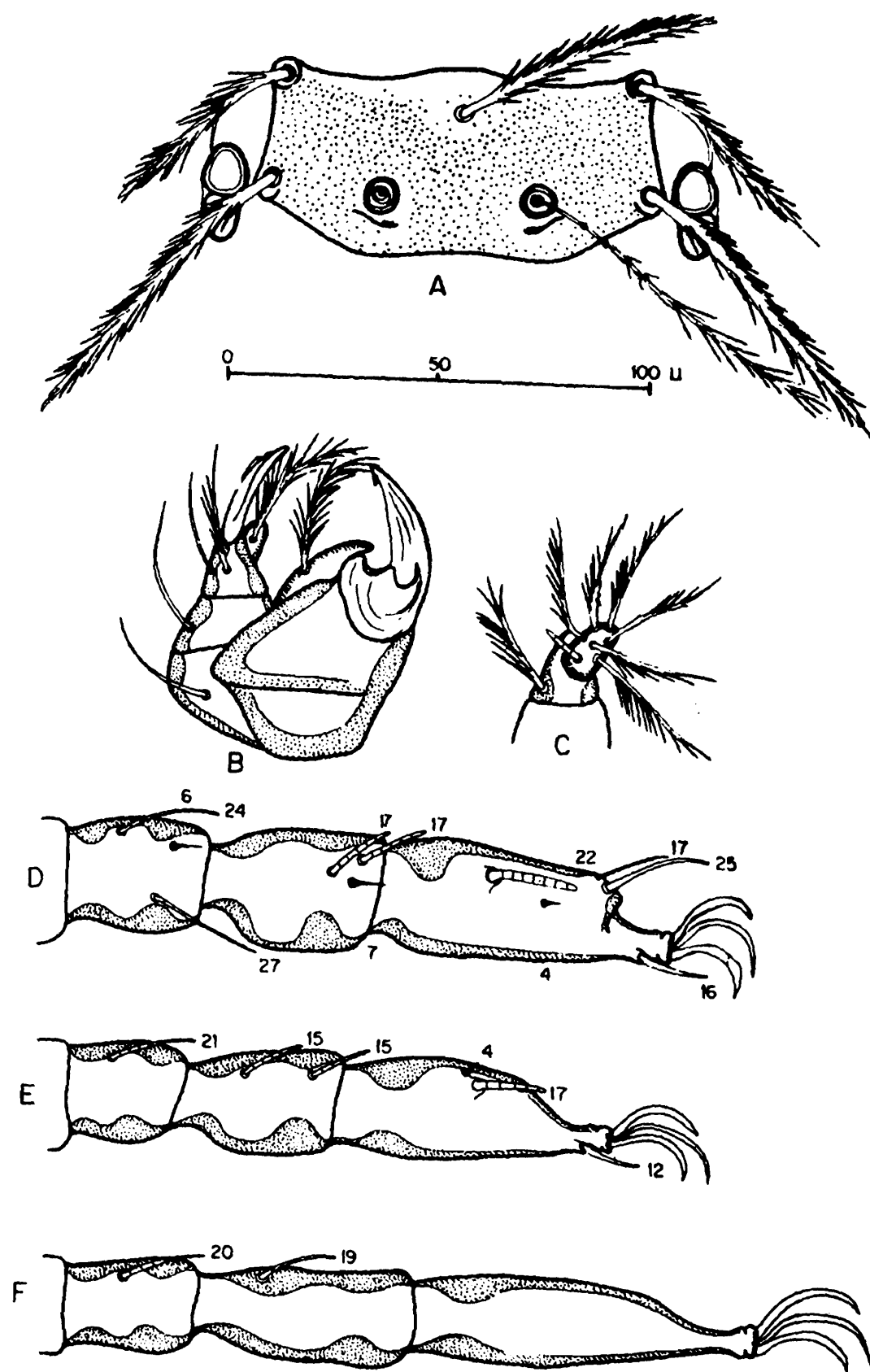


Fig. 41. *Leptotrombidium parapalpale*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly posterior to level of PL bases; $PL > AM > AL$ (Original description and Vercammen-Grandjean and Langston (1976) : $PL > AM$); sensillae flagelliform with basal barbs and branches on distal 1/2; $PW/SD = 1.74-2.10$. Scutal measurements giving means of 6 specimens after original description, followed by measurements of holotype and mean of 4 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 76 (76, 74); PW 87 (86, 83); SB 36 (35, 33); ASB 31 (30, 30); PSB 14 (13, 15); AP 25 (23, 24); AM 64 (60, 62); AL 49 (50, 49); PL 64 (65, 62); sens. 85 (86, 85). Scutal measurements giving means and ranges of 10 NIV specimens : AW 82, 78-89; PW 91, 87-98; SB 35, 32-40; ASB 33, 28-36; PSB 14, 14-15; AP 26, 21-27; AM 64, 57-68; AL 49, 40-56; PL 74, 67-78; sens. 84, 79-87.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : $Ip = 884-903$. Leg I : 301-309; tarsus (70x26), tarsala (22). Leg II : 268-274; tarsus (66x23), tarsala (17). Leg III : 313-327; tarsus (82x19). Measurements giving mean of 6 specimens after original description followed by means of holotype and 4 specimens in parentheses after Vercammen-Grandjean and Langston (1976) : $Ip = 857$ (853, 852). Leg I : 285 (291, 285). Leg II : 260 (265, 259). Leg III : 312 (297, 298).

Type data : Holotype and 5 paratypes, JAMMU and KASHMIR, Kanzalwan, ex 'rat', VI.1949, S.L. Kalra, coll.

Type depository : Holotype and 5 paratypes at SAM.

Additional records : JAMMU and KASHMIR, Gurais, 3 ex 'rat', 1949, S.L. Kalra, coll.

New records : 10 records of collections from the Himalayan region by NIV field teams : JAMMU and KASHMIR, Ladakh District, Bodhkarbu, 3200-3350m, 3 ex *Mus musculus*, 21.VIII.1967. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 2 ex *Rattus rattoides*, 7.X.1967; Chamoli District, Badrinath, 3100-3650m, 302 ex *Alticola roylei*, 3.VI.1968; Dogalbita, 2300-2650m, 20 ex *R. rattoides*, 5.XI.1969; 5, same data, but ex *Ochotona roylei*; Lambagarh, 2150-2450m, 3 ex *M. musculus*, 26.VI.1968; Pithoragarh District, Dharchula, 900-1100m, 7 ex *R. rattoides*, 15.V.1968; Milam, 3800m, 2 ex *A. roylei*, 23.IX.1967.

Specimen examined : 1 specimen (#23771) on loan from M. Nadchatram : INDIA, Kashmir, Baltal, ex *Rattus alticola roylei*, IMR and Hooper Foundation, coll.; date of collection not recorded.

Remarks : The above redescription is based on the literature, the study of specimen (#23771) and the NIV specimens. *L. parapalpale* runs to couplet 36 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having $Ip = 820-860$, 96-110 total body setae, and PW measuring 80-86. The NIV specimens differ from the description in the literature in having the body and scutal setae usually longer, and a greater number of body setae. They, however,

agree with the other reported standard measurements and diagnostic characters; and hence, are regarded as *L. parapalpale*. The species name draws attention to its resemblance to *L. palpale* (Nagayo *et al.*, 1919).

**49. *Leptotrombidium (Leptotrombidium) parviscutum* Mitchell and Nadchatram .
(Fig. 42)**

Leptotrombidium (Leptotrombidium) parviscutum Mitchell and Nadchatram, 1966, 65; Mitchell *et al.*, 1966, 120; Nadchatram, 1970c, 147; Fernandes *et al.*, 1988, 109.

Leptotrombidium (Hypotrombidium) parviscutum, Vercammen-Grandjean and Langston, 1976, 716.

Leptotrombidium parviscutum, Prasad, 1974, 85.

Redescription of species : Larva.

Idiosoma : Measuring 310-390 x 185-290 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 27-35; 26 dorsal idiosomal setae, measuring 26-38, arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 30-32, posterior 24-26; 12-14 preanal setae, 17-23; 12-16 postanal setae, 19-30; total idiosomal setae 58-60.

Gnathosoma : Palpal setal formula B/B/NBB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (24-25) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, small, subrectangular with anterior margin shallowly concave; posterior margin weak, convex; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AL>AM; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.44-1.54. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses after original description : AW 40 (42, 40-43); PW 43 (44, 42-46); SB 11 (12, 11-13); ASB 18 (19, 18-21); PSB 10 (11, 10-12); AP 21 (21, 20-23); AM 18 (16? 17-19); AL 26 (26, 24-28); PL 31 (31, 28-33); sens. 38 (36, 34-38). Scutal measurements of PT 211264 after Vercammen-Grandjean and Langston (1976) followed by means and ranges of 10 NIV specimens in parentheses : AW 43 (43, 40-47); PW 45 (44, 42-47); SB 12 (13, 11-15); ASB 20 (19, 18-21); PSB 11 (12, 11-12); AP 22 (22, 21-24); AM 20 (20, 18-21); AL 29 (27, 26-28); PL 34 (32, 30-34); sens. 48 (40, 36-42).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 590-610. Leg I : tarsus (52-58 x 15-16), tarsala (17). Leg II : tarsus (44-48 x 13-14), tarsala (15-16). Leg III : tarsus (65-67 x 11). Measurements of NIV specimens, followed by measurements after Vercammen-Grandjean and Langston (1976) in parentheses : Ip = 586-642 (662). Leg I : 202-217 (227). Leg II : 177-200 (197). Leg III : 207-225 (238).

Type data : Holotype (BISHOP 6625) and 8 paratypes, MADHYA PRADESH, Mandla

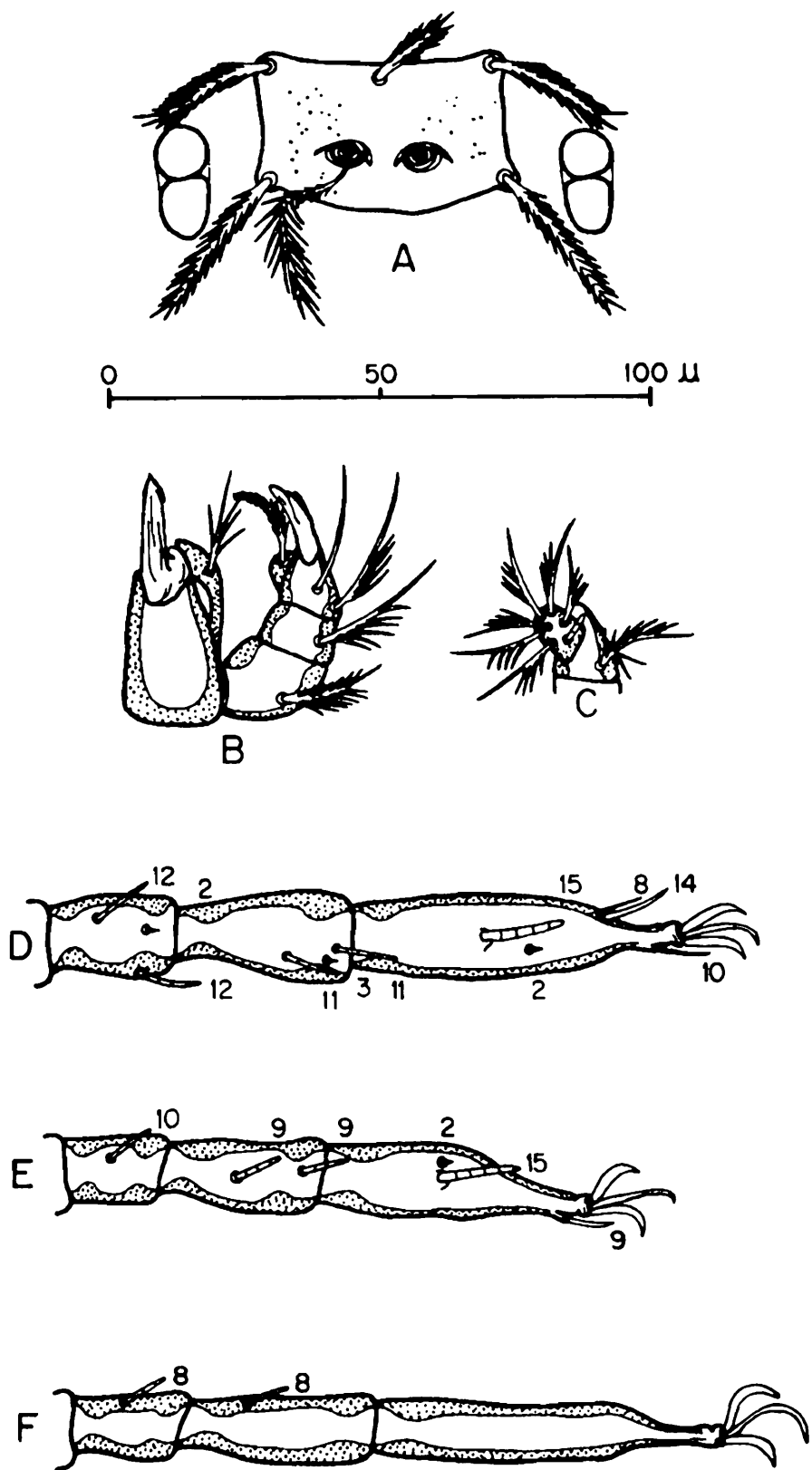


Fig. 42. *Leptotrombidium parviscutum*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

District, Kanha National Park, 540-840m, ex *Rattus blanfordi*, 20.XII.1964, C.J. Mitchell, G.B. Schaller and J. Spillett, coll.; 1 paratype, same data, but ex *Rattus rattus rufescens*, taken 22.XII.1964; 3 paratypes, same data, but ex *Rattus rattus narbadae*, taken 20.XII.1964; 3 paratypes, same data, but ex *Mus booduga booduga*, taken 21,22.XII.1964; 6 paratypes, same data, but ex *Mus musculus humourus*, taken 20,27.XII.1964.

Type depository : Holotype at BPBM; paratypes at BPBM, IMR, BM(NH), USNM, ZSI, RML, IA, and collections of Traub, Mitchell and Nadchatram.

Additional records : MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, 76 ex *M.m. humourus*, 21-27.XII.1964, C.J. Mitchell, G.B. Schaller and J. Spillett, coll; 34, same data, but ex *M. b. booduga*, 20-24.XII.1964; 19, same data, but ex *R. r. rufescens*, 20,22.XII.1964; 32, same data, but *R. r. narbadae*, 20,27.XII.1964; 2, same data, ex *Vandeleuria oleracea*, 21.XII.1964.

New records : 27 records of collections from the Himalayan region by NIV field teams: JAMMU and KASHMIR, Doda District, Khilani, 1200-1400m, 1 ex *Mus musculus*, 20.XI.1969; Rajouri District, Naoshera, 750m, 42 ex 7 *M. musculus*, 7-10.XII.1969; 1, same data, but ex *Suncus murinus*, taken 7.XII.1969; Udhampur District, Dehari, 750-900m, 12 ex 3 *Rattus* sp., 30.XI,1.XII.1969; 1, same data, but ex *S. murinus*, taken 1.XII.1969; 9, same data, but ex *Millardia meltada*, taken 30.XI.1969; Phalata, 750m, 9 ex 2 *Rattus* sp., 23.XI.1969; 8, same data, but ex 3 *M. musculus*, taken 26,27.XI.1969; 18, same data, but ex 4 *Mus platythix*, 22-26.XI.1969. UTTARANCHAL, Nainital District, Garjia, 400-500m, 13 ex *Rattus rattus gangutrianus*, 17.XI.1967; Pithoragarh District, 1500-2600m, 3 ex *R.r. gangutrianus*, 12.VIII.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. parviscutum* runs to couplet 10 of the key to species of the subgenus *Hypotrombidium* given by Vercammen-Grandjean and Langston (1976). This subgenus is here considered a synonym of the nominate subgenus. Vercammen-Grandjean and Langston characterize *L. parviscutum* as the smallest *Leptotrombidium* species (Ip = 590-662) with a very small scutum (PW measuring 40-46), having scutal setae and sensillae with numerous thin and long branches. Mitchell and Nadchatram (1966) consider *L. parviscutum* similar to *L. pelta* (Womersley, 1952) in the dimensions and shape of the scutum, and in the number and arrangement of dorsal body setae. They distinguish these species by differences in their palpo setal formulae. Vercammen-Grandjean and Langston (1976) have synonymized *L. pelta* with *L. vietzi* (Womersley, 1952). The NIV specimens agree closely with the description in the literature. The species name, derived from the Latin meaning 'small scutum', draws attention to the extremely small scutum of this species.

50. *Leptotrombidium (Leptotrombidium) peniscutum* Vercammen-Grandjean *et al.*

Leptotrombidium (Leptotrombidium) peniscutum Vercammen-Grandjean, Nadchatram and Traub, 1966, 451; Vercammen-Grandjean, 1967, 128; Vercammen-Grandjean and Langston, 1976, 379; Traub and Nadchatram, 1967a, 10; Nadchatram, 1970c, 147.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 66; 26 dorsal idiosomal setae, measuring 48-66, arranged: 8-6-6-4-2; 2 pairs of sternal setae; 20 preanal setae, 31; 20 postanal setae, 48-52; total idiosomal setae 72.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; apical tips broken off in cheliceral blades; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with straight anterior margin; posterior margin bilobed, shallowly convex medially; AM posterior to level of AL bases; PL setae extra-scutal; PL > AM > AL; sensillae broken off. Scutal measurements of unique holotype after original description: AW 74; PW -; SB 40; ASB 32; PSB 20; AP -; AM 60; AL 40; PL 66; sens. -.

Legs : Similar to *L. baltalense* in the number of sensory setae. Number of ordinary setae not reported. Measurements as follows : Ip = 864. Leg I : 300. Leg II 264. Leg III : 300.

Type data : Holotype (B-666240-64), JAMMU and KASHMIR, Gilgit Agency, Kohighizar, Phandar, 3000m, ex *Apodemus* sp., 9.IX.1963, R. Traub, coll.

Type depository : Holotype at USNM.

Remarks : The above redescription is based only on the literature. *L. peniscutum* runs to couplet 61 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). This species possesses the diagnostic characters of *Leptotrombidium* s. str., but is exceptional in having extra-scutal PL setae. The unique holotype has been collected from Phandar, Gilgit Agency, which falls in Jammu and Kashmir, India, not Pakistan as reported in the literature. The species name draws attention to its reduced scutum.

51. *Leptotrombidium (Leptotrombidium) pseudofulmentum*
Vercammen-Grandjean and Langston

Leptotrombidium (Leptotrombidium) pseudofulmentum Vercammen-Grandjean and Langston, 1976, 395.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of humeral setae, measuring 60-62; 28 dorsal idiosomal setae, measuring 44-57, arranged : 8-6-6-4-4; 2 pairs of sternal setae; 14 preanal setae, 33-34; 10 postanal setae, 50-58; total idiosomal setae 58.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL>AM>>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.68-1.87. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 69 (66, 55-70); PW 73 (74, 64-77); SB 29 (28, 25-30); ASB 26 (28, 25-29); PSB 13 (14, 13-15); AP 25 (25, 23-27); AM 57 (56, 43-62); AL 46 (45, 40-48); PL 59 (60, 50-62); sens. 82 (82, -).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 789-810. Leg I : 273-284. Leg II : 234-245. Leg III : 276-284.

Type data : Holotype (#1712-16) and 4 paratypes, MANIPUR, Imphal, ex 'unknown' host, 17.XII.1945, name of collector not recorded; 1 paratype, same data, but taken 20.XII.1945; 2 paratypes, same data, but taken ?1945, K.L. Cockings, coll.

Type depository : Holotype and paratypes at SAM.

Remarks : The above redescription is based only on the original description. *L. pseudofulmentum* falls out in couplet 43 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. monstrosum* (Schluger *et al.*, 1960). They distinguish *L. pseudofulmentum* in having scutal margin posterior to PL bases concave (rounded in *L. monstrosum*), and PL>AM>AL (AM>PL>AL in *L. monstrosum*). The type specimens were earlier labelled *L. deliense* (Walch, 1922). *L. pseudofulmentum* shares the same palpo-setal formula with *L. bhimtalense* (Womersley, 1952) and *L. kitaokai* Asanuma *et al.*, 1959. The scutal aspect, Ip and body setal formulae serve to separate *L. pseudofulmentum* from the other 2 species. *L. pseudofulmentum* is close to *L. fulmentum* Vercammen-Grandjean and Langston, 1976, but may easily be distinguished in having a higher Ip (729-774 in *L. fulmentum*), PL>AM>>AL (PL>>AM>AL in *L. fulmentum*), and ventrotibial palpal seta barbed (nude in *L. fulmentum*). The species name draws attention to its similarity to *L. fulmentum*.

52. *Leptotrombidium (Leptotrombidium) puta* (Womersley) (Fig. 43)

Trombicula (?*Leptotrombidium*) *puta* Womersley, 1952, 57.

Trombicula (Leptotrombidium) puta, Womersley and Audy, 1957, 257.

Leptotrombidium puta, Radford, 1954, 260.

Leptotrombidium (Leptotrombidium) puta, Traub and Nadchatram, 1967a, 10; Traub *et al.*, 1967, 36; Nadchatram, 1970c, 145; Vercammen-Grandjean and Langston, 1976, 605.

Trombicula puta, Prasad, 1974, 97.

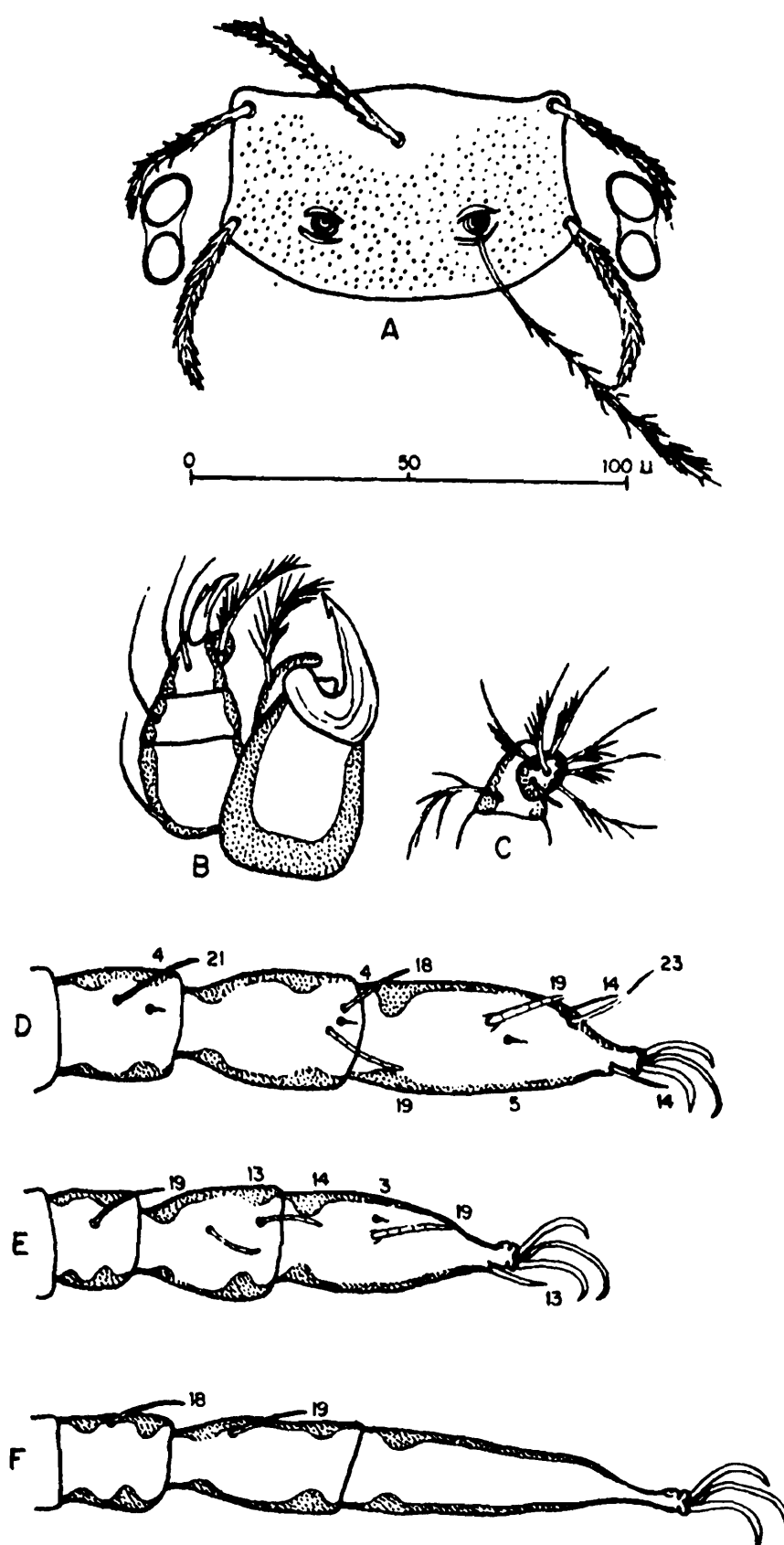


Fig. 43. *Leptotrombidium puta*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Redescription of species : Larva. Colour in life orange(?).

Idiosoma : Measuring 260-396 x 195-252 in unengorged to partially engorged specimens. Eyes 2/2, subequal, on ocular plate. Two pairs of humeral setae, measuring 38-45; 44-52 dorsal idiosomal setae, measuring 31-45, irregularly arranged, arrangement summarized after Nadchatram (1970c) : (10-11)-(8-10)-2-(10-11)-(8-10)-(4-6)-(2-4); 2 pairs of sternal setae, anterior 50, posterior 42; 16-18 preanal setae, 34-40; 12-14 postanal setae, 31-45; total idiosomal setae 84-92. Dorsal body setae with thick shafts and numerous spike-like barbs.

Gnathosoma : Palpal setal formula N/N/NNB/7B, as in original description (Nadchatram (1970c) and Vercammen-Grandjean and Langston (1976) : palpo-setal formula N/N/BNB); palpal claw 3-pronged; galeala B; cheliceral blade (34-38) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly convex, medially truncate; AM base posterior to level of AL bases; SB level with or slightly posterior to PL bases; AM>PL>AL; PL setae with thick shaft and numerous spike-like barbs; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD after original description and Vercammen-Grandjean and Langston (1976) = 1.84-1.88, after Nadchatram (1970c) = 1.64-1.75. Scutal measurements of holotype after original description followed by measurements of holotype and 1 Pakistani specimen in parentheses after Vercammen-Grandjean and Langston (1976) : AW 76 (74, 72); PW 81 (79, 81); SB 36 (35, 34); ASB 28 (28, 28); PSB 15 (14, 16); AP 25 (24, 23); AM 42 (47, 54); AL 36 (42, 43); PL 42 (43, 49); sens. - (-, 80). Scutal measurements giving means and ranges of 10 Nepali specimens after Nadchatram (1970c) : AW 70, 64-75; PW 76, 72-86; SB 32, 30-36; ASB 29, 26-30; PSB 17, 16-19; AP 27, 23-28; AM 48, 42-52; AL 39, 35-41; PL 44, 38-48; sens. 80, 73-80.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, single genuala I and peditarsal setation : 22-16-15. Measurements of holotype after original description followed by measurements of holotype and 1 Pakistani specimen in parentheses after Vercammen-Grandjean and Langston (1976) : Ip = 675 (761, 793). Leg I : 227 (266, 271). Leg II : 208 (233, 241). Leg III : 240 (262, 281). Measurements giving ranges of Nepali specimens after Nadchatram (1970c) : Ip = 767-800. Leg I : 260-280; tarsus (65-67 x 24-25), tarsala (20-22). Leg II : 232-235; tarsus (55-56 x 21-22), tarsala (18-19). Leg III : 275-285; tarsus (75-77 x 15-18).

Type data : Holotype, JAMMU and KASHMIR, Kanzalwan, ex 'rat', 12.X.1948, S.L. Kalra, coll.

Type depository : Holotype at SAM.

Additional record : JAMMU and KASHMIR, Gurais, ex *Apodemus flavicollis* near *wardii*, 1948, S.L. Kalra, coll.

Material examined : 1 specimen (IMR Malaysia, BBM 3050-6) on loan from M. Nadchatram, collection data not recorded.

Remarks : The above redescription is based on the literature and study of the IMR specimen (BBM 3050-6). *L. puta* falls out in couplet 27 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. spilletti* Mitchell and Nadchatram, 1966. They distinguish *L. puta* in having fewer body setae (numbering 140-162 in *L. spilletti*), narrower PW (measuring 85-97 in *L. spilletti*), a lower Ip range (810-910 in *L. spilletti*), and AM>PL (AM>>PL in *L. spilletti*). They draw attention to the single genuala I, which distinguishes *L. puta* from all other species in the nominate subgenus. The specimen examined agrees closely with the description in the literature and confirms the palpo-setal formula reported in the original description : N/N/NNB!

53. *Leptotrombidium (Leptotrombidium) radfordi* (Sinha)

Mehracula radfordi Sinha, 1954, 330.

Trombicula (Leptotrombidium) radfordi, Sinha, 1957, 295; Audy, 1957, 232.

Leptotrombidium radfordi, Mitchell and Nadchatram, 1966, 68.

Leptotrombidium (Leptotrombidium) radfordi, Vercammen-Grandjean and Langston, 1976, 335.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 41; 46 dorsal idiosomal setae, measuring 43, arranged : 10-10-(2+8)-8-6-2 (Vercammen-Grandjean and Langston (1976) : Humeral setae measuring 57; 48 dorsal idiosomal setae, measuring 40-50, arranged : 10-10-10-8-6-4); 2 pairs of sternal setae; 26 preanal setae, 34; 14 postanal setae, 40-52; total idiosomal setae 92-94.

Gnathosoma : Palpal setal formula N/N/BNN/7B (Vercammen-Grandjean and Langston (1976): ventrotibial seta barbed); palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; AM>PL>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.49 (Vercammen-Grandjean and Langston (1976) : 1.61). Scutal measurements of holotype after original description and after Vercammen-Grandjean and Langston (1976) : AW 65, 68; PW 70, 74; SB 29, 31; PSB 18, 15; AP 28, 30; AM 54, 60; AL 40, 47; PL 44, 58; sens. 57, 78.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of sensory setae. Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 761. leg I : 258. Leg II : 229. Leg III : 274.

Type data : Holotype (No. R2/1.12.45), MANIPUR, Madbung village off Kanglatongbi, Camp MS 117, ex *Herpestes urva*, 1.XII.1945, M.L. Roonwal, coll.; over 14 (2 extant) paratypes, same data, but Dimapur-Imphal Road, ex *Dremomys macmillani*, taken 12.XI.1945.

Type depository : Holotype and paratypes at ZSI.

Material examined : Holotype and 1 paratype at ZSI.

Remarks : The above redescription is based only on the literature. The types examined are in poor condition. *L. radfordi* falls out in couplet 34 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. macacum* (Womersley, 1952). They distinguish *L. radfordi* in having subrectangular scutum with PW/AP ratio = 2.13-2.64 (trapezoidal scutum with PW/AP ratio = 2.66-2.78), fewer body setae (numbering 96-104 in *L. macacum*), and a higher Ip (724-747 in *L. macacum*). Vercammen-Grandjean and Langston consider this species close to *L. scutellare* (Nagayo *et al.*, 1921) in the shape and reduced dimensions of the scutum. *L. radfordi* may be distinguished in having posterior scutal margin biconvex (broadly convex in *L. scutellare*), SB anterior to level of PL bases (level with PL bases in *L. scutellare*), and AM>PL (PL>AM in *L. scutellare*). The type locality falls in Manipur and not Assam as recorded in the literature. This species has been named in honour of Squadron Leader C.D. Radford of the Scrub Typhus Research Unit, in recognition of his contribution to trombiculid mite studies in S.E. Asia.

54. *Leptotrombidium (Leptotrombidium) rupestre* Traub and Nadchatram (Fig. 44)

Leptotrombidium (Leptotrombidium) rupestre Traub and Nadchatram, 1967a, 4; Traub *et al.*, 1967, 37; Nadchatram, 1970c, 162; Srivastava and Wattal, 1981, 124; Vercammen-Grandjean and Langston, 1976, 509.

Redescription of species : Larva.

Idiosoma : Measuring 220-440 x 180-280 in unengorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 55-68; 38-55 dorsal idiosomal setae, measuring 40-65, irregularly arranged, arrangements summarized after original description : (14-18)-(8-13)-(2)-(8-10)-(6-8)-(2-4)-2; 2 pairs of sternal setae, anterior 50-55, posterior 44-51; 24-30 preanal setae, 30-40; 10-20 postanal setae, 40-54; total idiosomal setae 84-100.

Gnathosoma : Palpal setal formula N/N/BN(b)N(b)/7B; palpal claw 3-pronged; galeala B; cheliceral blade (38-39) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; PL>AM>AL; sensillae flagelliform with branches on distal

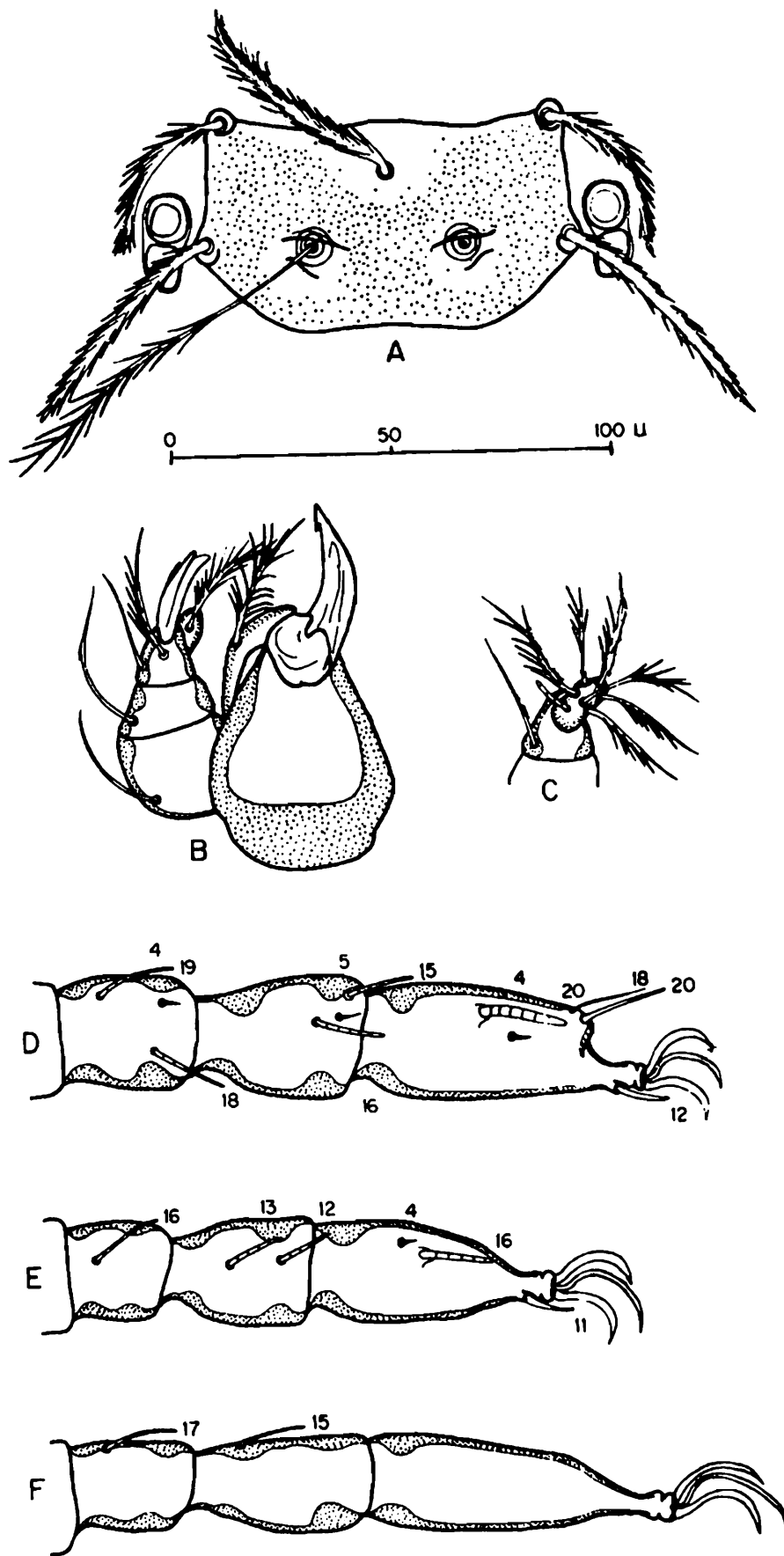


Fig. 44. *Leptotrombidium rupestre*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

2/3; PW/SD = 1.78-2.00. Scutal measurements of holotype followed by means and ranges of 20 specimens in parentheses after original description : AW 76 (80, 76-86); PW 90 (89, 85-94); SB 36 (36, 34-38); ASB 29 (31, 29-33); PSB 16 (17, 16-19); AP 26 (27, 24-29); AM 50 (51, 48-52); AL 44 (42, 41-44); PL 58 (57, 53-61); sens. 75 (76, 71-78). Scutal measurements giving means and ranges of 8 specimens after Vercammen-Grandjean and Langston (1976) : AW 78, 76-82; PW 87, 85-91; SB 6, 33-39; ASB 32, 30-34; PSB 17, 16-18; AP 27, 26-29; AM 54, 50-56; AL 46, 43-49; PL 60, 55-65; sens. 81, 80-84. Scutal measurements giving means and ranges of 10 NIV specimens : AW 78, 72-84; PW 87, 84-92; SB 36, 33-41; ASB 29, 27-31; PSB 19, 18-20; AP 26, 24-29; AM 55, 50-60; AL 42, 39-45; PL 59, 56-64; sens. 74, 72-80.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 874-929. Leg I : 297-319; tarsus (65-73 x 23-26), tarsala (20-22). Leg II : 264-286; tarsus (55-63 x 22-24), tarsala (16-17). Leg III : 313-324; tarsus (78-84 x 17-20). Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 854-900. Leg I : 296-312. Leg II : 256-278. Leg III : 286-314. Measurements of NIV specimens : Ip = 773-866. Leg I : 275-285; tarsus (65x26), tarsala (20). Leg II : 223-267; tarsus (55x22), tarsala (16). Leg III : 275-315; tarsus (70x21).

Type data : Holotype (B67446-2c) and 1 paratype, PAKISTAN, Kaghan Valley, Besal, 3075m, ex *Alticola roylei*, 29.VIII.1963, R. Traub, coll.; 16 paratypes as follows : Besal, 3290m, 5 ex 2 *Hyperacrius fertilis*, 26.VIII.1963 and 1.IX.1963; Saif ul Maluke, 3075m, 1 *A. roylei*, 6.IX.1963; Gitidas, 3630-4555m, 4 ex 3 *A. roylei*, 16-29.VIII.1963; Naran, 2430m, 1 ex *A. roylei*, 4.IX.1963; 1, same locality, but ex *Ochotona roylei*, taken 23.VII.1964; Soch, 9.5km N of Naran, 1 ex *O. roylei*, 7.VIII.1963; Lulu Sar Lake, 3290m, 1 ex *A. roylei*, 23.VIII.1963; Shogran, 2925m, 2 ex 2 *Apodemus* sp., 26,29.VII.1963.

Type depository : Holotype at USNM; paratypes at IMR, BM(NH), BPBM, RML, IA, and collections of R. Traub and other acarologists.

Additional records : JAMMU and KASHMIR, Gilgit Agency, 1500-1800m, ex *Rattus rattoides*, 1962-1964, University of Maryland and Pakistan Medical Research Centre field teams, coll.; Gulmarg, 2730m, 54 ex *Alticola roylei montosa*, IX.1970, NICD, coll.

New records : 23 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 1 ex *O. roylei*, 20.IX.1968; Kinnaur District, Chitkul, 3400m, 4 ex *A. roylei*, 23.VI.1970; 23, same data, but ex 8 *Apodemus flavicollis*, 22-24.VI.1970; 14, same data, but ex *Rattus* sp., taken 22.VI.1970; Rackcham, 3120m, 115 ex 9 *A. flavicollis*, 19,20.VI.1970; 162, same data, but ex 2 *Rattus rattus gangutrianus*, taken 19.VI.1970; 2, same data, but ex *R. rattoides*.

Specimen examined : 1 specimen (B66451 EF 10 3) on loan from M. Nadchatram : WEST PAKISTAN, Hazara District, Kaghan Valley, Gitidas, 3640m, ex *Alticola* sp., 29.VII.1964, R. Traub, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. rupestre* runs to couplet 105 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They consider this species close to *L. pavlovskyi* (Schluger, 1948). *L. rupestre* may be distinguished in having $Ip = 869$ (818 in *L. pavlovskyi*), and arrangement of dorsal body setae commencing : 12-8-8 to 16-12-10 (10-10-8 or 10-8-8 in *L. pavlovskyi*). Traub and Nadchatram (1967a) consider *L. rupestre* close to *L. intermedium* (Nagayo *et al.*, 1920) in scutal shape and palpo-setal formula. They separate *L. rupestre* by the greater number of dorsal body setae, irregularly arranged (36-38, in symmetrically arranged rows in *L. intermedium*). They distinguish this species from *L. tithwalense* (Womersley, 1952) in having nude or weakly barbed (1-2 barbs) ventrotibial palpal seta (with 6-10 barbs in *L. tithwalense*), and greater number of dorsal body setae, irregularly arranged (maximum of 40 dorsal body setae, with regular arrangement in *L. tithwalense*). They separate *L. rupestre* from *L. parapalpale* (Womersley, 1952) by the scutal shape and nude ventrotibial palpal seta (distinctly barbed in *L. parapalpale*). The scutal measurements of the NIV specimens are well within the range given in the literature, but the leg measurements are slightly lower. Traub and Nadchatram (1967a) draw attention to the absence of this species from Gilgit Agency. Traub *et al.* (1967), however, have recorded *L. rupestre* from this locality which falls within Jammu and Kashmir, India and not Pakistan. The species name derived from the Latin meaning 'pertaining to rocks', draws attention to the rocky terrain in the glaciated slopes and vales of the Kaghan valley where this species was very common.

55. *Leptotrombidium (Leptotrombidium) russicum* (Oudemans)
(Fig. 45)

Thrombidium russicum Oudemans, 1902, 43; 1903, 142; 1909, 52; Ewing, 1950, 291.

Trombicula russica, Philip and Traub, 1950, 29; Audy, 1952, 132.

Trombicula (Neotrombicula) ? russica, Womersley, 1952, 361.

Trombicula (Leptotrombidium) russica, Wharton and Fuller, 1952, 55; Audy, 1954b, 141; Womersley and Audy, 1957, 296.

Leptotrombidium russicum, Kepka, 1964, 548; Kolebinova and Beron, 1965, 71.

Leptotrombidium (Leptotrombidium) russicum, Kolebinova, 1970, 93.

Leptotrombidium (Leptotrombidium) russicum russicum, Vercammen-Grandjean and Langston, 1976, 283.

Redescription of species : Larva.

Idiosoma : Measuring 478-574 x 281-333 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 55-61; 26-28 dorsal idiosomal setae, measuring 48-59, arranged : 8-6-6-4-2(4); 2 pairs of sternal setae, anterior 42-45, posterior 37-41; 14-16 preanal setae, 30-34; 6-12 postanal setae, 40-54; total idiosomal setae 54-58.

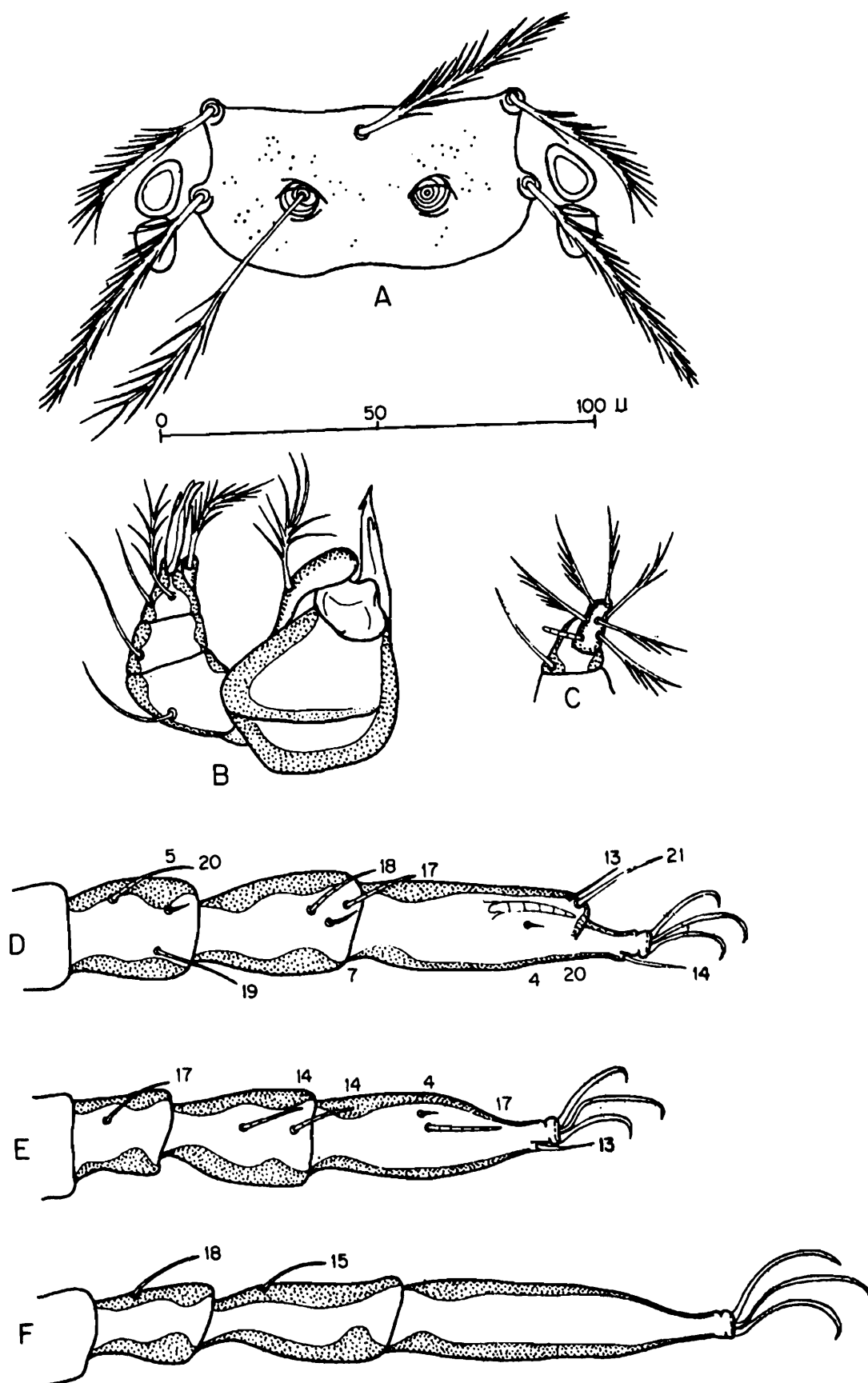


Fig. 45. *Leptotrombidium russicum*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; $PL > AM > AL$; sensillae flagelliform with basal barbs and branches on distal 1/2; $PW/SD = 1.80-1.90$. Scutal measurements after Vercammen-Grandjean and Langston (1976) giving measurements of holotype after Fuller (1952) and their own study, followed by means of 7 specimens after Kepka (1964) : AW 60, 68, 71; PW 69, 80, 81; SB 24, 28, 31; ASB 21, 25, 28; PSB ?, 19, 16; AP 21, 21, 27; AM 49, 52, 50; AL 35, 36, 37; PL 55, 68, 61; sens. -, -, 64. Scutal measurements giving means and ranges of 10 NIV specimens : AW 70, 66-76; PW 75, 71-81; SB 28, 26-31; ASB 22, 21-23; PSB 17, 15-19; AP 23, 20-28; AM 53, 49-57; AL 37, 36-40; PL 58, 54-61; sens. 66, 63-70.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements of holotype after Vercammen-Grandjean and Langston (1976) : Ip = 676. Leg I : 235. Leg II : 200. Leg III : 241. Measurements of NIV specimens : Ip = 714-771. Leg I : 243-260; tarsus (67x20), tarsala (20). Leg II : 223-233; tarsus (55x18), tarsala (17). Leg III : 248-278; tarsus (75x18).

Type data : Type specimens, Southern RUSSIA, 'Rusland', ex *Vleermnis* (bat), VIII.1898, Prof. J. Wagner, coll.

Type depository : Type specimens at RMNH.

New records : 4 records of collections from the Himalayan region by NIV field teams : UTTARANCHAL, Almora District, Katarmal, 1300m, 14 ex *Hipposideros armiger*, 19.VIII.1970; Chamoli District, Dogalbita, 2300-2650m, 19 ex *Myotis siligorensis*, 10.V.1969; 25, same data, but ex *Pipistrellus babu*, 12.VII.1970; Pithoragarh District, Goucher (Thal), 750-1200m, 1 ex *Rousettus leschenaulti*, 5.VIII.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. russicum russicum* falls out at couplet 50 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with the subspecies *L. russicum koreanum* which they have described. They separate the subspecies *L.r. russicum* by the broader PW (measuring 70-72 in *L. r. koreanum*), and the anterodorsal body setae measuring 52-61 (43-50 in *L. r. koreanum*). They have reported *L. r. russicum* from the U.S.S.R. and Europe, and consider records from other than 'bat' hosts doubtful. The NIV specimens have been taken only on 'bat' hosts and agree closely, except for the higher Ip range, with the redescription of Vercammen-Grandjean and Langston (1976). Their subspecific distinction proposed in this genus is not followed here. The species name is derived from the type locality.

56. *Leptotrombidium (Leptotrombidium) siligorensis* new species
(Fig. 46)

Description of species : Larva.

Idiosoma : Measuring 535-612 x 311-375 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 56-58; 41-43 dorsal idiosomal setae, measuring 48-53, irregularly arranged, arrangement in holotype : 9-8-8-6-2-4-4; 2 pairs of sternal setae, anterior 42-53, posterior 35-37; 20-22 preanal setae, 29-32; 12 postanal setae, 39-45; total idiosomal setae 79-83.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; cheliceral blade (32) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly concave, posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with PL bases; PL > AM > AL; sensillae flagelliform with branches on distal 2/3; PW/SD = 1.90-1.95. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 72 (75, 72-80); PW 80 (80, 75-85); SB 33 (31, 28-33); ASB 27 (26, 25-27); PSB 18 (17, 16-18); AP 24 (25, 23-26); AM 48 (48, 45-49); AL 37 (36, 32-40); PL 56 (57, 52-60); sens. 60, (60, -).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston (1976) in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 787-812. Leg I : 258-278; tarsus (66x22), tarsala (20-21). Leg II : 236-248; tarsus (56x22), tarsala (19-20). Leg III : 286-301; tarsus (72x18).

Type data : Holotype (NIV A-83546.9) and 9 paratypes, UTTARANCHAL, Chamoli District, Dogalbita, 2300-2650m, ex *Myotis siligorensis*, 10.V.1969, NIV, coll.

Remarks : *L. siligorensis* falls out in couplet 55 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. myotis myotis* (Ewing, 1929). *L. siligorensis* may be separated in having a broader scutum (AW measuring 62-70 and PW 72-80 in *L. m. myotis*), longer PL setae (measuring 44-54 in *L. m. myotis*), and SB level with PL bases (posterior in *L. m. myotis*). The species has been named after the host species.

57. *Leptotrombidium (Leptotrombidium) sinhgarhense* Kulkarni
(Fig. 47)

Leptotrombidium (Leptotrombidium) sinhgarhense Kulkarni, 1973, 519; 1979, 18; Kulkarni *et al.*, 1979, 10.

Leptotrombidium (Leptotrombidium) crassipilum Vercammen-Grandjean and Langston, 1976, 307, new synonymy.

Redescription of species : Larva. Colour in life orange.

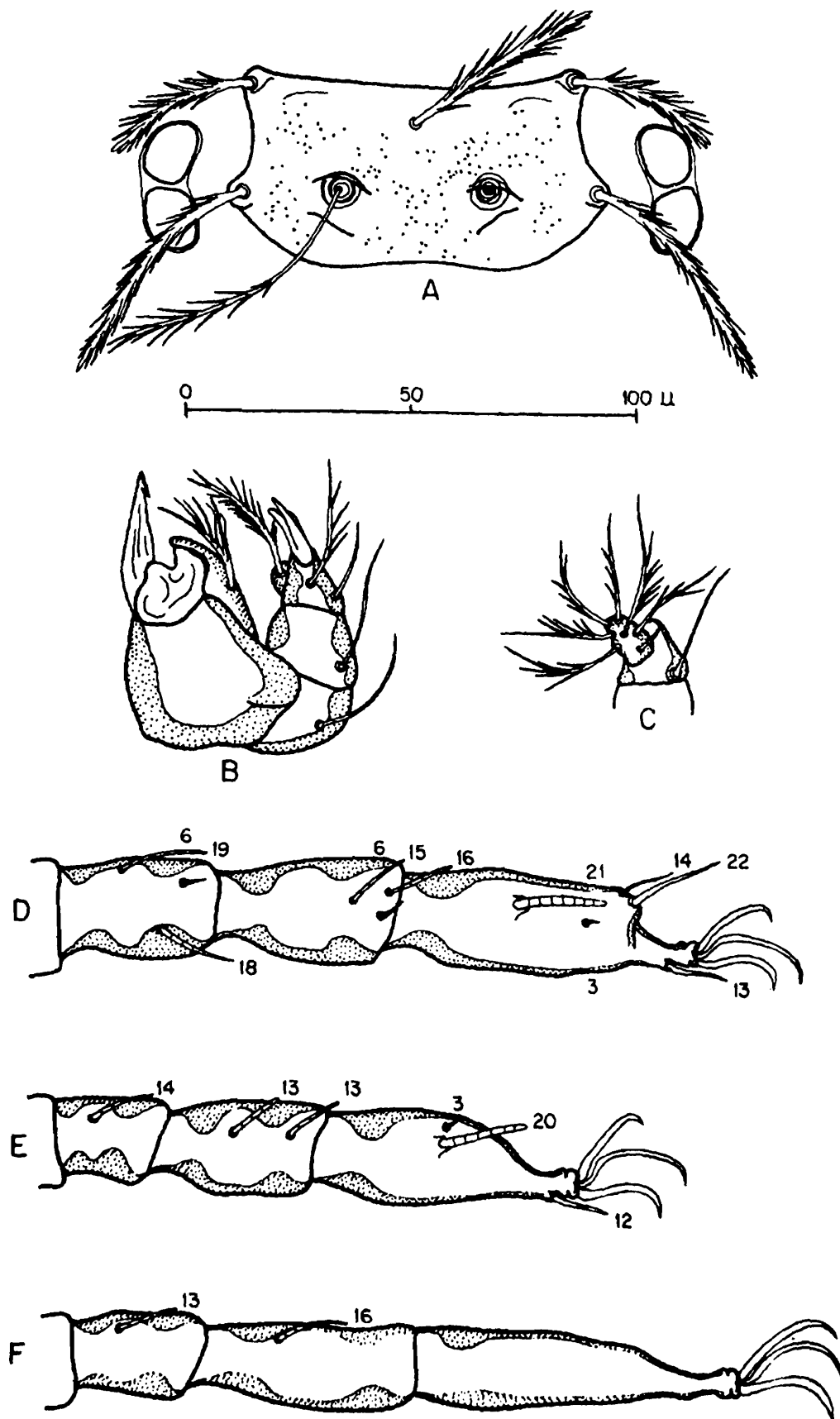


Fig. 46. *Leptotrombidium siligorense* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

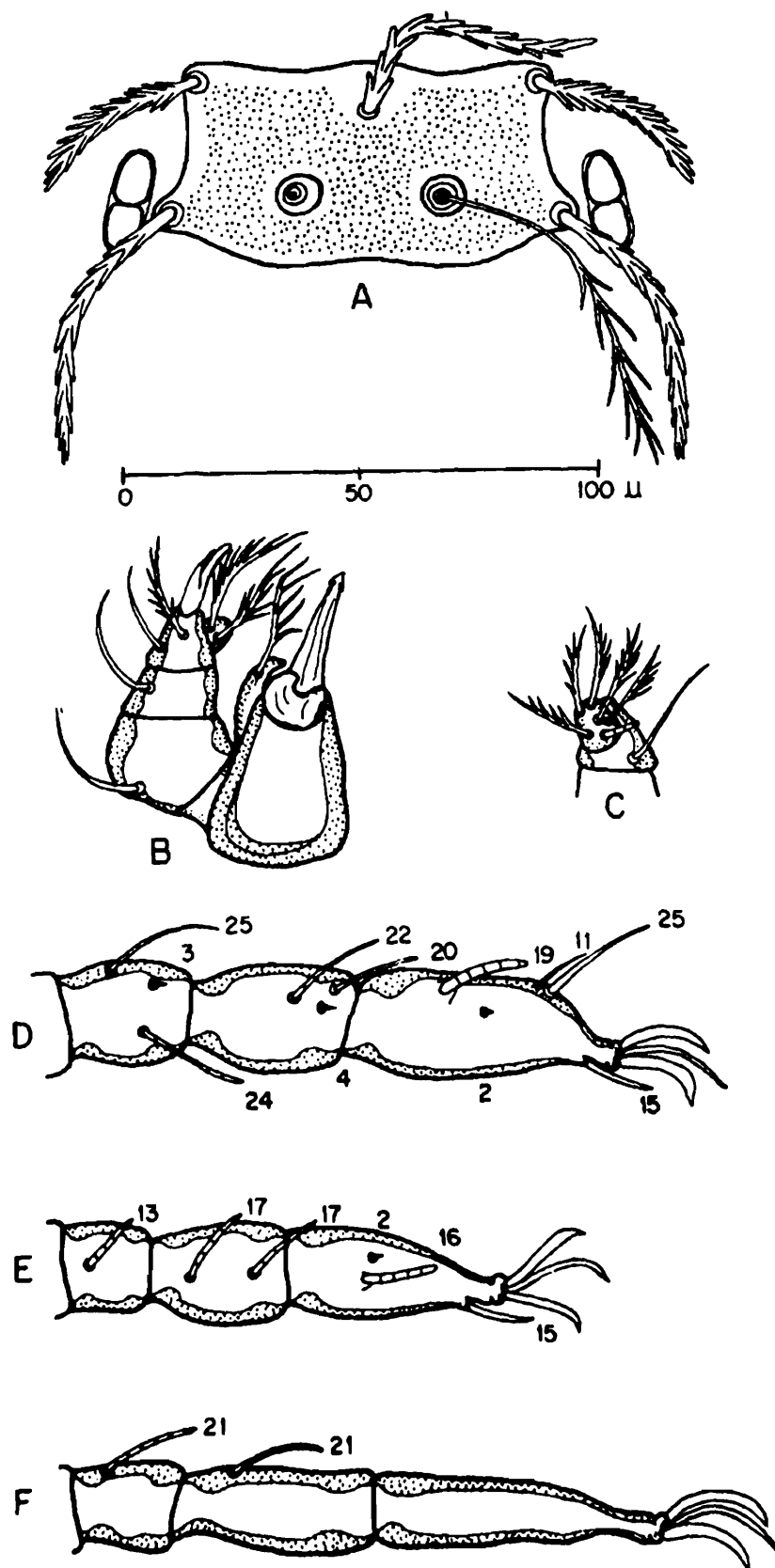


Fig. 47. *Leptotrombidium sinhgarihense*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 292-508 x 184-446 in unengorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 56-63; 42-46 dorsal idiosomal setae, measuring 40-58, arranged : 10-10-10(8)-2(4)-6(8)-4(2); 2 pairs of sternal setae, anterior 42-55, posterior 39-44; 18-22 preanal setae, 28-34; 14-18 postanal setae, 40-50; total idiosomal setae 80-92.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) (Original description : 22-24) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly convex, medially truncate; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; PL>AM>>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.78-1.88. Scutal measurements of holotype followed by means and ranges of 20 paratypes in parentheses after original description : AW 67 (69, 66-80); PW 79 (81, 77-87); SB 31 (33, 31-36); ASB 28 (30, 28-33); PSB 14 (14, 14-15); AP 28 (30, 28-38); AM 59 (60, 56-70); AL 45 (42, 33-45); PL 59 (63, 56-70); sens. 66 (68, 63-77). Scutal measurements of holotype and paratype of *L. crassipilum* Vercammen-Gandjean and Langston 1976 after original description : AW 70, 72; PW 78, 83; SB 31, 32; ASB 28, 30; PSB 14, 15; AP 26, 28; AM 56, 58; AL 40, 42; PL 59, 61; sens. 80, 76.

Legs : Similar to *L. baltalense* Vercammen-Gandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 803-852. Leg I : 277-283; tarsus (59-63 x 21-22), tarsala (17-21). Leg II : 234-261; tarsus (49-52 x 14-21), tarsala (14-21). Leg III : 292-308; tarsus (66-73 x 15-19). Measurements of holotype and paratype of *L. crassipilum* after original description : Ip = 756, 769. Leg I : 266, 272. Leg II : 228, 229. Leg III : 262, 268.

Type data : Holotype (NIV A-89953) and 7 paratypes, MAHARASHTRA, Pune District, Atkarwadi, 650m, ex 4 *Rattus rattus rufescens*, 15.VIII.1969, S.M. Kulkarni, coll.; 33 paratypes, same data, but ex 3 *Suncus murinus*, taken 15.VIII, 12.XI.1969; 3 paratypes, same data, but Sinharh, 1270m, ex *Millardia kondana*, taken 16.X.1970; 2 paratypes, same data, but Lonavala, 650m, ex *S. murinus*, taken 21.IX.1969; 1 paratype, same data, but Nighudgarh, 620m, ex *Rattus rattus satarae*, taken 23.X.1969.

Type depository : Holotype at NIV; paratypes at NIV, IM, BM(NH), RML and IMR.

Additional records : MAHARASHTRA, Pune District, approximately 9800 ex *S. murinus*, *R. r. rufescens*, *M. kondana*, *R. r. satarae*, *Rattus blanfordi*, *Mus booduga*, *Funambulus tristriatus*, *Bandicota bengalensis*, and *Mus platythix*, VI-XII.1970 and VII-IX.1971, S.M. Kulkarni, coll. Holotype and paratype of *L. crassipilum*: MAHARASHTRA, Bombay, Bhandup area, ex *Rattus rattus*, 29.VIII.1959, A.K. Joshee, coll.

New records : GOA, Bondla Wildlife Sanctuary, 244 ex *S. murinus* and *B. bengalensis*, 22.XII.1983, S. Fernandes, coll. GUJARAT, Dediapada and Jhankvav, 537 ex *S. murinus*, 26, 27.X.1984, S. Fernandes, coll.

Material examined : 1 specimen (MZ 110466) loaned by A.K. Joshee : Bhandup area, NW Bombay, ex *Rattus rattus*, 29.VIII.1959, A.K. Joshee, coll. - labelled *L. akamushi*.

Remarks : The above redescription is based on the literature, study of specimen (MZ 110466) and the NIV specimens. *L. crassipilum* falls out at couplet 138 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with another new species they have described *L. cebephium*. They distinguish *L. crassipilum* in having Ip range = 756-769 (724-776 in *L. cebephium*), and scutal and dorsal body setae with thick shafts and strong, short barbs (thinner and shorter setae in *L. cebephium*). The type specimens of *L. crassipilum* are not accessible. However, study of specimen (MZ 110466) from the same collection reveals that it is a true *sinhgarhense*. Vercammen-Grandjean and Langston's description of *L. crassipilum* agrees closely with the original description of *L. sinhgarhense*, differing only in having the Ip range slightly lower. Study of a larger sample of NIV specimens of *L. sinhgarhense* revealed a lower Ip limit of 777 in the type specimens and 726 in the Goa specimens. Hence, *L. crassipilum* Vercammen-Grandjean and Langston 1976 is a synonym of *L. sinhgarhense*. Kulkarni (1973) considers this species close to *L. scutellare* (Nagayo *et al.*, 1921). He separates *L. sinhgarhense* by the shape of the posterior scutal margin, the densely punctate scutum, the slightly shorter PSB, and distinctly shorter AL setae. This species has been named after Sinhgarh, an ancient fort near Pune, where most of the type collection was made.

58. *Leptotrombidium (Leptotrombidium) solitarium* new species (Fig. 48)

Description of species : Larva.

Idiosoma : Measuring 407-560 x 274-309 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 58-64; 58-67 dorsal idiosomal setae, 46-58, irregularly arranged, arrangement in holotype : 12-8-2-13-2-14-8-4-2; 2 pairs of sternal setae, anterior 53-58, posterior 39-50; 42 preanal setae, 31-35; 20 postanal setae, 43-45; total idiosomal setae 126-135.

Gnathosoma : Palpal setal formula N/B/BBB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (39) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Idiosoma : Moderately punctate, subrectangular with anterior margin very shallowly concave; posterior margin biconvex; AM base posterior to level of AL bases; SB slightly posterior to level of PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 2/3; PW/SD = 1.98-2.24. Scutal measurements of holotype, followed by measurements of 2 paratypes : AW 74, 75, 79; PW 83, 86, 88; SB 35, 35, 37; ASB 28, 30, 29; PSB 14, 16, 14; AP 25, 26, 27; AM 64, 61, 61; AL 47, 46, 47; PL 67, 58, 58; sens. 71, 77, -.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but peditarsal setation: 22-16-15. Measurements as follows

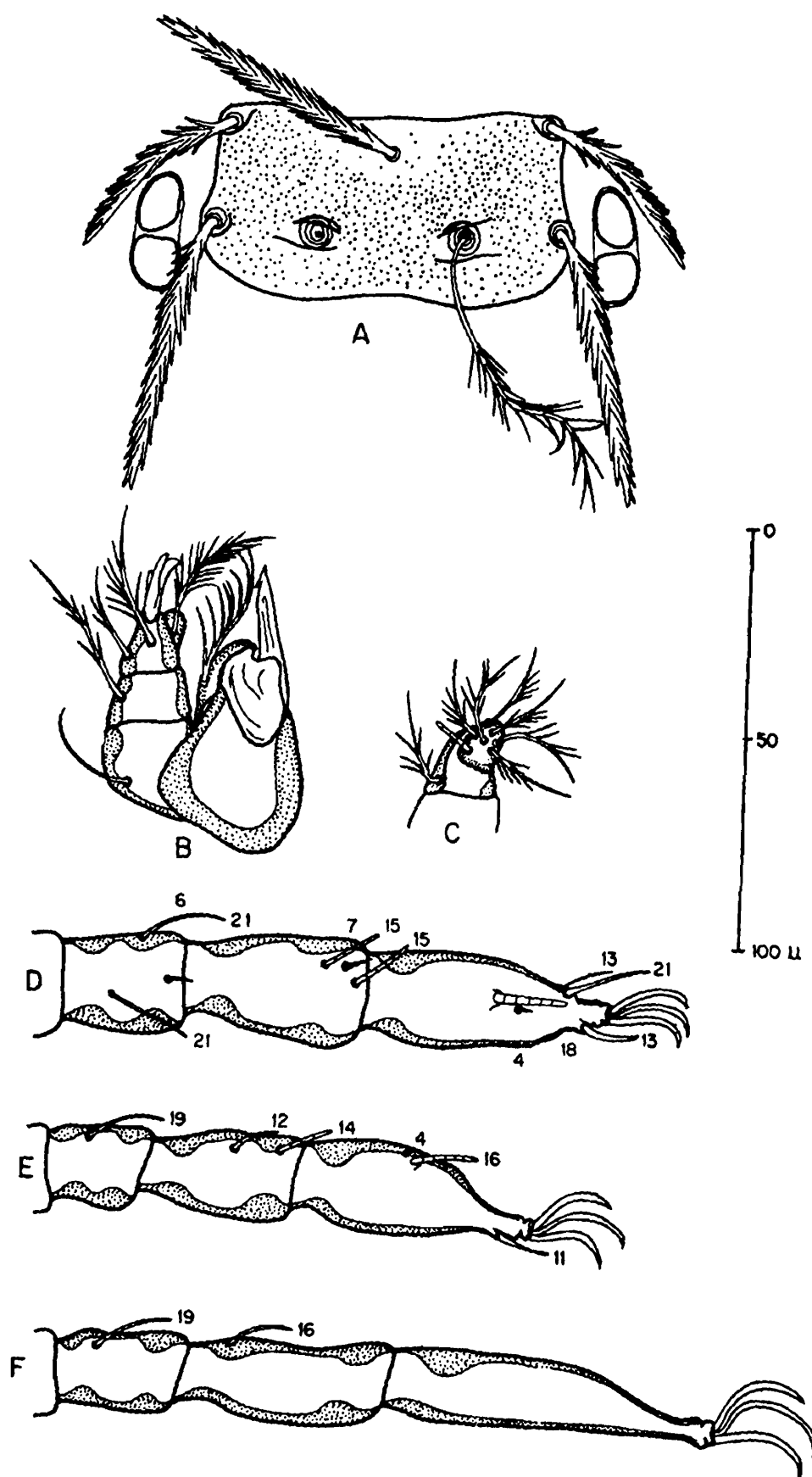


Fig. 48. *Leptotrombidium solitarium* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

: Ip = 871. leg I : 294; tarsus (57x22), tarsala (18-19). Leg II : 267; tarsus (56x21), tarsala (15-16). Leg III : 310; tarsus (76x17).

Type data : Holotype (NIV A-84735.15), HIMACHAL PRADESH, Lahul District, Kiriting, 2680-3250m, ex *Alticola roylei*, 23.IX.1968, NIV, coll.; 2 paratypes, same data, but Chamba District, Tindi, 2440-2590m, taken 19.IX.1968.

Remarks : *L. solotarium* falls out at couplet 2 of the key to species of the subgenus *Leptotrombidium* given by Vecammen-Grandjean and Langston (1976) along with *L. elisbergi* Traub and Lakshana, 1966. *L. elisbergi* may easily be separated by its palpo-setal formula (B/B/BBN in *L. elisbergi*), its biconvex posterior scutal margin (smoothly rounded in *L. elisbergi*), higher Ip (752 in *L. elisbergi*), and greater number of body setae (56 in *L. elisbergi*). The species name from the Latin meaning 'standing alone' draws attention to the unique palpo-setal formula which distinguishes *L. solitarium* from all other species in the subgenus.

59. *Leptotrombidium (Leptotrombidium) spilletti* Mitchell and Nadchatram (Fig. 49)

Leptotrombidium (Leptotrombidium) spilletti Mitchell and Nadchatram, 1966, 66; Mitchell *et al.*, 1966, 121; Vercammen-Grandjean and Langston, 1976, 611.

Leptotrombidium spilletti, Nadchatram, 1970c, 150; Prasad, 1974, 85.

Redescription of species : Larva.

Idiosoma : Measuring 250-350 x 200-260 in unengorged to partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 56-67; 68-84 dorsal idiosomal setae, measuring 36-58, irregularly arranged, arrangement summarized after original description : (10-14)-(10-14)-(8-14)-(8-14)+(22-32); 2 pairs of sternal setae, anterior 50-55, posterior 37-40; 36-42 preanal setae, 28-34; 28-34 postanal setae, 40-56; total idiosomal setae 140-162. Body setae well-barbed.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (32-36) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly convex; AM base posterior to level of AL bases; SB level with PL bases; AM>>PL>AL; sensillae with basal barbs and branches on distal 2/3; PW/SD = 1.66-1.81. Scutal measurements of holotype, followed by means and ranges of 10 type specimens in parentheses after original description : AW 81 (78, 73-83); PW 93 (92, 85-97); SB 34 (34, 33-35); ASB 38 (36, 31-38); PSB 18 (16, 14-18); AP 33 (34, 31-36); AM 66 (68, 64-76); AL 52 (52, 48-57); PL 57 (56, 54-59); sens. 85 (85, 83-86). Scutal measurements giving means and ranges of 4 NIV specimens : AW 76, 73-78; PW 93, 88-102; SB 34, 33-

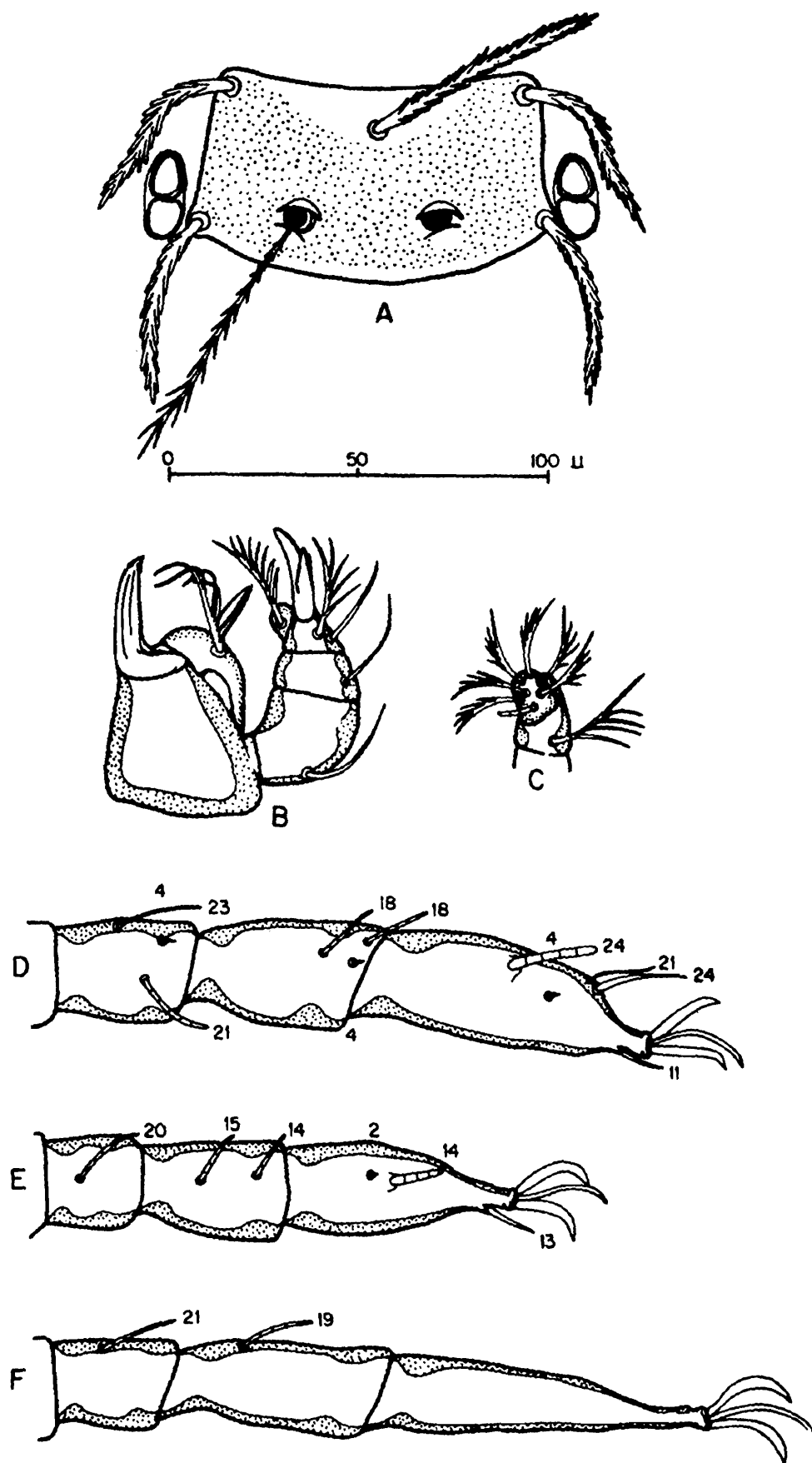


Fig. 49. *Leptotrombidium spilletti*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

36; ASB 35, 33-37; PSB 19, 18-19; AP 36, 34-37; AM 70, 67-72; AL 52, 47-57; PL 54, 52-58; sens. 86, -.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation: 22-16-15. Measurements after original description : Ip = 810-900. Leg I : tarsus (65-70 x 21-24), tarsala (20-22). Leg II : tarsus (56-62 x 19-21), tarsala (14-17). Leg III : tarsus (90-93 x 16-17). Measurements of PT (No.251264) after Vercammen-Grandjean and Langston (1976) : Ip = 910. Leg I : 309. Leg II : 265. Leg III : 336. Measurements of NIV specimens : Ip = 869-892. Leg I : 280-300; tarsus (73x27), tarsala (24). Leg II : 261-262; tarsus (60x24), tarsala (14). Leg III : 319-345; tarsus (83x16).

Type data : Holotype (Bishop 6627), and 16 paratypes, MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Rattus blanfordi*, 25.XII.1964, J. Spillett and G.B. Schaller, coll.

Type depository : Holotype in BPBM; paratypes in BPBM, IMR, BM(NH), USNM, ZSI, RML, IA, and collections of R. Traub, C.J. Mitchell and M. Nadchatram.

New records : JAMMU and KASHMIR, Rajouri District, Naoshera, 750m, 1 ex *Rattus rattoides*, 8.XII.1969, NIV, coll.; 3, same data, but ex *Golunda ellioti*.

Material examined : Holotype on loan from BPBM, and 1 paratype (1. 251264) on loan from M. Nadchatram.

Remarks : The above redescription is based on the literature, study of the holotype and paratype (1. 251264), and the NIV specimens. *L. spilletti* falls out at couplet 27 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. puta* (Womersley, 1952). They distinguish *L. spilletti* in having a greater number of body setae (78-86 in *L. puta*), a higher Ip range (762-800 in *L. puta*), and AM>> PL (AM>PL in *L. puta*). Mitchell and Nadchatram (1966) consider *L. spilletti* close to *L. dux* (Womersley, 1952), *L. kalrai* (Radford, 1953), *L. parapalpale* (Womersley, 1952), *L. radfordi* (Sinha, 1954) and *L. multisetosum* (Joshee, 1964), from which species it may easily be separated by the combination of its characters. The NIV specimens agree closely with the type specimens examined and the description in the literature. This species has been named for Mr. Juan Spillett who collected much of the material in the Kanha National Park ectoparasite study.

60. *Leptotrombidium (Leptotrombidium) subintermedium* (Jameson and Toshioka)
(Fig. 50)

Trombicula (Leptotrombidium) subintermedium Jameson and Toshioka, 1954, 11; Traub *et al.*, 1958, 148.

Leptotrombidium (Leptotrombidium) subintermedium, Traub and Nadchatram, 1967a, 10; Traub *et al.*, 1967, 36; Traub and Wisseman, 1968, 223; Vercammen-Grandjean, 1968b, 75; Vercammen-Grandjean and Langston, 1976, 440.

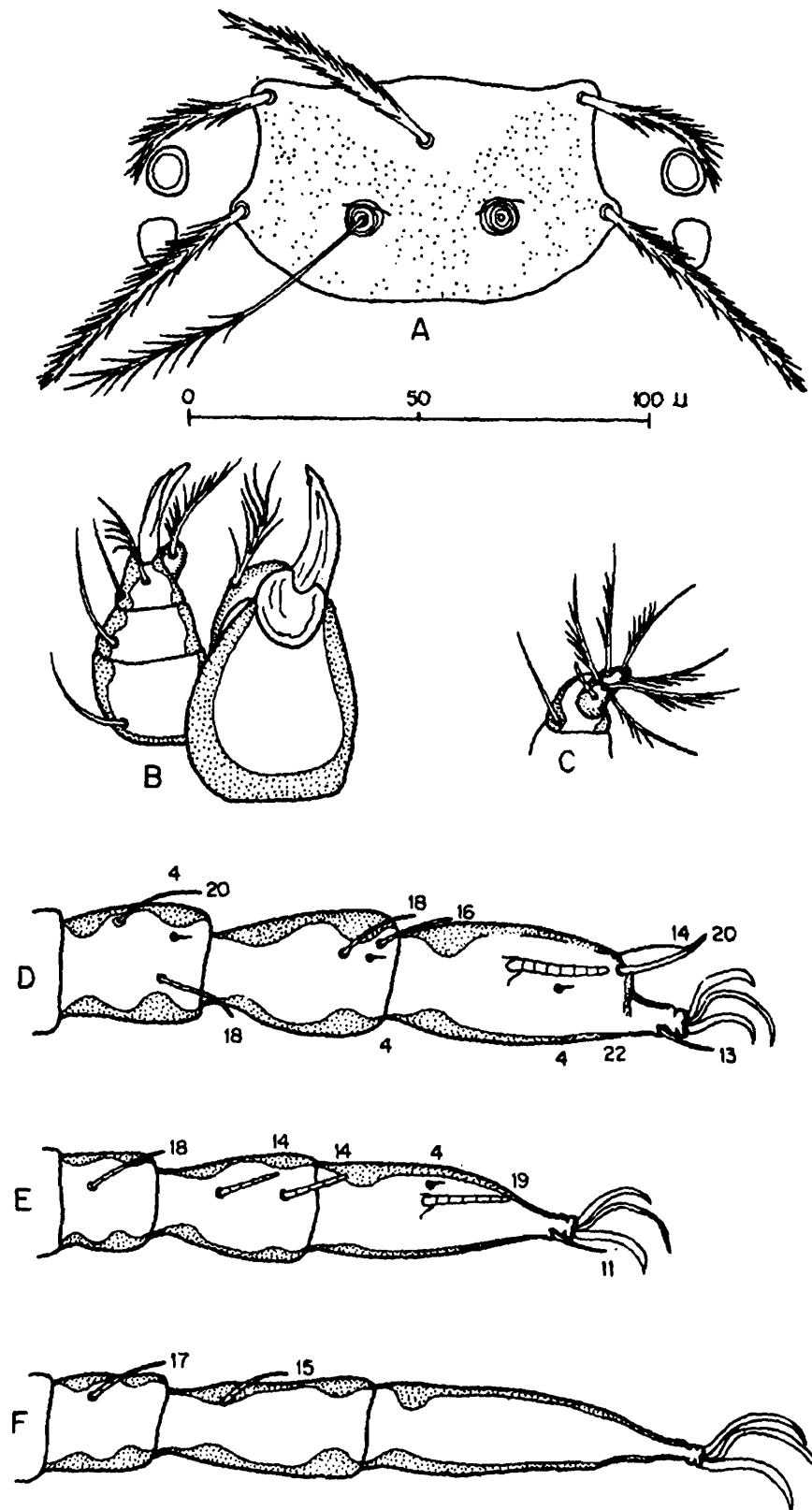


Fig. 50. *Leptotrombidium subintermedium*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Leptotrombidium subintermedium, Chow, 1973, 31.

Redescription of species : Larva.

Idiosoma : Measuring 554 x 335 in engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 58-59; 32 dorsal idiosomal setae, measuring 38-60, arranged : 8-6-6-6-4-2; 2 pairs of sternal setae, anterior 52, posterior 42; 28 preanal setae, 29-36; 20 postanal setae, 38-50; total idiosomal setae 86.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (38) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin convex, medially truncate; AM base posterior to level of AL bases; SB slightly posterior to level of PL bases; PL>AM>>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.59-1.64. Scutal measurements of holotype after original description followed by measurements of holotype and 2 Korean specimens (T-3711 and T-3724) in parentheses after Vercammen-Grandjean and Langston (1976) : AW 70 (69, 68, 70); PW 77 (74, 73, 72); SB 31 (31, 32, 32); ASB 27 (29, 30, 28); PSB 20 (17, 16, 17); AP 25 (21, 22, 22); AM 50 (53, 50, 50); AL 36 (37, 38, 38); PL 63 (58, 62, 58); sens. 67 (72, 70, -).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation: 22-16-15. Measurements of holotype and 2 Korean specimens after Vercammen-Grandjean and Langston (1976) : Ip = 754, 756, 738. Leg I : 264, 266, 262; tarsala (20). Leg II : 224, 223, 214; tarsala (17). Leg III : 266, 267, 262. Measurements of Gilgit Agency specimen examined : Leg I : 271; tarsus (62x25), tarsala (22). Leg II : 241; tarsus (56x21), tarsala (19). Leg III : 288; tarsus (72x18).

Type data : Holotype (K-291), SOUTH KOREA, 3km SE of Yonchon, ex *Apodemus agrarius*, 27.XI.1951, 37th Preventive Medical Commission, coll.

Type depository : Holotype at USNM.

Additional records : JAMMU and KASHMIR, Gilgit Agency, 1540-3075m, ex *Cricetulus migratorius* and *Rattus rattoides*, 1962-1964, University of Maryland and Pakistan Medical Research Centre field teams, coll.

Material examined : 1 specimen (B665413) on loan from M. Nadchatram : INDIA (not WEST PAKISTAN, as recorded), Gilgit Agency, Gilgit District, Naltar, (2900m), ex *Cricetulus migratorius*, 8.VIII.1964, name of collector not recorded.

Remarks : The above redescription is based on the redescription by Vercammen-Grandjean and Langston (1976) and the study of the Gilgit Agency specimen. *L. subintermedium* runs to couplet 115 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize this species as having 32 dorsal idiosomal

setae and PL>AM>>AL. They consider *L. subintermedium* close to *L. orientale* (Schluger, 1948), from which it differs by its palpo-setal formula (N/N/BNB in *L. orientale*), and in having SB only slightly posterior to level of PL bases (very much posterior in *L. orientale*). The record of this species from Gilgit Agency by Traub and Nadchatram (1967a) and Traub *et al.* (1967), falls in Jammu and Kashmir, India and not Pakistan as reported. The species name draws attention to its resemblance to *L. intermedium* (Nagayo *et al.*, 1920).

61. *Leptotrombidium (Leptotrombidium) subrussicum* KOLEBINOVA
(Fig. 51)

Leptotrombidium (Leptotrombidium) subrussicum KOLEBINOVA, 1970, 93; Vercammen-Grandjean and Langston, 1976, 426.

Redescription of species : Larva.

Idiosoma : Measuring 306-494 x 206-382 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 68-70 (Vercammen-Grandjean and Langston (1976) : 54-65); 26 dorsal idiosomal setae, measuring 64-68 (Vercammen-Grandjean and Langston (1976) : 42-66), arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 53-66, posterior 40-54; 16-20 preanal setae, 33-41; 6-10 postanal setae, 42-65; total idiosomal setae 56-60.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B: cheliceral blade (31) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin very shallowly concave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases (Vercammen-Grandjean and Langston (1976): slightly posterior to level of PL bases); PL>AM>>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.82-1.95. Scutal measurements of holotype followed by means and ranges of 29 Bulgarian specimens in parentheses after Vercammen-Grandjean and Langston (1976) : AW 61 (64, 60-68); PW 73 (76, 68-80); SB 28 (30, 26-32); ASB 26 (26, 24-28); PSB 14 (13, 12-15); AP 22 (22, 19-24); AM 50 (59, 53-66); AL 32 (36, 34-39); PL 57 (64, 57-73); sens. - (77, 72-80). Scutal measurements giving means and ranges of 10 NIV specimens : AW 67, 65-70; PW 75, 70-81; SB 30, 27-33; ASB 25, 24-26; PSB 16, 15-17; AP 22, 19-26; AM 54, 48-58; AL 39, 35-42; PL 65, 54-73; sens. - (broken off in all specimens).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditaral setation : 22-16-15. Measurements after Vercammen-Grandjean and Langston (1976) : lp = 702-781. Leg I : 241-271. Leg II : 214-238. Leg III : 243-272. Measurements of NIV specimens : lp = 707-765. Leg I : 239-268; tarsus (61x21), tarsala (18). Leg II : 208-227; tarsus (49x20), tarsala (16). Leg III : 260-276; tarsus (65x18).

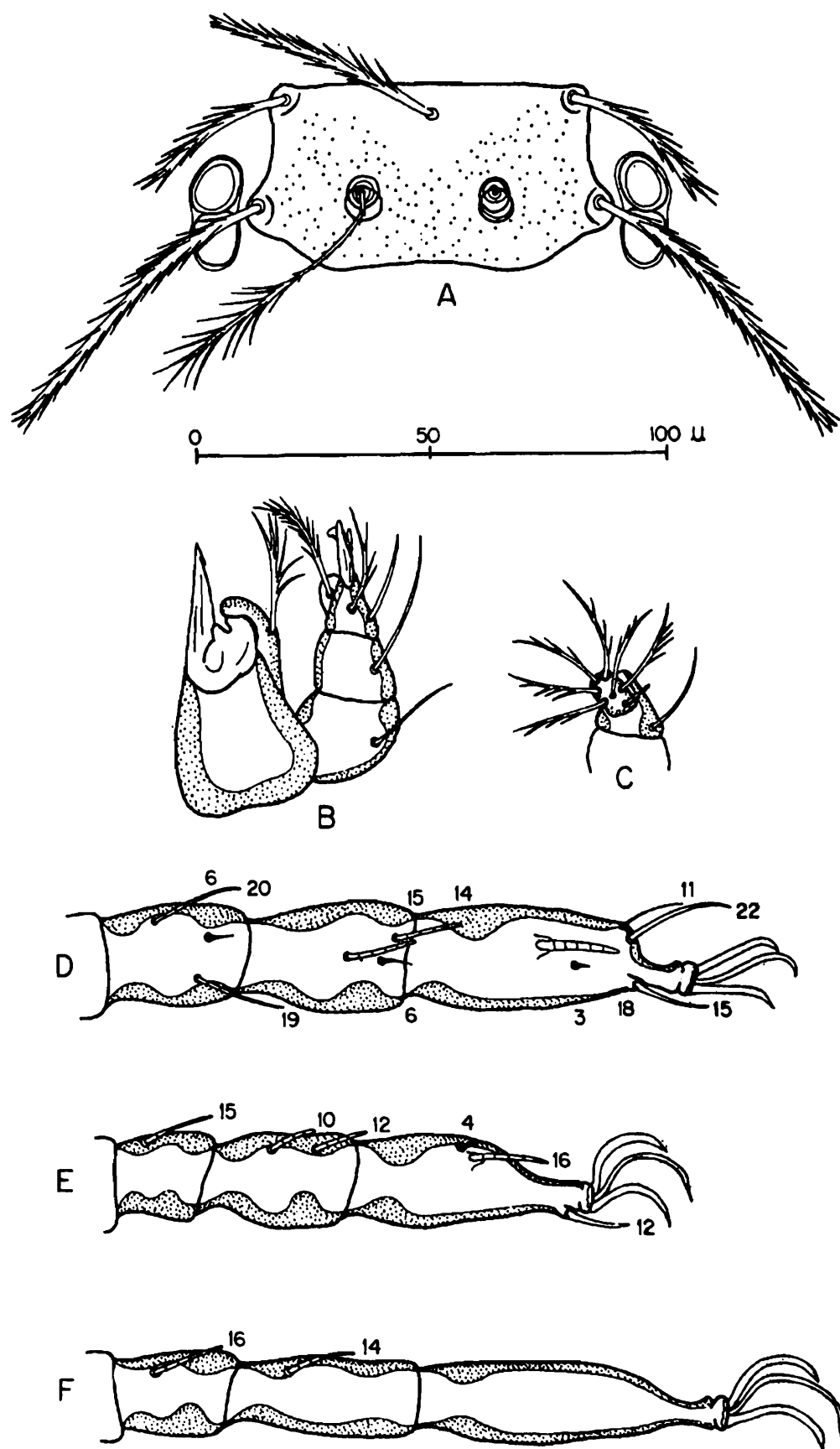


Fig. 51. *Leptotrombidium subrussicum*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type data : Holotype, FRANCE, Corsica Island, Monte Cinto, 1800m, ex *Eliomys quercinus*, 23.IX.1967, P. Beron, coll.; 3 paratypes and 2 specimens, same data, but Monte Cinto and vicinity of Castiglione, 600m, ex *E. quercinus* and *Rattus* sp., 23.IX, 23.XI.1967.

Type depository : Holotype and paratypes at Institute of Zoology, Bulgarian Academy of Sciences - Sofia.

New records : UTTARANCHAL, Tehri District, Chirbatia, 1800-300m, 19 ex Green backed tit *Parus monticolus monticolus*, 26.V.1969, NIV, coll.

Remarks : The above redescription is based on the redescription by Vercammen-Grandjean and Langston (1976) and the study of the NIV specimens. *L. subrussicum* falls out at couplet 143 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with a new species they have described, *L. imphalum*. They distinguish *L. subrussicum* in having PW/AP ratio >3.3 (<2.7 in *L. imphalum*), usually 24 ventral setae (24-28 in *L. imphalum*), and Ip range = 702-781 (722-792 in *L. imphalum*). They suggest that altitude could be a determining factor in the wide variation of measurements observed in *L. subrussicum*. This species has usually been recorded from small mammals hosts, but Vercammen-Grandjean and Langston (1976) report 1 specimen (No. 836) from BULGARIA, Kamchiya, ex great tit *Parus major*, 22.XI.1969, M. Kolebinova, coll. The NIV specimens, taken on *Parus m. monticolus*, agree closely with the redescription of Vercammen-Grandjean and Langston (1976). The species name draws attention to its resemblance to *L. russicum* (Oudemans 1902).

62. *Leptotrombidium* (*Leptotrombidium*) *tithwalense* (Womersley) (Fig. 52)

Trombicula tithwalensis Womersley, 1952, 123; Prasad, 1974, 98.

Trombicula (*Leptotrombidium*) *tithwalensis*, Womersley and Audy, 1957, 257.

Leptotrombidium (*Leptotrombidium*) *tithwalense*, Traub and Nadchatram, 1967a, 7; Traub *et al.*, 1967, 36; Traub and Wisseman, 1968, 223; Vercammen-Grandjean and Langston, 1976, 498.

Leptotrombidium (*Leptotrombidium*) *tithwalensis*, Srivastava and Wattal, 1981, 124.

Leptotrombidium (*Leptotrombidium*) sp. E Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 374-520 x 254-520 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, 54-67; 34-38 dorsal idiosomal setae, measuring 46-60, arranged : 10-8-8-6-(4)-(2); 2 pairs of sternal setae, anterior 58-62, posterior 46-53; 22-26 preanal setae, 32; 6-12 postanal setae, 51; total idiosomal setae 70-80. Original description : approximately 40 dorsal idiosomal setae, measuring 56-70, arranged : 12-8-8-6-4-2; approximately 36 ventral setae; total idiosomal setae 82. Vercammen-Grandjean and Langston (1976) : 42 dorsal idiosomal setae, measuring 46-63, arranged : 12-10-8-6-4-2; 30 preanal setae, 29-30; 18 postanal setae, 49-57; total idiosomal setae 96.

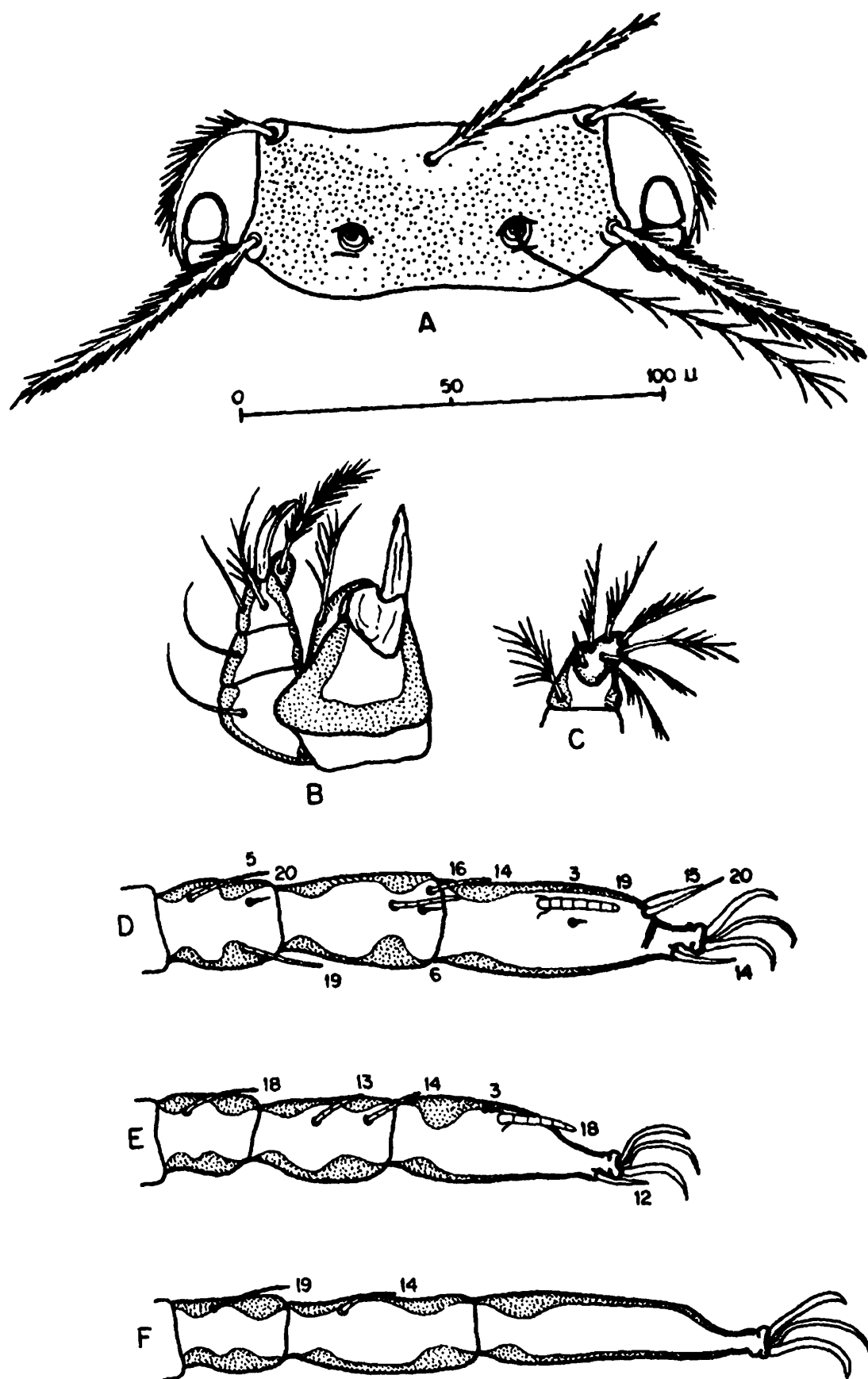


Fig. 52. *Leptotrombidium tithwalense*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula N/N/BNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex (Original description : posterior scutal margin lightly concave laterally from PL, and medially almost straight; Vercammen-Grandjean and Langston (1976), pl. 126 : posterior margin with deep medial concavity); AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; $PL > AM > AL$; sensillae flagelliform with branches on distal 2/3; $PW/SD = 1.84-2.00$. Scutal measurements giving means of 4 specimens after original description followed by measurements of holotype and 1 paratype after Vercammen-Grandjean and Langston (1976) : AW 83, 82, 76; PW 94, 90, 88; SB 36, 36, 33; ASB 35, 32, 30; PSB 16, 16, 14; AP 29, 25, 22; AM 51, 60, -; AL 48, 48, 46; PL 58, 62, -; sens. 78, 94, -. Scutal measurements giving means and ranges of 10 NIV specimens : AW 80, 73-85; PW 88, 80-97; SB 36, 31-39; ASB 29, 25-33; PSB 15, 14-16; AP 24, 21-28; AM 64, 60-69; AL 47, 45-49; PL 70, 67-73; sens. - (broken off in all specimens).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description followed by measurements after Vercammen-Grandjean and Langston (1976) in parentheses : $Ip = 780$ (766, 770). Leg I : 260 (254, 254). Leg II : 234 (238, 244). Leg III : 286 (274, 272). Measurements of NIV specimens : $Ip = 761-777$. Leg I : 252-261; tarsus (62x22), tarsala (18-19). Leg II : 235-241; tarsus (54x20), tarsala (17-18). Leg III : 269-285; tarsus (68x16).

Type data : Holotype, JAMMU and KASHMIR, Tithwal, ex 'rat', IX.1948, S.L. Kalra, coll.; 3 specimens (Womersley and Audy, 1957 : 31 specimens; Vercammen-Grandjean and Langston, 1976 : 1 paratype and 29 specimens), same data, but Baltal, ex 'mouse'

Type depository : Holotype and 1 paratype at SAM.

Additional records : JAMMU and KASHMIR, Gulmarg, 2730m, 7 ex *Alticola roylei montosa*, IX.1970, NICD, coll.

New records : 14 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 1 ex *Apodemus flavicollis*, 17.IX.1968; Kinnaur District, Chitkul, 3400, 3 ex *Alticola roylei*, 2.VI.1970; Rakcham, 3120, ex *A. flavicollis*, 19.VI.1970; Sangla, 2700m, 7 ex *A. flavicollis*, 9.VI.1970; Lahul District, Kirting, 2680-3250m, 1 ex *A. roylei*, 24.IX.1968; Thiro, 2850m, 1 ex *A. flavicollis*, 11.IX.1968. JAMMU and KASHMIR, Udhampur District, Kulwanda, 1700-1800m, 2 ex 2 *Rattus rattoides*, 3.XII.1969. UTTARANCHAL, Almora District, Sukhidang, 250-1400m, 3 ex 3 *Suncus murinus*, 2,4.III.1967; Chamoli District, Gwaldam, 1700-2000m, 5 ex *R. rattoides*, 22.VII.1970; Nainital District, Bhimtal, 1200-1700m, 4 ex *S. murinus*, 28.XI.1966; Uttarkashi District, Sakhi, 2700m, 1 ex *R. rattoides*, 5.VI.1969.

Material examined : 2 specimens (# B66960 - #28ET and #29ET) on loan from M. Nadchatram : WEST PAKISTAN, Shogran, Mt. Makra, 2350m, ex *Hyperacrius wynnei*, 23.IX.1964, name of collector not recorded.

Remarks : The above redescription is based on the literature, study of the Shogran and NIV specimens. *L. tithwalense* falls out at couplet 37 of the key to species of the subgenus *Leptotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. gemiticulum* Traub *et al.*, 1958. They distinguish *L. tithwalense* in having scutal setae thick and long, clothed with strong, long barbs (shorter with thinner and shorter barbs in *L. gemiticulum*), humeral setae measuring 60-70 (51-59 in *L. gemiticulum*), Ip range = 766-770 (745-762 in *L. gemiticulum*), number of body setae 96-98 (96-110 in *L. gemiticulum*), and PW measuring 88-90 (79-83 in *L. gemiticulum*). They consider *L. tithwalense* close to *L. parapalpale* (Womersley, 1952), but distinguish *L. tithwalense* as having lower Ip (821-857 in *L. parapalpale*). The number of body setae in the NIV specimens are fewer than that recorded by Vercammen-Grandjean and Langston (1976), but close to the original description. The scutal shape of the NIV specimens agrees with the original description, lacking the deep medial concavity of the posterior scutal margin illustrated in the redescription by Vercammen-Grandjean and Langston (1976). The scutal measurements of the NIV specimens are lower, but proportional to the measurements given in the literature; and hence, the NIV specimens are regarded as *L. tithwalense*. The species name has been derived from the type locality.

63. *Leptotrombidium* (*Ericotrombidium*) *bhattipadense* (Joshee) new combination
(Fig. 53)

Trombiula bhattipadensis Joshee, 1964, 47.

Leptotrombidium (*Leptotrombidium*) *bhattipadense*, Nadchatram and Joshee, 1966, 441; Nadchatram, 1970c, 147.

Leptotrombidium bhattipadense, Mitchell and Nadchatram, 1966, 66; Prasad, 1974, 84; Srivastva and Wattal, 1975b, 318.

Leptotrombidium (*Hypotrombidium*) *bhattipadense*, Vercammen-Grandjean and Langston, 1976, 720.

Leptotrombidium (*Ericotrombidium*) *kalyani* Kulkarni, 1981, 65, new synonymy.

Leptotrombidium (*Ericotrombidium*) sp. A Fernandes *et al.*, 1988, 109.

Redescription of species : Larva. Colour in life pale orange-red.

Idiosoma : Measuring 320-410 x 260-340 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 37-47; 26-32 dorsal idiosomal setae, measuring 36-47, arranged : 8-6-6-6(4)-4(2)-(2); 2 pairs of sternal setae, anterior 35-42, posterior 35; 12-22 preanal setae, 28-35; 12-16 postanal setae, 39-43; total idiosomal setae 58-68.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S (Nadchatram and Joshee, 1966,

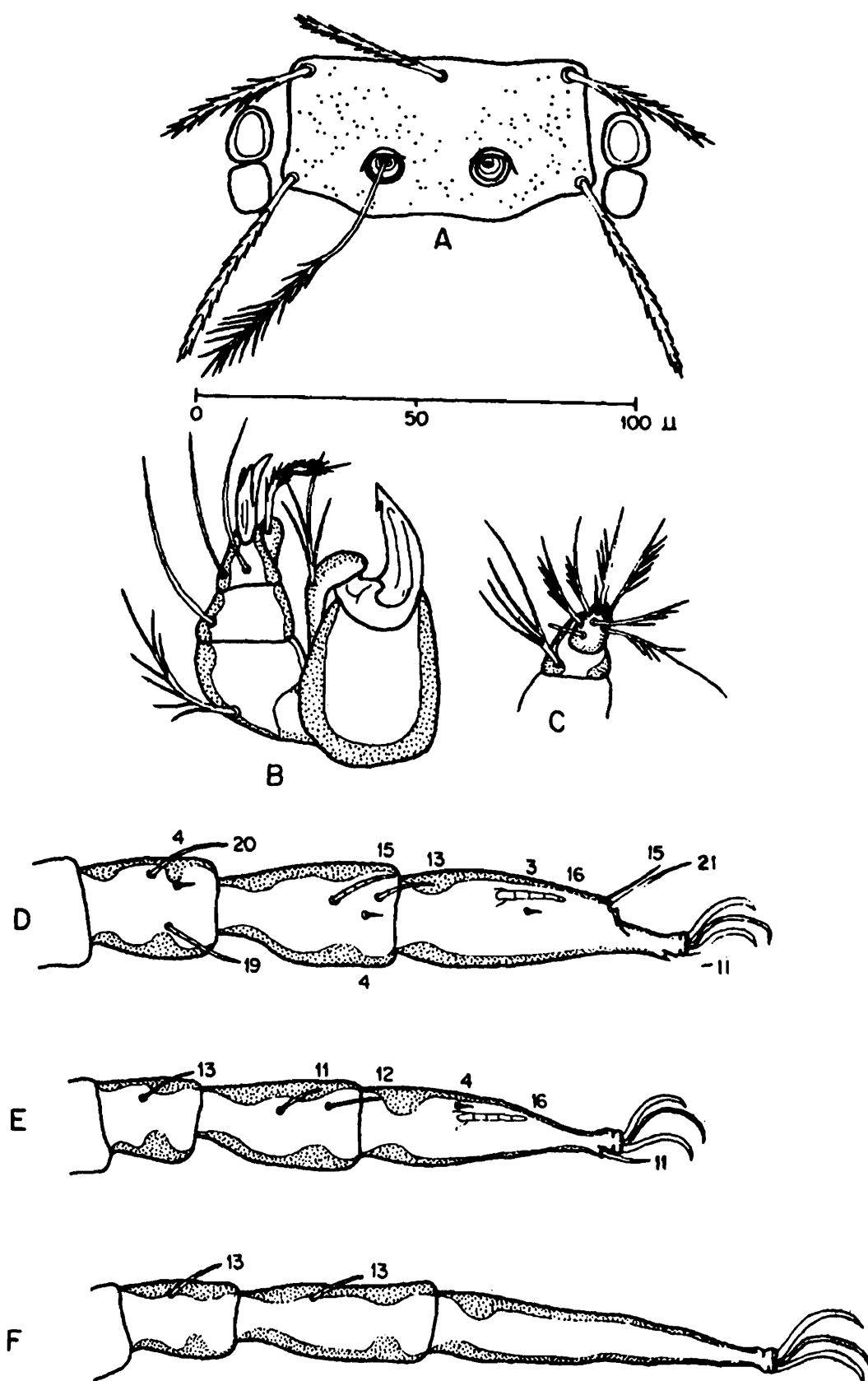


Fig. 53. *Leptotrombidium bhattipadense*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Vercammen-Grandjean and Langston, 1976 : palpal tarsal setation 7B!); palpal claw 3-pronged; galeala B; cheliceral blade (33-40) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex (Vercammen-Grandjean and Langston (1976) : posterior margin convex, sinuous!); AM slightly posterior to level of AL bases; SB anterior to or level with PL bases; $PL > AL > AM$; sensillae flagelliform with basal barbs and branches on distal 2/3; $PW/SD = 1.82-2.03$. Scutal measurements of holotype followed by means and ranges of 6 paratypes in parentheses after Nadchatram and Joshee (1966) : AW 63 (63, 60-67); PW 72 (70, 68-73); SB 24 (22, 21-25); ASB 26 (26, 24-28); PSB 12 (12, 9-14); AP 23 (23, 21-26); AM 34 (35, 33-38); AL 41 (42, 40-44); PL 45 (45, 43-46); sens. 57 (59, 57-60). Scutal measurements giving means and ranges of 10 NIV specimens : AW 65, 58-70; PW 74, 69-82; SB 25, 21-27; ASB 25, 22-26; PSB 12, 11-14; AP 25, 21-28; AM 34, 30-38; AL 39, 36-42; PL 48, 41-53; sens. 62, 58-66. Scutal measurements of holotype followed by means and ranges of 10 paratypes of *L. kalyani* in parentheses after Kulkarni (1981) : AW 63 (65, 63-68); PW 70 (73, 68-77); SB 24 (25, 23-28); ASB 26 (26, 24-28); PSB 10 (11, 10-12); AP 28 (28, 24-30); AM 35 (33, 28-38); AL 40 (40, 35-44); PL 47 (47, 38-52); sens. 56 (56, 52-58).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after Nadchatram and Joshee (1966) : Ip = 720-750. Leg I : 250; tarsus (66x20), tarsala (17). Leg II : 225; tarsus (50x18), tarsala (16). Leg III : 270; tarsus (70x13). Scutal measurements of *L. kalyani* after Kulkarni (1981) : Ip = 845-869. Leg I : 294-300; tarsus (77x21), tarsala (21). Leg II : 256-269; tarsus (65x17), tarsala (21). Leg III : 294-297; tarsus (82x18). Measurements of NIV specimens : Ip = 712-835. Leg I : 255-301; tarsus (67x22), tarsala (16). Leg II : 213-265; tarsus (59x17), tarsala (16). Leg III : 244-298; tarsus (77x13).

Type data : Holotype (MZ 110440) and 6 paratypes, MAHARASHTRA, Bombay, Bhandup area, Bhattipada, ex *Rattus rattus*, 17.X.1959, A.K. Joshee, coll.; 1 paratype, same data, but taken 16.IX.1959.

Type depository : Holotype at BPBM; paratypes at IMR, ZSI, USNM, BM(NH), and RML.

Additional records : MAHARASHTRA, Bhattipada, additional specimens, same data as holotype, but taken VIII-XII.1959; Nagpur District, Nagpur, 1 ex *Millardia meltada*, VI.1967-IV.1968, S.P. Srivastva, coll. ORISSA, Balangir District, Matkhai forest, 14 ex *Rattus blanfordi* and *Rattus cutchicus*, 1-2.XII.1972, H.N. Kaul, coll.

Records of *L. kalyani* : MAHARASHTRA, Pune District, approximately 5700 ex *Rattus rattus rufescens*, *R. blanfordi*, *Rattus rattus satarae*, *Suncus murinus*, *Funambulus tristriatus*, *Millardia kondana*, *Golunda ellioti*, and *Bandicota bengalensis*, I.1970-VI.1971, S.M. Kulkarni, coll.

New records : KARNATAKA, Shimoga District, Hennagere, 1 ex *Rattus rattus wroughtoni*, 12.X.1966, NIV, coll. GOA, Brittona, 1 ex *S. murinus*, 16.XII.1983, S. Fernandes, coll. GUJARAT, Navrangapura and Jhankvav, 30 ex 4 *S. murinus*, 25,27.X.1984, S. Fernandes, coll. MAHARASHTRA, Akola District, Mhaispur, 176 ex *S. murinus*, 25.IX.1986, P.V. Mahadev, coll. 43 records of collections from the Himalayan region by NIV field teams : CHHATTISHGARH, Bilaspur District, Deoli, 510m, 4 ex *Rattus rattus gangutrianus*, 25.III.1968. HIMACHAL PRADESH, Kangra District, Dadh, 1080-1110m, 36 ex *Rattus rattoides*, 3.VI.1967; Simla District, Nalagarh, 500-600m, 3 ex *R. r. rufescens*, 6.IV.1969; 49, same data, but ex *R. r. gangutrianus*. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 2 ex *R. rattoides*; Tangmag, 600m, 1 ex *Alticola roylei*, 20.X.1969; Ladakh District, Kargil, 2440-2740m, 46 ex *Mus musculus*, 30.VII.1968. UTTARANCHAL, Almora District, Dwarahat, 1400-2000m, 21 ex *R. r. gangutrianus*, 1.V.1967; Chamoli District, Chamoli, 1100-1500m, 176 ex 4 *R. r. gangutrianus*, 26,27.V.1967; Kanraprayag, 750-1100m, 53 ex 2 *R. r. gangutrianus*, 11,14.V.1967; Nandprayag, 900-1200m, 72 ex *R. r. gangutrianus*, 24,26.IV.1968; Dehra Dun District, Asarodi, 600-750m, 1 ex *Rattus* sp., 2.VI.1970; (Pauri) Garhwal District, Rudraprayag, 600-900m, 412 ex 11 *R. r. gangutrianus*, 18-23.V.1967; Nainital District, Mukteshwar, 1400-2300m, 1 ex *R. rattoides*, 25.XI.1967; Pithoragarh District, Dharchula, 900-1100m, 58 ex *Agama tuberculata*, 18.V.1968; Tehri District, Ghansali, 900-1100m, 194 ex 6 *R. r. gangutrianus*, 19-21.V.1969; Uttarkashi District, Sukhrala, 1400-1800m, 7 ex *A. tuberculata*, 27.VI.1969; Uttarkashi, 900-1800m, 42 ex 2 *R. r. gangutrianus*, 11.VI.1967 and 14.IV.1968. WEST BENGAL, Jalpaiguri, Chunabhatti, 150-200m, 4 ex *Rattus rattus brunneusculus*, 24.III.1969.

Material examined : Holotype on loan from BPBM, and paratype (MZ 110442) loaned by A.K. Joshee. Type series of *L. kalyani* at NIV.

Remarks : The above redescription is based on the literature, study of the types examined and the NIV specimens. *L. bhattipadense* falls out at couplet 8 of the key to species of the subgenus *Hypotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. angustatum* Feider, 1968. They distinguish *L. bhattipadense* in having PW/AP ratio 3.13 (3.37-3.64 in *L. angustatum*), PW measuring 72 (80-87 in *L. angustatum*), and posterior scutal margin rounded or slightly biconvex (distinctly biconvex in *L. angustatum*). Nadchatram and Joshee (1966) have illustrated the subterminala of the palpal tarsus (fig. 12), but reported palpal tarsus as 7B! Nadchatram (1970) reports palpal tarsus as 7B.S, which has been confirmed in the holotype and paratype examined. Hence, *L. bhattipadense* is transferred to the subgenus *Ericotrombidium* Vercammen-Grandjean, 1966. Kulkarni (1981) described *L. kalyani* which agrees with *L. bhattipadense* in the diagnostic characters and standard measurements. Hence, *L. (E.) kalyani* Kulkarni, 1981, is a synonym of *L. (E.) bhattipadense*. *L. (E.) bhattipadense* will dead end at couplet 2' of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) in having PW usually <2SD. If the path with PW>2SD is followed, this species will fall out with *L. accraense* Vercammen-Grandjean and Langston, 1976, and *L. caucasicum* Schluger, 1967. *L. bhattipadense* may be distinguished from *L. accraense* in having greater number of body setae (50 in *L.*

accraense); and from *L. caucasicum* in having longer AL and PL setae (AL measuring 36-38, and PL 37-38 in *L. caucasicum*), and wider Ip range (729-767 in *L. caucasicum*). If the path with $PW < 2SD$ is followed, *L. bhattipadense* will fall out with *L. oguni* Vercammen-Grandjean and Langston, 1976, and *L. gliricolens* (Hirst, 1915). It differs from *L. oguni* in having fewer dorsal setae (numbering 38 in *L. oguni*), and microtarsala I distal to tarsala I (proximal in *L. oguni*); and from *L. gliricolens* in having dorsal body setal arrangement commencing : 8-6-6 (8-8-8 in *L. gliricolens*). The species name is based on the type locality.

64. *Leptotrombidium* (*Ericotrombidium*) *eximium* new species
(Fig. 54)

Description of species : Larva.

Idiosoma : Measuring 310-648 x 252-544 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 54-55, 30-34 dorsal idiosomal setae, measuring 47-59, arranged : 8-6-6-6(4)-6(4)-2; 2 pairs of sternal setae, anterior 45-51, posterior 32-35; 20-22 preanal setae, 32-36; 12 postanal setae, 47-52; total idiosomal setae 70-72.

Gnathosoma : Palpal setal formula N/N/NNB/7B.S; palpal claw 3-pronged; galeala N, rarely with 1 or 2 barbs; cheliceral blade (35) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin very shallowly concave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB level with PL bases; $PL > AL > AM$; sensillae flagelliform with branches on distal 2/3; $PW/SD = 1.73$. Scutal measurements of holotype, followed by means and ranges of type series : AW 71 (76, 71-79); PW 85 (96, 85-107); SB 28 (30, 28-32); ASB 33 (34, 33-35); PSB 16 (16, 15-17); AP 31 (33, 31-35); AM 37 (38, 36-40); AL 45 (49, 45-52); PL 54 (56, 54-58); sens. - (broken in all specimens).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 878-987. Leg I : 297-326; tarsus (81x22), tarsala (18-19). Leg II : 266-303; tarsus (67x18), tarsala (19-21). Leg III : 315-358; tarsus (94x16).

Type data : Holotype (NIV A82230.22), HIMACHAL PRADESH, Simla District, Simla, 1700-2000m, ex *Rattus rattus*, 29.X.1967, NIV, coll.

Additional records : 4, same data as holotype; 13, same data, but ex 2 *R. rattus*, taken 4.XI.1967.

Remarks : *L. eximium* dead ends at couplet 1 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976). It differs from all

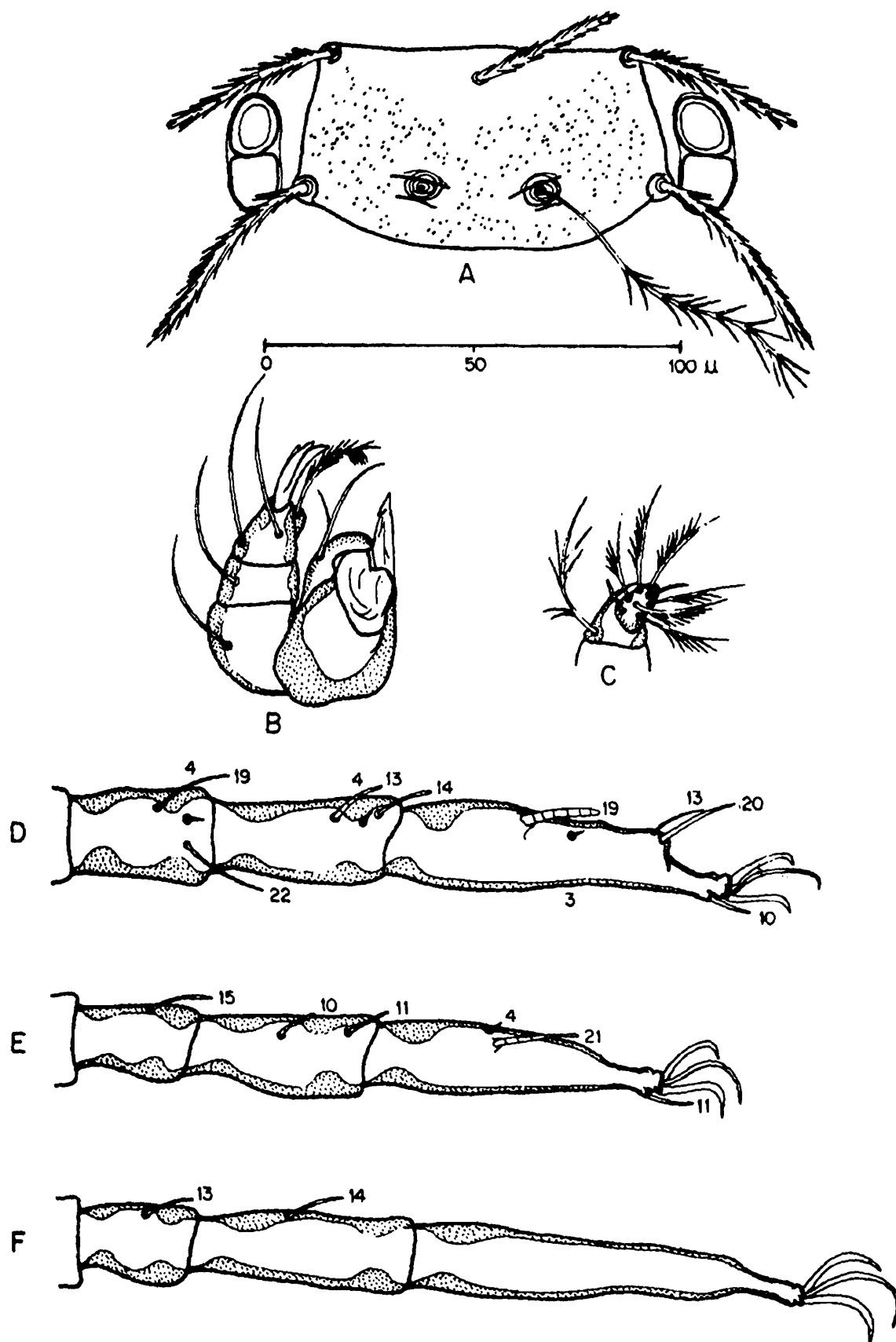


Fig. 54. *Leptotrombidium eximium* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

other species of the subgenus in having only one palpal seta, the ventrotibial, barbed. The species is similar to *L. scotophilum* Vercammen-Grandjean and Langston, 1976, in having galeala nude. *L. eximium* may, however, easily be separated in having greater number of body setae (50 in *L. scotophilum*), a higher Ip range (812-828 in *L. scotophilum*), and $AL > AM$ ($AL = AM$ in *L. scotophilum*). The species name derived from the Latin meaning 'exceptional', draws attention to its unique palpal formula in the subgenus *Ericotrombidium*.

65. *Leptotrombidium (Ericotrombidium) gliricolens* (Hirst)

Microthrombidium gliricolens Hirst, 1915, 185; Sen and Fletcher, 1962, 513.

Trombicula gliricolens, Womersley and Heaslip, 1943, 82; not Womersley, 1952, 134; Prasad, 1974, 95, in part.

Trombicula (Trombicula) gliricolens, Wharton and Fuller, 1952, 65.

Eutrombicula gliricolens, Radford, 1954, 261.

Trombicula (Leptotrombidium) gliricolens, Womersley and Audy, 1957, 255, in part.

Leptotrombidium (Ericotrombidium) gliricolens, Vercammen-Grandjean, 1968b, 73, in part; Vercammen-Grandjean and Langston, 1976, 776; Kulkarni, 1981, 65.

Redescription of species : Larva.

Idiosoma : Measuring 240 in length in holotype. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 32-43; 34-36 dorsal idiosomal setae, measuring 30-46, arranged: 8-8-8-6-4(2)-2; 2 pairs of sternal setae; 22 preanal setae, 25-34; 14 postanal setae, 34-43; total idiosomal setae 76-78.

Gnathosoma : Palpal setal formula B/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly concave; posterior margin pronounced, broadly rounded with median indentation; AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; $PL > AL > AM$; sensillae flagelliform with basal barbs, thickly branched on distal 2/3; $PW/SD = 1.60-1.72$. Scutal measurements after Vercammen-Grandjean and Langston (1976) giving measurements of Womersley and Heaslip (1943) and their own measurements from original data and illustrations of Hirst (1915): AW 60, 56; PW 65, 64; SB 28, 23; ASB 28, 28; PSB 11, 12; AP 25, 25; AM 30, 30; AL 30, 33; PL 40, 41; sens. 55, 58. Scutal measurements of proposed neotype followed by means and ranges of 7 designated type specimens in parentheses after Vercammen-Grandjean and Langston (1976): AW 57 (58, 55-61); PW 64 (67, 63-71); SB 20 (20, 19-21) ASB 26 (26, 25-30); PSB 12 (13, 12-13); AP 25 (26, 25-28); AM 32 (32, 30-35); AL 36 (40, 36-45); PL 41 (42, 39-44); sens. 62 (63, 60-66).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after

Vercammen-Grandjean and Langston (1976) : Ip = 780-832. Leg I : 272-292. Leg II : 238-254. Leg III : 270-290.

Type data : Holotype, WEST BENGAL, Calcutta, *Rattus rattus* (= *Mus rattus*), 20.III.1915, C. Pavia, coll. Type series designated by Vercammen-Grandjean and Langston (1976) : Neotype (#743), Calcutta, ex *Rattus rattus*, 29.XII.1950, M. Raja Varma, coll.; 7 paratypes, same data, but 'unknown' host, taken 21.II, 27.XII.1950 and 8, 26.II.1951.

Type depository : Holotype at BM(NH). Vercammen-Grandjean and Langston (1976) report that the type has not been located during the last 25 years. Neotype and 6 paratypes at BM(NH), 1 paratype in Vercammen-Grandjean collection.

Remarks : The above redescription is based only on the literature. *L. gliricolens* falls out at couplet 4 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with a new species they have described, *L. oguni*. They distinguish *L. gliricolens* in having a lower Ip (864 in *L. oguni*), fewer dorsal body setae, differently arranged (38, arranged : 8-6-6-6-6-4-2 in *L. oguni*), and microtarsala I distal to tarsala I (proximal in *L. oguni*). Vercammen-Grandjean and Langston (1976) have designated a neotype and 7 paratypes from the material of M. Raja Varma, taken in the type locality. They consider the Kashmir specimens, used by Womesley (1952) in the redescription of *L. gliricolens*, as a new species, *L. pseudogliricolens*. They distinguish *L. gliricolens* from *L. pseudogliricolens* in having a different palpo-setal formula (B/B/NNB in *L. pseudogliricolens*), narrower SB (measuring 27 in *L. pseudogliricolens*), SB slightly anterior to level of PL bases (level with or slightly posterior in *L. pseudogliricolens*), fewer dorsal body setae, differently arranged (38, arranged : 10-8-8-6-4-2 in *L. pseudogliricolens*), and $PL \geq AL > AM$ ($PL > AL \geq AM$ in *L. pseudogliricolens*). *L. gliricolens* has not been recorded in the NIV collections.

66. *Leptotrombidium* (*Ericotrombidium*) *indicum* new species (Fig. 55)

Leptotrombidium (*Ericotrombidium*) sp. B Fernandes *et al.*, 1988, 109.

Leptotrombidium (*Ericotrombidium*) sp. C Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 300-445 x 232-300 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 55-62; 60-72 dorsal idiosomal setae, measuring 52-62, irregularly arranged, arrangement usually commencing : (8-10)-6-(4-6)-(8-12)-4-6; 2 pairs of sternal setae, anterior 50-54, posterior 38-44; 42-48 preanal setae, 31-34; 20-24 postanal setae, 45-47; total idiosomal setae 131-143.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (40) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

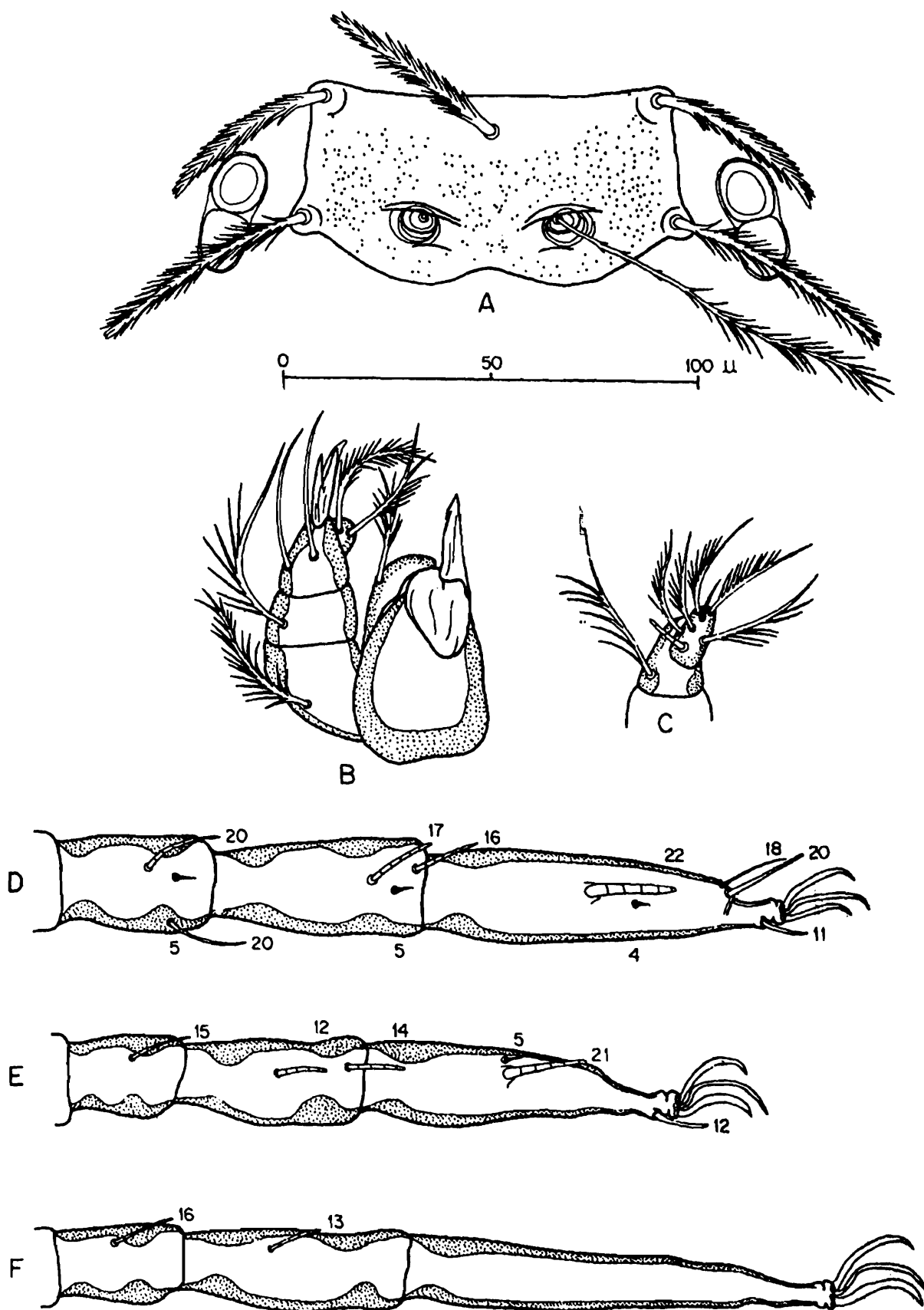


Fig. 55. *Leptotrombidium indicum* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin markedly biconvex; AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; $PL > AM > AL$; sensillae flagelliform with basal barbs and branches on distal 1/2; $PW/SD = 1.93$. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 83 (79, 71-87); PW 96 (92, 79-98); SB 35 (33, 27-35); ASB 32 (32, 31-34); PSB 18 (17, 16-19); AP 32 (30, 29-32); AM 50 (48, 43-50); AL 47 (47, 44-50); PL 59 (55, 52-59); sens. 82 (85, 82-87).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : $Ip = 961-987$. Leg I : 320-340; tarsus (88x22), tarsala (22). Leg II : 285-298; tarsus (74x20), tarsala (21). Leg III : 342-371; tarsus (102x15).

Type data : Holotype (NIV A74489.8) and 5 paratypes, UTTARANCHAL, Chamoli District, Gwaldam, 1500-2100m, ex *Rattus rattoides*, 12.IV.1967, NIV, coll.; 2 paratypes, same data, but taken 11.IV.1967; 2 paratypes, same data, but Chamoli, 1100-1500m, ex *Rattus rattus gangutrianus*, taken 26.V.1967.

Additional records : 15 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kinnaur District, Karcham, 1700m, 1 ex *R. rattoides*, 19.X.1967; Kulu District, Jibi, 1000-1922m, 16 ex *R. rattoides*, 20.IV.1969; Simla District, Simla, 1700-2000m, 6 ex 3 *R. rattoides*, 4.XI.1967. UTTARANCHAL, Almora District, Sukhidang, 250-1400m, 60 ex 4 *Suncus murinus*, 2.III.1967; Nainital District, Bhimtal, 1200-1700m, 1 ex *S. murinus*, 28.XI.1966; Haldwani, 400-1100m, 13 ex 5 *R. r. gangutrianus*, 5.XII.1966 and 23,25.II.1967.

Remarks : *L. indicum* falls out at couplet 6 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. ugandense* Vercammen-Grandjean and Langston, 1976. *L. indicum* may be distinguished in having a lower Ip range (1002-1021 in *L. ugandense*), a larger number of body setae (116 in *L. ugandense*), and a different palpo setal formula (B/B/NBB in *L. ugandense*). Fernandes *et al.* (1988) suggested the creation of 2 independent taxa for the NIV material of the present species. Further study, however, indicated a single taxon with wide variation in standard data and in the number and arrangement of body setae. The species is named to celebrate the rich and beautiful diversity of everything Indian!

67. *Leptotrombidium (Ericotrombidium) lepidum* new species
(Fig. 56)

Description of species : Larva.

Idiosoma : Measuring 407-494 x 296-416 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 32-33; 30 dorsal

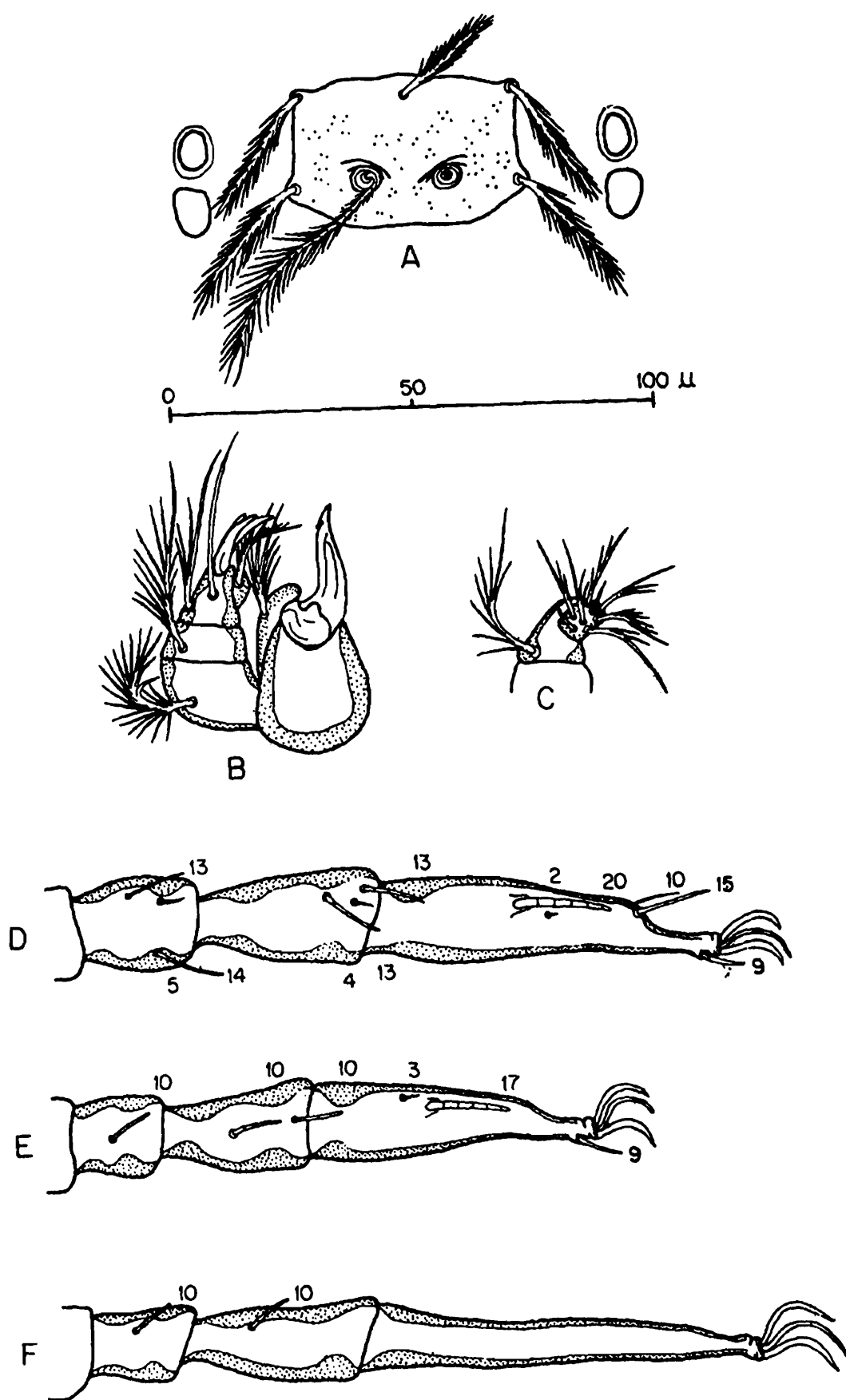


Fig. 56. *Leptotrombidium lepidum* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

idiosomal setae, measuring 32-37, arranged : 8-6-6-4-4-2; 2 pairs of sternal setae, anterior 33-39, posterior 25-28; 16 preanal setae, 25-26; 16 postanal setae, 30-34; total idiosomal setae 68.

Gnathosoma : Palpal setal formula B/B/NBB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (30) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin sinuate; posterior margin shallowly convex; AM base slightly posterior to level of AL bases; SB slightly anterior to level of PL bases; PL>AL>AM; sensillae flagelliform with basal barbs, densely branched on distal 3/4; PW/SD = 1.73. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 46 (46, 44-47); PW 52 (52, 49-54); SB 17 (17, 16-18); ASB 23 (21, 19-23); PSB 11 (11, 10-11); AP 21 (19, 18-21); AM 26 (26, 23-28); AL 31 (30, 27-31); PL 32 (32, 31-34); sens. - (53, 51-55).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows : Ip = 705-734. Leg I : 245-257; tarsus (72x17), tarsala (19-20). Leg II : 214-220; tarsus (59x15), tarsala (17-18). Leg III : 246-260; tarsus (80x10).

Type data : Holotype (NIV A26324.8) and 1 paratype, GOA, Porvorim, ex *Mus saxicola*, 9.II.1984, S. Fernandes, coll.; 4 paratypes, same data, but taken 4.V.1984.

Remarks : *L. lepidum* falls out at couplet 22 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. rodhaini* Vercammen-Grandjean and Langston, 1976, and *L. galliardi* Vercammen-Grandjean and Taufflieb, 1959. *L. lepidum* may be distinguished from these 2 species in having a lower Ip range (877-933 in *L. rodhaini* and 867-890 in *L. galliardi*). It may be further distinguished from *L. rodhaini* in having posterior scutal margin biconvex (smoothly convex in *L. rodhaini*); and from *L. galliardi* in having shorter PL setae (measuring 40 in *L. galliardi*). *L. lepidum* is close to *L. pulchrum* (Schluger, 1955), but may easily be distinguished in having shorter PL and AL setae (PL measuring 45 and AL 42 in *L. pulchrum*), lower PW/SD ratio (2 in *L. pulchrum*), and a larger number of body setae (60 in *L. pulchrum*). The species name is derived from the Latin meaning 'charming'. This is the first new trombiculid species described from the beautiful land of Goa, and is dedicated to the many wonderful people who assisted me with the field work there!

68. *Leptotrombidium (Ericotrombidium) murphyi* Nadchatram
(Fig. 57)

Leptotrombidium (Leptotrombidium) murphyi Nadchatram, 1970c, 145.

Leptotrombidium (Ericotrombidium) murphyi, Vercammen-Grandjean and Langston, 1971, 453; 1976, 785; Fernandes *et al.*, 1988, 109.

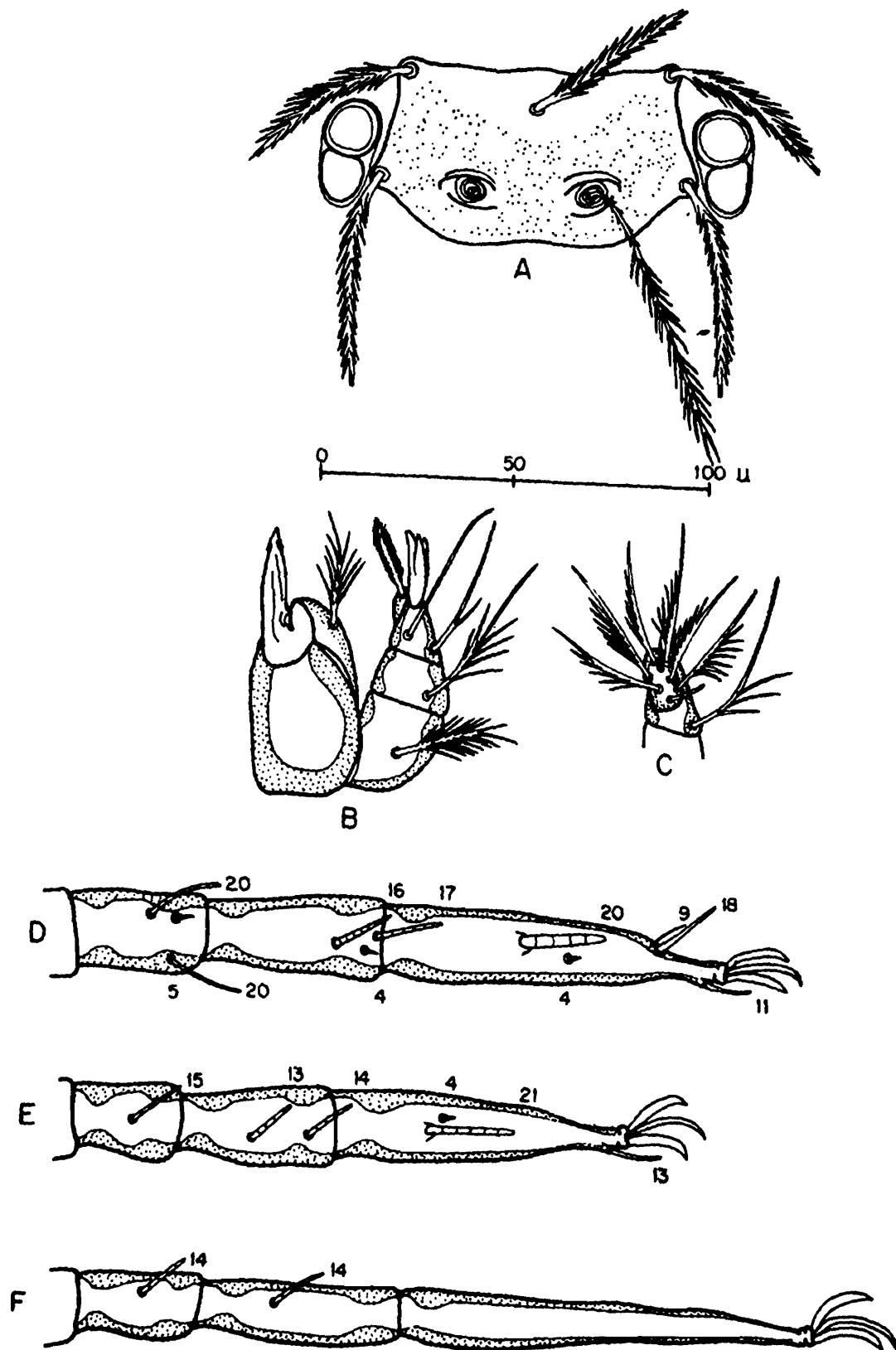


Fig. 57. *Leptotrombidium murphyi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Redescription of species : Larva.

Idiosoma : Measuring 274-689 x 208-664 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 45-57; 47-56 dorsal idiosomal setae, measuring 34-57, irregularly arranged, summary arrangement after original description : (9-11)-(2-4)-(9-10)-(1-4)-(8-10)-8-(4-6)-(2-4); 2 pairs of sternal setae, anterior 50-56, posterior 40-43; 22 preanal setae, 30-35; 12 postanal setae, 34-46; total idiosomal setae 88-96. Original description : 32-36 preanal setae; 20-24 postanal setae; total idiosomal setae 105-119. Vercammen-Grandjean and Langston (1976) : 26 preanal setae; 28 postanal setae; total idiosomal setae 112.

Gnathosoma : Palpal setal formula B/B/NN(f)B/7B.S (Original description and Vercammen-Grandjean and Langston (1976) : dorsolateral tibial seta B); palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases; PL>AL>AM; sensillae flagelliform with branches on distal 3/4; PW/SD = 1.64-1.74 (Original description and Vercammen-Grandjean and Langston (1976) : 1.73-1.89). Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 68 (69, 68-72); PW 83 (83, 78-84); SB 30 (28, 27-30); ASB 31, (31, 30-32); PSB 13 (13, 12-15); AP 26 (27, 26-29); AM 38 (37, 36-38); AL 40 (43, 40-46); PL 58 (54, 50-58). Scutal measurements giving means and ranges of 10 NIV specimens : AW 65, 63-68; PW 74, 70-78; SB 25, 24-28; ASB 30, 28-32; PSB 14, 12-15; AP 27, 24-28; AM 36, 31-40; AL 43, 39-46; PL 48, 46-55; sens. 66, 64-70.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description : Ip = 920-940. Leg I : 310-320; tarsus (86-90 x 19), tarsala (21). Leg II : 280-285; tarsus (72-77 x 16-18), tarsala (22). Leg III : 330-335; tarsus (106-110 x 12-13). Measurements of 2 paratypes after Vercammen-Grandjean and Langston (1976) : Ip = 926, 944. Leg I : 316, 322. Leg II : 284, 286. Leg III : 326, 336. Measurements of NIV specimens : Ip = 893-940. Leg I : 302-315; tarsus (89x17), tarsala (21). Leg II : 273-286; tarsus (74x15), tarsala (21). Leg III : 317-346; tarsus (105x12).

Type data : Holotype (BBM-NP 30293-15) and 1 paratype, NEPAL, Syabrudens, 35km NE Tisuli, 1450m, ex *Rattus rattus*, 5.XI.1965, L.W. Quate, coll.; 4 paratypes, same data, but taken 1-5.XI.1965 : 1 ex *Rattus rattus tistae* (?), 2 ex *Rattus rattus brunneus*, and 1 ex *Rattus rattus brunneusculus*.

Type depository : Holotype at BPBM; paratypes at BPBM, IMR, USNM, BM(NH), and ZSI.

New records : 105 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kangra District, Dadh, 1080-1110m, 1 ex *Rattus rattus gangutrianus*, 14.IX.1967; Kinnaur District, Kalpa, 2590-2740m, 3 ex same host, 14.V.1968. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 6 ex 2 *Rattus rattoides*, 2.XI.1969; 2, same data, but ex *Mus musculus*, taken 31.X.1969; 1, same data, but ex *Suncus murinus*, taken 3.XI.1969; Rampore, 1400m, 32 ex 4 *R. rattoides*, 7.XI.1969; 152 ex 7 *Rattus* sp., 8.XI.1969; Doda District, Bhadarwah, 1700m, 11 ex *Rattus rattus rufescens*, 17.XI.1969; 461 ex 6 *R. rattoides*, 15,17.XI.1969; 21 ex 6 *M. musculus*, 16,17.XI.1969; 11, same data, but ex 2 *S. murinus*, taken 15.XI.1969; Khilani, 1200-1400m, 5 ex *R. rattoides*, 19.XI.1969; 1, same data, but ex *M. musculus*, taken 20.XI.1969. UTTARANCHAL, Almora District, Sukhidang, 250-1400m, 55 ex *R. r. gangutrianus*, 6.III.1967; 6, same data, ex 3 *S. murinus*, 4.III.1967; Chamoli District, Dogalbita, 2300-3800m, 2 ex *R. r. rufescens*, 9.VII.1970; Gwaldam, 1500-2100m, 4 ex *Rattus niviventer*, 9.IV.1967; Dehra Dun District, Dehra Dun, 600-800m, 114 ex 3 *R. r. gangutrianus*, 29,31.X.1967; 21, same data, but ex 2 *S. murinus*, taken 31.X.1967; Mussourie, 1400-2300m, 7 ex 2 *R. rattoides*, 8.XI.1967; Pauri Garhwal, Dogadda, 700-900m, 58 ex 7 *R. r. gangutrianus*, 11-13.XI.1967; 6, same data, but ex *S. murinus*, 12.XI.1967; Nainital District, Bhimtal, 1200-1700m, 303 ex 7 *R. r. gangutrianus*, 24,27.XI.1966; 38, same data, but ex 3 *Mus* sp., 27,28.XI.1966; 15, same data, but ex 3 *S. murinus*, 27,28.XI.1966; Bhowali, 1200-1700m, 682 ex 6 *R. r. gangutrianus*, 23.XI.1967; 17, same data, but ex *S. murinus*; Garjia, 400-500m, 15 ex 2 *R. r. gangutrianus*, 16.XI.1967; Haldwani, 400-1100m, 726 ex 2 *R. r. gangutrianus*, 3-7.XII.1966, 23,25.II.1967, and 29.XI.1967; Mukteshwar, 1400-2300m, 4 ex 3 *R. rattoides*, 14.XI.1966, 1.V.1967, and 26.XI.1967; 1, same data, but ex *R. niviventer*, taken 26.XI.1967.

Material examined : Holotype on loan from BPBM; 1 paratype (BBM-NP 30293-14) at ZSI.

Remarks : The above redescription is based on the literature, study of the holotype, 1 paratype and the NIV specimens. *L. murphyi* falls out at couplet 20 in the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. worthi* Nadchatram, 1970. They distinguish *L. murphyi* in having dorsolateral palpotibial seta strongly barbed (nude or forked in *L. worthi*), $PL > AL$ ($PL = AL$ in *L. worthi*), and humeral setae measuring 50-56 (43-46 in *L. worthi*). Further points of distinction reported are: $PW/SD = 1.9$ (1.6 in *L. worthi*), posterior scutal margin measuring 15-16 in depth (9-13 in *L. worthi*), and SB level with or posterior to level of PL bases (slightly anterior in *L. worthi*). The NIV specimens agree closely with the description of *L. murphyi* given in the literature, but differ in having fewer ventral body setae, dorsolateral palpotibial seta nude or forked, and lower PW/SD ratio. These features are intermediate between *L. murphyi* and *L. worthi*, and serve to accentuate their close relationship. This species has been named in honour of Robert Murphy, Administrative Director of the Thomas A. Dooley Foundation Field Team, which conducted the Nepal Health Survey.

69. *Leptotrombidium (Ericotrombidium) pseudogliricolens*

Vercammen-Grandjean and Langston

(Fig. 58)

Leptotrombidium (Ericotrombidium) pseudogliricolens Vercammen-Grandjean and Langston, 1976, 780; Kulkarni, 1981, 65.

Trombicula gliricolens, Womersley, 1952, 134, in part.

Trombicula (Leptotrombidium) gliricolens, Womersley and Audy, 1957, 255, in part.

Leptotrombidium (Leptotrombidium) gliricolens, Traub and Nadchatram, 1967a, 10; Traub *et al.*, 1967, 37; Traub and Wisseman, 1968, 224; Nadchatram, 1970c, 146, in part.

Leptotrombidium (Ericotrombidium) gliricolens, Vercammen-Grandjean, 1968b, 73, in part.

Redescription of species : Larva.

Idiosoma : Measuring 266-650 x 202-420 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 45-54; 38 dorsal idiosomal setae, measuring 33-53, arranged : 10-8-8-6-4-2; 2 pairs of sternal setae; 24 preanal setae, 29-35; 12 postanal setae, 34-48; total idiosomal setae 80 (In specimens examined : 36-38 dorsal idiosomal setae, arranged : 10(8)-8-8-6-4-2; 2 pairs of sternal setae, anterior 36-44, posterior 28-33; 22 preanal setae, 28-30; 8 postanal setae, 37-44; total idiosomal setae 72-74).

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (32) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB level with or posterior to level of PL bases (anterior in specimens examined); PL>AL>AM; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.87-2.05. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description: AW 62 (66, 62-73); PW 75 (78, 73-86); SB 24 (26, 23-30); ASB 28 (28, 27-31); PSB 12 (13, 12-15); AP 26 (26, 24-29); AM 40 (38, 34-43); AL 38 (38, 34-44); PL 50 (49, 45-54); sens. 68 (70, 68-72). Scutal measurements giving means of 11 specimens after Womersley (1952) : AW 70; PW 84; SB 26; ASB 28; PSB 14; AP 24; AM 33; AL 39; PL 51; sens. 63. Scutal measurements of NIV specimen, followed by means and ranges of 4 specimens examined from Womersley's collection in parentheses : AW 61 (69, 68-70); PW 73 (80, 78-84); SB 23 (26, -); ASB 24 (27, 25-28); PSB 14 (15, 14-16); AP 23 (26, 24-29); AM 40 (38, 37-38); AL 41 (37, 33-40); PL 46 (50, 44-55); sens. - (62, 61-63).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston 1976 in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description followed by means of 11 specimens after Womersley (1952) in parentheses : Ip

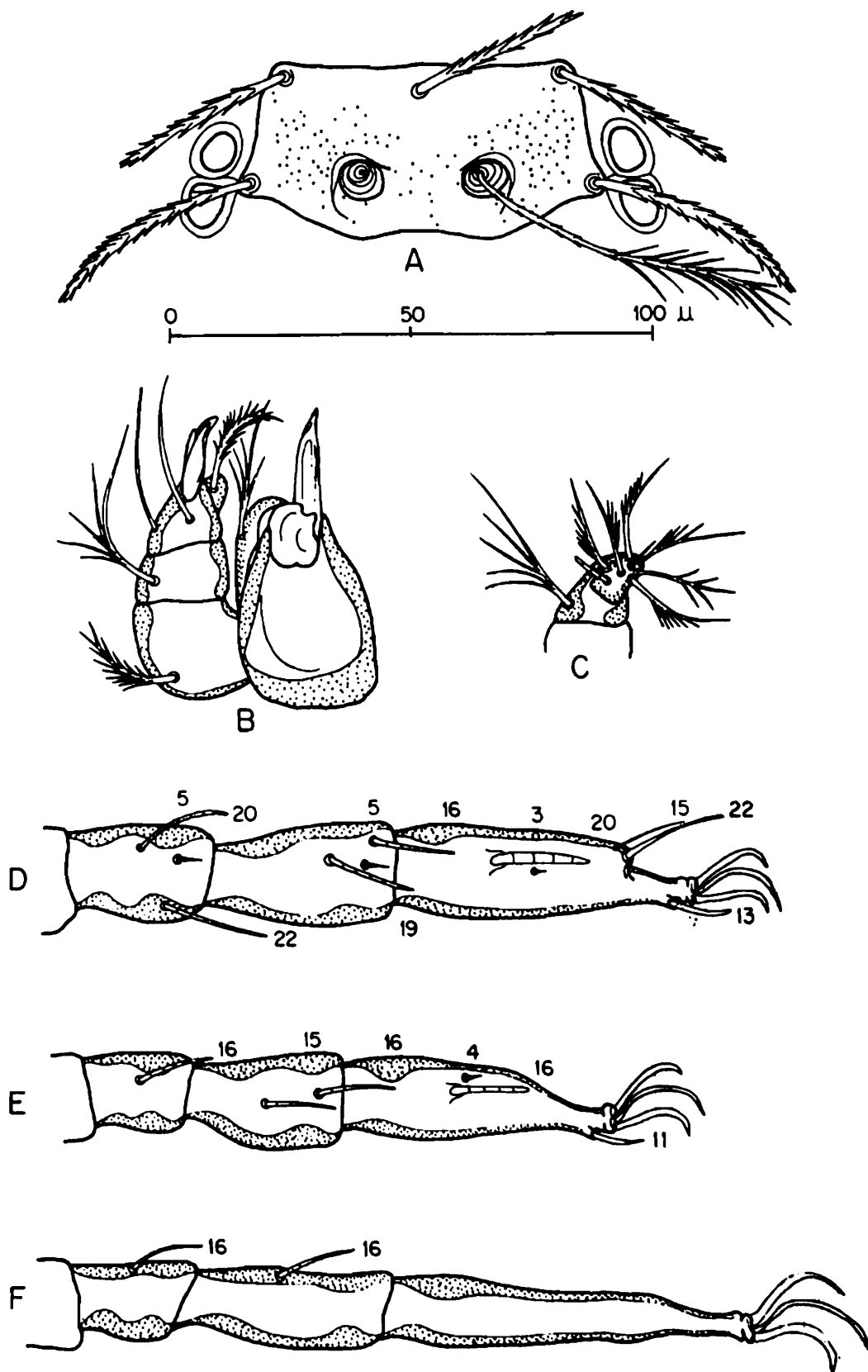


Fig. 58. *Leptotrombidium pseudogliricolens*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

= 762-840 (845). Leg I : 263-288 (285). Leg II : 227-257 (260). Leg III : 260-298 (300). Measurements of NIV specimen : Ip = 741. Leg I : 249; tarsus (63x18), tarsala (20). Leg II : 230; tarsus (55x17), tarsala (16). Leg III : 262; tarsus (74x19).

Type data : Holotype (#6322b) and 7 paratypes, JAMMU and KASHMIR, Baramulla, ex 'rat', probably 1948, S.L. Kalra, coll.; 10 paratypes, same data, but Tithwal, ex 'rats', taken 1945; 7 paratypes, same data, but taken IX.1945; 16 paratypes, same data, but Uri, ex *Rattus rattus*, taken 1948-1949; 1 paratype, same data, but Tanghdhar, ex 'rat'(?), taken 8.XII.1948; 12 paratypes, same data, but ex 'unknown' host, taken probably 1947; 1 paratype, same data, but Rajouri, ex 'unknown' host, taken V.1949. 1 paratype, JAMMU and KASHMIR, Gilgit Agency, Chilas, 1230m, ex *Rattus rattoides*, 31.VIII.1963, UM and PMRC field teams, coll.; 1 paratype, same data, but taken 2.IX.1963.

Type depository : Holotype and most paratypes at SAM.

Additional records : JAMMU and KASHMIR, Tithwal, ex *Rattus rattoides*, IX.1948, S.L. Kalra, coll.; same data, but Chaukibal, ex *Rattus rattus* subsp.(?); Gilgit Agency, 1230-3050m, ex *R. rattoides*, *Cricetulus migratorius*, *Crocidura* sp., and *Apodemus flavicollis*, taken 1962-1965, UM and PMRC field teams, coll. UTTARANCHAL, Kumaon Hills, Ranikhet, ex *R. rattus* subsp. (?), IX.1946, S.L. Kalra, coll.

New records : JAMMU and KASHMIR, Udhampur District, Phalata, 750m, 1 ex *Rattus* sp., 22.XI.1969, NIV, coll.

Material examined : 4 specimens labelled *Trombicula gliricolens* from Womersley's collection : No. 23265, JAMMU and KASHMIR, Rajouri, ex 'rat', V.1949, STRU, coll.; No. 23274, same data; No. 23278, same data, but Tithwal; No. 24409, same data, but Chaukibal, taken VII.1949.

Remarks : The above redescription is based on the original description, study of the specimens from the Womersley collection and the NIV specimen. *L. pseudogliricolens* runs to couplet 11 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976). They have described this species from Womersley's material labelled *Trombicla gliricolens* Hirst, 1915, originating from Kashmir. They report 10 different characters which serve to separate *L. pseudogliricolens* from *L. gliricolens*, and consider the differences in scutal aspect and surface, palpal formula and body setae as most important. Thus, *L. pseudogliricolens* may be distinguished in having wider SB (measuring 19-21 in *L. gliricolens*), posterior scutal margin biconvex (broadly rounded in *L. gliricolens*), palpo-setal formula: B/B/NNB (B/N/NNB in *L. gliricolens*), and 80 total body setae (76 in *L. gliricolens*). Study of the material examined confirms important points of distinction and the taxonomic status of *L. pseudogliricolens*. However, the differences in the number and arrangement of body setae, and the lower Ip range in the specimens studied, suggest a greater variation in these characters. Traub and Nadchatram (1967a), Traub *et al.* (1967) and Traub and Wisseman (1968) have recorded *L. pseudogliricolens* (as *L. gliricolens*) from Gilgit Agency which falls in Jammu and Kashmir, INDIA, and not PAKISTAN, as reported. The species name draws attention to its relationship with *L. gliricolens*.

70. *Leptotrombidium (Ericotrombidium) rajaniae* Kulkarni
(Fig. 59)

Leptotrombidium (Leptotrombidium) rajaniae Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 18.

Leptotrombidium (Ericotrombidium) rajaniae, Kulkarni, 1981, 62, original description.

Redescription of species : Larva. Colour in life pale orange.

Idiosoma : Measuring 190-328 x 180-338 in unengorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 52; 46-48 dorsal idiosomal setae, measuring 45-56, arranged : 8-2-10(8)-8(10)-8-6-4-(2); 2 pairs of sternal setae, anterior 37-40, posterior 24-28; 26 preanal setae, 24-31; 14 postanal setae, 54-56; total idiosomal setae 92-94.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (26-30) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB anterior to level of PLL bases; PL>>AL>AM; sensillae flagelliform with basal barbs, densely branched on distal 2/3; PW/SD = 2.00-2.27. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 63 (65, 6-66); PW 70 (74, 70-84); SB 26 (25, 24-26); ASB 25 (25, no variation recorded); PSB 10 (11, 10-12); AP 24 (24, 23-24); AM 28 (34, 28-35); AL 31 (36, 31-38); PL 56 (52, 48-56); sens. 56 (56, 52-59).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15; Measurements as follows: Ip = 752-760. Leg I : 255-257; tarsus (61x18), tarsala (18). Leg II : 224-227; tarsus (50x16), tarsala (16). Leg III : 273-276; tarsus (70x13).

Type data : Holotype (NIV A95442) and 3 paratypes, MAHARASHTRA, Pune District, Sinhgarh, ex *Rattus blanfordi*, 5.II.1971, S.M. Kulkarni, coll.; 5 paratypes, same data, but ex 5 *Suncus murinus*, taken 12.XII.1970; 2 paratypes, same data, but taken 20.I.1971; 3 paratypes, same data, but ex 2 *S. murinus*, taken 5.II.1971; 3 paratypes, same data, but ex *Golunda ellioti*.

Type depository : Holotype at NIV; paratypes at NIV, IM, BPBM, and IMR.

Additional records : MAHARASHTRA, Pune District, approximately 1600 ex *Funambulus tristriatus*, *Millardia kondana*, *Rattus rattus rufescens*, *Rattus rattus satarae*, *R. blanfordi*, *S. murinus*, and *G. ellioti*, IX.1970-IX.1971, S.M. Kulkarni, coll.

Material examined : Type specimens in NIV collection.

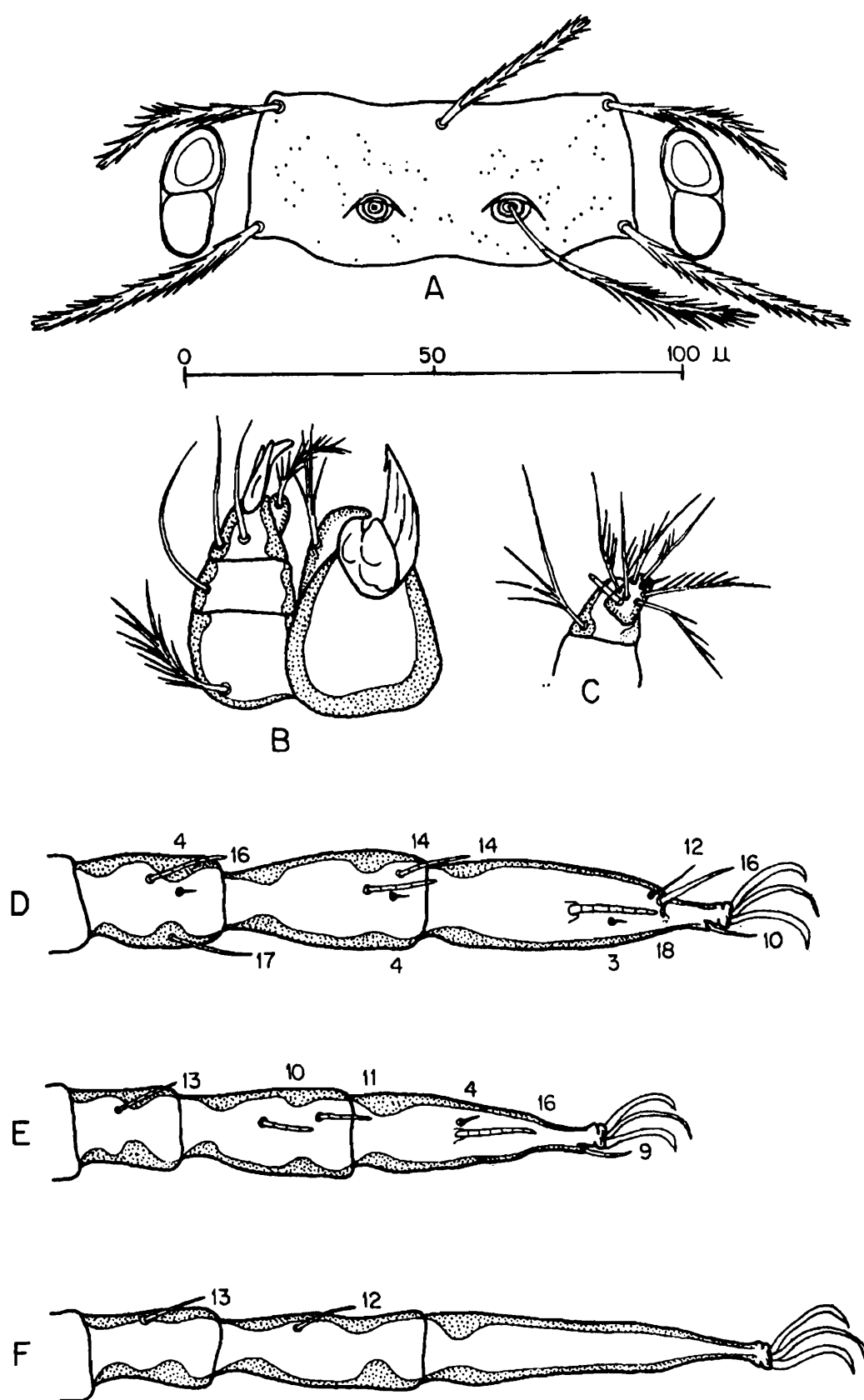


Fig. 59. *Leptotrombidium rajaniae*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above,

Remarks : The above redescription is based on the original description and study of the NIV type specimens. *L. rajaniae* will fall out at couplet 3 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. accraense* Vercammen-Grandjean and Langston, 1976, and *L. caucasicum* Schluger, 1967. *L. rajaniae* differs from both these species in having a greater number of body setae (50 in *L. accraense* and 66 in *L. caucasicum*). Kulkarni (1981) considers *L. rajaniae* close to *L. pseudogliricolens* Vercammen-Grandjean and Langston, 1976, from which it may be distinguished in having palpo-setal formula: B/N/NNB (B/B/NNB in *L. pseudogliricolens*), different arrangement of dorsal body setae (10-8-8-6-4-2 in *L. pseudogliricolens*), and SB anterior to level of PL bases (level with or slightly posterior in *L. pseudogliricolens*). *L. rajaniae* is similar to *L. gliricolens* (Hirst, 1915) in having the same palpo-setal formula and SB anterior to level of PL bases, but differs in the arrangement of dorsal body setae (8-8-8-6-2-2 in *L. gliricolens*). Kulkarni (1979) and Kulkarni *et al.* (1979) have reported *L. rajaniae* preceding the original description. Hence, technically, the species name is a **nomen nudum**. The species has been named in honour of Rajani, wife of Dr. S.M. Kulkarni.

71. *Leptotrombidium (Ericotrombidium) rajasthanense* new species
(Fig. 60)

Leptotrombidium (Ericotrombidium) n. sp. Kaul *et al.*, 1978, 23.

Description of species : Larva.

Idiosoma : Measuring 307-455 x 232-383 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 38-44; 26 dorsal idiosomal setae, measuring 39-45, arranged : 8-6-6-4-2; 2 pairs of sternal setae, anterior 38-42, posterior 29-35; 18 preanal setae, 27-30; 12 postanal setae, 37-43; total idiosomal setae 62.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (30) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB usually level with PL bases; PL>AM>AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 2.05. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 67 (66, 63-69); PW 78 (77, 72-82); SB 24 (22, 18-24); ASB 26 (24, 23-26); PSB 13 (13, 12-13); AP 24 (23, 21-24); AM 38 (38, 36-41); AL 39 (37, 35-39); PL 45 (44, 43-47); sens. 65 (62, 58-65).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements as follows

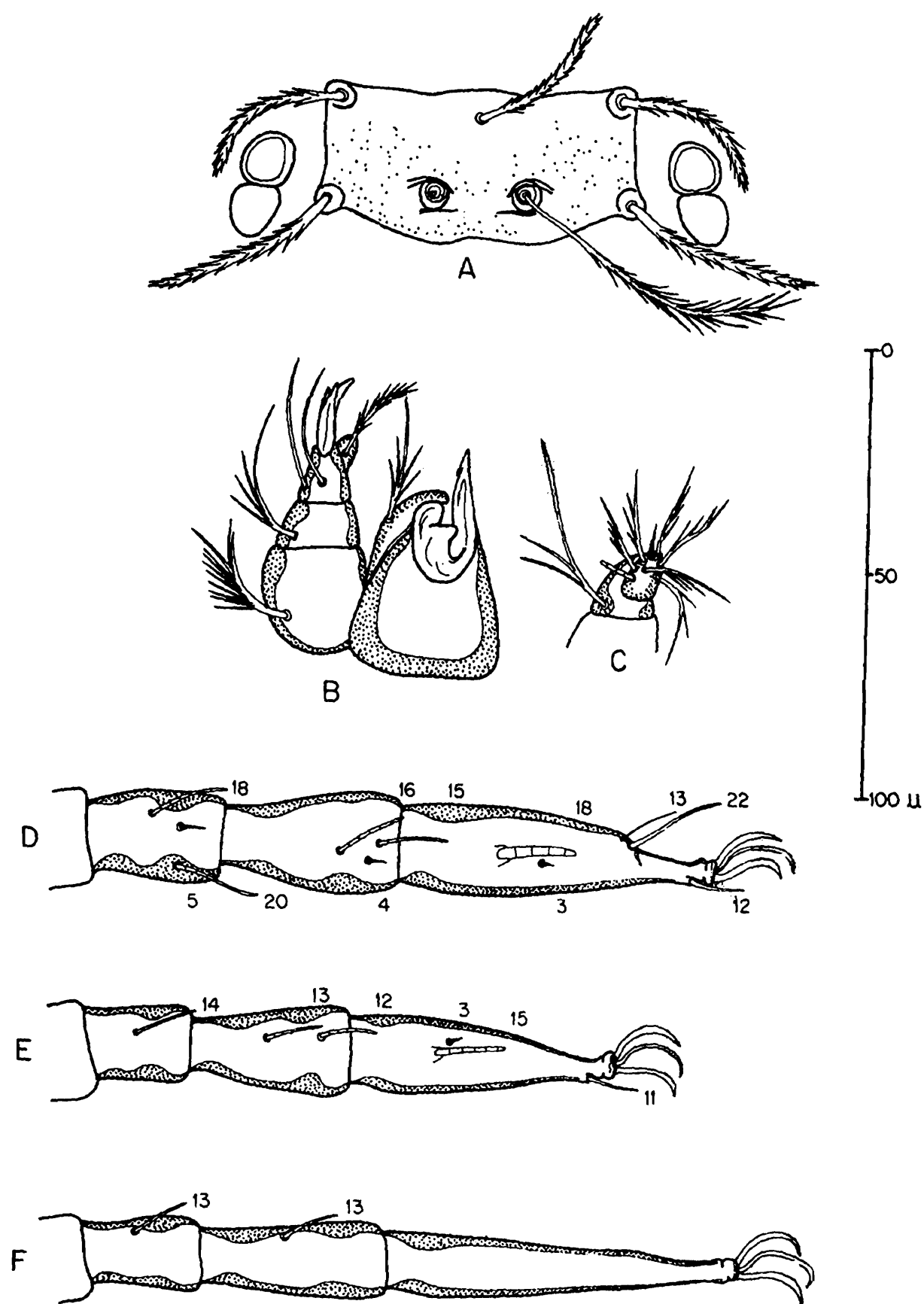


Fig. 60. *Leptotrombidium rajasthanense* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

: Ip = 780-805. Leg I : 268-275; tarsus (72x21), tarsala (16-18). Leg II : 235-249; tarsus (59x18), tarsala (15-17). Leg III : 274-281; tarsus (78x13).

Type data : Holotype and 9 paratypes, RAJASTHAN, Kota District, Kota, ex 2 *Rattus rattus rufescens*, 28.X.1971, H.N. Kaul, coll.

Additional records : RAJASTHAN, 382 ex *Suncus murinus*, *Rattus cutchicus rajput*, *R. r. rufescens* and *Mus musculus*, 28.X-18.XI.1971, H.N. Kaul, coll. GUJARAT, Navrangapura, 9 ex *S. murinus*, 25.X.1984, S. Fernandes, coll.

Remarks : *L. rajasthanense* will fall out at couplet 12 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. hasei* (Feider, 1958). *L. rajasthanense* may be distinguished in having 26 dorsal body setae, arranged : 8-6-6-4-2 (30, arranged : (8+4)-6-6-4-2 in *L. hasei*), PW<2SD (PW>2SD in *L. hasei*), a higher Ip (772 in *L. hasei*), and microtarsala II distal to tarsala II (proximal in *L. hasei*). *L. rajasthanense* is close to *L. pseudogliricolens* Vercammen-Grandjean and Langston, 1976, but may be distinguished in having fewer body setae (80 in *L. pseudogliricolens*), and arrangement of dorsal body setae commencing : 8-6-6 (10-8-8 in *L. pseudogliricolens*). The species name is based on the type locality.

72. *Leptotrombidium (Ericotrombidium) uriense* Vercammen-Grandjean and Langston (Fig. 61)

Leptotrombidium (Ericotrombidium) uriense Vercammen-Grandjean and Langston, 1976, 786; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 523-581 x 336-344 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 61-66; 78-84 dorsal idiosomal setae, measuring 48-60, arrangement in holotype : 15-8-12-8-8-7-8-6-4-2; 2 pairs of sternal setae, anterior 49-53, posterior 35-44; 32 preanal setae, 31-40; 26 postanal setae, 48-53; total idiosomal setae 142-148.

Gnathosoma : Palpal setal formula B/B/BNB/7B.S (Palpo-setal formula : B/B/NbB in NIV specimens); palpal claw 3-pronged; galeala B; cheliceral blade (35) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL>>AL>AM; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.79-1.86. Scutal measurements of holotype after original description followed by means and ranges of 10 NIV specimens in parentheses : AW 80 (80, 75-84); PW 102 (94, 88-100); SB 34 (33, 31-35); ASB 38 (34, 33-36); PSB 19 (15, 14-16); AP 33 (28, 26-33); AM 44 (51, 50-56); AL 47 (49, 46-54); PL 62 (61, 55-68); sens. - (82, 80-84).

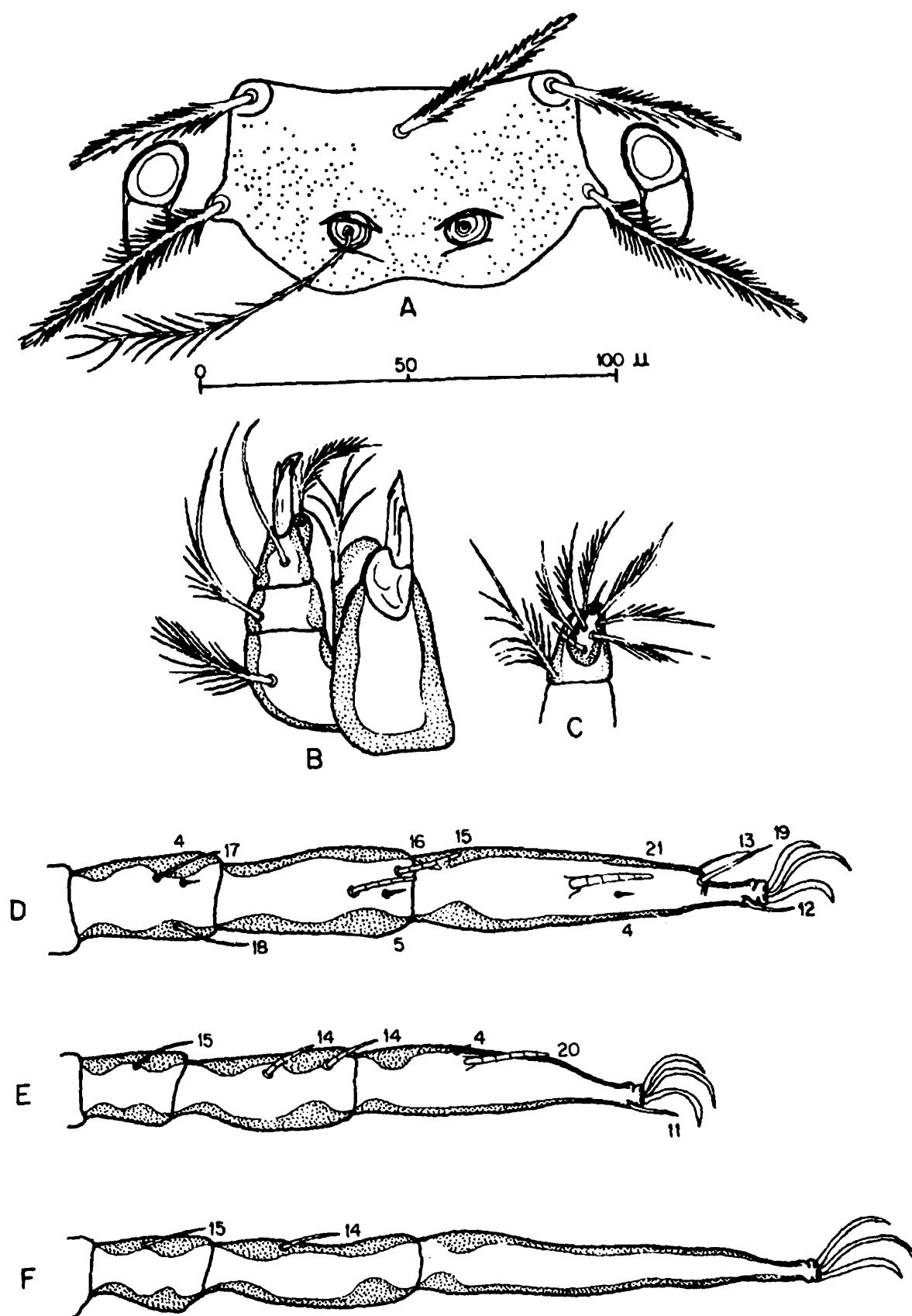


Fig. 61. *Leptotrombidium uriense*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description: Ip = 1034. Leg I : 360. Leg II : 322. Leg III : 352. Measurements of NIV specimens : Ip = 932-1106. Leg I : 323-378; tarsus (86x20); tarsala (21). Leg II : 278-333; tarsus (69x16), tarsala (20). Leg III : 331-395; tarsus (95x14).

Type data : Holotype (L : K.49/1), JAMMU and KASHMIR, Uri, ex *Rattus rattus*, 1949, S.L. Kalra, coll.

Type depository : Holotype at SAM.

New records : 3 records of collections from the Himalayan region by NIV field teams: JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 33 ex 2 *Rattus* sp., 8.XI.1969. UTTARANCHAL, Dehra Dun District, Kanasar, 1800-2300m, 20 ex *Rattus rattoides*, 30.III.1968.

Remarks : The above redescription is based on the original description and study of the NIV specimens. The sensillae and cheliceral blade, which are broken off in the unique holotype, are described and illustrated from the NIV specimens. *L. uriense* falls out in couplet 18 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976). They characterize *L. uriense* by palpo-setal formula : B/B/BNB, Ip>1000, and 124 total body setae. The NIV specimens agree closely with the original description, but differ in the palpo-setal formula and the smaller scutal measurements. Vercammen-Grandjean and Langston (1976) have described this species from specimen c, one of 3 specimens on a slide in Womersley's collection. They have designated the other 2 (specimens a and b) as paratypes of another new species *L. pseudogliricolens*. Womersley (1952) and Womersley and Audy (1957), however, make no mention of these 3 specimens from Uri, taken by Kalra in 1949. The species name is based on the type locality.

73. *Leptotrombidium (Ericotrombidium) vietzi* (Womersley) (Fig. 62)

Trombicula vietzi Womersley, 1952, 130; Womersley and Audy, 1957, 261; Prasad, 1974, 99.

Leptotrombidium (Leptotrombidium) vietzi, Nadchatram, 1970c, 146.

Leptotrombidium (Ericotrombidium) vietzi, Vercammen-Grandjean and Langston, 1976, 772.

Trombicula pelta Womersley, 1952, 137; Vercammen-Grandjean and Langston, 1976, 772, **synonymy**.

Trombicula (Leptotrombidium) pelta, Womersley and Audy, 1957, 257.

Leptotrombidium (Leptotrombidium) pelta, Mitchell and Nadchatram, 1966, 61; Mitchell *et al.*, 1966, 121; Wattal *et al.*, 1967, 352; Nadchatram, 1970c, 147; Srivastva and Wattal, 1975b, 318; Kaul *et al.*, 1978, 23; Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 18.

Leptotrombidium pelta, Prasad, 1974, 85.

Leptotrombidium paltai, sic! Soman, 1954, 389; Joshee, 1964, 49.

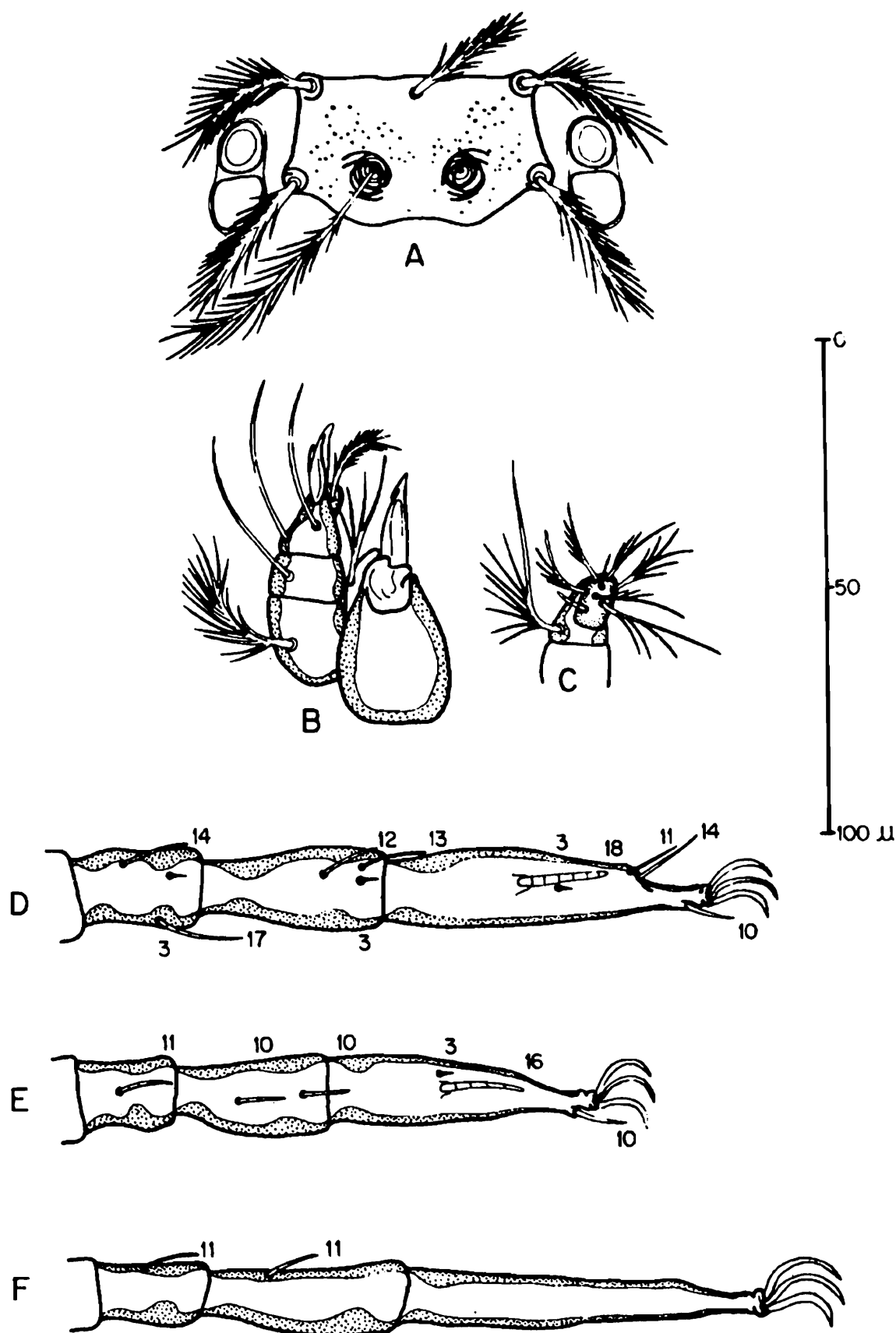


Fig. 62. *Leptotrombidium vietzi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Redescription of species : Larva.

Idiosoma : Measuring 330-594 x 200-465 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 30-38; 26-30 dorsal idiosomal setae, measuring 34-44, arranged : 8-6-6-4(6)-2(4)-(2); 2 pairs of sternal setae, anterior 37-41, posterior 26-31; 12-24 preanal setae, 24-30; 10-20 postanal setae, 32-41; total idiosomal setae 60-78.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (26-29) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly sinuate; posterior margin biconvex; AM base slightly posterior to level of AL bases; SB slightly anterior to, level with, or slightly posterior to PL bases; $PL > AL > AM$; sensillae flagelliform with basal barbs, densely branched on distal 2/3; $PW/SD = 1.77-1.97$. Scutal measurements giving means of type series followed by measurements of holotype of *L. pelta* after original descriptions : AW 51, 43; PW 59, 53; SB 20, 16; ASB 20, 22; PSB 10, 7; AP 20, 16; AM 27, 30; AL 27, 29; PL 30, 36; sens. 60, -. Scutal measurements giving means and ranges of 8 specimens from Kanha National Park after Mitchell and Nadchatram (1966), followed by measurements of 1 specimen from the same locality in parentheses after Vercammen-Grandjean and Langston (1976) : AW 45, 43-49 (46); PW 55, 52-58 (53); SB 18, 17-19 (16); ASB 20, 19-21 (22); PSB 10, 9-11 (8); AP 18, 17-19 (17); AM 30, 28-30 (31); AL 29, 29-31 (34); PL 35, 32-36 (38); sens. 58, 55-62 (-). Scutal measurements giving means and ranges of 10 NIV specimens : AW 45, 44-48; PW 51, 48-54; SB 18, 16-18; ASB 21, 20-22; PSB 10, 10-11; AP 20, 18-20; AM 28, 26-30; AL 29, 28-32; PL 35, 33-37; sens. 53, 50-55.

Legs : Similar to *L. baltalense* Vercammen-Gandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements of *L. vietzi* and *L. pelta* after original descriptions : $Ip = 717, 706$. Leg I : 248, 241. Leg II : 221, 210. Leg III : 248, 255. Measurements after Mitchell and Nadchatram (1966) : $Ip = 723-754$. Leg I : tarsus (62-70 x 16-17), tarsala (18-29!). Leg II : tarsus (57-58 x 15), tarsala (17-18). Leg III : tarsus (79-80 x 12). Measurements after Vercammen-Grandjean and Langston (1976) : $Ip = 708-738$. Leg I : 248-260. Leg II : 214-220. Leg III : 246-258. Measurements of NIV specimens : $Ip = 696-736$. Leg I : 233-252; tarsus (68x16), tarsala (18). Leg II : 208-228; tarsus (57x15), tarsala (16). Leg III : 245-256; tarsus (75x10).

Type data : Holotype and 4 paratypes, MADHYA PRADESH, Jabalpur, ex 'rat', I.1947, S.L. Kalra, coll.

Type depository : Holotype and paratypes at SAM.

Additional records : Holotype of *L. pelta*: UTTARANCHAL, Kumaon Hills, Nainital, ex 'rat', 10.X.1946, S.L. Kalra, coll. Earlier records of *L. pelta* : MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, 603 ex *Mus musculus humourus*, *Mus booduga booduga*, *Rattus blanfordi*, *Rattus rattus narbadae*, *Rattus rattus rufescens*, *Golunda ellioti*,

and *Vandeleuria oleracea*, 20-27.XII.1964, C.J. Mitchell, J. Spillelt, and G.B. Schaller, coll. MAHARASHTRA, Bombay, ex 'rats', 1947-1948, Haffkine Institute, coll.; Nagpur, 43 ex *Millardia meltada*, *Suncus murinus*, and *Rattus rattus*, VI.1967-IV.1968, S.P. Srivastva, coll.; Pune District, approximately 1200 ex *S. murinus*, *Millardia kondana*, *G. ellioti*, *R. r. rufescens*, *M. musculus*, *M. booduga*, and *Mus platythrix*, I.1970-I.1971, S.M. Kulkarni, coll. UTTARANCHAL, Nainital District, Tarai zone, 210m, 46 ex *M. meltada*, and *S. murinus*, VIII.1967, NICD, coll. RAJASTHAN, Kota and Bundi, 58 ex *S. murinus*, and *R. r. rufescens*, 28-30.X.1971, H.N. Kaul, coll.

New records : GUJARAT, Dediapada and Jhankvav, 73 ex *S. murinus*, 26,27.X.1984, S. Fernandes, coll. MAHARASHTRA, Akola District, Mhaispur, 146 ex *S. murinus*, 25.IX.1986, P.V. Mahadev, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *L. vietzi* falls out at couplet 2 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976). They have synonymized *L. pelta* (Womersley, 1952) with *L. vietzi* and characterize this species as having palpo-setal formula B/N/NNB, very small scutum with PW measuring 47-60 and SD 29-30, and SB posterior to level of PL bases. The NIV specimens agree closely with the description given in the literature. There is some discrepancy in the records regarding the number of type specimens of *L. pelta*. Mitchell and Nadchatram (1966) and Vercammen-Grandjean and Langston (1976) confirm the original record of a unique holotype by Womersley (1952). Womersley and Audy (1957), however, report 6 specimens of *L. pelta* ex 'rat' from Nainital, taken 10.X.1946. This species has been named in honour of Dr. Karl Vietz, a noted Hydrachnologist.

74. *Leptotrombidium (Ericotrombidium) wallacei* Mitchell and Nadchatram, new combination (Fig. 63)

Leptotrombidium (Leptotrombidium) wallacei Mitchell and Nadchatram, 1966, 66; Mitchell *et al.*, 1966, 121; Nadchatram, 1970c, 146.

Leptotrombidium (Hypotrombidium) wallacei, Vercammen-Grandjean and Langston, 1976, 722.

Leptotrombidium wallacei, Prasad, 1974, 86.

Redescription of species : Larva.

Idiosoma : Measuring 450-540 x 300-330 in partially engorged specimens. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of humeral setae, measuring 40-47; 36-44 dorsal idiosomal setae, measuring 32-46, arranged : (8-11)-(8-9)-(8-10)-(6-8)-(2-4)-2, arrangement in holotype 10-8-10-8-4-2; 2 pairs of sternal setae, anterior 40, posterior 30; 20-22 preanal setae, 27-30; 12-20 postanal setae, 34-35; total idiosomal setae 78-92.

Gnathosoma : Palpal setal formula B/N/NNB/7B.S (Original description and Vercammen-Grandjean and Langston (1976) : palpal tarsal setation : 7B; Nadchatram (1970c) : 7B.S);

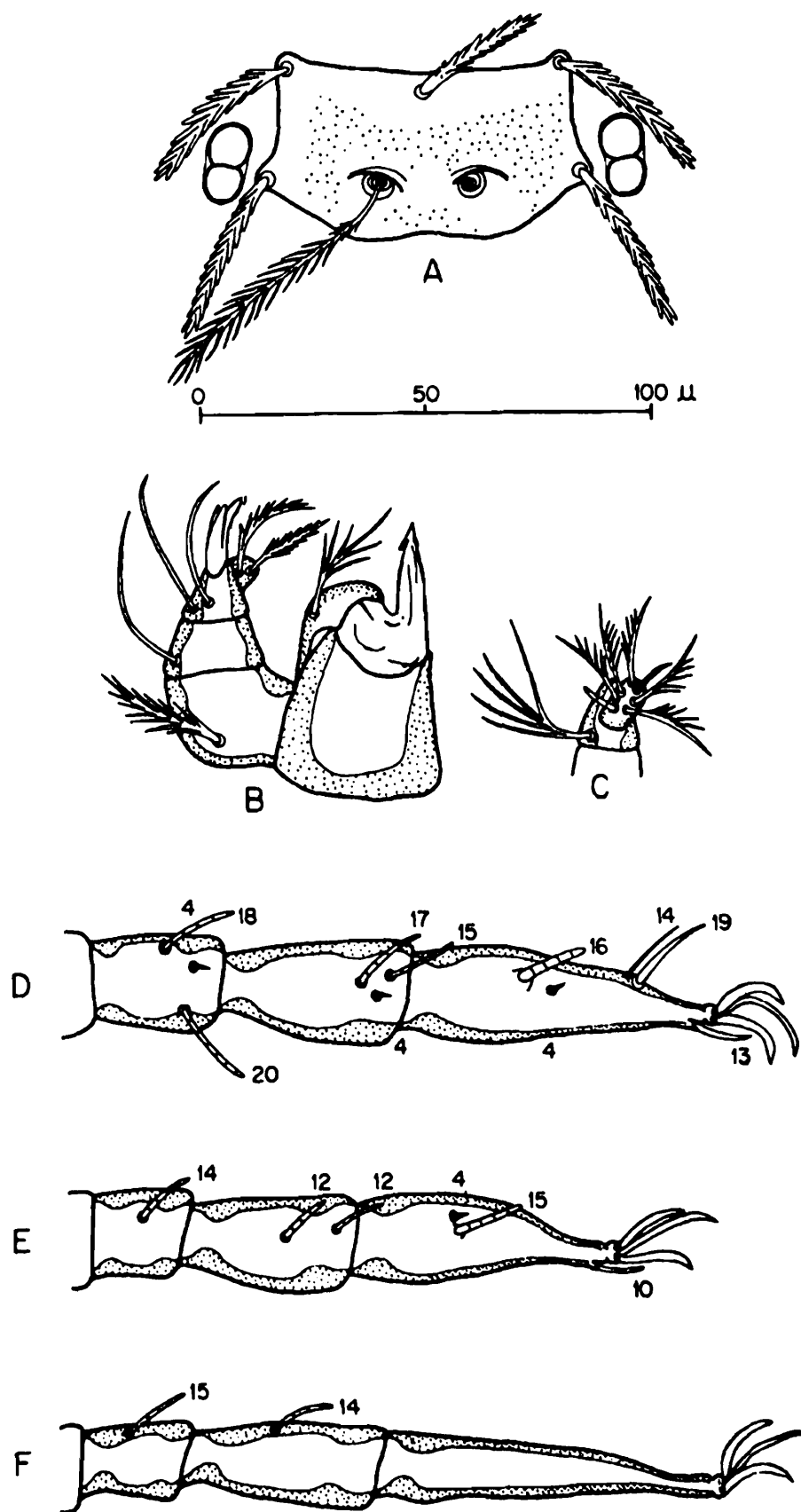


Fig. 63. *Leptotrombidium wallacei*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

palpal claw 3-pronged; galeala B; cheliceral blade (32-33) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly concave; posterior margin markedly biconvex; AM base posterior to level of AL bases; SB level with or slightly posterior to level of PL bases (Vercammen-Grandjean and Langston, 1976 : slightly anterior); PL>AL>AM; sensillae flagelliform with basal barbs, thickly branched on distal 2/3; PW/SD = 1.69-1.81. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 61 (66, 61-74); PW 74 (80, 74-87); SB 21 (25, 21-28); ASB 29 (29, 26-34); AM 32 (32, 31-35); AL 45 (42, 39-45); PL 43 (45, 42-50); sens. 62 (63, 58-69).

Legs : Similar to *L. baltalense* Vercammen-Grandjean and Langston, 1976, in the number of ordinary and sensory setae; but, peditarsal setation : 22-16-15. Measurements after original description: Ip = 780. Leg I : tarsus (66x18), tarsala (16). Leg II : tarsus (56x17), tarsala (17). Leg III : tarsus (77x12). Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 798. Leg I : 282. Leg II : 238. Leg III : 278.

Type data : Holotype (BISHOP 6626) and 35 paratypes, MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Rattus blanfordi*, 20.XII.1964, C.J. Mitchell, J. Spillett, and G.B. Schaller, coll.

Type depository : Holotype at BPBM; paratypes at BPBM, IMR, BM(NH), USNM, ZSI, RML, IA, and collections of R. Traub, C.J. Mitchell and M. Nadchatram.

Additional records : 254, same data as holotype, but ex 3 *Rattus rattus narbadae*, taken 20,26.XII.1964; 266, same data, but ex 3 *Rattus rattus rufescens*, taken 20,22.XII.1964.

Material examined : Holotype on loan from BPBM; and 1 paratype (No. 201264) at ZSI.

Remarks : The above redescription is based on the literature and study of the holotype and paratype (No. 201264). This study confirms the correction of Nadchatram (1970c) reporting the presence of a subterminala on the palpal tarsus. Hence, *L. wallacei* is transferred to the subgenus *Ericotrombidium*. *L. wallacei* will fall out at couplet 4 of the key to species of the subgenus *Ericotrombidium* given by Vercammen-Grandjean and Langston (1976) along with *L. oguni* Vercammen-Grandjean and Langston, 1976, and *L. gliricolens* (Hirst, 1915). *L. wallacei* may be distinguished from *L. oguni* in having a lower Ip (864 in *L. oguni*), and microtarsala I distal to tarsala I (proximal in *L. oguni*). *L. wallacei* differs from *L. gliricolens* in having posterior scutal margin markedly biconvex (broadly rounded in *L. gliricolens*), and dorsal body setal arrangement usually commencing : 10-8-10 (8-8-8 in *L. gliricolens*). This species has been named in honour of Dr. Craig K. Wallace, Administrator of the John Hopkins Centre for Medical Research and Training - Calcutta, who made the Kanha National Park ectoparasite study possible.

Genus *Microtrombicula* Ewing

Microtrombicula Ewing, 1950, 297; Vercammen-Grandjean, 1960, 469; 1965, 34; 1968b, 70; Traub and Nadchatram, 1966a, 305; Nadchatram and Dohany, 1974, 59; Goff *et al.*, 1986c, 171.

Eutrombicula (*Eltonella*), Audy, 1956b, 32.

Eltonella, Vercammen-Grandjean, 1960, 469; 1965, 34, 1968b, 69.

Microtrombicula (*Scapuscutala*), Vercammen-Grandjean, 1960, 469; 1965, 37; Webb and Loomis, 1971, 319.

Ascoschoengastia (*Microtrombicula*), Vercammen-Grandjean and Langston, 1976, 53.

Ascoschoengastia (*Scapuscutala*), Vercammen-Grandjean and Langston, 1976, 78.

Ascoschoengastia (*Eltonella*), Vercammen-Grandjean and Langston, 1976, 113.

Microtrombicula (*Eltonella*), Goff, 1979b, 321; Goff, 1982d, 376.

Ascoschoengastia, Lester, 1984, 493, **in part**; Domrow and Lester, 1985, 19, **in part**.

Type species : *Microthrombidium minutissimum* Oudemans, 1910, by original designation.

Diagnosis : Trombiculini larvae parasitic on mammals, birds and reptiles. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 1-3 (usually 3) genualae I, genuala II and III usually present; tibiala III; usually a short, fine mastitarsala III. Palpal tarsus 6B (or combination of N and B); palpal claw 2- or 3-pronged; cheliceral blade with tricuspid cap, additional dorsal subapical tooth may be present; galeala N, rarely barbed. Eyes 2/2 or 1/1. Scutum small, pentagonal or quadrate; scutal punctae simple; posterior margin convex, rounded or acute; AL setae usually submarginal, sometimes marginal; sensillae flagelliform, very slender to thick with basal barbs, branched distally.

Remarks : Vercammen-Grandjean (1965) has traced the genesis and chequered history of the taxonomic status of *Microtrombicula* and *Eltonella*, considering them as closely related genera. While describing 5 new Pakistani species and indicating the necessity for a redefinition of the subgenus *Scapuscutala* Vercammen-Grandjean, 1960, Traub and Nadchatram (1966a) redefined the genus *Microtrombicula* with *Eltonella* as a subgenus. Nadchatram and Dohany (1974) and Goff (1979b) have confirmed this status, with the latter redefining the subgenus *Eltonella*. It may be distinguished from the nominate subgenus in having the 6 setae on palpal tarsus in a combination of N and B (all B in nominate subgenus), palpal claw 3-pronged (2- or 3-pronged in nominate subgenus), 3 genualae I (1-3 genualae I in nominate subgenus), and scutum pentagonal with acute posterior margin (quadrate or pentagonal with posterior margin usually rounded in nominate subgenus). Nadchatram and Dohany (1974) consider the nominate subgenus to be congeneric with *Ascoschoengastia* Ewing, 1946. Lester (1984) has synonymized *Microtrombicula* with *Ascoschoengastia*, contending that difference in sensillary shape alone (flagelliform versus expanded) does not warrant independent generic status. Domrow and Lester (1985) reiterate this view. The taxonomic arrangement of Nadchatram and Dohany (1974) and Goff (1979b, 1982d) is followed here. 19 Indian *Microtrombicula* species are reported here, 9 new to science, all in the nominate subgenus.

75. *Microtrombicula (Microtrombicula) alpicula* Traub and Nadchatram
(Fig. 64)

Microtrombicula alpicula Traub and Nadchatram, 1966a, 310.

Redescription of species : Larva.

Idiosoma : Measuring 500x270 in engorged specimen. Eyes 2/2, posterior larger, on ocular plate. One pair of humeral setae, measuring 43-45; 38-39 dorsal idiosomal setae, measuring 31-38, arranged : 8-2(3)-8-6-6-4-2-2; 2 pairs of sternal setae, anterior 28-34, posterior 27; 40-42 preanal setae, 21-24; 6-8 postanal setae, 30-35; total idiosomal setae 90-94.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (24-29) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with shallowly biconcave anterior margin and prominent anterolateral shoulders; caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform, slightly expanded, profusely branched, distal branches longer; PW/SD = 1.00-1.06. Scutal measurements of holotype followed by paratypes after original description : AW 42, 42, 44; PW 47, 52, 50; SB 15, 18, 15; ASB 24, 25, 25; PSB 23, 27, 24; AP 22, 21, 22; AM 29, 29, 31; AL 24, 25, 23; PL 36, 37, 39; sens. 44, 44, -

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip (mean of 3) = 601 (paratype B66784-8 : 648). Leg I : 212 (234); coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (56-60 x 17-21) 21B, tarsala (11-12), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 178 (185); coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (44-45 x 16-17), tarsala (16), microtarsala, pretarsala. Leg III : 211 (229); coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (58-60 x 13-14) 13B, nude mastitarsala (42).

Type data : Holotype (B66784-17) and 1 paratype (B66784-8), JAMMU and KASHMIR, Gilgit Agency, Chilas District, 6.4km North of Babusar, 2742m, ex *Rattus rattoides*, 10.IX.1964, R. Traub, coll.; 1 paratype (B66799-11), Babusar, 3137m, ex *Alticola roylei*, 11.IX.1964, R. Traub and A.B. Mirza, coll.

Type depository : Holotype in USNM, paratypes in IMR and Traub collection.

Material examined : 1 paratype (B66784-8) on loan from M. Nadchatram.

Remarks : The above redescription is based on the original description and the study of paratype (B66784-8). *M. alpicula* runs to couplet 9 of the key to *Microtrombicula* species

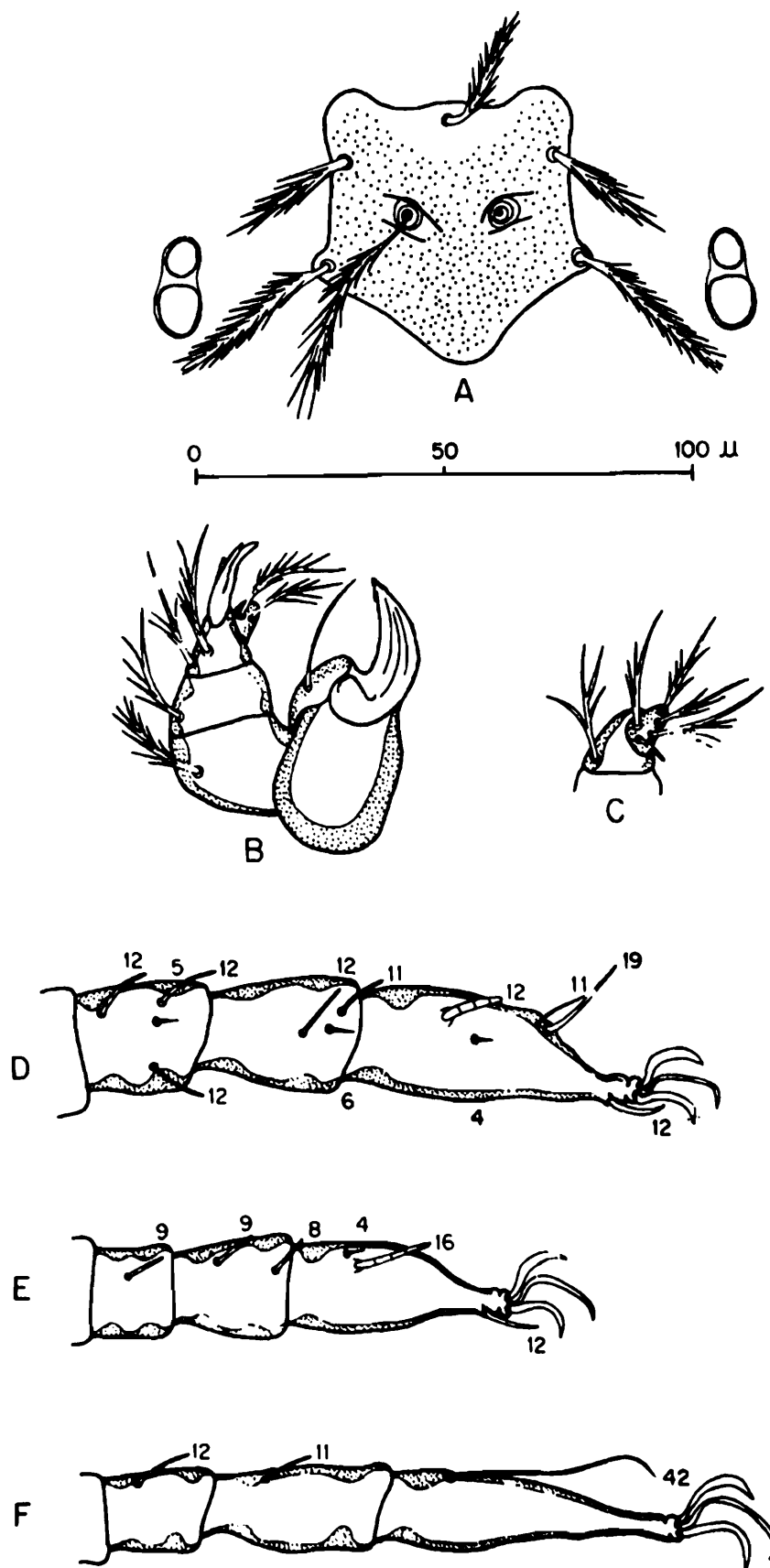


Fig. 64. *Microtrombicula alpicula*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

known from Pakistan and India given by Traub and Nadchatram (1966a), along with *M. munda* (Gater, 1932). It may easily be separated by the higher number and arrangement of dorsal body setae (26, arranged : 6-6-4-4-2-2 in *M. munda*), and in having palpal claw 3-pronged (2-pronged in *M. munda*). Traub and Nadchatram (1966a) consider *M. alpicula* close to *M. khurdangensis* (Womersley, 1952) in having unisetose coxae I-III and 3 genualae I. They distinguish *M. alpicula* in having mastitarsala III (absent in *M. khurdangensis*), 1 pair of humeral setae (2 or more pairs in *M. khurdangensis*), smaller scutum (AW measuring 53-62, PW 66-73, ASB 28-33, and PSB 28-32 in *M. khurdangensis*), and shorter tarsi I-III (measuring 85x22, 70x18, and 93x16 in *M. khurdangensis*). The type locality given in the original description as Gilgit Agency, WEST PAKISTAN, falls within Jammu and Kashmir, INDIA.

76. *Microtrombicula (Microtrombicula) altens* new species
(Fig. 65)

Microtrombicula sp. D Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 388-523 x 254-295 in partially engorged to engorged specimens. Eyes 2/2, anterior well defined, free on cuticle. Two pairs of humeral setae, measuring 52-57; 30 dorsal idiosomal setae, measuring 41-47, arranged : 8-6-6-6-4-4-2; 2 pairs of sternal setae, anterior 33-39, posterior 33-36; 32-38 preanal setae, 31-34; 4-8 postanal setae, 35-40; total idiosomal setae 74-80.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 2-pronged, axial prong internal; galeala N; cheliceral blade (29) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform with basal barbs, distal 2/3 profusely branched; PW/SD = 0.93-1.02. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 51 (52, 50-56); PW 54 (56, 54-60); SB 22 (22, 21-24); ASB 27 (28, 26-29); PSB 29 (30, 29-31); AP 25 (25, 23-27); AM 46 (42, 37-46); AL 31 (30, 28-33); PL 45 (45, 43-47); sens. 60 (65, 60-72).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 798-848. Leg I : 282-298; tarsus (77x18), tarsala (13-15). Leg II : 233-253; tarsus (66x15), tarsala (18-22). Leg III : 278-300; tarsus (86x12), mastitarsala (37).

Type data : Holotype (NIV A83781.9) and 9 paratypes, HIMACHAL PRADESH, Kinnaur District, Kalpa, 2590-2740m, ex *Rattus rattus gangutrianus*, 10.V.1968, NIV, coll.

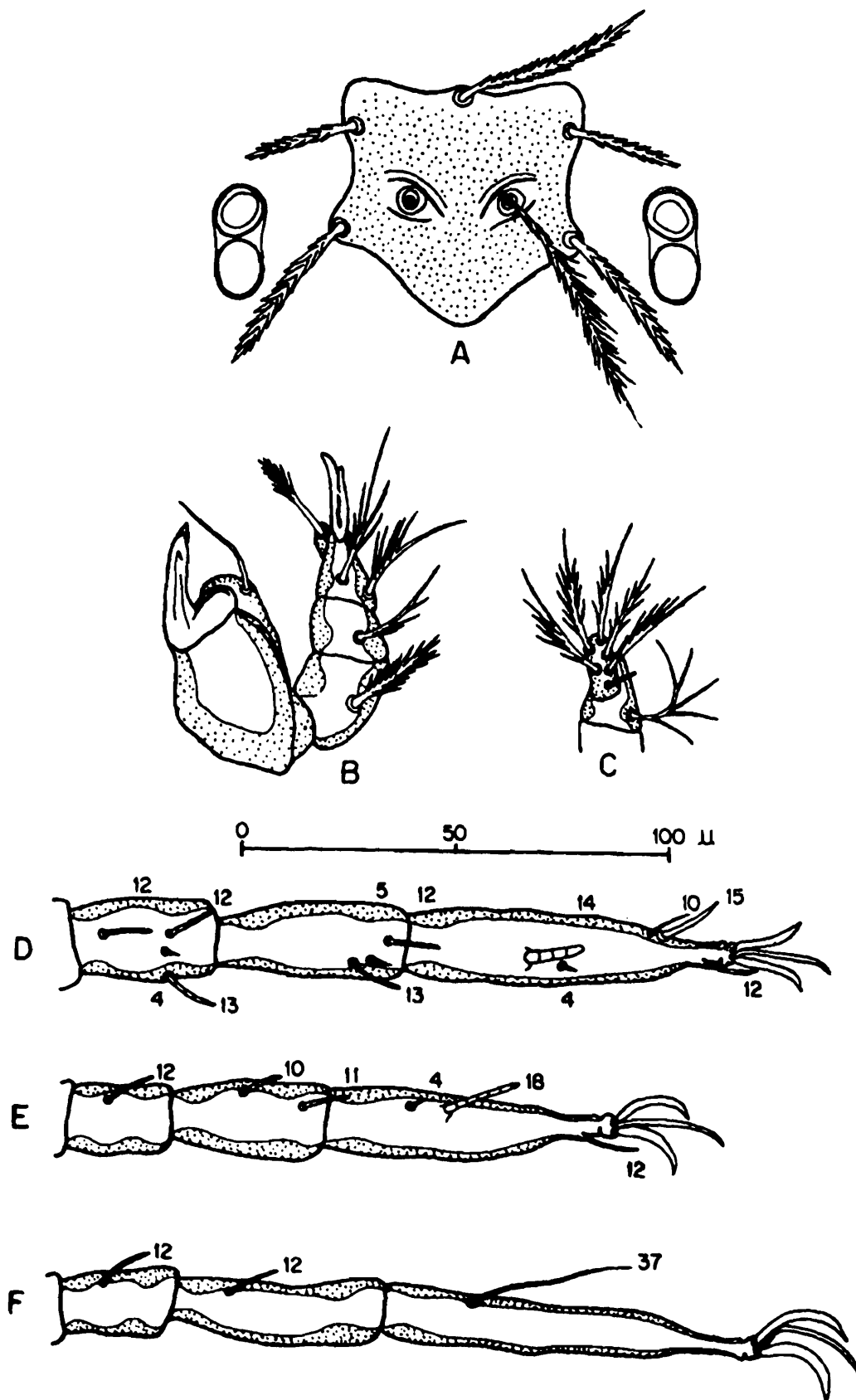


Fig. 65. *Microtrombicula altens* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Additional records : 4 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Kinnaur District, Karcham, 1700m, 29 ex 2 *Rattus rattoides*, 19.X.1967; Mahasu District, Sarhan, 1300-2140m, 16 ex 2 *R. rattoides*, 5.V.1968.

Remarks : *M. altens* will run to couplet 5 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. buxtoni* (Womersley, 1952) and *M. latens* Traub and Nadchatram, 1966. *M. altens* may easily be separated from *M. buxtoni* in having 8 setae in 1st posthumeral row (6 in *M. buxtoni*), palpal claw 2-pronged (3-pronged in *M. buxtoni*), and tarsala II>I (II<I in *M. buxtoni*). *M. altens* differs from *M. latens* in having 2 pairs of humeral setae (1 pair in *M. latens*), and palpal claw 2-pronged (3-pronged in *M. latens*). The species name is an anagram of *latens*, which it is closely resembles.

77. *Microtrombicula (Microtrombicula) buxtoni* (Womersley)
(Fig. 66)

Trombicula buxtoni Womersley, 1952, 124; Prasad, 1974, 93.

Trombicula (Miyatrombicula) buxtoni, Audy, 1957, 233; Womersley and Audy, 1957, 257.

Eltonella (Eltonella) buxtoni, Vercammen-Grandjean, 1965, 77.

Microtrombicula buxtoni, Traub and Nadchatram, 1966a, 316; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 212-510 x 141-262 in unengorged to engorged specimens. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of humeral setae, measuring 38-55; 24-34 dorsal idiosomal setae, measuring 38-54, arranged : 6-6-4(6)-4-2(4,6)-(2,4) (Traub and Nadchatram, 1966a : 24, measuring 46, arranged : 6-6-4-4-2-2); 2 pairs of sternal setae, anterior 31-44, posterior 22-32; 22-34 preanal setae, 20-32; 6-12 postanal setae, 28-45; total idiosomal setae 62-82 (Traub and Nadchatram 1966a : 62-66).

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (27) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with shallowly concave anterior margin and anterolateral shoulders; AW and PW subequal; posterior margin shallow behind PL bases, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform, profusely branched, distal branches longer; PW/SD = 0.81-0.89. Scutal measurements of 7 type specimens giving ranges/means after original description : AW 42-48; PW 45-48; SB 18-19; ASB 29; PSB 22; AP 26; AM 38; AL 22; PL 42; sens. 54-56. Scutal measurements of holotype after Vercammen-Grandjean (1965), followed by measurements of Pakistani specimen after Traub and Nadchatram (1966a) : AW 47, 41; PW 48, 39; SB 20, 15; ASB 30, 25; PSB 24, 20; AP 28, 26; AM 38, -; AL 23, 17; PL 40, 39; sens. 74, -. Scutal measurements of 10 NIV specimens giving means followed

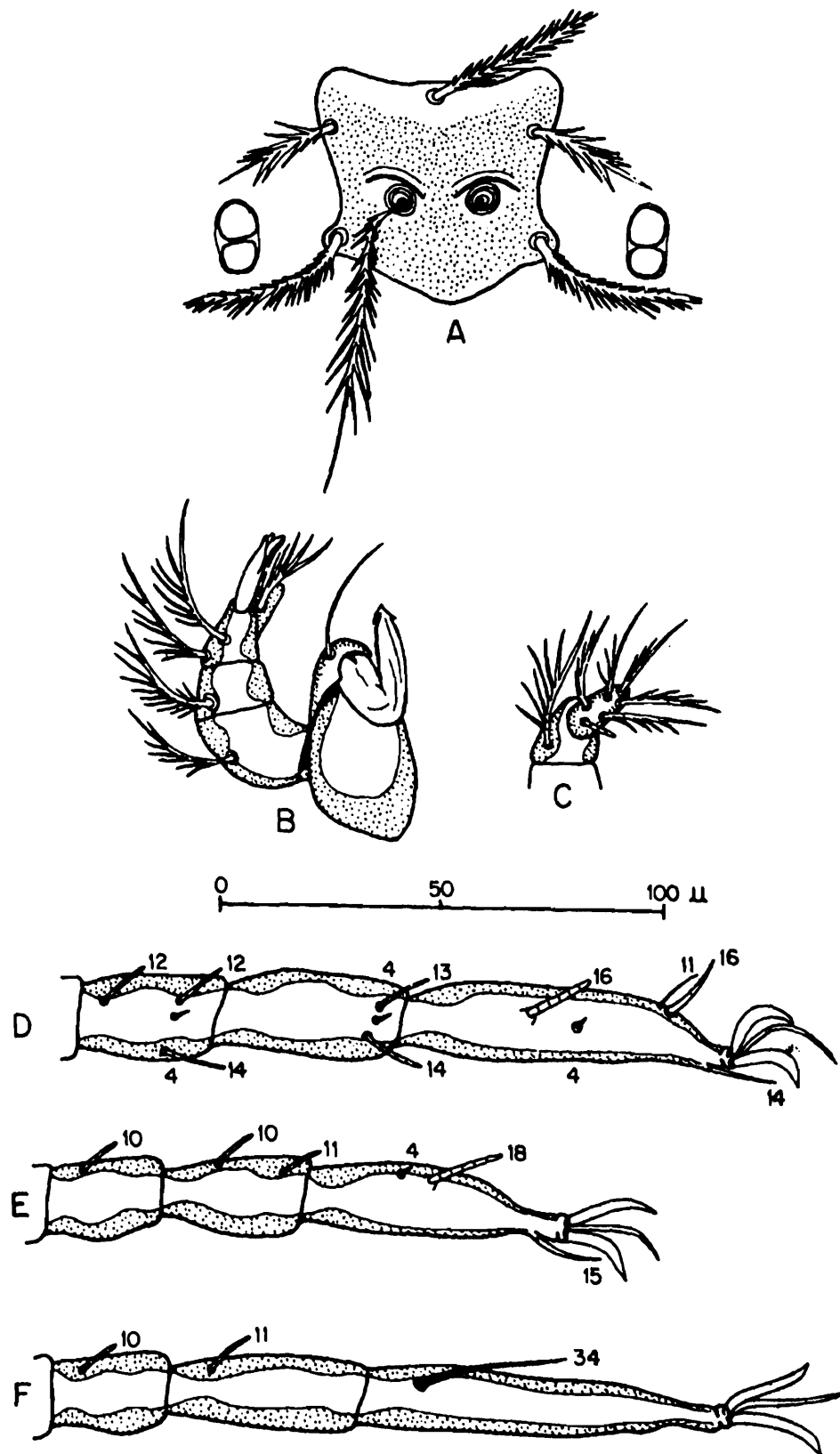


Fig. 66. *Mictrombicula buxtoni*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

by ranges : AW 47, 40-53; PW 45, 37-50; SB 19, 16-21; ASB 30, 26-32; PSB 24, 22-25; AP 28, 25-32; AM 38, 31-41; AL 25, 20-30; PL 42, 33-51; sens. 64, 58-70.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 618-903 (Original description : 838; Vercammen-Grandjean, 1965 : 748; Traub and Nadchatram, 1966a : 625). Leg I : 222-316 (285; 262; 215); tarsus (58-67 x 17), tarsala (14-21). Leg II : 177-272 (241; 225; 187); tarsus (47-57 x 16), tarsala (16-20). Leg III : 219-315 (312; 261; 223); tarsus (63-79 x 14); mastitarsala (34).

Type data : Holotype and 7 paratypes, UTTARANCHAL, Kumaon Hills, Ranikhet, ex 'yellow coloured rat', 20.X.1946, S.L. Kalra, coll.

Type depository : Holotype in SAM.

New records : 99 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 5 ex 2 *Rattus rattus gangutrianus*, 8.IV.1968; Kinnaur District, Kalpa, 2590-2740m, 3 ex 2 *R. r. gangutrianus*, 10,14.V.1968; 16, same data, but ex *Rattus rattoides*, taken 14.V.1968; 1, same data, but ex *Mus musculus*; Karcham, 1700m, 34 ex 2 *R. rattoides*, 19.X.1967; Sangla, 2700m, 1 ex *R. r. gangutrianus*, 7.VI.1970; 1, same data, but ex *R. rattoides*; Kulu District, Bhui, 1100-1550m, 222 ex 3 *R. rattoides*, 11.X.1967; 158, same data, but ex *M. musculus*; Jibi, 1000-1922m, 28 ex *R. rattoides*, 15.IV.1969; Manali, 1820-1860m, 12 ex *R. rattoides*, 8.VIII.1970; Palchan, 1800-2290m, 155 ex 13 *R. rattoides*, 3,4.X.1967 and 27.VIII.1970; 320, same data, but ex 7 *Rattus rufescens*, 1,2.X.1968; 12, same data, but ex 4 *R. r. gangutrianus*, 27.VIII.1970; 8, same data, but ex 3 *M. musculus*, 3.X, 1967 and 1.X.1968; 3, same data, but ex *Crocidura* sp., 2.X.1968; Lahul District, Kirting, 2680-3250m, 4 ex *Alticola roylei*, 24.IX.1968; 3, same data, but ex 2 *R. rufescens*; Mahasu District, Baghi, 2700-2760m, 30 ex 7 *R. rattoides*, 11-14.VII.1970; Kotkhai, 1800-1900m, 3 ex *R. rattoides*, 11.V.1969; Sarhan, 1300-2140m, 153 ex 3 *R. rattoides*, 5.V.1968; Sungri, 2650-2750m, 2 ex *R. rattoides*, 17.VII.1970; Simla District, Nalagarh, 500-600m, 1 ex *Mus platythrix*, 8.IV.1969; Simla, 1700-2000m, 74 ex 4 *R. rattoides*, 29.X,4.XI.1967. JAMMU and KASHMR, Baramulla District, Rampore, 1400m, 33 ex 4 *R. rattoides*, 6,7.XI.1969; Sopore, 500m, 110 ex *Suncus murinus*, 25.X.1969; Rajouri District, Naoshera, 750m, 1 ex *M. musculus*, 8.XII.1969. UTTARANCHAL, Almora District, Loharghat, 1700-2100m, 2 ex *R. rattoides*, 11.III.1967; Phurkia, 1100-2450m, 2 ex *R. rattoides*, 8.X.1967; Chamoli District, Dogalbita, 2300-3800m, 12 ex *R. rattoides*, 8.VII.1970; Gwaldam, 1500-2100m, 355 ex 3 *R. rattoides*, 11,12.IV.1967; 1, same data, but ex *Rattus fulvescens*, 10.IV.1967; Lambagarh, 2150-2450m, 3 ex *M. musculus*, 26.VI.1968; Tapoban, 1800-2100m, 11 ex *R. rattoides*, 7.VI.1968; Dehra Dun District, Kanasar, 1800-2300m, 10 ex *R. rattoides*, 31.III.1968; Mussourie, 1400-2300m, 10 ex 3 *R. rattoides*, 8.XI.1967; Pauri Garhwal District, Dogadda, 700-900m, 6 ex *R. r. gangutrianus*, 11.XI.1967; Rudraprayag, 600-900m, 3 ex *R. r. gangutrianus*, 23.V.1967; Nainital District, Mukteshwar, 1400-2300m, 27 ex 2 *R. rattoides*, 28.IV,25.XI.1967; Tehri District, Chirbatia, 1800-3200m, 1 ex *R. rattoides*, 26.V.1969; Uttarkashi District, Sakhi, 2700m, 79 ex 9 *R. rattoides*, 4-7.VI.1969; Harsil, 2600m, 25 ex 2 *R. r. gangutrianus*, 14.VI.1967.

Remarks : The above redescription is based on the literature and the study of the NIV specimens. *M. buxtoni* runs to couplet 5 of the key to *Microtrombicula* species from Pakistan and India given by Traub and Nadchatram (1966a), along with *M. latens* Traub and Nadchatram, 1966, in having coxa III bisetose and mastitarsala III present. They distinguish *M. buxtoni* in having tarsala II<I (tarsala II>I in *M. latens*), posterior margin behind PL bases shallow, not exceeding 8 (measuring 14-15 in *M. latens*), PW-SD dimensions unequal (subequal in *M. latens*), and number of setae in 1st posthumeral row 6 (8 in *M. latens*). Womersley and Audy (1957) placed this species in subgenus *Miyatrombicula* of genus *Trombicula* on account of the subpentagonal scutum, bisetose coxa III, and presence of barbs on the proximal as well as distal halves of the sensilla. Vercammen-Grandjean (1965) transferred *buxtoni* to *Eltonella*, which he raised to generic status. Traub and Nadchatram (1966a) redefined *Microtrombicula* and included *buxtoni* in this genus. They consider this species unique in having AW and PW subequal, and the scutal margin posterior to PL bases shallowest among the known *Microtrombicula* species. The wide range of variation in the standard measurements reported for this species is confirmed in the NIV specimens studied. The material from Himachal Pradesh agrees closely with the unique Pakistani specimen of Traub and Nadchatram (1966a). The NIV specimens from Uttaranchal are, however, close to the type series from Kumaon Hills.

78. *Microtrombicula (Microtrombicula) cotrivensa* new species
(Fig. 67)

Microtrombicula sp. C Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 340-536 x 195-334 in partially engorged to engorged specimens. Eyes 2/2, anterior well defined, on ocular plate. One pair of humeral setae, measuring 46-56; 30-32 dorsal idiosomal setae, measuring 40-44, arranged : 8-6-6-6(4)-4-2; 2 pairs of sternal setae, anterior 33-44, posterior 32-40; 28-38 preanal setae, 30-32; 6-8 postanal setae, 34-40; total idiosomal setae 74-82.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N (rarely f); cheliceral blade (28) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with basal barbs, distal 3/4 profusely branched; PW/SD = 1.07-1.22. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 58 (55, 52-58); PW 65 (61, 57-65); SB 23 (21, 20-23); ASB 30 (28, 25-30), PSB 30 (28, 26-30); AP 20 (20, 18-22); AM 39 (37, 35-40); AL 31 (29, 27-31); PL 48 (46, 43-48); sens. 68 (65, 60-68).

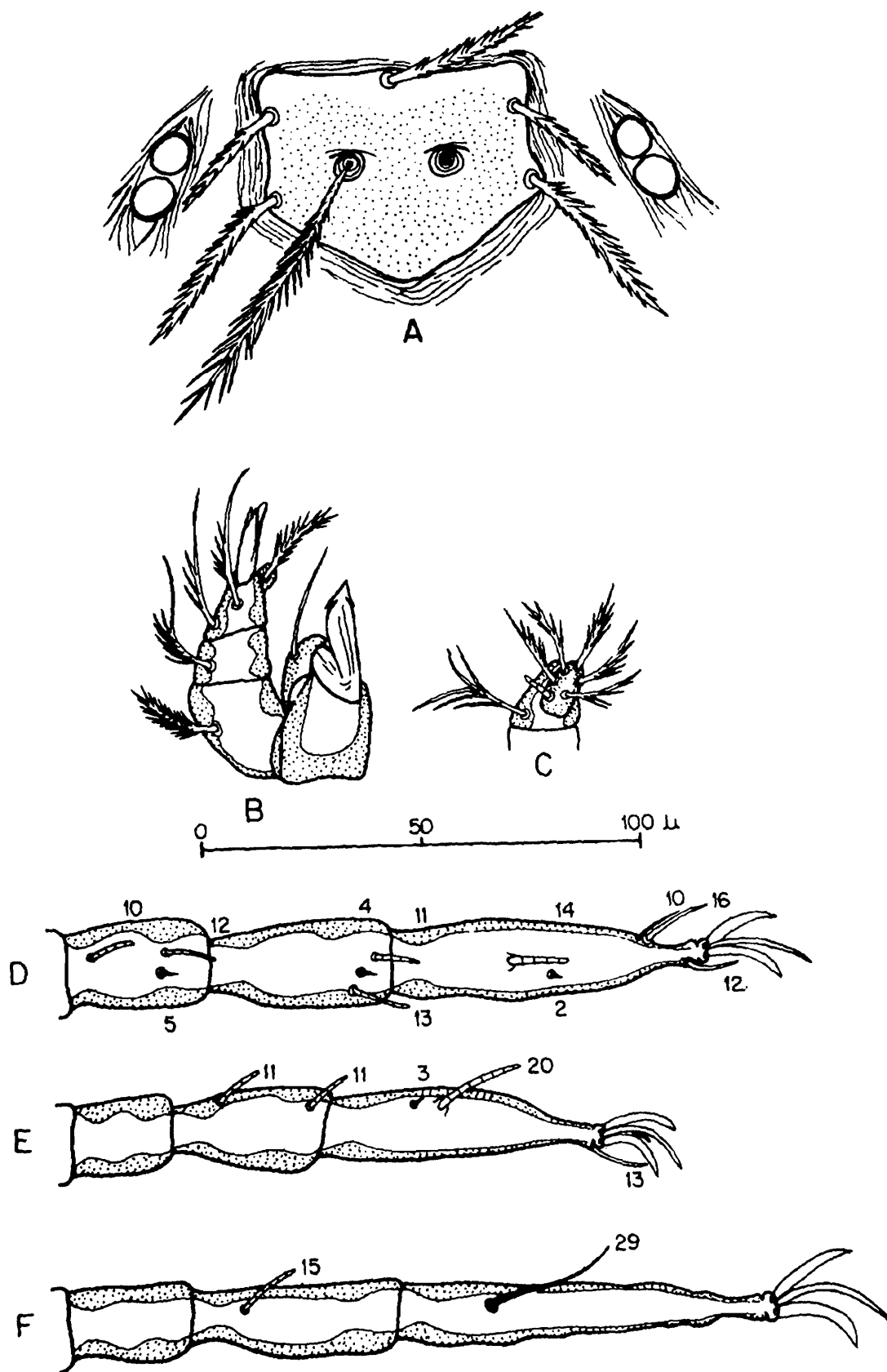


Fig. 67. *Microtrombicula cotrivensa* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 5B, 2 genualae, microgenuala; genu II 4B, genuala absent; genu III 4B, genuala absent; Measurements as follows : Ip = 772-876. Leg I : 261-297; tarsus (71x18), tarsala (14-16). Leg II : 234-254; tarsus (63x15), tarsala (20-21). Leg III : 275-325; tarsus (85x13), mastitarsala (37).

Type data : Holotype (NIV A74482.14), UTTARANCHAL, Chamoli District, Gwaldam, 1500-2100m, ex *Rattus rattoides*, 11.IV.1967, NIV, coll.; 11 paratypes, same data, but Nainital District, Mukteshwar, 1400-2300m, ex *R. rattoides*, 25.XI.1967.

Additional records : 10 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kinnaur District, Kalpa, 2590-2740m, 1 ex *Rattus rattus gangutrianus*, 10.V.1968; 4, same data, but ex *R. rattoides*, 14.V.1968. UTTARANCHAL, Chamoli District, Gwaldam, 5 ex 2 *R. rattoides*, 12.IV.1967; Nainital District, Mukteshwar, 2 ex *Rattus niviventer*, 26.XI.1967; Tehri District, Chirbatia, 1800-3200m, 2 ex *R. rattoides*, 26.V.1969; Uttarkashi District, Sakhi, 2700m, 9 ex 4 *R. rattoides*, 4-7.VI.1969.

Remarks : *M. cotrivensa* will run to couplet 6 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a), along with *M. ventricosa* Traub and Nadchatram, 1966, in having 2 genualae I. *M. cotrivensa* may easily be distinguished in having galeala N/f (B in *M. ventricosa*), genuala II and III absent (present in *M. ventricosa*), and fewer dorsal body setae (38 in *M. ventricosa*). The species name is an anagram of *ventricosa*, which it closely resembles.

79. *Microtrombicula (Microtrombicula) kajutekrii* (Joshee) (Fig. 68)

Trombicula kajutekrii Joshee, 1964, 46.

Microtrombicula (Scapuscutala) kajutekrii, Nadchatram and Joshee, 1966, 439.

Microtrombicula kajutekrii, Traub and Nadchatram, 1966a, 321; Prasad, 1974, 86; Kaul *et al.*, 1978, 19.

Redescription of species : Larva. Colour in life pale white.

Idiosoma : Measuring 260-337 x 184-274 in unengorged to engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, 26-35; 26-28 dorsal idiosomal setae, measuring 19-28, arranged : 8-6-4-4-2(4)-2; 2 pairs of sternal setae, anterior 15-18, posterior 19-22; 18-22 preanal setae, 16-19; 6-8 postanal setae, 20-23; total idiosomal setae 58-62 (Nadchatram and Joshee, 1966: 12 preanal setae, 13; 8 postanal setae, 17; total idiosomal setae 50-52).

Gnathosoma : Palpal setal formula B(b)/b/NNb/6B; palpal claw 2-pronged, axial prong internal (Original description : 2-pronged; Nadchatram and Joshee, 1966 : reported as 3-pronged, but figs. 3 and 4 illustrate 2-pronged claw, axial prong internal); galeala N; cheliceral blade (24-28) with conspicuous dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

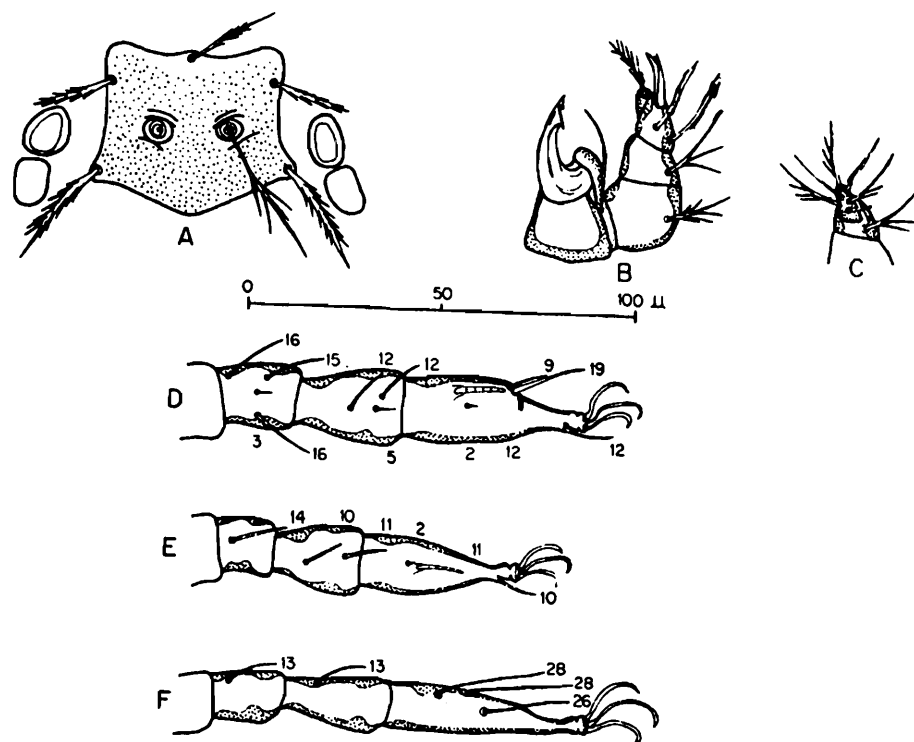


Fig. 68. *Microtrombicula kajutekrii*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Moderately punctate, subquadrate with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; $PL > AM > AL$; sensillae flagelliform, 4-5 branches on distal 1/2; $PW/SD = 1.12-1.26$ (Nadchatram and Joshee, 1966 : 1.26-1.38). Scutal measurements of holotype followed by means and ranges of type series after Nadchatram and Joshee, 1966 : AW 38 (37, 34-40); PW 47 (47, 44-48); SB 17 (16, 15-19); ASB 17 (17, 17-19); PSB 17 (19, 17-19); AP 19 (19, 18-20); AM 20 (20, 16-23); AL 14 (17, 13-20); PL 26 (22, 20-26); sens. 32 (29, 26-32). Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 42, 39-43; PW 48, 46-50; SB 18, 17-18; ASB 20, 19-20; PSB 21, 20-22; AP 21, 19-22; AM 24, 21-26; AL 20, 17-22; PL 29, 29-31; sens. 35, 31-38.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, tarsus III 11B, 3 mastitarsalae, 2 dorsal and 1 dorsolateral (Nadchatram and Joshee, 1966 : 2 mastitarsalae, 1 dorsal and 1 dorsolateral). Measurements as follows : $Ip = 552-572$. Leg I : 189-200; tarsus (46x17), tarsala (12). Leg II : 169-181; tarsus (41x14) tarsala (11). Leg III : 192-196; tarsus (50x12), mastitarsalae (28, 28, 26). Measurements after original description : $Ip = 495$. Leg I : 165. Leg II : 156. Leg III : 174. Measurements after Nadchatram and Joshee, 1966 : $Ip = 450-480$. Leg I : 160; tarsus (36x14), tarsala (11). Leg II : 140; tarsus (31x13), tarsala (11). Leg III : 160; tarsus (40x12).

Type data : Holotype (MZ 110455) and 7 paratypes, MAHARASHTRA, Bombay, Bhandup area, Kajutekari, ex *Rattus rattus*, 26.XI.1959, A.K. Joshee, coll.

Type depository : Holotype in BM(NH); paratypes in IMR, ZSI, USNM, GWHF, RML and Joshee collection.

Additional records : RAJASTHAN, Kota District, 15 ex 2 *Rattus rattus rufescens*, 30.X.1971, H.N. Kaul, coll. 547 specimens from the same locality, reported by Kaul *et al.* (1978) as *M. kajutekrii*, are in fact *M. munda* (Gater, 1932).

Material examined : 1 paratype (MZ 110456) loaned by A.K. Joshee.

Remarks : The above redescription is based on the literature, study of paratype (MZ 110456) and the NIV specimens. *M. kajutekrii* runs to couplet 8 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a). They distinguish this species from *M. munda* and *M. alpicula* by the absence of mastitarsala III (present in *M. munda* and *M. alpicula*). This is evidently a *lapsus*! *M. kajutekrii* differs, rather, in having 3 mastitarsalae III. Joshee (1964) considers this species close to *M. spicea* (Gater, 1932), differing, however, in the shape of the scutum, length of sensillae, length and arrangement of dorsal body setae. Nadchatram and Joshee (1966) consider this species close to *M. munda* from which it may be separated by the shape of the scutum, number of dorsal body setae and structure of chelicera. The NIV specimens agree closely with the description given in the literature and the paratype examined; the standard data is, however, higher. The species name is based on the type locality.

80. *Microtrmbicula* (*Microtrombicula*) *khurdangencosa* new species

(Fig. 69)

Description of species : Larva.

Idiosoma : Measuring 390-492 x 250-324 in partially engorged to engorged specimens. Eyes 2/2, free on cuticle. One pair of humeral setae, measuring 59-64; 42-52 dorsal idiosomal setae, irregularly arranged, arrangement in holotype : (8+6)-(7+3)-7-5-6-2, measuring 39-52, anterolateral setae longer; 2 pairs of sternal setae, anterior 38-42, posterior 36-38; 40-56 preanal setae, 30-32; 6-10 postanal setae, 43-49; total idiosomal setae 100-120.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N/f; cheliceral blade (31) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform, slightly expanded, with basal barbs and branches on distal 1/2; PW/SD = 1.06-1.24. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 64 (65, 63-67); PW 70 (73, 68-78); SB 26 (24, 21-26); ASB 28 (30, 28-32); PSB 34 (34, 32-35); AP 27 (29, 27-31); AM 38 (40, 38-43); AL 38 (37, 35-39); PL 58 (59, 56-63); sens. 60 (71, 60-75).

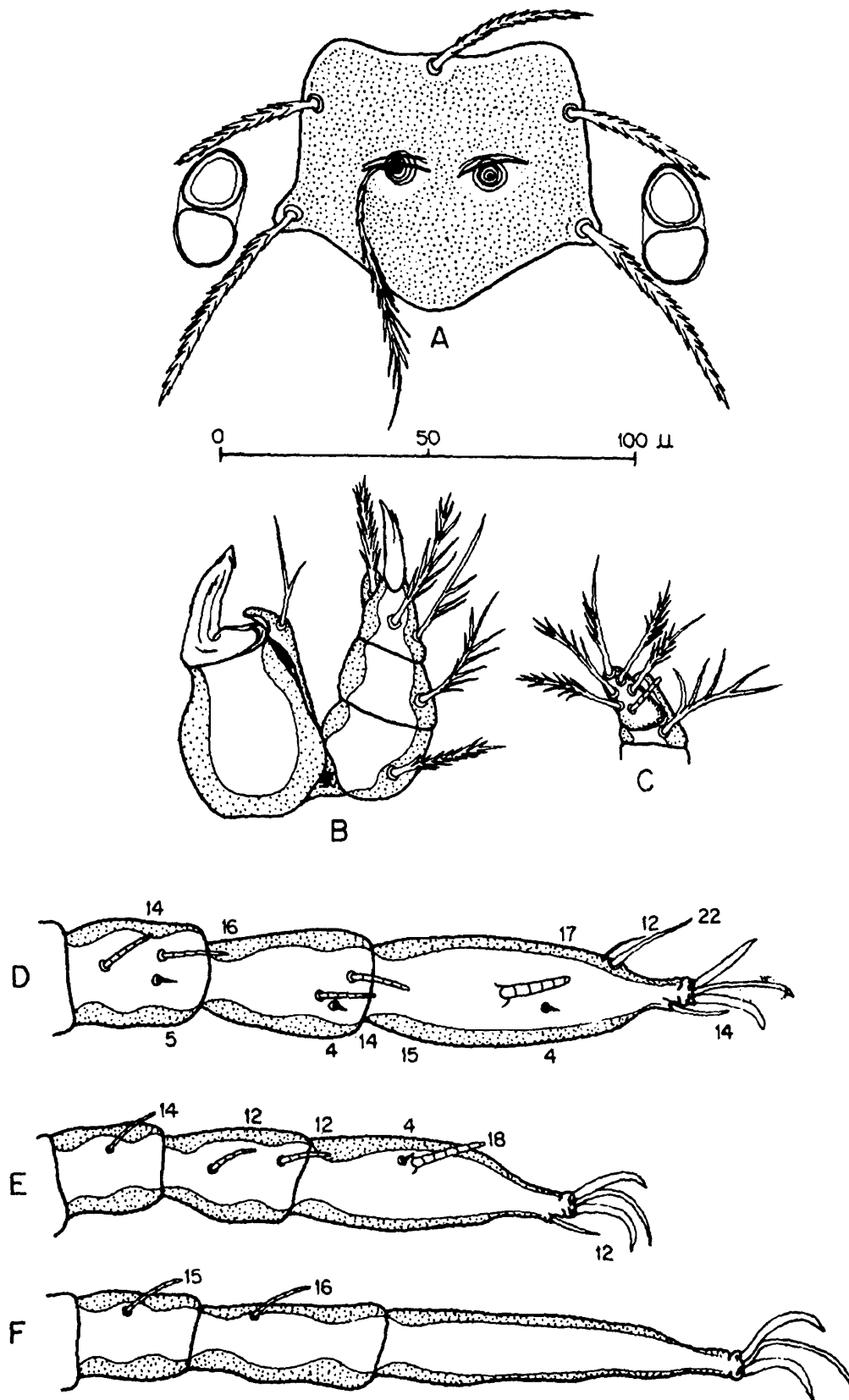


Fig. 69. *Microtrombicula khurdangencosa* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 5B, 2 genualae, microgenuala; and tarsus III 14B, mastitarsala absent. Measurements as follows : Ip = 882-933. Leg I : 306-322; tarsus (78x26), tarsala (17-18). Leg II : 268-282; tarsus (64x21), tarsala (18-20). Leg III : 308-333; tarsus (87x16).

Type data : Holotype (NIV A81446.15) and 3 paratypes, UTTARANCHAL, Pithoragarh, Milam, 1100-3800m, ex *Alticola roylei*, 23.IX.1967, NIV, coll.; 3 paratypes, same data, but ex *Apodemus flavicollis*.

Remarks : *M. khurdangencosa* will run to couplet 6 of the key of *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. ventricosa* Traub and Nadchatram, 1966, in having 2 genualae I. It differs in having galeala N/f (B in *M. ventricosa*), greater number of dorsal body setae (38 in *M. ventricosa*), and mastitarsala III absent (present in *M. ventricosa*). *M. khurdangencosa* is also close to *M. khurdangensis* (Womersley, 1952), but may be distinguished in having a single pair of humeral setae (2 or more pairs in *M. khurdangensis*), 2 genualae I (3 in *M. khurdangensis*), and galeala N/f (N in *M. khurdangensis*). The species name is a combination of *khurdangensis* and *ventricosa*, which species it closely resembles.

81. *Microtrombicula (Micotrombicula) khurdangensis* (Womersley) (Fig. 70)

Trombicula khurdangensis Womersley, 1952, 119.

Trombicula (Trombicula) khurdangensis, Womersley and Audy, 1957, 258.

Microtrombicula (Scapuscutala) khurdangensis, Vercammen-Grandjean, 1965, 122.

Microtrombicula khurdangensis, Traub and Nadchatram, 1966a, 309; Webb and Loomis, 1971, 321; Prasad, 1974, 86.

Redescription of species : Larva.

Idiosoma : Measuring 585-700 x 325-560 in partially engorged to engorged specimens. Eyes 2/2, faintly discernable, on ocular plate. 5-8 humeral setae, measuring 48; 40-44 dorsal idiosomal setae, measuring 38-44, irregularly arranged, arrangement in specimen (B 67450) : 8-6-8-4-6-5-4-2; 2 pairs of sternal setae, anterior 38, posterior 33; 40 preanal setae, 26-31; 8 postanal setae, 37-42 (Original description : 56 ventral setae); total idiosomal setae 88-102.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; gaeala N; cheliceral blade (26-29) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin convex, caudally angulate; AM base

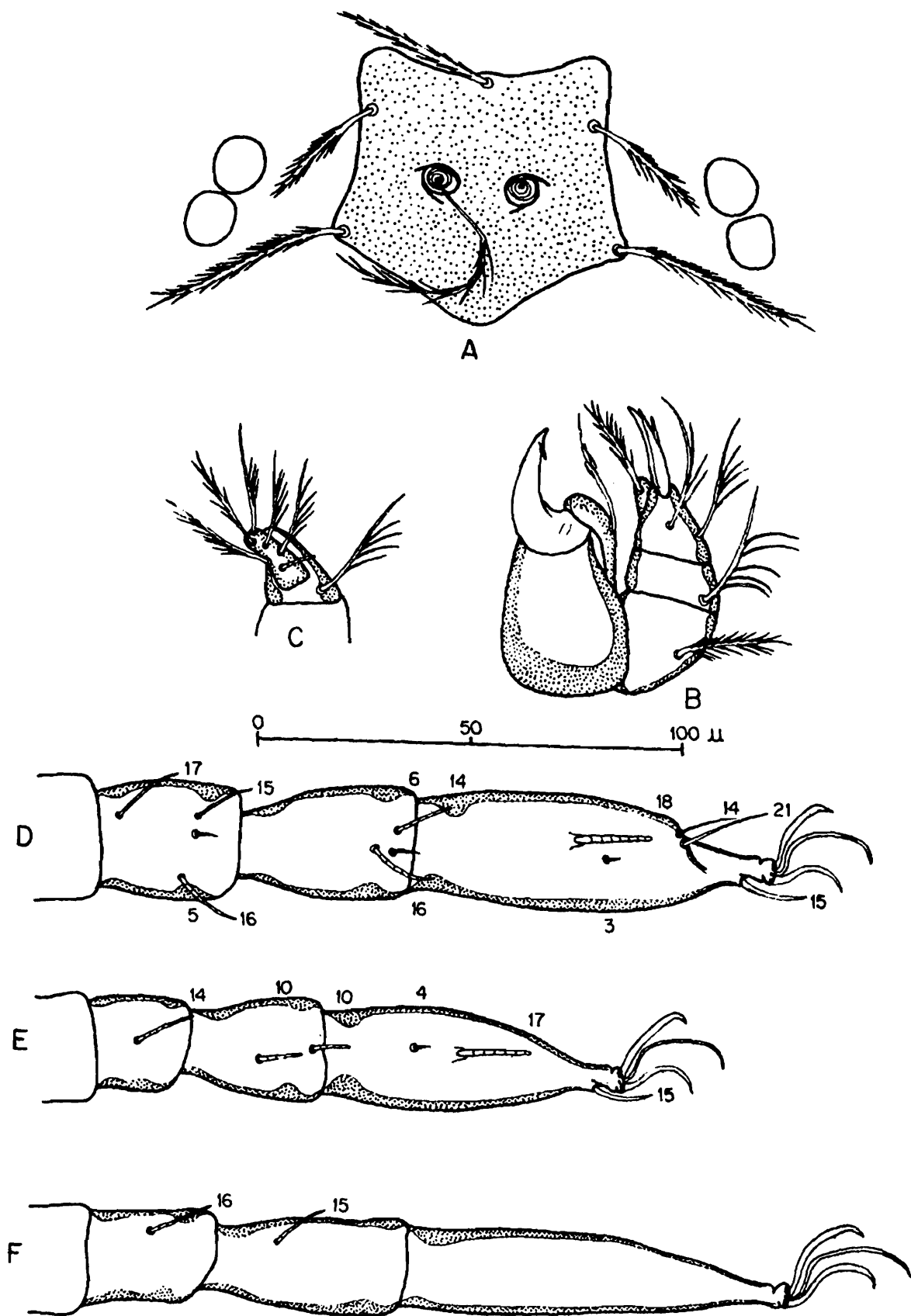


Fig. 70. *Microtrombicula khurdangensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

anterior to AL bases; SB anterior to level of PL bases; $PL >> AM > AL$; sensillae flagelliform with basal barbs, branched on distal 3/4; $PW/SD = 1.11-1.30$. Scutal measurements of holotype after original description, followed by means and ranges of 5 Pakistani specimens in parentheses after Traub and Nadchatram (1966a) : AW 62 (56, 53-62); PW 73 (68, 66-73); SB 22 (20, 19-22); ASB 28 (31, 28-33); PSB 28 (30, 28-32); AP 30 (28, 27-30); AM 36 (36, 35-37); AL 31 (31, 28-33); PL 48 (51, 48-51); sens. 64 (60, 60-64).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, tarsus III 14B, mastitarsala absent. Measurements as follows : Ip = 793-894. Leg I : 260-315; tarsus (81-85 x 22-28), tarsala (15-18). Leg II : 240-258; tarsus (70-72 x 18-24), tarsala (14-17). Leg III : 286-321; tarsus (91-93 x 16-19).

Type data : Holotype, JAMMU and KASHMIR, Khurdang, ex 'rat', VI.1949, S.L. Kalra, coll.

Type depository : Holotype in SAM.

Additional records : JAMMU and KASHMIR, Gilgit Agency, Chilas District, 6.4km N of Babusar, 2742m, 1 ex *Rattus rattoides*, 10.IX.1964, R. Traub and UM field team, coll.

Material examined : 1 specimen (B67450-12) on loan from M. Nadchatram, labelled : "*Microtrombicula khurdangensis* (Womersley 1952) - *Ochotona roylei* - Naran, Kaghan Valley, Hazara District, W. Pakistan, 2376m - 17 September 1964 - Coll. R. Traub"

Remarks : The above redescription is based on the literature and study of specimen (B67450-12) from PAKISTAN. *M. khurdangensis* runs to couplet 7 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a). It may be separated from other *Microtrombicula* species in having more than 1 pair of humeral setae and 3 genualae I, as also by the scutal dimensions and lack of mastitarsala III. Traub and Nadchatram (1966a) have recorded *M. khurdangensis* from Gilgit Agency, which falls within Jammu and Kashmir, India (and not Pakistan), as well as from Kaghan Valley in Pakistan. The microtarsala is inserted distal to tarsala on leg I, not proximal as illustrated (fig.12) by Traub and Nadchatram (1966a). The species name is derived from the type locality. Womersley and Audy (1957) point out that the type specimens were taken in Shyock valley, 8km below the Khurdang Pass in the Ladakh Province, and hence the name is to some extent a misnomer.

82. *Microtrombicula (Microtrombicula) latens* Traub and Nadchatram (Fig. 71)

Microtrombicula latens Traub and Nadchatram, 1966a, 305.

Microtrombicula sp. A Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

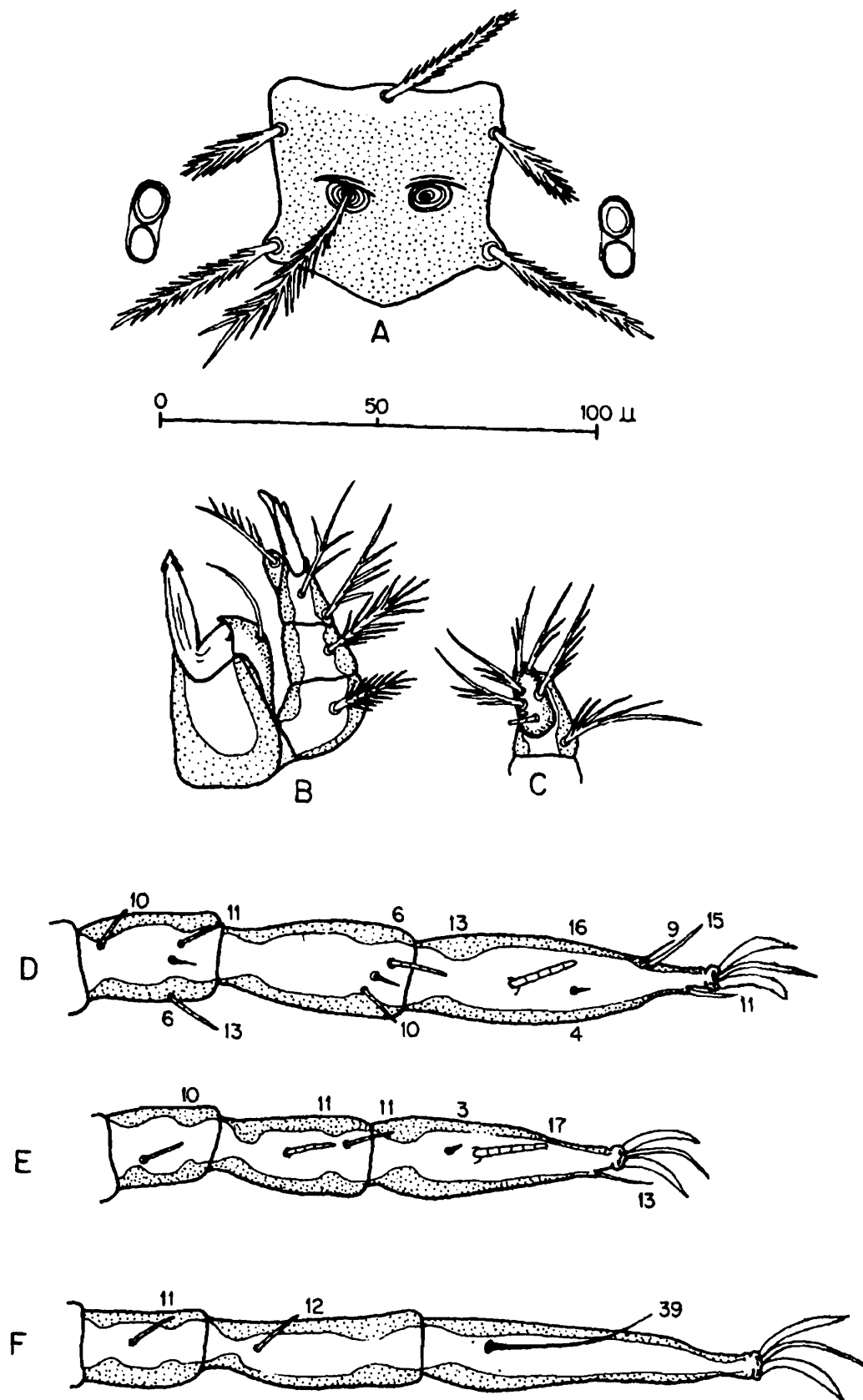


Fig. 71. *Microtrombicula latens*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 700x450 in engorged specimen. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 44-48; 28-36 dorsal idiosomal setae, measuring 42-48, arranged : 8-6(8)-6-4(6)-4(2)-2(4) (Original description : 28-30, measuring 48, arranged : 8-6-6-4-4(2)-2); 2 pairs of sternal setae, anterior 30-40, posterior 28-34; 30-36 preanal setae, 25-28; 6-8 postanal setae, 35-40; total idiosomal setae 74-86.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (30) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subquadrate with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin convex, caudal angle rounded; AM anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform with basal barbs, branched profusely along distal 1/2; PW/SD = 0.96-1.12. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 54 (53, 50-54); PW 55 (56, 53-58); SB 24 (22, 20-24); ASB 24 (27, 24-28); PSB 25 (25, 22-26); AP 25 (26, 24-28); AM 34 (34, 33-37); AL 26 (27, 25-29); PL 42 (43, 42-47); sens. 46 (46, -). Scutal measurements giving means and ranges of 4 NIV specimens : AW 47, 45-50; PW 51, 49-54; SB 18, 16-20; ASB 26, 25-27; PSB 26, 25-27; AP 25, 24-26; AM 34, 32-37; AL 23, 21-28; PL 39, 38-41; sens. 48, 45-54.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 779-803. Leg I : 273-288; tarsus (68-70 x 19-22), tarsala (15-16). Leg II : 227-238; tarsus (54-58 x 18-19), tarsala (17-21). Leg III : 276-279; tarsus (73-75 x 15), mastitarsala (43).

Type data : Holotype (B67926-10) and 1 paratype, PAKISTAN, Dir State, Dir, ex *Rattus* sp., 14.VIII.1964, R.L. Amoureux, coll.; 4 paratypes, same data, but ex *Rattus rattoides*, 13.VIII.1964; 1 paratype, Hazara District, Shogran, 2361m, ex *Rattus* sp., 4.VIII.1964; 1 paratype, same data, but taken 31.VI.1964.

Type depository : Holotype in USNM; paratypes in IMR, BM(NH), RML, GWHF, and Traub collection.

New records : HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 4 ex *Rattus rattus gangutrianus*, 17.IX.1968, NIV, coll.

Material examined : Paratype (B 67874-1), on loan from M. Nadchatram, labelled : "*Microtrombicula latens* - *Rattus* - Hazara District - Shogran 7750' - W. Pakistan - 31 July 1964" (31.VI.1964 in the original description).

Remarks : The above redescription is based on the original description, study of paratype (B 67874-1) and the NIV specimens. *M. latens* runs to couplet 5 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. buxtoni* (Womersley, 1952) in having coxa III 2B and mastitarsala III. They distinguish

M. latens in having tarsala II>I (tarsala II<I in *M. buxtoni*), posterior scutal margin behind PL bases measuring 14-15 (not exceeding 8 in *M. buxtoni*), PW-SD subequal (unequal in *M. buxtoni*) and 8 setae in 1st posthumeral row (6 in *M. buxtoni*). The only consistent differences encountered in our study are in the PW-SD dimensions and number of setae in 1st posthumeral row. Traub and Nadchatram (1966a) describe the posterior scutal margin as broadly rounded. In our study, the posterior margin is convex, but angled rather than rounded caudally. The microtarsala is inserted distal to tarsala on leg I, not proximal as illustrated (fig. 29) by Traub and Nadchatram (1966a). The differences in the number and arrangement of dorsal body setae, and the lower Ip (779-785) in the NIV specimens led Fernandes *et al.* (1988) to consider these specimens as separate from *M. latens*. The species name has been derived from the Latin meaning "hidden", suggested by the apparent scarcity of this chigger as well as by the possibility that it may be a hypodermal species.

83. *Microtrombicula (Microtrombicula) munda* (Gater) (Fig. 72)

Trombicula munda Gater, 1932, 149; Krishnan *et al.*, 1949c, 67.

Trombicula (Trombicula) munda, Wharton and Fuller, 1952, 67; Womersley and Audy, 1957, 258.

Trombicula (?Neotrombicula) munda, Womersley, 1952, 106.

Microtrombicula (Scapuscutala) munda, Vercammen-Grandjean, 1965, 118; Nadchatram and Joshee, 1966, 441.

Microtrombicula munda, Traub and Nadchatram, 1966a, 135; Prasad, 1974, 86.

Redescription of species : Larva. Colour in life pale orange.

Idiosoma : Measuring 245-375 x 210-290 in partially engorged specimens. Eyes 2/2, free on cuticle (Original description : 1/1; Vercammen-Grandjean, 1965 : 2/2). One pair of humeral setae, measuring 34-39; 24-28 dorsal idiosomal setae, measuring 19-29, arranged : 6-6-4-4-2(4)-2-(2); 2 pairs of sternal setae, anterior 20-24, posterior 24-29; 20-26 preanal setae, 16-24; 6-10 postanal setae, 20-28; total idiosomal setae 60-62.

Gnathosoma : Palpal setal formula B/b/bb(N)b/6B; palpal claw 3-pronged, ventral prong often inconspicuous (Original description and Vercammen-Grandjean, 1965 : 2-pronged); galeala N; cheliceral blade (25) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Subpentagonal with sparse, clear punctae and pronounced anterolateral shoulders; anterior margin shallowly biconcave; posterior margin convex, caudally angled; AM anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with few branches on distal 1/2; PW/SD = 1.19-1.28. Scutal measurements of holotype after Vercammen-Grandjean (1965), followed by range of 5 Malaysian specimens after Womersley (1952) : AW 35, 34-36; PW 47, 48-56; SB 14, 14-17; ASB 19, 20-22; PSB 18, 17-20; AP

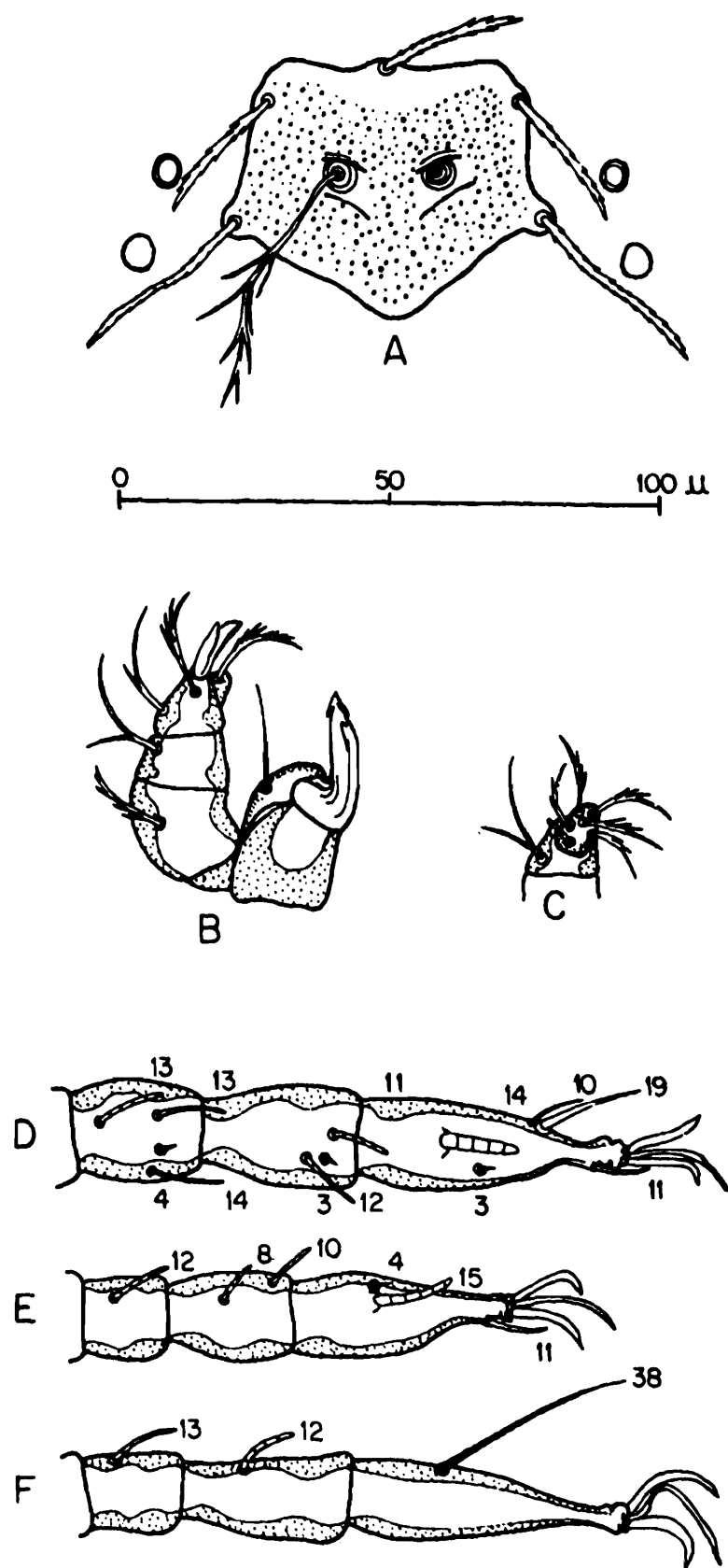


Fig. 72. *Microtrombicula munda*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

20, 20-22; AM 22, 25; AL 20, 17-20; PL 30, 25-28; sens. 38, 28. Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 46, 43-49; PW 57, 53-59; SB 17, 14-20; ASB 21, 19-22; PSB 25, 23-26; AP 23, 20-25; AM 27, 26-28; AL 26, 24-32; PL 34, 32-36; sens. 45, 38-50.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae. Measurements as follows : Ip = 541-613 (Vercammen-Grandjean, 1965 : 488). Leg I : 194-218 (Original description : 124; Vercammen-Grandjean, 1965 : 176); tarsus (50x17), tarsala (14). Leg II : 164-185 (Vercammen-Grandjean, 1965 : 138); tarsus (39x15), tarsala (15). Leg III : 183-212 (Vercammen-Grandjean, 1965 : 174); tarsus (51x14), mastitarsala (38).

Type data : Holotype and numerous paratypes, MALAYSIA, Kuala Lumpur, ex *Rattus rattus diardi*, 1929, Dr. W.J. Vickers and Dr. E.P.G. Ritchie, coll.

Type depository : Holotype and 2 paratypes in BM(NH); paratypes in USNM, MI, and King Edward VII College of Medicine, Singapore.

Additional records : WEST BENGAL, Calcutta, Barrackpore, ex *Rattus rattus*, 1947-48, Krishnan *et al.*, coll. MAHARASHTRA, Bombay, Bhandup area, Kajutekari, ex *R. rattus*, 26.XI.1959, A.K. Joshee, coll.

New records : KARNATAKA, Shimoga and North Kanara Districts, 41 ex *Rattus rattus wroughtoni*, 30.X-2.XI.1966, NIV, coll. MAHARASHTRA, Pune District, approximately 3,100 specimens ex *S. murinus*, *Paradoxurus hermaphroditus*, *Funambulus tristriatus*, *Rattus rattus rufescens*, and *Rattus rattus satarae*, I.1970-IX.1971, S.M. Kulkarni, coll.; Satara District, Mahabaleshwar, 126 ex *R. r. wroughtoni*, 12.XII.1984, P.K. Deshmukh, coll. RAJASTHAN, Kota District, 498 specimens ex 4 *R. r. wroughtoni* and 2 *S. murinus*, 28-30.X.1971, H.N. Kaul, coll. GOA, Mollem, 17 ex *R. r. wroughtoni*, 16.II.1984, S. Fernandes, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *M. munda* runs to couplet 9 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. alpicula* Traub and Nadchatram, 1966, in having coxae I-III unisetose, 3 genualae I, galeala N, 1 pair of humeral setae and mastitarsala III present. They distinguish *M. munda* in having 24 dorsal idiosomal setae, arranged : 6-6-4-4-2-2 (38, arranged : 8-2-8-6-6-4-2-2 in *M. alpicula*), and palpal claw 2-pronged (3-pronged in *M. alpicula*). The study of the NIV specimens indicates that the palpal claw is 3-pronged (ventral prong often inconspicuous), and eyes 2/2. The standard data is also higher than that given for the Malaysian specimens in the literature. The differences, however, are essentially proportional; hence, the NIV specimens are here regarded as representing *M. munda*. The NIV material from Pune District was earlier recorded by Kulkarni (1979) and Kulkarni *et al.* (1979) as *Blankaartia (Blankaartia) sp. indet.*, while the Rajasthan specimens were reported by Kaul *et al.* (1978) as *M. kajuterkrii*.

84. *Microtrombicula (Microtrombicula) palicula* new species

(Fig. 73)

Description of species : Larva.

Idiosoma : Measuring 491-566 x 317-356 in engorged specimens. Eyes 2/2, anterior distinct, on ocular plate. One pair of humeral setae, measuring 54-56; 42-43 dorsal idiosomal setae, measuring 38-42, arranged : 8-4-8-2(3)-6-6-4-4; 2 pairs of sternal setae, anterior 34, posterior 32; 37-40 preanal setae, 23-28; 8 postanal setae, 38-42; total idiosomal setae 93-97.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged, ventral prong often inconspicuous; galeala N (rarely f); cheliceral blade (33) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.13-1.19. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 69 (67, 65-69); PW 74 (72, 69-74); SB 22 (21, 21-22); ASB 30 (29, 28-30); PSB 32 (33, 32-34); AP 62 (62, 61-62); AM 39 (37, 35-39); AL 39 (35, 33-39); PL 49 (48, 47-49); sens. 64 (66, 64-68).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae. Measurements as follows : Ip = 833-847. Leg I : 285-290; tarsus (74x21), tarsala (16-17). Leg II : 252-259; tarsus (67x18), tarsala (17-20). Leg III : 293-302; tarsus (83x16), mastitarsala (47).

Type data : Holotype (NIV A96683.3) and 4 paratypes, HIMACHAL PRADESH, Mahasu District, Baghi, 2700-2760m, ex *Ochotona roylei*, 18.VII.1970, NIV, coll.

Remarks : *M. palicula* will run to couplet 9 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. munda* (Gater, 1932) and *M. alpicula* Traub and Nadchatram, 1966, in having 1 pair of humeral setae, coxae I-III unisetose, 3 genualae I, and mastitarsala III present. *M. palicula* may easily be separated from *M. munda* in having a greater number of dorsal idiosomal setae (24-28 in *M. munda*), a higher Ip range (541-613 in *M. munda*), and larger scutum (AW<50, PW<60 in *M. munda*). *M. palicula* differs from *M. alpicula* in having a higher Ip range (<648 in *M. alpicula*), larger scutum (AW measuring <44 and PW<52 in *M. alpicula*), and PW/SD ratio higher (1.00-1.06 in *M. alpicula*). The species name is an anagram of *alpicula*, which it closely resembles.

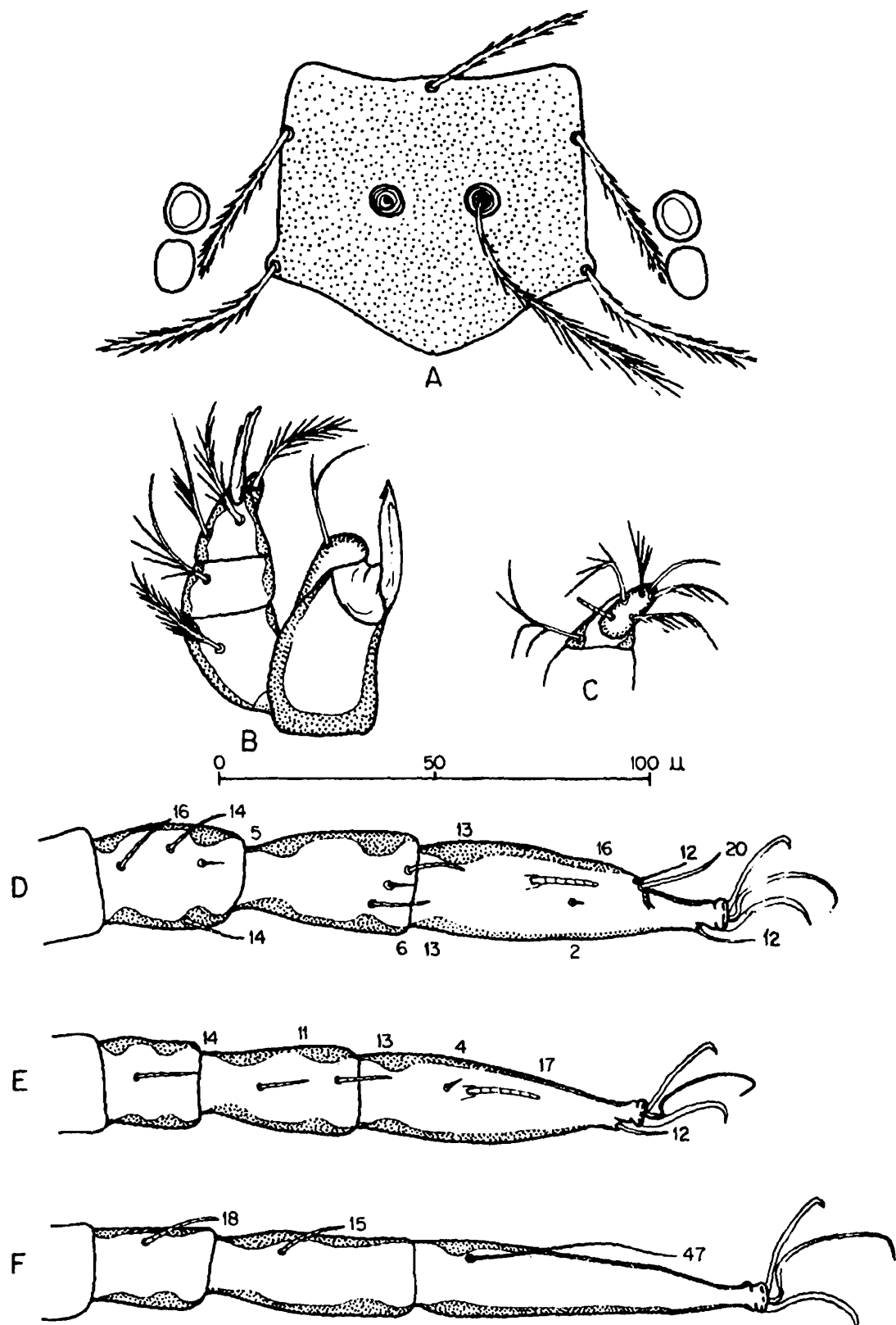


Fig. 73. *Microtrombicula palicula* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

85. *Microtrombicula (Microtrombicula) perissochaeta* Traub and Nadchatram
(Fig. 74)

Microtrombicula perissochaeta Traub and Nadchatram, 1966a, 317; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 400-620 x 224-350 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 48-56; 24 dorsal idiosomal setae, measuring 42-50, arranged : 6-6-4-4-2-2; 2 pairs of sternal setae, anterior 31-39, posterior 20-26; 36-42 peranal setae, 21-27; 6-8 postanal setae, 32-39; total idiosomal setae 72-80.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala B/b; cheliceral blade (24-30) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subquadrate with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin shallowly convex with caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL > AM > AL; sensillae flagelliform with basal barbs and few branches on distal 1/2; PW/SD = 0.94-1.06. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 47 (47, 45-50); PW 52 (53, 52-56); SB 22 (22, 21-23); ASB 31 (29, 27-31); PSB 24 (25, 24-26); AP 34 (34, 32-35); AM 42 (42, 40-44); AL 30 (28, 27-30); PL 52 (49, 51-54); sens. 71 (70, 68-71). Scutal measurements giving means and ranges of 10 NIV specimens : AW 47, 45-49; PW 51, 49-56; SB 22, 20-24; ASB 28, 27-29; PSB 23, 22-24; AP 30, 28-33; AM 38, 34-43; AL 26, 23-28; PL 48, 45-50; sens. 58, 55-60.

Legs : Similar to *M. alpicula* Nadchatram and Traub, 1966, in the number of ordinary and sensory setae; but, genu I 5B, 2 genualae, microgenuala, and coxa II 2B. Measurements as follows : Ip = 709-857 (Original description : mean of 3, 725). Leg I : 243-305; tarsus (71-80 x 15-18), tarsala (13). Leg II : 207-256; tarsus (58-66 x 15-17), tarsala (18). Leg III : 254-296; tarsus (72-86 x 13-14), mastitarsala (33).

Type data : Holotype (B66216-8), JAMMU and KASHMIR, Gilgit Agency, Kohighizar, Gupis, ex *Rattus* sp., 5.IX.1963, R. Traub and A.B. Mirza, coll.; 3 paratypes, same data, but 2361m, ex *Cricetulus* sp., taken 27.VIII.1964; 6 paratypes, same data, but ex *Rattus rattoides*; 1 paratype, same data, but Gilgit District, Kargah Nullah, 1463m, taken 21.VIII.1964. 5 paratypes, PAKISTAN, Dir State, Dir, East side of river, ex *Rattus* sp., 14.VIII.1964, R. Traub and A.B. Mirza, coll.; 3 paratypes, same data, but Chitral State, Chitral, 1463m, ex *R. rattoides*, taken 17.VIII.1964.

Type depository : Holotype and paratypes in USNM; paratypes in IMR, GWHF, RML, BM(NH), and R. Traub collection.

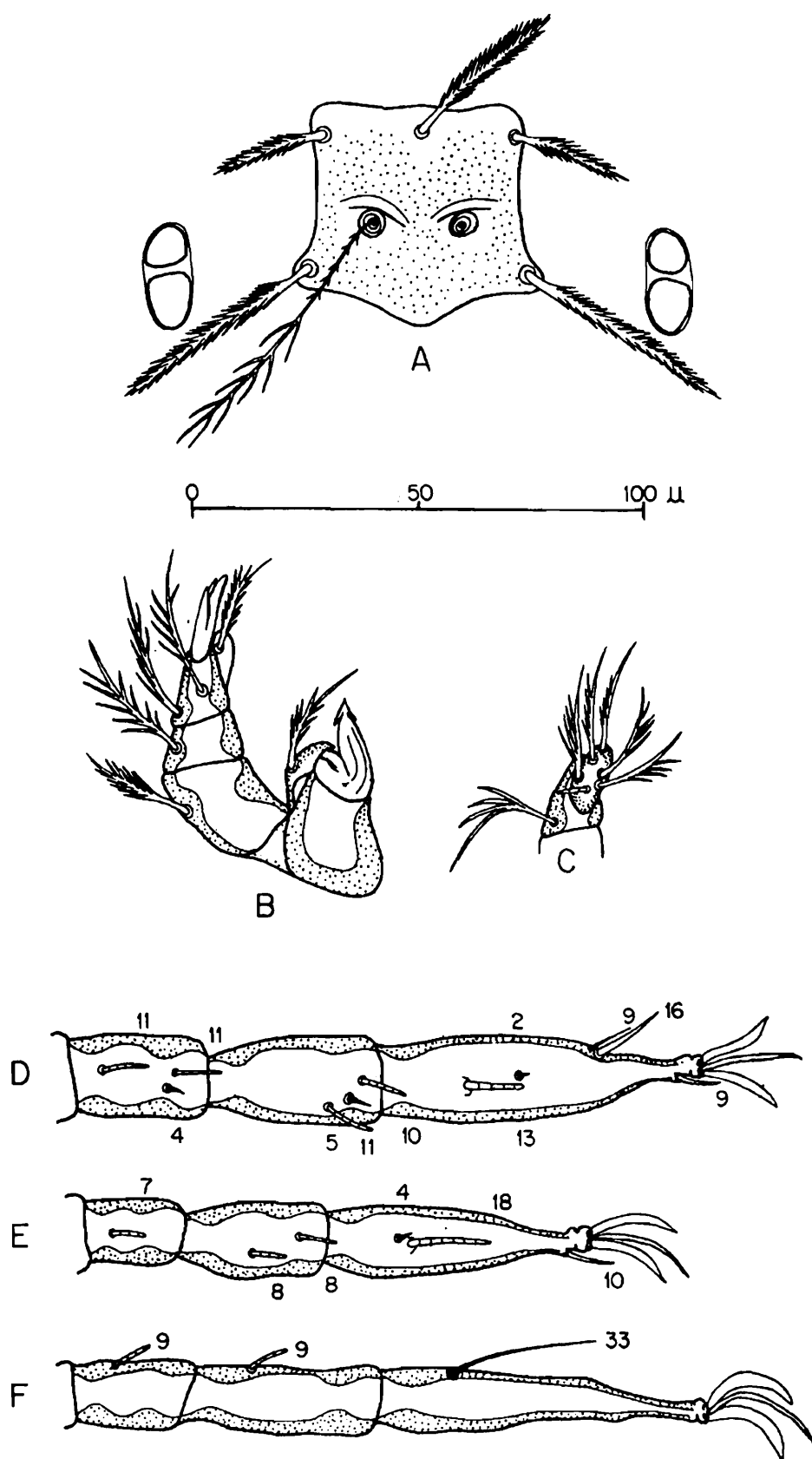


Fig. 74. *Microtrombicula perissochaeta*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Additional records : From JAMMU and KASHMIR, Gilgit, 56 ex 6 *Cricetulus* sp. and 5 *R. rattoides*, 11.VIII-2.IX.1964, R. Traub, coll.

New records : 6 records of collections from the Himalayan region by NIV field teams : JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 1 ex *Rattus rattoides*, 17.XI.1969; 2, same data, but ex 2 *Rattus* sp., 8.XI.1969; Ladakh District, Batalik, 2600-2900m, 12 ex *R. rattoides*, 27.VIII.1967; Kargil, 2440-2900m, 30 ex 2 *R. rattoides*, 17.VIII.1967 and 29.VII.1968.

Material examined : 3 paratypes on loan from USNM, labelled : “(B66701-7IN) - *Cricetulus* sp. - Gilgit Agency - Kohighizar, Gupis 7750' - W. Pakistan - 27 August 1964” 2 specimens (B66669-5 and -17) on loan from M. Nadchatram, labelled: “*R. rattoides* - Gilgit Agency - Gilgit, 3 miles SW of Gilgit, 5100' - W. Pakistan - 22 August 1964”

Remarks : The above redescription is based on the original description, study of the 3 paratypes, specimens B66669-5, B66669-17 and the NIV specimens. *M. perissochaeta* runs to couplet 3 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. anastosi* Traub and Nadchatram, 1966, in having coxa II bisetose. They distinguish *M. perissochaeta* in having posterior scutal margin convex (concave, evenly excised in *M. anastosi*), scutum larger (AW measuring 31, SB 15, and SD 37 in *M. anastosi*), and galeala barbed (nude in *M. anastosi*). The NIV specimens indicate a wide Ip range. Traub and Nadchatram (1966a) have recorded *M. perissochaeta* from Gilgit Agency, which falls within Jammu and Kashmir, INDIA, and not PAKISTAN as reported. The species name has been derived from the Greek *periss* meaning “in excess of the regular number”, and *chaeta* for “hair”, with reference to the bisetose coxa II.

86. *Microtrombicula (Microtrombicula) pseudoperissochaeta* new species (Fig. 75)

Description of species : Larva.

Idiosoma : Measuring 174-349 x 121-226 in unengorged to partially engorged specimens. Eyes 2/2, subequal, free on cuticle. One pair of humeral setae, measuring 33-40; 24-26 dorsal idiosomal setae, measuring 28-32, arranged : 6-6-4-4(2)-2; 2 pairs of sternal setae, anterior 23-25, posterior 20-21; 26-42 preanal setae, 16-20; 6-8 postanal setae, 22-26; total idiosomal setae 64-82.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (24) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subquadrate with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin shallowly convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform, slightly expanded, with basal barbs and branches on distal 2/3; PW/SD = 0.93-1.07. Scutal measurements of holotype followed by means and ranges of 10 specimens in

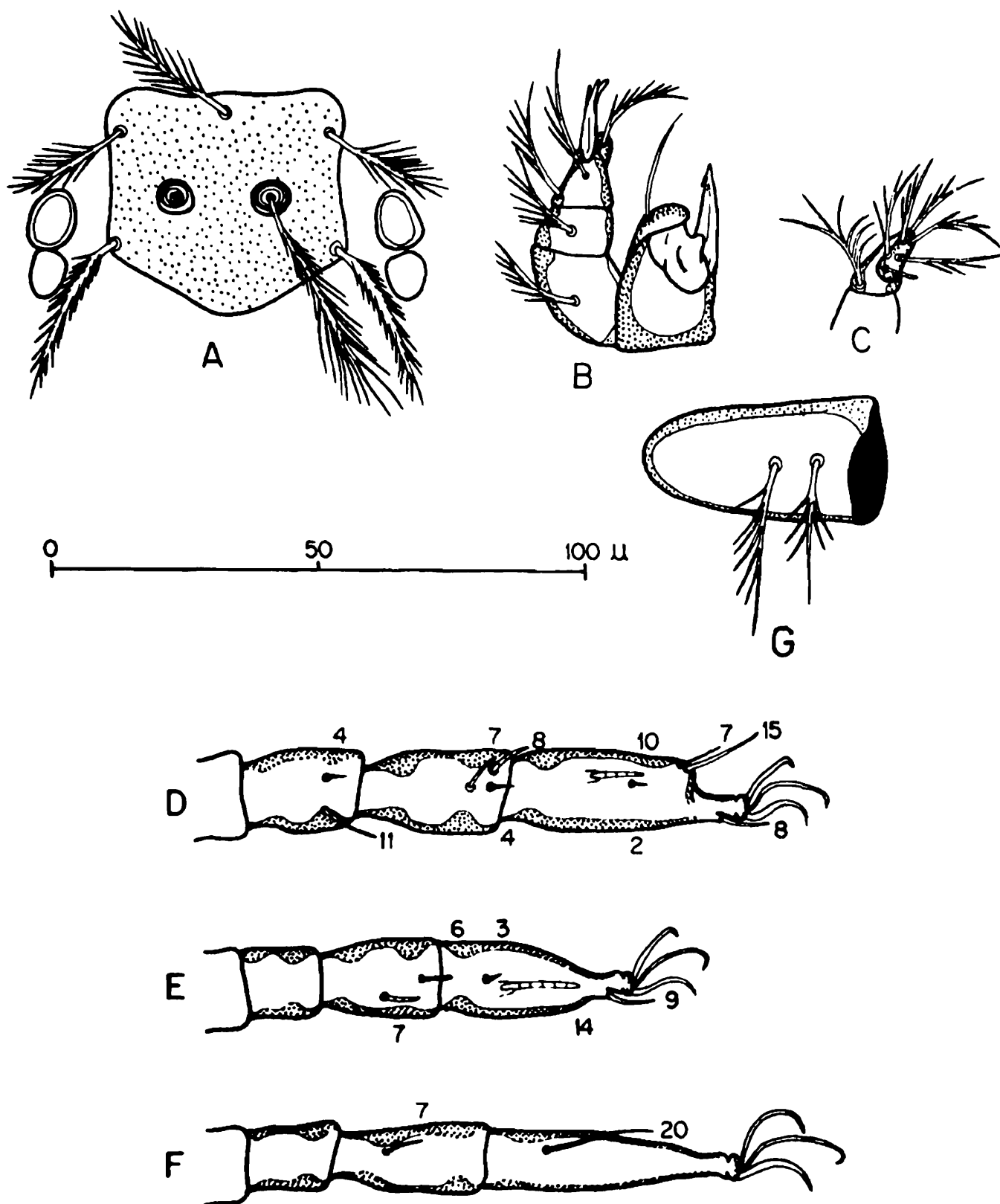


Fig. 75. *Microtrombicula pseudoperissochaeta* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa II.

parentheses : AW 40 (42, 40-45); PW 42 (44, 40-45); SB 18 (19, 17-20); ASB 22 (21, 20-23); PSB 22 (22, 20-24); AP 22 (22, 21-24); AM 24 (26, 24-32); AL 18 (20, 18-23); PL 33 (33, 32-34); sens. 35 (39, 35-44).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 6B, gennuala, microgennuala; coxa II 2B; genu II 4B, gennuala absent; genu III 4B, gennuala absent. Measurements as follows : Ip = 543-577. Leg I : 190-214; tarsus (44x15), tarsala (10). Leg II : 162-172; tarsus (36x14), tarsala (14). Leg III : 188-200; tarsus (48x11), mastitarsala (20).

Type data : Holotype (NIV A92617.9) and 9 paratypes, JAMMU and KASHMIR, Rajouri District, Naoshera, 750m, ex *Rattus rattoides*, 7.XII.1969, NIV, coll.

Additional records : 13 records of collections from the Himalayan region by NIV field teams : 64, same data as holotype, ex 2 *R. rattoides*; 43, same data, but taken 8.XII.1969; 1, same data, but ex *Tatera indica*, taken 7.XII.1969; 9, same data, but ex 3 *Mus musculus*, taken 7,8.XII.1969; 1, same data, but ex *Suncus murinus*, taken 7.XII.1969; Udhampur District, Dehari, 750-900m, 24 ex 2 *Rattus* sp., 30.XI.1969; 1, same data, but ex *Golunda ellioti*; Kulwanda, 1700-1800m, 4 ex 2 *R. rattoides*, 3,4.XII.1969.

Remarks : *M. pseudoperissochaeta* will run to couplet 3 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. perissochaeta* Traub and Nadchatram, 1966, and *M. anastosi* Traub and Nadchatram, 1966, in having coxa II bisetose. *M. pseudoperissochaeta* may easily be distinguished from these and other *Microtrombicula* species in a having single gennuala I with gennuala II and III absent. It may further be separated from *M. perissochaeta* in having galeala nude (barbed in *M. perissochaeta*), and a lower Ip range (709-857 in *M. perissochaeta*). The NIV *M. pseudoperissochaeta* specimens were taken in Udhampur and Rajouri Districts of Jammu and Kashmir; whereas, *M. perissochaeta* specimens were taken in Ladakh and Baramulla Districts. *M. pseudoperissochaeta* further differs from *M. anastosi* in having posterior scutal margin convex (concave, evenly excised in *M. anastosi*), and higher Ip (508 in *M. anastosi*). The species name draws attention to its close resemblance to *M. perissochaeta*.

87. *Microtrombicula (Microtrombicula) rajoriensis* (Womersley) (Fig. 76)

Trombicula rajoriensis Womersley, 1952, 120.

Trombicula (Miyatrombicula) rajoriensis, Womersley and Audy, 1957, 257.

Microtrombicula (Scapuscutala) rajoriensis, Vercammen-Grandjean, 1965, 122.

Microtrombicula rajoriensis, Traub and Nadchatram, 1966a, 314; Srivastava and Wattal, 1971, 154; Webb and Loomis, 1971, 321; Prasad, 1974, 87; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

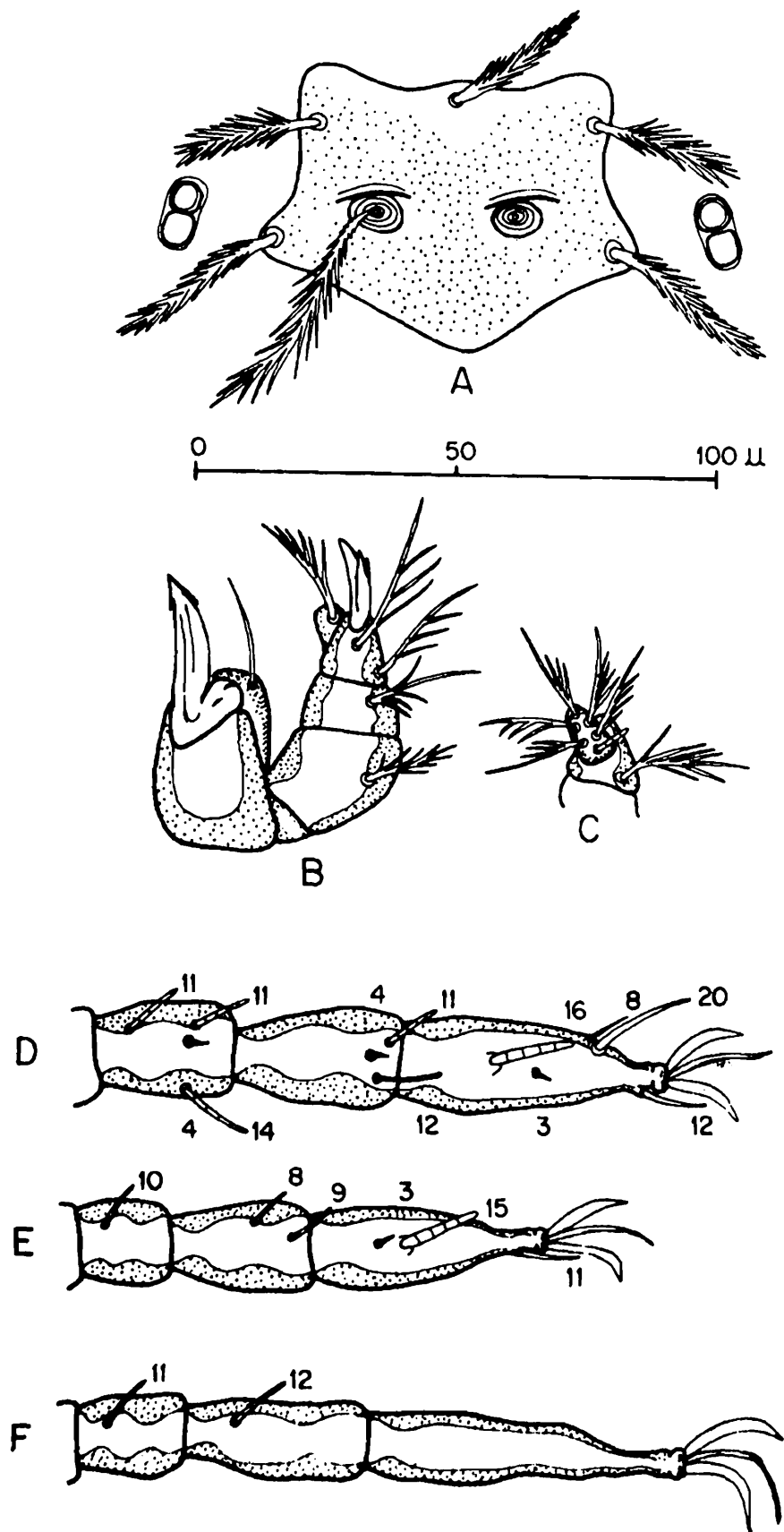


Fig. 76. *Microtrombicula rajoriensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 223-725 x 181-500 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 37-43; 36-48 dorsal idiosomal setae, measuring 35-40, arrangement highly variable as indicated in summary : (8-13)-(8-12)-(6-8)-(4-8)-(4-6)-(2-4)-(2) (Traub and Nadchatram (1966a) : 32-36, measuring 38, arranged : 8-8-8(6)-6(4)-4-2); 2 pairs of sternal setae, anterior 30-40, posterior 26-32; 34-46 preanal setae, 22-26; 6-12 postanal setae, 27-32 (Traub and Nadchatram (1966a) : 46-50 ventral setae); total idiosomal setae 84-106.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged (Original description and Vercammen-Grandjean, 1965 : 2-pronged; Traub and Nadchatram (1966a) : 3-pronged); galeala N (Original description and Vercammen-Grandjean, 1965 : B; Traub and Nadchatram, 1966a : N); cheliceral blade (30-34) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin shallowly convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 0.98-1.35 (Traub and Nadchatram, 1966a : 0.88-1.16). Scutal measurements of holotype after original description, followed by means of 6 Rajouri and 5 Pakistani specimens after Traub and Nadchatram (1966a) : AW 53, 53, 50; PW 56, 58, 58; SB 22, 23, 22; ASB 31, 28, 24; PSB 34, 27, 26; AP 28, 27, 24; AM 40, 37, 31; AL 25, 24, 24; PL 50, 45, 40; sens. 56, 58, -. Scutal measurements of 10 NIV specimens giving means and ranges : AW 52, 44-61; PW 59, 46-70; SB 23, 19-26; ASB 25, 22-28; PSB 25, 23-28; AP 24, 20-26; AM 30, 27-35; AL 25, 22-28; PL 36, 32-37; sens. 54, 39-54.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, coxa III 2B and tarsus III 14B with mastitarsala absent. Measurements as follows : Ip = 601-674 (Original description : 846; Traub and Nadchatram, 1966a : 611). Leg I : 212-246 (286; 213); tarsus (51-65 x 16-20), tarsala (16). Leg II : 178-206 (260; 182); tarsus (45-52 x 15-18), tarsala (15). Leg III : 211-237 (300; 216); tarsus (61-68 x 11-15).

Type data : Holotype, JAMMU and KASHMIR, Rajouri, ex 'rat', V.1948, S.L. Kalra, coll.

Type depository : Holotype in SAM.

Additional records : JAMMU and KASHMIR, Rajouri, 7 ex 'rat', V.1949, S.L. Kalra, coll.; 2, same data, but Mehandar, taken 22.IX.1950. HIMACHAL PRADESH, Kangra District, Dharamsala, ex *Suncus murinus*, IX.1968, NICD, coll.

New records : 82 records of collections from the Himalayan region by NIV field teams : CHATISHGARH, Bilaspur District, Deoli, 510m, 1 ex *Rattus rattus gangutrianus*, 25.III.1968. HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 16 ex *Suncus murinus*, 5.IV.1968; 1, same data, but ex *R. r. gangutrianus*, 8.IV.1968; Kangra District, Dadh, 1080-

1110m, 5 ex 2 *R. r. gangutrianus*, 14.IX.1967; Hamirpur, 900m, 19 ex *S. murinus*, 20.III.1969; 19, same data, but ex *R. r. gangutrianus*, taken 21.III.1969; Nurpur, 580-600m, 1 ex *R. r. gangutrianus*, 13.III.1969; Lahul District, Keylong, 3110-3170m, 5 ex *Apodemus flavicollis*, 28.IX.1967; Mandi District, Mandi, 920-1070m, 3 ex *S. murinus*, 31.VIII.1970; 13, same data, but taken 19.IX.1967. JAMMU and KASHMIR, Doda District, Khilani, 1200-1400m, 1 ex *M. musculus*, 20.XI.1969; Rajouri District, Naoshera, 750m, 597 ex 2 *R. rattoides*, 7,8.XII.1969; 188, same data, but ex 8 *M. musculus*, 7-9.XII.1969; 18, same data, but ex 2 *Millardia meltada*, 7,8.XII.1969; 1, same data, but ex *Golunda ellioti*, taken 9.XII.1969; 1, same data, but ex *S. murinus*, taken 7.XII.1969; Udhampur District, Dehari, 750-900m, 5 ex 2 *Rattus* sp., 30.XI.1969; 1, same data, but ex *S. murinus*; Kulwanda, 1700-1800m, 41 ex 3 *R. rattoides*, 3,4.XII.1969; Phalata, 750m, 15 ex 2 *Rattus* sp., 22,27.XI.1969; 2, same data, but ex *M. musculus*, taken 27.XI.1969; 1, same data, but ex *M. platythrix*, taken 22.XI.1969. UTTARANCHAL, Almora District, Sukhīdang, 250-1400m, 4 ex 3 *S. murinus*, 2,4.III.1967; Chamoli District, Nandprayag, 900-1200m, 4 ex *R. r. gangutrianus*, 24.IV.1968; Dehra Dun District, Dehra Dun, 600-800m, 2 ex *Bandicota bengalensis*, 28.X.1967; 13, same data, but ex *S. murinus*, taken 31.X.1967; Kanasar, 1800-2300m, 1 ex *R. rattoides*, 29.III.1968; Mussourie, 1400-2300m, 2 ex *R. rattoides*, 8.XI.1967; Pauri Garhwal District, Dogadda, 700-900m, 17 ex 7 *R. r. gangutrianus*, 12,13.XI.1967; 13, same data, but ex 3 *S. murinus*, taken 12.XI.1967; Shrinagar, 550m, 1 ex *S. murinus*, 24.X.1967; Nainital District, Bhimtal, 1200-1700m, 8 ex 2 *R. r. gangutrianus*, 24.XI.1966 and 23.XI.1967; 1, same data, but ex *Mus* sp., 27.XI.1966; 9, same data, but ex 3 *S. murinus*, 27,28.XI.1966; Bhowali, 1200-1700m, 1 ex *S. murinus*, 23.XI.1967; Garjia, 400-500m, 144 ex 3 *R. r. gangutrianus*, 15-19.XI.1967; 6, same data, but ex *S. murinus*, taken 19.XI.1967; Haldwani, 400-1100m, 20 ex 10 *R. r. gangutrianus*, 2-7.XII.1966 and 23-25.II, 28.XI.1967; 54, same data, but ex 4 *S. murinus*, taken 1-3.XII.1966 and 8.IX,28.XI.1967; Ranibag, 650m, 3 ex *R. r. gangutrianus*, 25.VIII.1970; Tehri District, Munikireti, 450m, 1 ex *Funambulus pennanti*, 25.X.1967.

Material examined : 1 topotype on loan from USNM, labelled : “*Microtrombicula rajoriensis* - No. 12485(a) - Rat - Rajori, Kashmir - May 1949” The specimen is in poor condition, without palps and legs, scutum without sensillae and AM.

Remarks : The above redescription is based on the literature, study of the topotype and NIV specimens. *M. rajoriensis* runs to couplet 4 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a). They consider this species closest to *M. latens* Traub and Nadchatram, 1966, from which it may be distinguished in lacking mastitarsala III (present in *M. latens*), in having scutum subpentagonal (subquadrate in *M. latens*), dorsal body setae arrangement commencing : 8-8-8 (8-6-6, in *M. latens*), and tarsala I>II (tarsala I<II in *M. latens*). The NIV material differs from the description of Traub and Nadchatram (1966a) of specimens taken from Rajouri and Pakistan by the greater number of dorsal body setae and their highly variable arrangement. It is close to the Rajouri series in the standard data and in having palpal claw 3-pronged and galeala N. Vercammen-Grandjean (1965) describes the legs as 7-7-6 segmented! Study of the NIV specimens confirms that the legs are all 7-segmented, as is usual in the genus *Microtrombicula*. The species name has been derived from the type locality.

88. *Microtrombicula (Microtrombicula) spicea* (Gater)

(Fig. 77)

Trombicula spicea Gater, 1932, 151.

Trombicula (?*Neotrombicula*) *spicea*, Womersley, 1952, 107.

Trombicula (Trombicula) spicea, Wharton and Fuller, 1952, 70; Womersley and Audy, 1957, 258.

Trombicula (Neotrombicula) spicea, Audy *et al.*, 1953, 27.

Trombicula (Microtrombicula) spicea, Domrow and Nadchatram, 1963, 162.

Microtrombicula (Scapuscutala) spicea, Vercammen-Grandjean, 1965, 120.

Microtrombicula spicea, Vercammen-Grandjean, 1968b, 70; Nadchatram, 1970b, 135; Fernandes *et al.*, 1988, 109.

Trombicula spicia, sic! Krishnan *et al.*, 1949c, 67.

Trombicula (Neotrombicula) specea, sic! Joshee, 1964, 47.

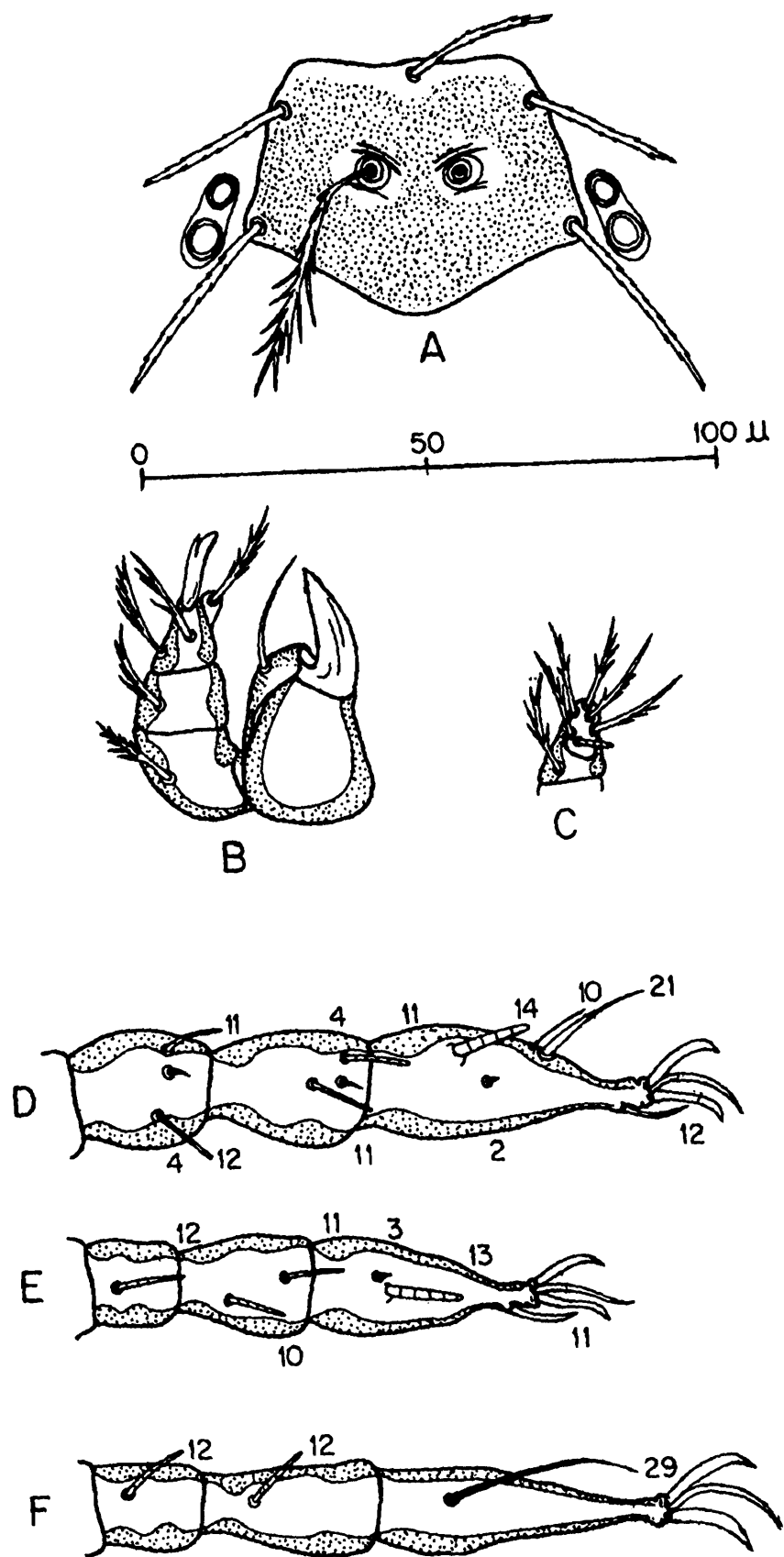
Redescription of species : Larva. Colour in life pale orange.

Idiosoma : Measuring 250-429 x 160-273 in partially engorged to engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 40-46; 22-24 dorsal idiosomal setae, measuring 29-38, arranged : 6-6-4-4-2-(2); 2 pairs of sternal setae, anterior 17-21, posterior 19-23; 18-26 preanal setae, 16-22; 6-10 postanal setae, 26-32; total idiosomal setae 54-64.

Gnathosoma : Palpal setal formula b/b(B)/bbb(B)/6b; palpal claw 2-pronged, axial prong internal; galeala N; cheliceral blade (23) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subquadrate with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin shallowly convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform, slightly expanded, with basal barbs and branches on distal 1/2; PW/SD = 1.17-1.31 (Womersley, 1952 : 1.33-1.37; Vercammen-Grandjean, 1965 : 1.22-1.33). Scutal measurements of a Malaysian and a Sri Lankan specimen after Vercammen-Grandjean (1965), followed by ranges of 4 Sri Lankan specimens after Womersley (1952) in parentheses : AW 40, 44 (42-50); PW 50, 56 (56-62); SB 13, 16 (17-20); ASB 19, 22 (25); PSB 22, 20 (17-20); AP 19, 23 (22-28); AM 24, 25 (20-22); AL 21, 21 (-); PL 29, 32 (31-36); sens. 46, - (-). Scutal measurements giving means and ranges of 10 NIV specimens : AW 48, 43-50; PW 60, 54-65; SB 16, 14-18; ASB 23, 21-25; PSB 26, 23-27; AP 23, 21-27; AM 30, 27-32; AL 28, 27-30; PL 39, 36-41; sens. 50x2, 45-57 x 2-3.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary

Fig. 77. *Microtrombicula spicea*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

and sensory setae. Measurements as follows : Ip = 580-633 (Vercammen-Grandjean, 1965 : 516 in Malaysian and 534 in Sri Lankan specimen), Leg I : 200-228 (183, 190); tarsus (49x18), tarsala (14). Leg II : 178-194 (157, 158); tarsus (40x16), tarsala (13). Leg III : 199-224 (176, 186); tarsus (50x14), mastitarsala (29).

Type data : Holotype and 4 paratypes, MALAYSIA, Selangor, Sungei Buloh, ex *Rattus canus malaisia*, 8.VIII.1930, M.L. Webber, coll.

Type depository : Holotype in BM(NH); paratypes in USNM, and IMR.

Additional records : MANIPUR, Palel, ex *Hadromys humei*, IX-XI.1945, STRU, coll. WEST BENGAL, Calcutta, Barrackpore, *Rattus rattus*, 1947-1948, K.V. Krishnan, coll.

New records : 22 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 25 ex 2 *Rattus rattus gangutrianus*, 8.IV.1968; Surkhigali, 1600-1620m, 6 ex 2 *Rattus rattoides*, 7,8.IX.1967; Kangra District, Dadh, 1080-1110m, 1 ex *R. rattoides*, 3.VI.1967; Dharamsala, 1220-1830m, 11 ex *R. r. gangutrianus*, 16.IX.1967; Kulu District, Kothi, 2 ex 2 *R. rattoides*, 2.X.1967; Manali, 1820-1860m, 7 ex 2 *R. rattoides*, 8,9.VIII.1970; 78, same data, but ex *Rattus* sp.; Palchan, 2000-2290m, 2 ex 2 *R. r. gangutrianus*, 27.VIII.1970; Mahasu District, Sungri, 2650-2750m, 26 ex 2 *R. rattoides*, 16,17.VII.1970. JAMMU and KASHMIR, Udhampur, Kulwanda, 1700-1800m, 1 ex *R. rattoides*, 3.XII.1969. UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, 1 ex *R. r. gangutrianus*, 26.III.1968; Kanasar, 1800-2300m, 1 ex *R. rattoides*, 31.III.1968; Sahaspur, 600m, 1 ex *S. murinus*, 2.IV.1968; Nainital District, Mukteshwar, 1400-2300m, 3 ex *R. rattoides*, i.V.1967; Uttarkashi District, Kuthanur, 1700-3200m, 1 ex *Rattus* sp., 20.VI.1969; Sukhrala, 1400-1800m, 46 ex *Rattus* sp., 27.VI.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Though earlier recorded from India by Krishnan *et al.* (1949c) and Audy *et al.* (1953), Traub and Nadchatram (1966a) make no reference to *M. spicea* in their key to the *Microtrombicula* species known from Pakistan and India. *M. spicea* will run to couplet 9 of this key along with *M. munda* (Gater, 1932) in having mastitarsala III present and 24 dorsal body setae, arranged : 6-6-4-4-2-2. *M. spicea* may be distinguished in having sensilla slightly expanded (not expanded in *M. munda*), palpal claw 2-pronged (3-pronged in *M. munda*), and scutum moderately punctate (sparsely punctate in *M. munda*). Vercammen-Grandjean (1965) reports the leg segmentation as 7-6-6! Study of NIV specimens confirms that the legs are all 7-segmented, as is usual in the genus *Microtrombicula*. He does, however, make an important observation that the slightly expanded sensillae of this species link it to the Schoengastine subgenus *Laurentella* Audy, 1956 (now synonymized with the nominate subgenus *Ascoschoengastia* Ewing, 1946).

89. *Microtrombicula (Microtrombicula) talens* new species
(Fig. 78)

Description of species : Larva.

Idiosoma : Measuring 215-487 x 139-341 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 38-40; 30-32 dorsal idiosomal setae, measuring 31-40, arranged : 8-6-6-4-4(6)-2; 2 pairs of sternal setae, anterior 26-32, posterior 22-27; 22-34 preanal setae, 22-27; 4-10 postanal setae, 27-33; total idiosomal setae 64-76.

Gnathosoma : Palpal setal formula B/B/b(B)b(B)B/6B; palpal claw 3-pronged, ventral prong often inconspicuous; galeala N; cheliceral blade (27) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subquadrate with shallowly biconcave anterior margin and pronounced anterolateral shoulders; posterior margin shallowly convex, caudally rounded; AM base anterior to level of AL bases, SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 3/4; PW/SD = 0.93-1.02. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 41 (41, 39-44); PW 43 (42, 41-46); SB 17 (18, 16-19); ASB 22 (22, 21-24); PSB 22 (22, 20-25); AP 23 (23, 20-27); AM 25 (28, 24-32); AL 18 (20, 17-23); PL 34 (34, 30-38); sens. - (46, 44-46).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, coxa III 2B and tarsus III 14B with mastitarsala absent. Measurements as follows : Ip = 658-694. Leg I : 232-248; tarsus (56x17), tarsala (14-15). Leg II : 192-204; tarsus (46x14), tarsala (15-18). Leg III : 232-247; tarsus (59-63 x 12-14).

Type data : Holotype (NIV A81613.3) and 1 paratype, UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, ex *Rattus rattus gangutrianus*, 29.X.1967, NIV, coll.; 4 paratypes, same data, but taken 31.X.1967; 6 paratypes, same data, but Mussourie, 1400-2300m, ex *Rattus rattoides*, taken 8.XI.1968.

Additional records : 102 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kinnaur District, Sangla, 2700m, 1 ex *R. r. gangutrianus*, 7.VI.1970; Kulu District, Jibi, 1000-1922m, 1 ex *R. rattoides*, 20.IV.1969; Mahasu District, Kotkhai, 1800-1900m, 8 ex *R. rattoides*, 11.V.1969; 1, same data, but ex *Mus musculus*, taken 14.V.1969; Simla District, Simla, 1700-2000m, 5 ex *R. rattoides*, 4.XI.1967. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 1 ex *R. rattoides*, 2.XI.1969; 1, same data, but ex *Suncus murinus*, 3.XI.1969; 2, same data, but ex *Capra* sp., 1.XI.1969; Rampore, 1400m, 1 ex *R. rattoides*, 5.XI.1969. UTTARANCHAL, Almora District, Loharghat, 1700-2100m, 3 ex *R. rattoides*, 11.III.1967; Sukhidang, 250-1400m, 7 ex *R. r. gangutrianus*, 6.III.1967; 5, same data, but ex 3 *S. murinus*, taken 4.III.1967; Chamoli District, Gwaldam, 1500-2100m, 4 ex 2 *R. rattoides*, 11.IV.1967 and 22.VII.1970; 6, same data, but ex *Rattus*

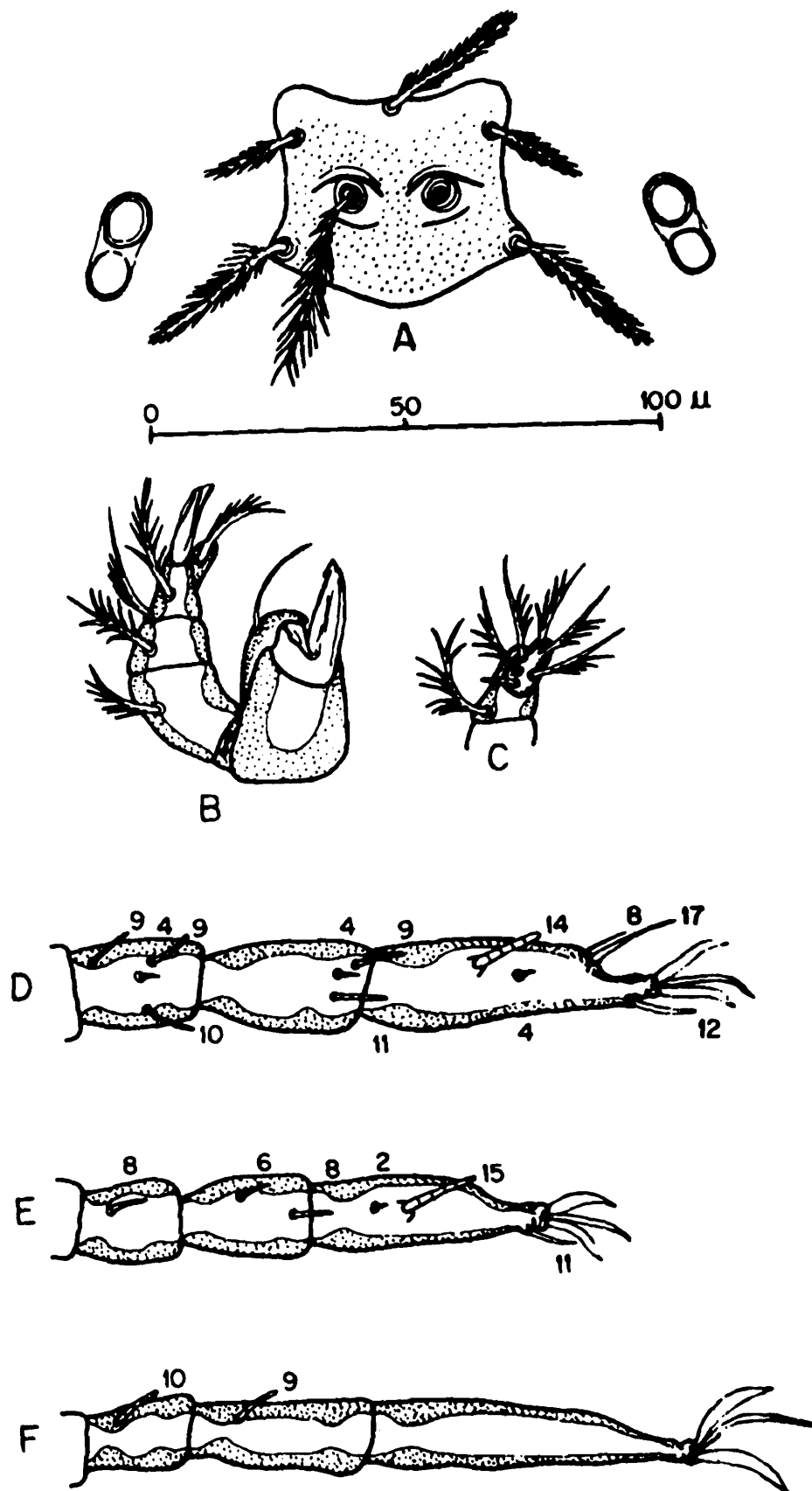


Fig. 78. *Microtrombicula talens* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

niviventer, 9.IV.1967; Nandprayag, 900-1200m, 7 ex 2 *R. r. gangutrianus*, 24,28.IV.1968; Dehra Dun District, Dehra Dun, 600-800m, 3 ex *R. r. gangutrianus*, 31.X.1967; Kanasar, 1800-2300m, 21 ex 3 *R. rattoides*, 30,31.III.1968; Mussourie, 1400-2300m, 26 ex 2 *R. rattoides*, 8.XI.1967; Pauri Garhwal District, Dogadda, 700-900m, 176 ex 10 *R. r. gangutrianus*, 11-13.XI.1967; 6, same data, but ex 2 *S. murinus*, 12.XI.1967; Shrinagar, 550m, 102 ex *R. r. gangutrianus*, 24.X.1967; 5, same data, but ex *S. murinus*; Nainital District, Bhimtal, 1200-1700m, 24 ex 4 *R. r. gangutrianus*, 24,27.XI.1966; 1, same data, but ex *Mus* sp., 27.XI.1966; Bhowali, 1200-1700m, 19 ex *R. r. gangutrianus*, 23.XI.1967; 1, same data, but ex *S. murinus*; Garjia, 400-500m, 306 ex 6 *R. r. gangutrianus*, 16-19.XI.1967; 3, same data, but ex *S. murinus*, 19.XI.1967; Haldwani, 400-1100m, 739 ex 34 *R. r. gangutrianus*, 2-7.XII.1966, 23-25.II.1967, and 28-29.XI.1967; Mukteshwar, 1400-2300m, 4 ex *R. rattoides*, 1.V.1967; 1, same data, but ex *R. niviventer*, 26.XI.1967; Pithoragarh District, Dharchula, 750-1100m, 67 ex *R. r. gangutrianus*, 18.III.1967; 1, same data, but ex *R. rattoides*, taken 15.V.1968; Milam, 1800-4400m, 2 ex *Alticola roylei*, 1.VI.1968; Uttarkashi District, Harsil, 2600m, 3 ex 2 *Apodemus flavicollis*, 11.VI.1969; 12, same data, but ex 2 *R. r. gangutrianus*, taken 14.VI.1967; Kuthanur, 1700-3200m, 28 ex 2 *Rattus* sp., 20.VI.1969; Sukhrala, 1400-1800m, 4 ex *R. rattoides*, 28.VI.1969; Uttarkashi, 900-1800m, 40 ex 3 *R. r. gangutrianus*, 10-13.IV.1968.

Remarks : *M. talens* will run to couplet 4 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. rajoriensis* (Womersley, 1952) in having bisetose coxae III and mastitarsala III absent. *M. talens* may easily be distinguished in having fewer idiosomal setae (84-106 in *M. rajoriensis*), dorsal body setal arrangement commencing : 8-6-6 (usually : 8-8-8 in *M. rajoriensis*) and scutum subquadrate (subpentagonal in *M. rajoriensis*). *M. talens* is also close to *M. latens* Traub and Nadchatram, 1966, from which it may easily be separated in having tarsus III 14B with mastitarsala absent (13B with mastitarsala present in *M. latens*), and a lower Ip range (779-803 in *M. latens*). The species name is an anagram of *latens*, which it closely resembles.

90. *Microtrombicula (Microtrombicula) unigenuala* new species

(Fig. 79)

Microtrombicula sp. E Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 522-544 x 21-330 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 61-63; 35 dorsal idiosomal setae, measuring 46-49, arranged : (7/9)-6-6-4-4-4-(4/2); 2 pairs of sternal setae, anterior 44-45, posterior 38-40; 39-40 preanal setae, 31-33; 5-6 postanal setae, 40-43; total idiosomal setae 86.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (27) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

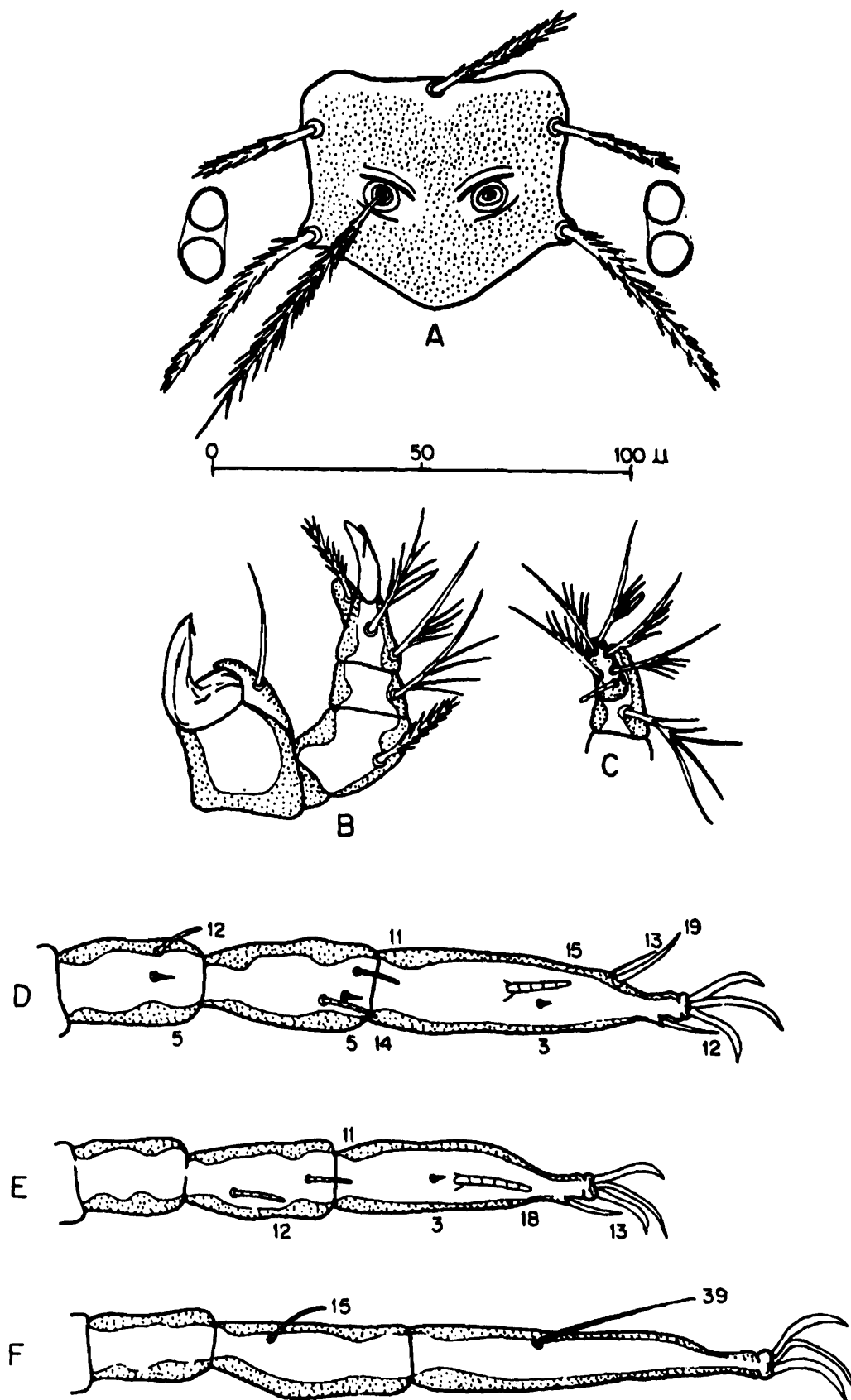


Fig. 79. *Microtrombicula unigenuala* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Densely punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudally angled; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform with basal barbs and branches on distal 3/4; PW/SD = 1.14-1.21. Scutal measurements of holotype followed by paratype : AW 59, 59; PW 63, 64; SB 24, 24; ASB 28, 25; PSB 27, 28; AP 25, 24; AM 38, 37; AL 30, 32; PL 54, 54; sens. 73, 66.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 6B, genuala, microgenuala; genu II 4B, genuala absent; coxa III 2B, and genu III 4B with genuala absent. Measurements as follows : Ip = 840-851. Leg I : 296-297; tarsus (76x18), tarsala (15-16). Leg II : 248-253; tarsus (62x16), tarsala (18-20). Leg III : 296-301; tarsus (86x15), mastitarsala (39).

Type data : Holotype (NIV A83160.3) and 1 paratype, UTTARANCHAL, Chamoli, Badrinath, 3650m, ex *Alticola roylei*, 16.VI.1968, NIV, coll.

Remarks : *M. unigenuala* will run to couplet 5 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. buxtoni* (Womersley, 1952) and *M. latens* Traub and Nadchatram, 1966, in having coxa III bisetose and mastitarsala III present. *M. unigenuala* may easily be distinguished in having a single genuala I with genuala II and III absent (3 genualae I with genuala II and III present in other 2 species). This unusual number of genualae (2-0-0) is seen also in *M. pseudoperissochaeta* n. sp. *M. unigenuala* differs, however, in having coxa II 1B and coxa III 2B (2B and 1B in *M. pseudoperissochaeta*), a higher number of dorsal body setae (24-26 in *M. pseudoperissochaeta*), and a higher Ip range (543-577 in *M. pseudoperissochaeta*). The species name draws attention to the single genuala on leg I, unusual in *Microtrombicula* species.

91. *Microtrombicula (Microtrombicula) vacillata* new species

(Fig. 80)

Description of species : Larva.

Idiosoma : Measuring 496-568 x 275-366 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 48-53; 42-46 dorsal idiosomal setae, measuring 35-43, irregularly arranged, arrangement in holotype : 10-4-8-8-4-6-4-2; 2 pairs of sternal setae, anterior 30-38, posterior 30-32; 36-46 preanal setae, 24-30; 4-6 postanal setae, 32-38; total idiosomal setae 90-102.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged, ventral prong often inconspicuous; galeala N (rarely f); cheliceral blade (28) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

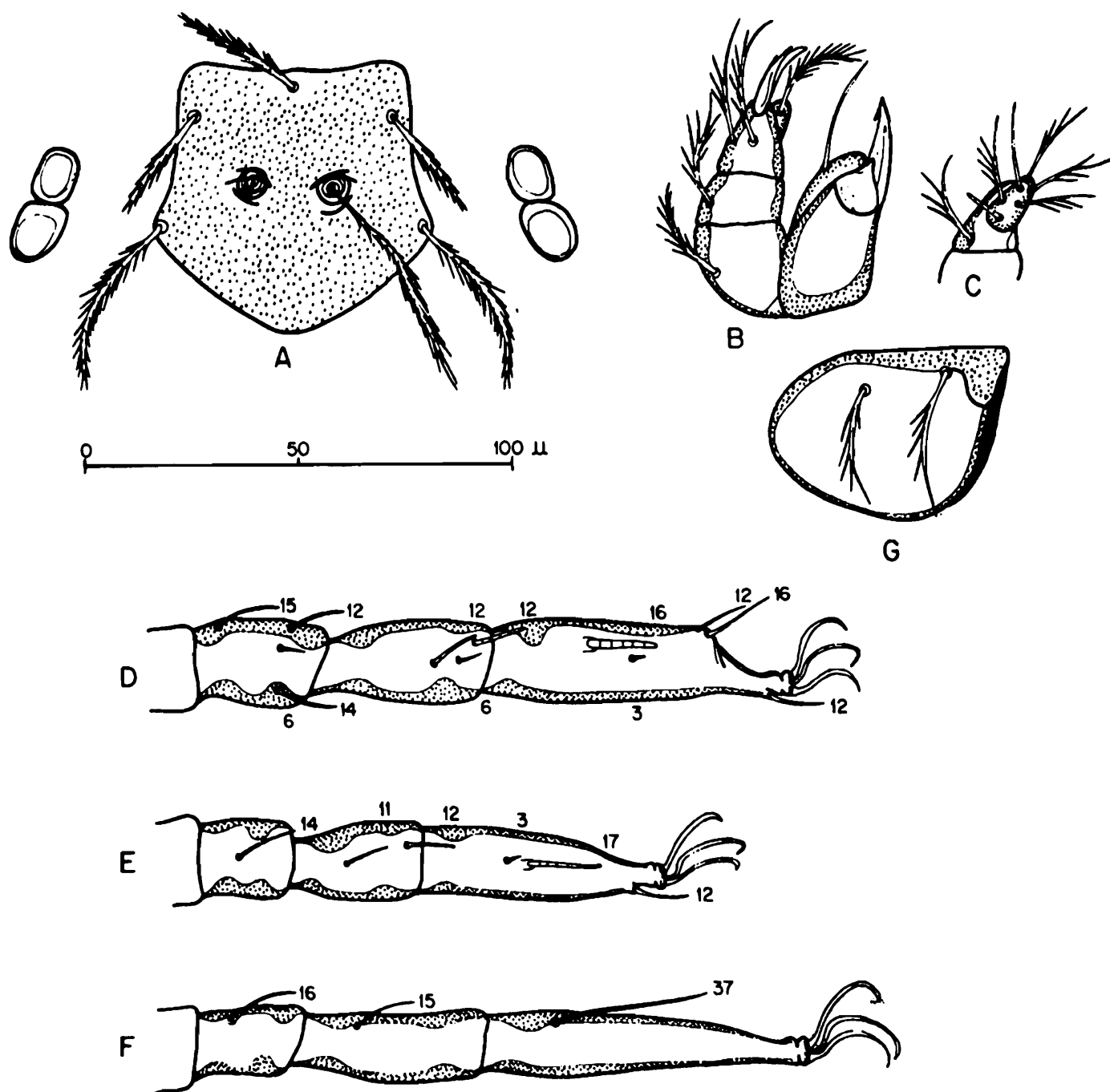


Fig. 80. *Microtrombicula vacillata* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudally angled; AM base anterior to level of AL bases; SB anterior to level of PL bases; $PL \gg AM > AL$; sensillae flagelliform with basal barbs and branches on distal 1/2; $PW/SD = 0.95-1.13$. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 46 (50, 46-55); PW 55 (57, 54-60); SB 18 (18, 17-20); ASB 28 (26, 23-28); PSB 30 (29, 27-31); AP 26 (26, 24-27); AM 31 (33, 31-34); AL 27 (27, 26-29); PL 44 (46, 44-47); sens. 59 (55, 50-59).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 4B, 3 genualae (sometimes 5B, 2 genualae on one leg), microgenuala, and coxa III 2B (rarely 3B on one leg). Measurements as follows : Ip = 748-766. Leg I : 263-271; tarsus (70x19), tarsala (15-16). Leg II : 217-229; tarsus (55x15), tarsala (16-18). Leg III : 268-272; tarsus (74x14), mastitarsala (37).

Type data : Holotype (NIV A84731.13), and 1 paratype, HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, ex *Ochotona roylei*, 20.IX.1968, NIV, coll.; 3 paratypes, same data, but Lahul District, Kirting, 2680-3250m, ex 2 *Rattus rufescens*, taken 23.IX.1968.

Remarks : *M. vacillata* will run to couplet 5 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. buxtoni* (Womersley, 1952) and *M. latens* Traub and Nadchatram, 1966, in having coxa III bisetose and mastitarsala III present. *M. vacillata* may be distinguished in having a greater number of dorsal body setae (24-34 in *M. buxtoni*; 28-36 in *M. latens*), and their arrangement irregular (usually : 6-6-4-4-2-2 in *M. buxtoni* and : 8-6-6-4-4-2 in *M. latens*). *M. vacillata* may further be separated from *M. buxtoni* in having a higher PW/SD ratio (0.81-0.89 in *M. buxtoni*). It further differs from *M. latens* in having a lower Ip range (779-803 in *M. latens*). The species name draws attention to the variable number of genualae I and coxalae III.

92. *Microtrombicula (Microtrombicula) vencotrisa* new species (Fig. 81)

Microtrombicula sp. F Fernandes et al., 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 376-480 x 220-290 in partially engorged to engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 47-51; 34-40 dorsal idiosomal setae, measuring 35-48, irregularly arranged, arrangement in holotype : 8-2-6-2-6-2-6-2-2; 2 pairs of sternal setae, anterior 33-38, posterior 30-31; 32-38 preanal setae, 25-29; 4-10 postanal setae, 30-38; total idiosomal setae 84-88.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (26) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

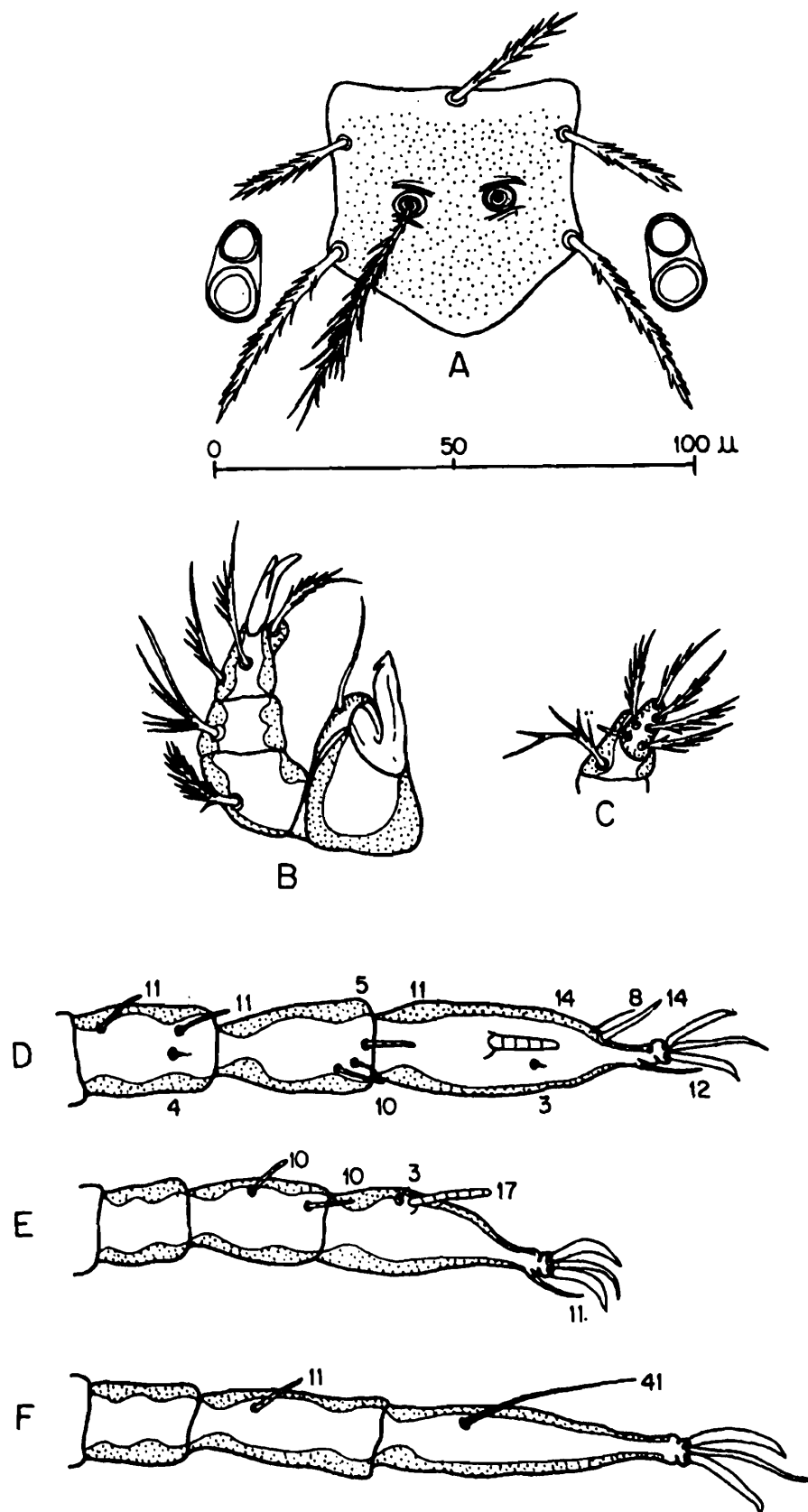


Fig. 81. *Microtrombicula vencotrisa* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>>AM>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD 0.84-0.98. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 48 (48, 45-50); PW 49 (50, 46-53); SB 19 (18, 16-19); ASB 24 (24, 23-27) PSB 28 (29, 27-30); AP 22 (23, 22-25); AM 31 (32, 31-34); AL 27 (27, 26-30); sens. 46 (52, 46-55).

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 5B, 2 genualae, microgenuala; genu II 4B, genuala absent; coxa III 2B, and genu III 4B, genuala absent. Measurements as follows : Ip = 684-731. Leg I : 237-256; tarsus (60x19), tarsala (14-15). Leg II : 202-216; tarsus (47x18), tarsala (17-18). Leg III : 240-263; tarsus (66x14), mastitarsala (41).

Type data : Holotype (NIV A74875.22) and 9 paratypes, UTTARANCHAL, Uttarkashi District, Harsil, 2600m, ex *Rattus rattus gangutrianus*, 14.VI.1967, NIV, coll.

Additional records : 32, same data as type series, but ex 2 *R. r. gangutrianus*; 13, same data, but Sakhi, 2700m, ex 2 *Rattus rattoides*, taken 6,7.VI.1969.

Remarks : *M. vencotrisa* will run to couplet 5 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a) along with *M. buxtoni* (Womersley, 1952) and *M. latens* Traub and Nadchatram, 1966, in having coxa III bisetose and mastitarsala III present. *M. vencotrisa* may easily be distinguished from these and all known *Microtrimbicula* species in having 2 genualae I with genuala II and III absent. *M. vencotrisa* is close to *M. ventricosa* Traub and Nadchatram, 1966, in having 2 genualae I, mastitarsala III and tarsala II>I. It may, however, be easily distinguished by the absence of genuala II and III (present in *M. ventricosa*), in having coxa III bisetose (unisetose in *M. ventricosa*), and a lower Ip range (798-849 in *M. ventricosa*). The species name is an anagram of *ventricosa*, which it closely resembles.

93. *Microtrombicula (Microtrombicula) ventricosa* Traub and Nadchatram (Fig. 82)

Microtrombicula ventricosa Traub and Nadchatram, 1966a, 305.

Microtrombicula sp. B Fernandes et al., 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 440-690 x 232-460 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 57-62; 36-40 dorsal idiosomal setae, measuring 42-47, arranged : 8-4(2-6)-8-6-6-4-2; 2 pairs of sternal setae, anterior 40-46, posterior 38; 36-42 preanal setae, 29-32; 8-16 postanal setae, 39-42; total idiosomal setae 92-98.

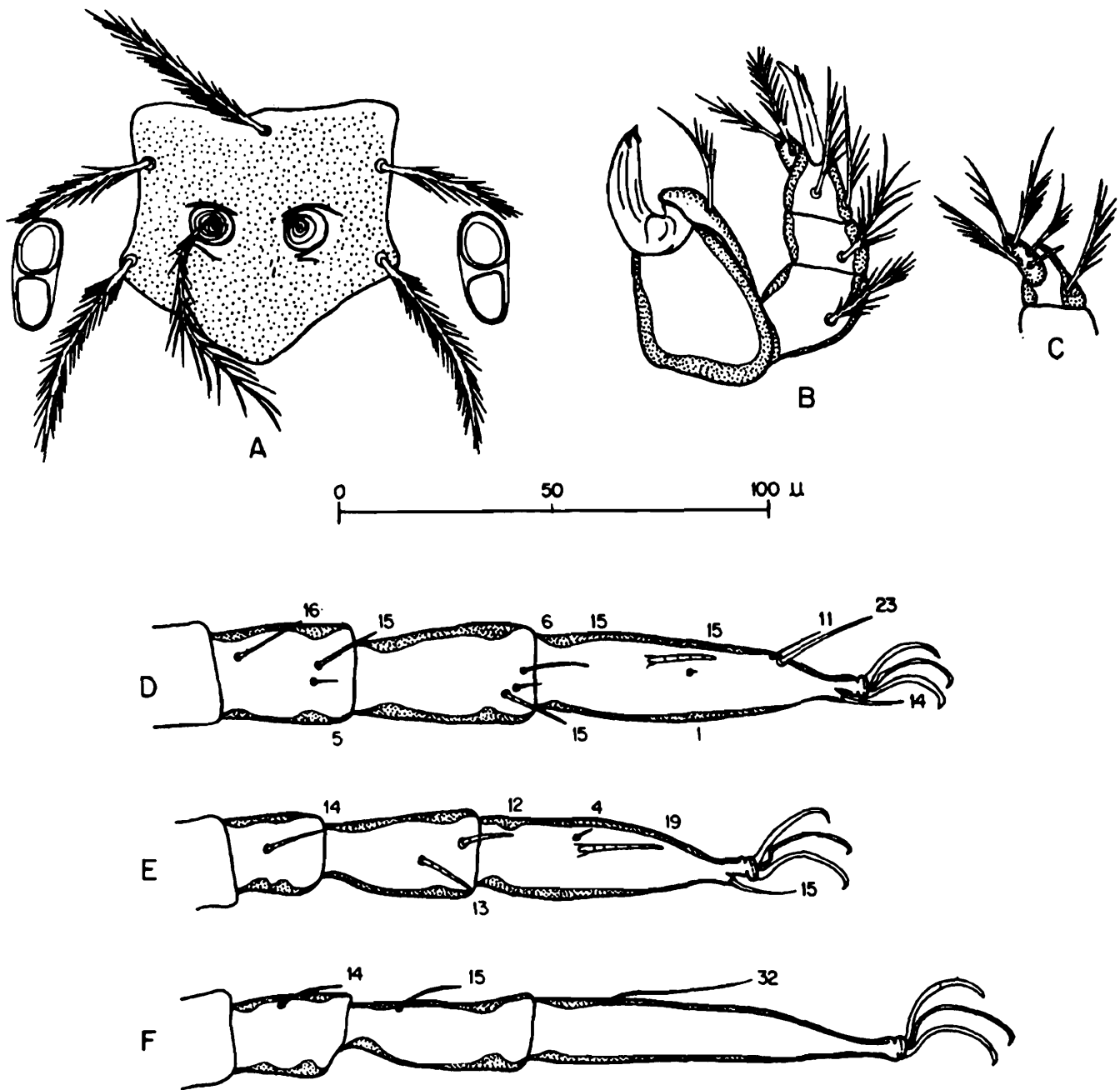


Fig. 82. *Microtrombicula ventricosa*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula B/B/BBB/6B; palpal claw 3-pronged; galeala B; cheliceral blade (30) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal with shallowly biconcave anterior margin and anterolateral shoulders; posterior margin convex, caudal angle rounded; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 0.92-0.98 (Original description : 1.02-1.10). Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 59 (60, 59-62); PW 69 (66, 64-69); SB 22 (21, 19-23); ASB 29 (31, 29-32); PSB 34 (34, 32-36); AP 26 (26, 24-28); AM 42 (44, 42-48); AL 30 (32, 29-34); PL 54 (55, 53-56); sens. 71 (no variation recorded). Scutal measurements giving means and ranges of 3 NIV specimens : AW 56, 55-57; PW 58, 57-60; SB 20, 19-21; ASB 30, 29-32; PSB 31, 30-33; AP 25, 24-26; AM 45, 44-46; AL 31, 30-32; PL 51, 48-53; sens. 71, 66-76.

Legs : Similar to *M. alpicula* Traub and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 5B, 2 genualae, and microgenuala. Measurements as follows : Ip = 798-849. Leg I : 275-297; tarsus (76-77 x 20), tarsala (15-16). Leg II : 241-251; tarsus (64-65 x 19), tarsala (19). Leg III : 281-301; tarsus (86-88 x 14), mastitarsala (32).

Type data : Holotype (B63456-4), Pakistan, Hazara District, Kaghan Valley, Naran, in an area of glacial till, 2376m, ex *Hyperacrius fertilis*, 14.X.1962, R. Traub, coll.; 1 paratype, same data, but taken 9.X.1962; 17 paratypes, same data, but ex 6 *Alticola roylei*, taken ?.X.1962; 1 paratype, same data, but ex *Rattus rattus*, taken 14.X.1962; 2 paratypes, same data, but ex 2 *Rattus rattoides*, 7,8.X.1964; 8 paratypes, same data, but Naran and Soch, ex 3 *A. roylei*, 18.IX and 8,9.X.1964.

Type depository : Holotype in USNM; paratypes in IMR, GWHF, RML, BM(NH), and Traub collection.

New records : JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 1 ex *Rattus rattoides*, 7.XI.1969, NIV, coll.; 2, same data, but ex *Rattus* sp., taken 8.XI.1969.

Remarks : The above redescription is based on the original description and study of the NIV specimens. *M. ventricosa* runs to couplet 6 of the key to *Microtrombicula* species known from Pakistan and India given by Traub and Nadchatram (1966a). They distinguish it from *M. khurdangensis* (Womersley, 1952), *M. kajutekrii* (Joshee, 1964), *M. munda* (Gater, 1932), and *M. alpicula* Traub and Nadchatram, 1966, with unisetose coxae, in having 2 genualae I (3 genualae in other 4 species), and galeala barbed (nude in other 4 species). The NIV specimens agree closely in standard data and other diagnostic characters with the Pakistani type series. The species name has been derived from the Latin for “pot-bellied” or “gluttonous”, suggested by the grossly distended body of the engorged specimens.

Genus *Miyatrombicula* Sasa *et al.*

Trombicula (*Miyatrombicula*) Sasa, Kawashima and Egashira, 1952, 337; Sasa and Ogata, 1953, 333; Audy, 1957, 217.

Miyatrombicula, Vercammen-Grandjean, 1960, 469; 1967, 127; 1968b, 62; Vercammen-Grandjean and Langston, 1976, 96; Brennan and Goff, 1977, 557; Kudryashova, 1978, 154; Tanskul and Nadchatram, 1983, 597.

Type species : *Trombicula kochiensis* Sasa, 1952, by original designation.

Diagnosis : Trombiculini larvae commonly parasitic on small mammals, rarely on reptiles. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 3 genualae I; coxa III uni- or multisetose; genuala III and short, fine mastitarsala III usually present. Palpal tarsus 7B or 7B.S; palpal femoral seta B, genual and tibial usually B; palpal claw 3-pronged; cheliceral blade with dorsal subapical tooth and tricuspid cap; galeala N or B. Eyes 2/2, on ocular plate. Scutum pentagonal without anterolateral shoulders; scutal punctae simple; sensillae flagelliform with distal branches, or slightly expanded.

Remarks : Tanskul and Nadchatram (1983) have reviewed and redefined the genus *Miyatrombicula* in the light of previously described species and their description of a new species *M. benensoni*. They have synonymized subgenus *Paramiyacula* Vercammen-Grandjean, 1960 (with palpal tarsus 7B) and subgenus *Miyacarus* Vercammen-Grandjean, 1967 (also proposed on the basis of palpal tarsus 7B) with the nominate subgenus. They point out that characters such as presence of mastitarsala III, multisetose coxa III, palpo setal formula B/B/BBB, and galeala B, once considered of generic importance, are no longer found to be common to the known *Miyatrombicula* species. Hence, they regard the presence or absence of subterminala on palpal tarsus insufficient basis to merit independent subgeneric status. The taxonomic arrangement proposed by Tanskul and Nadchatram (1983) is followed here. *Trombicula cooli* Domrow, 1962, and *Tragardhula najai* Hiregaudar, 1958, are transferred to *Miyatrombicula*. Thus, 2 species are reported here from India, bringing the number of known *Miyatrombicula* species to 21.

94. *Miyatrombicula cooli* (Domrow) new combination
(Fig. 83)

Trombicula cooli Domrow, 1962e, 39.

Redescription of species : Larva.

Idiosoma : Measuring 231-649 x 190-400 in unengorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 38-41; 34 dorsal idiosomal setae, measuring 28-37, arranged : 6-8-8-6-4-2; 2 pairs of sternal setae; 24 preanal setae, 24; 12 postanal setae, 33; total idiosomal setae 76.

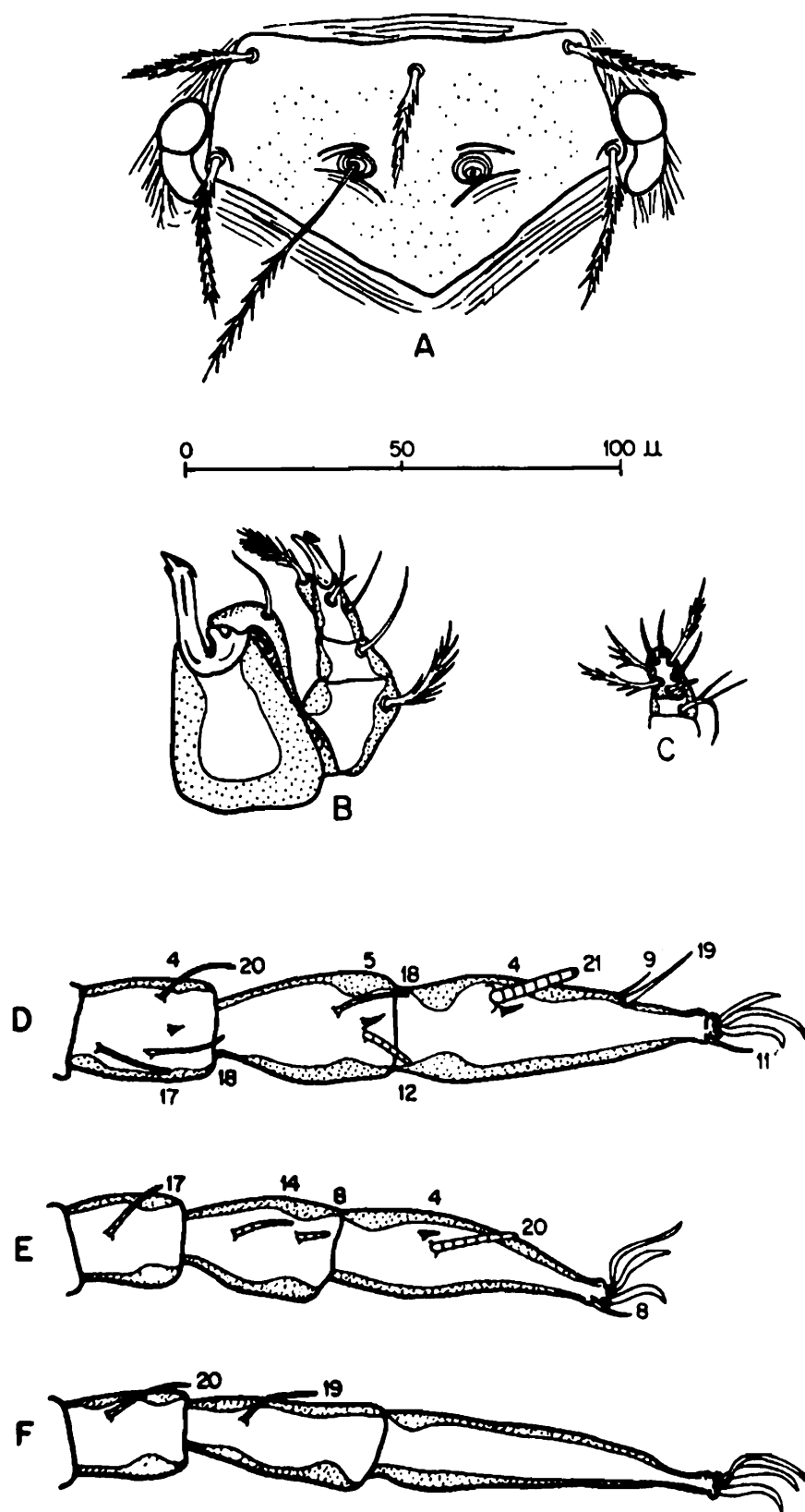


Fig. 83. *Miyatrombicula cooli*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gnathosoma : Palpal setal formula B/N/bNb/4B.3N; palpal claw 3-pronged, accessory prongs small, arising subapically from strong axial claw (Original description : 2-pronged); galeala N; cheliceral blade (31) with subapical dorsal tooth and distinct tricuspid cap; gnathobase impunctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, pentagonal with shallowly biconcave anterior margin; posterior margin convex, caudally angled; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AL>AM; sensillary bases with antero- and prominent postero-medial cuticular ridges; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.52-1.54. Scutal measurements of 3 type specimens after original description : AW 72, 74, 73; PW 94, 94, 94; SB 28, 29, 30; ASB 29, 30, 29; PSB 33, 31, -; AP 27, 26, 27; AM 30, -, 32; AL 31, 34, 35; PL 39, 36, 37; sens. 64, 69, 69.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip and leg measurements not recorded. Leg I : coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (74x22) 22B, tarsala (21), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (64x18) 16B, tarsala (18), microtarsala, pretarsala. Leg III : coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (78x15) 15B.

Type data : Holotype, 3 paratypes and 3 damaged specimens, UTTAR PRADESH, Lucknow, ex *Hemidactylus flaviviridis*, date not recorded, B.K. Tandon, coll.

Type depository : Holotype in USNM; paratypes in BM(NH), IMR and RML.

Material examined : Holotype and 1 paratype on loan from USNM, labelled : "QLD INSTITUTE OF MEDICAL RESEARCH - *Trombicula cooli* Domrow - *Hemidactylus flaviviridis* - Lucknow, India - B.K. Tandon"

Remarks : The above redescription is based on the original description and study of the type specimens examined. Domrow (1962e) described 7 new Oriental-Australasian chiggers. Among these was *cooli*, which he tentatively assigned to the broad genus *Trombicula* Berlese, 1905. He considers this species close to *T. ilesi* (Radford, 1948), which was later transferred to *Miyatrombicula* as type species of the subgenus *Miyacarus* Vercammen-Grandjean, 1967. Re-examination of the holotype and 1 paratype reveal the palpal tarsal setation is 7B (combination of 4B and 3N). This diagnostic character (not earlier reported), together with the pentagonal scutum (lacking anterolateral shoulders), B palpal femoral seta, 3-pronged palpal claw, 2 pairs of eyes, and 3 genualae I warrant the transfer of this species to genus *Miyatrombicula*. The combination of N and B setae on the palpal tarsus has not been reported earlier for *Miyatrombicula* species. Goff (1979b; 1982d) characterizes subgenus *Eltonella* (Audy, 1956) of the genus *Microtrombicula* Ewing, 1950, as having a similar combination of the palpal tarsal setae. Thus, *M. cooli* may be regarded as a link between *Microtrombicula* (*Eltonella*) and the genus *Miyatrombicula*. *M. cooli* is close to *M. nikitini*

Kudryashova and Farhang-Azad, 1976, from Iran (not U.S.S.R., as reported by Tanskul and Nadchatram, 1983) in having galeala N, coxa III unisetose and mastitarsala III absent. *M. cooli* may easily be distinguished in having palpal tarsal setation 7B (7B.S in *M. nikitini*), dorsal palpal tibial seta barbed (nude in *M. nikitini*), and fewer dorsal body setae (90 in *M. nikitini*).

95. *Miyatrombicula najai* (Hiregaudar) new combination
(Fig. 84)

Tragardhula najai Hiregaudar, 1957, 313, **nomen nudum**; 1958, 24, original description; Prasad, 1974, 91.

Redescription of species : Larva. Colour in life whitish.

Idiosoma : Measuring 500x300 in holotype, 473-605 x 349-407 in engorged specimens. Eyes 2/2, subequal, on ocular plate (Original description: very small, probably 1/1! Vercammen-Grandjean in unpublished illustration : 2/2, on ocular plate). One pair of humeral setae, measuring 37-39; 28-34 dorsal idiosomal setae, measuring 34-38, usually arranged : 6-6-2-6-6-2 (Original description : about 30, measuring approximately 36, arranged : 4-6-6-8-6-4-2; but in illustration, fig. 2 : 28 setae, arranged : 4-6-6-6-4-2); 2 pairs of sternal setae, anterior 26-28, posterior 20-25; 18-22 preanal setae, 22-23; 10-12 postanal setae, 30-34 (Original description : 34 ventral setae); total idiosomal setae 64-72.

Gnathosoma : Palpal setal formula B/N/bNB/5B,2N.S (Original description : B/b/??B/5-6B; Vercammen-Grandjean unpublished illustration : B/N/NNB/7B.S); palpal claw 3-pronged (ventral prong often inconspicuous); galeala N; cheliceral blade (28) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, pentagonal with shallowly biconcave anterior margin; posterior margin convex, caudally angled; intersensillary craters near anterior margin and anterior midline (not reported in original description; but demarcated in unpublished illustration of Vercammen-Grandjean); AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AL>AM (Original description : PL>AM>AL); sensillary bases with pronounced antero- and postero-medial cuticular ridges; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.43-1.57. Scutal measurements of holotype after original description, followed by means and ranges of 10 NIV specimens in parentheses : AW 66 (66, 63-69); PW 84 (87, 83-91); SB 32 (27, 26-30); ASB 30 (26, 25-28); PSB 22! (32, 29-35); AP 26 (25, 24-27); AM 28 (29, 25-32); AL 25 (31, 29-34); PL 33 (38, 37-40). sens. 57 (56, 53-57).

Legs : Similar to *M. cooli* (Domrow, 1962e) in the number of ordinary and sensory setae. Measurements as follows : Ip = 635-690 (Original description : 720). Leg I : 220-234 (240); tarsus (59x16), tarsala (20-22). Leg II : 193-211 (230); tarsus (50x15), tarsala (18-19). Leg III : 220-246 (250); tarsus (62x13).

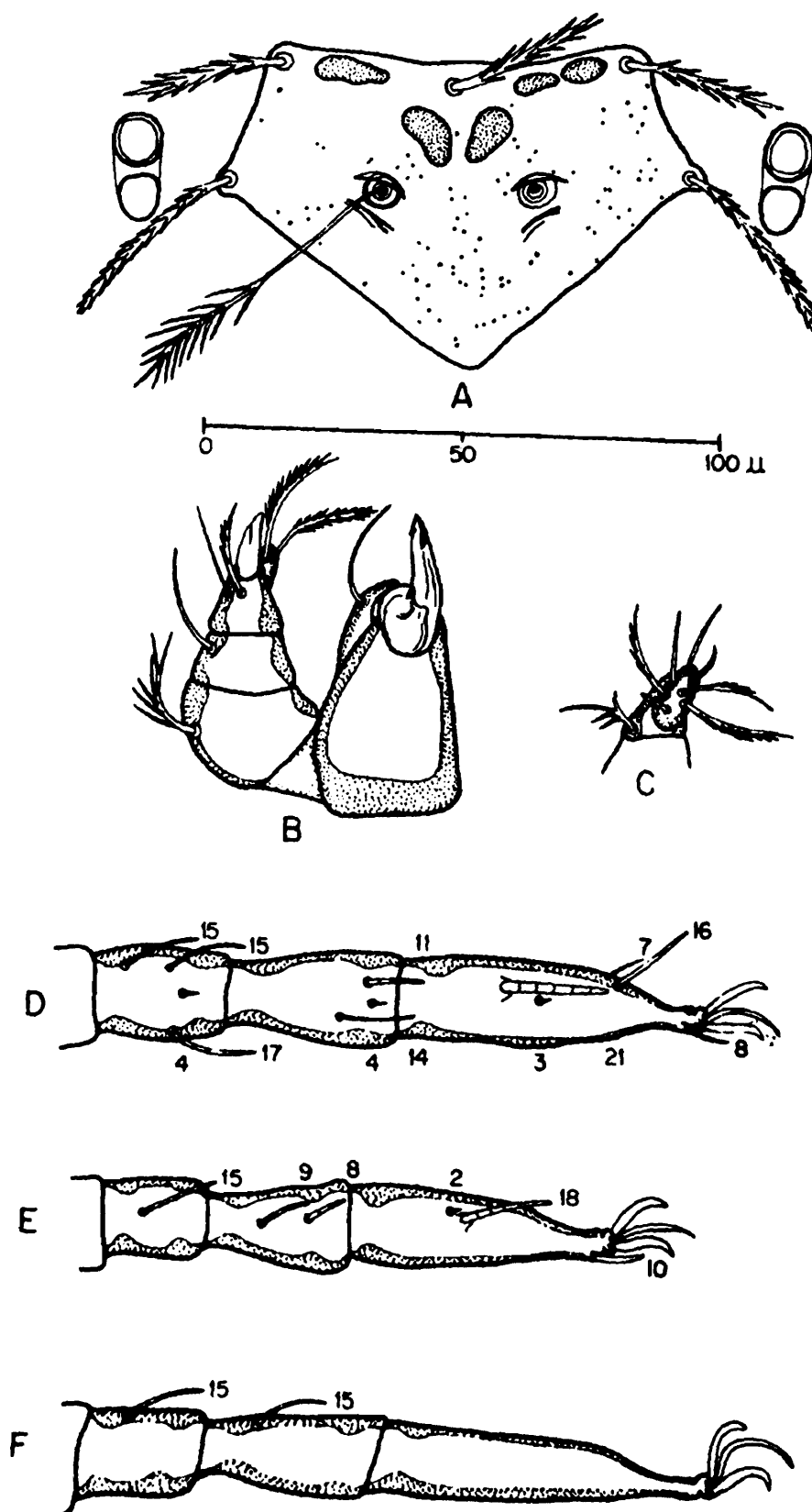


Fig. 84. *Miyatrombicula najai*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type data : Holotype (#2477/8), MAHARASHTRA, Bombay, Parel, Haffkine Institute compound, ex *Naja naja*, VII.1956, L.S. Hiregaudar, coll.

Type depository : Holotype in ZSI.

New records : MAHARASHTRA, Pune District, Khanapur near Sinhgarh, ex *Lycodon aulicus*, 28.XI.1986, S. Fernandes, coll.; 13, same data, but Pune, NIV campus, ex *Elaphe helenae*, taken 23.X.1987; 1, same data, but, Loyola School campus, ex *Argyrogaena fasciolatus*, taken 30.VIII.1988.

Material examined : Holotype, on loan from ZSI.

Remarks : The above redescription is based on the literature, study of the holotype and the NIV specimens. The original description is sketchy, and some diagnostic characters have not been reported. Vercammen-Grandjean studied the holotype and prepared an illustration, transferring the species to the genus *Miyatrombicula*. Dr. Hiregaudar has kindly sent us this illustration, which has apparently not been published. The rediscovery of this species from snakes in Pune, has made possible a complete redescription, and confirmation of the proposed transfer to *Miyatrombicula* by Vercammen-Grandjean. In the original description, ASB is reported as measuring 30, PSB 22, but SD 58! The average SD measurement for the NIV specimens is also 58. Hence, the PSB measurement reported for the holotype is apparently in error, and should be 28. In the unpublished illustration, Vercammen-Grandjean indicates the presence of subapical accessory claws on the claws and empodia of the legs. Goff (1979b) has reported these on the claws of certain species of subgenus *Eltonella* (Audy, 1956) of genus *Microtrombicula* Ewing, 1950. The accessory claws have not been observed in the study of the holotype (which is in poor condition), nor in the NIV specimens. The combination of N and B palpotarsal setae, noted in *M. cooli* (Domrow, 1962), has also been observed in this species. This confirms the link between *Microtrombicula* (*Eltonella*) and *Miyatrombicula*. *M. najai* is very close to *M. cooli*, but may easily be distinguished by the presence of a subterminala on the palpal tarsus (absent in *M. cooli*), by the intersensillary craters on the scutum (absent in *M. cooli*), and by the shorter leg tarsi I-III (measuring : (74x22), (64x18), and (78x15) in *M. cooli*). The species name is based on the type host.

Genus *Myotrombicula* Womersley and Heaslip

Myotrombicula Womersley and Heaslip, 1943, 99; Vercammen-Grandjean, 1968a, 65; 1968b, 79; Vercammen-Grandjean and Langston, 1976, 81; Nadchatram and Dohany, 1974, 57; Domrow and Lester, 1985, 29.

Type species : *Myotrombicula vespertilionis* Womersley and Heaslip, 1943, by monotypy and original designation.

Diagnosis : Trombiculini larvae parasitic on bats. Legs all 7-segmented, terminating in a

pair of claws and a clawlike empodium; onychotriches absent. 2 or 3 genualae I, genuala II and III; tibiala III. Palpal tarsus 7B or 7B.S; palpal claw 3-pronged; cheliceral blade with tricuspid cap and sometimes teeth on dorsal edge; galeala N/f. Eyes 2/2 or 1/1. Scutum subquadrate with pronounced anterolateral shoulders; punctae simple or coarse; sensillae flagelliform, branched distally.

Remarks : Vercammen-Grandjean (1968a) confirms the validity of the genus *Myotrombicula*, including four subgenera: *Alexfainia* Yunker and Jones, 1961, *Vergrandia* Yunker and Jones, 1961, *Perates* Brennan and Dalmat, 1960, and the nominate subgenus. The first 3 subgenera are restricted to Central America, while the nominate subgenus, characterized by palpal tarsus 7B and 2 genualae I, has been recorded from Australia, Asia, the Middle East and Africa. A single *Myotrombicula* species is reported here, the first record of the genus from India, placed in the nominate subgenus.

96. *Myotrombicula (Myotrombicula) kauli* new species
(Fig. 85)

Description of species : Larva.

Idiosoma : Measuring 260x205 in partially engorged holotype. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 31; 74 dorsal idiosomal seta, measuring 19-30, arranged : 8-10-8-8-10-12-6-6-4-2; 2 pairs of sternal setae, anterior 25, posterior 25; 48 preanal setae, 15; 22 postanal setae, 20-22; total idiosomal setae 150.

Gnathosoma : Palpal setal formula B/B/bbB/7B; palpal claw 3-pronged; galeala f; cheliceral blade (25) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Coarsely punctate, subquadrate with pronounced anterolateral shoulders; cuticular striations overlapping lateral and posterior margins; AM base anterior to level of AL bases; SB anterior to level of PL bases; AM>PL>AL; sensillary bases with antero- and posteromedial cuticular ridges; sensillae flagelliform with long branches on distal 1/3; PW/SD = 1.5. Scutal measurements of holotype : AW 46; PW 63; SB 22; ASB 26; PSB 16; AP 27; AM 32; AL 27; PL 30; sens. 50.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 654. Leg I : 232; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (62x20) 21B, tarsala (23), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 201; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (53x18) 16B, spoon-tipped tarsala (20), microtarsala, pretarsala. Leg III : 221; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, tapering genuala; tibia 6B, tapering tibiala; tarsus (67x14) 15B.

Type data : Holotype (NIV AA57.3), ORISSA, Bhubaneshwar, Khandagiri, ex *Rhinopoma hardwickei*, 13.XI.1972, H.N. Kaul, coll.

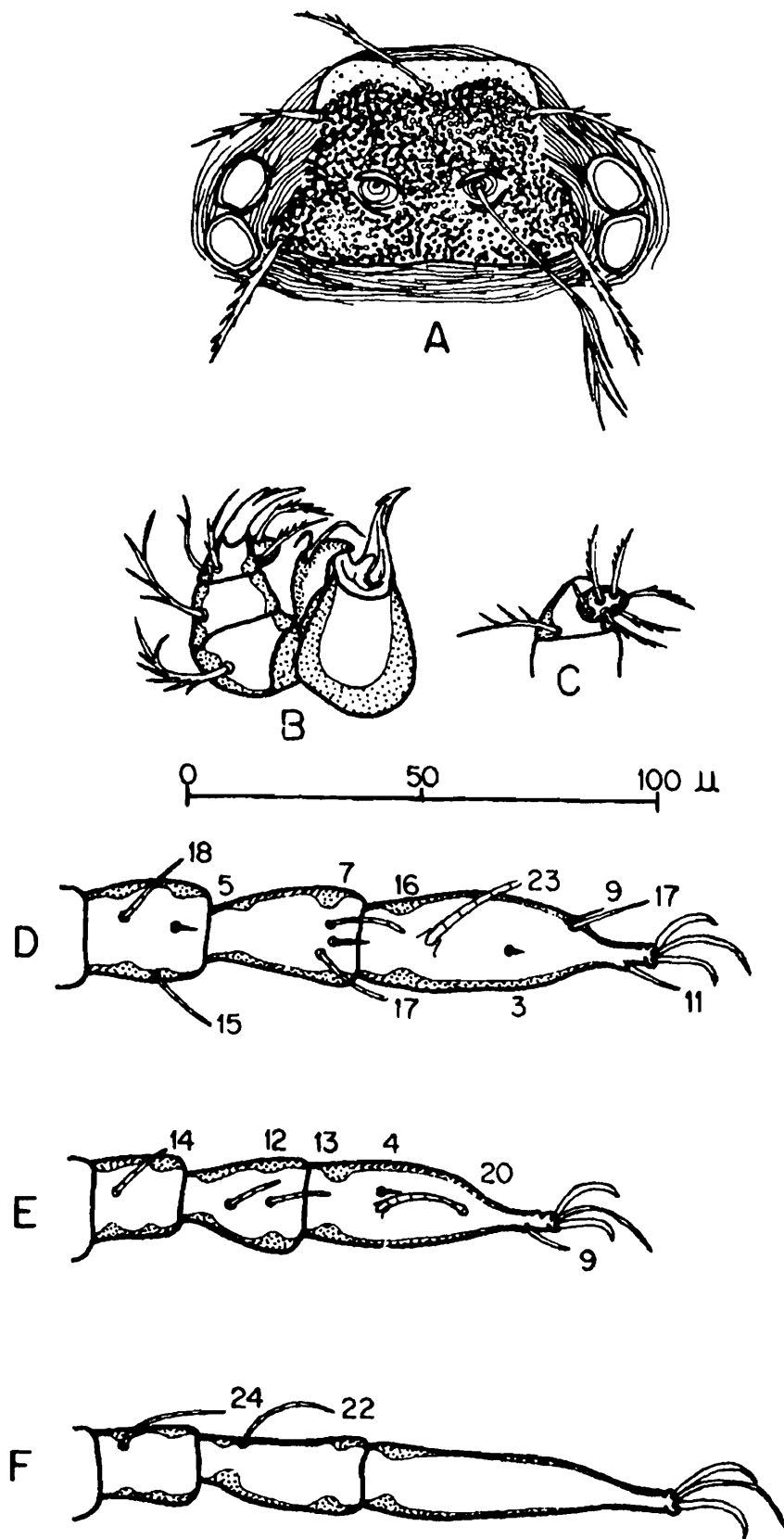


Fig. 85. *Myotrombicula kauli* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Remarks : The unique holotype was earlier misidentified as *Chiroptella insolli* (Philip and Traub, 1950). *M. kauli* is close to *M. womersleyi* Vercammen-Grandjean, 1968, from which it may be distinguished by the lower PW/SD scutal ratio (1.68 in *M. womersleyi*), greater number of idiosomal setae (122 in *M. womersleyi*), and higher Ip (564 in *M. womersleyi*). *M. kauli* also resembles *M. medwayi* Nadchatram and Lakshumy, 1969, from which it may be separated in having idiosomal setae inserted directly on cuticle (on large sclerotized platelets in *M. medwayi*), greater number of body setae (106 in *M. medwayi*), and lower Ip (770 in *M. medwayi*). This species is warmly dedicated to Dr. H.N. Kaul, former Deputy Director NIV, with gratitude for his constant encouragement and generous assistance.

Genus *Neotrombicula* Hirst

Neotrombicula Hirst, 1925, 609; Ewing, 1946c, 437; Womersley and Audy, 1957, 267; Vercammen-Grandjean, 1960, 469; 1968b, 85; Vercammen-Grandjean and Kolebinova, 1985, 65; Vercammen-Grandjean and Langston, 1976, 981; Nadchatram and Dohany, 1974, 59; Brennan and Goff, 1977, 561; Kolebinova and Vercammen-Grandjean, 1978, 101; Domrow, 1978, 85; Domrow and Lester, 1985, 15.

Trombicula (*Neotrombicula*), Brennan and Wharton, 1950, 153; Womersley, 1952, 20; Wharton and Fuller, 1952, 56.

Eutonella Kudryashova, 1988, 54, **new synonymy**.

Type species : *Acarus autumnalis* Shaw, 1790, by monotypy.

Diagnosis : Trombiculini larvae parasitic on mammals, birds and reptiles. Palpal tarsus 6B.S, 7B or 7B.S; palpal claw 3-pronged; galeala N or B; cheliceral blade with tricuspid cap. Eyes 2/2. Scutum pentagonal with markedly convex posterior margin; punctae simple; sensillae flagelliform, usually branched distally. Legs all 7-segmented; 2 or 3 genualae I; mastifemorala III, mastitibiala III may be present; 1 or 2 mastitarsalae III.

Remarks : Kolebinova and Vercammen-Grandjean (1978) proposed a new genus *Afrotrombicula* for the 25 Ethiopian *Neotrombicula* species and classified the species of the other zoogeographical regions into 3 groups on the basis of scutal shape. Vercammen-Grandjean and Kolebinova (1985) published a detailed revision of the *Neotrombicula* complex. They have proposed 11 subgenera, rejecting the earlier tentative classification of Vercammen-Grandjean (1960). The distinction of their subgenera is based on the palpo setal formula, number of mastisetæ III, and nature of the galeal seta. They acknowledge the artificial nature of this arrangement, but consider that it serves to bring a certain order and clarity within the genus. Kudryashova (1988) has proposed a new genus *Eutonella* for 13 *Neotrombicula* and 2 new species having palpal tarsal setation 7B.S, galeala N, and 2 genualae I. These distinguishing characters do not warrant separate generic status. Hence, *Eutonella* Kudryashova, 1988, is synonymized with *Neotrombicula*. Prasad (1974) mistakenly reports *Neotrombicula nyongae* (Taufllieb and Mouchet, 1959) from India. Taufllieb and Mouchet (1959) have recorded *N. nyongae* only from Cameroon; the record of distribution in India refers to the next species they have reported *Blankaartia acuscutellaris* (Walch, 1922). 12.

Neotrombicula species are reported here from India, including a new species, all with palpal tarsal setation 7B.S. The taxonomic arrangement proposed by Vercammen-Grandjean and Kolebinova (1985) is not followed, and no subgeneric distinction is made here. Known *Neotrombicula* species are orange to red in colour.

97. *Neotrombicula autumnalis* (Shaw)
(Fig. 86)

Acarus autumnalis Shaw, 1790, no pagination, next to plate 42d.

Trombicula holosericum Megnin, 1876, 1; Wharton and Fuller, 1952, 56, **synonymy**; Sen and Fletcher, 1962, 513.

Trombicula autumnalis, Philip and Fuller, 1950, 50; Richards, 1950a, 105; 1950b, 118; Prasad, 1974, 92.

Trombicula (Neotrombicula) autumnalis, Womersley, 1952, 364; Wharton and Fuller, 1952, 56; Audy, 1954b, 143.

Neotrombicula autumnalis, Womersley and Audy, 1957, 267.

Neotrombicula (Neotrombicula) autumnalis, Vercammen-Grandjean, 1968b, 85; Vercammen-Grandjean and Kolebnova, 1985, 69; Traub *et al.*, 1967, 36.

Redescription of species : Larva.

Idiosoma : Measuring 257-502 x 206-376 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 49-65; 30-34 dorsal idiosomal setae, arrangement variable, usually 6(7-9)-6-6-4-4-4; 2 pairs of sternal setae, anterior 48-49, posterior 40-47; 18-24 preanal setae, 32-36; 8-14 postanal setae, 44-50; total idiosomal setae 62-72.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (34) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, broadly rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; PL>AL=AM; sensillae flagelliform with branches on distal 2/3; PW/SD = 1.41-1.62. Scutal measurements of lectotype after Richards (1950a), followed by means and ranges of 10 NIV specimens in parentheses : AW 70 (73, 69-79); PW 87 (85, 79-91); SB 31 (30, 28-34); ASB - (27, 24-29); PSB 20 (29, 28-31); AP 28 (27, 25-30); AM 40 (42, 38-47); AL - (42, 38-44); PL 58 (56, 47-61); sens. - (71, 68-85).

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 779-917. Leg I : 256-317; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (78x21) 22B, tarsala (24), microtarsala, subterminala,

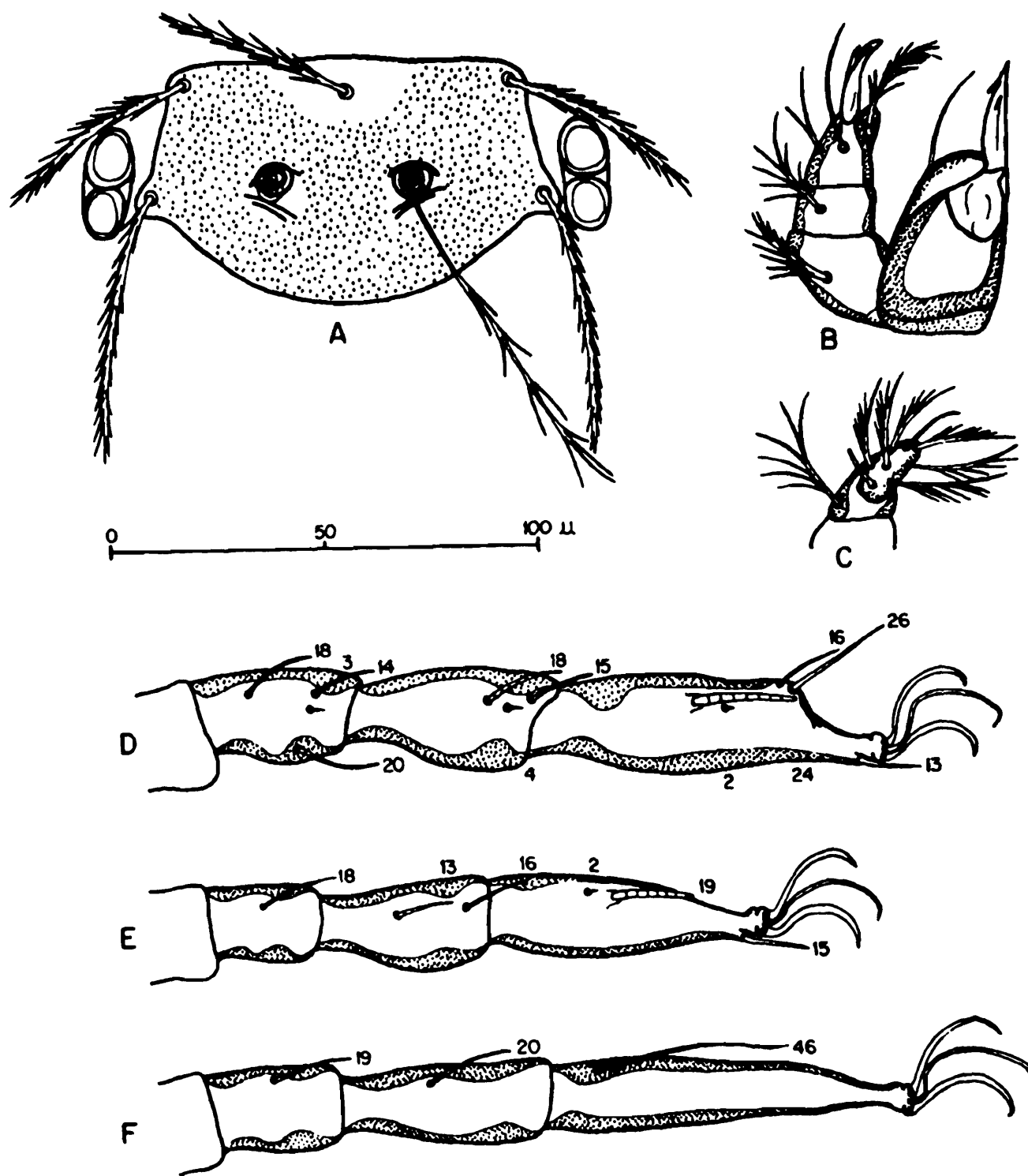


Fig. 86. *Neotrombicula autumnalis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

parasubterminala, pretarsala. Leg II : 234-279; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (64x20) 18B, tarsala (19), microtarsala, pretarsala. Leg III : 279-324; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (85x15) 14B, nude mastitarsala (46).

Type data : Lectotype, U.K., Berkshire, Streatley, Fair Mile, Warren Farm. Wharton and Fuller (1952) have reported *N. autumnalis* to be a common and widely distributed species throughout Europe.

Type depository : Lectotype in BM(NH).

Additional records : MAHARASHTRA, Bombay, ex 'chickens', 1934-1935, Naik, coll. JAMMU and KASHMIR, Gilgit Agency, mountain desert and mountain forest, 2900m, ex *Cricetulus migratorius*, VI-IX.1962-1965, UM and PMRC, coll.

New records : 17 records of collections in the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 59 ex *Alticola roylei*, 19.IX.1968; same locality, 2 ex *Apodemus flavicollis*, 17.IX.1968; same locality, 2 ex *Ochotona roylei*, 20.IX.1968; Udaipur, 2800-3000m, 1 ex *A. roylei*, 12.IX.1968; Kulu District, Bhui, 1100-1550m, 7 ex *Mus musculus*, 11.X.1967; Lahul District, Chhetru, 3450m, 2 ex *A. roylei*, 8.IX.1968; Kirting, 2680-3250m, 4 ex *A. roylei*, 23.IX.1968; Mahasu District, Rampur, 1000-1200m, 4 ex *M. musculus*, 16.X.1967. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 175 ex 6 *Rattus* sp., 8.XI.1969; Sopore, 500m, 10 ex *S. murinus*, 25.X.1969; Doda District, Bhadarwah, 1700m, 3 ex *Rattus rattoides*, 15.XI.1969; UTTARANCHAL, Chamoli District, Kailbinayak, 2100-4400m, 1 ex *B. bengalensis*, 15.X.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Richards (1950a,b) gives the distribution, biology and wide range of morphological variation of this species in Britain. This variation is evident in the NIV material as well. The PSB measurement given for the lectotype (Richards, 1950a) is apparently in error. This species, known as the European harvest mite, is a widespread pest in Europe, causing chiggerosis.

98. *Neotrombicula anax* Audy and Womersley

(Fig. 87)

Neotrombicula anax Audy and Womersley, 1957, 363; Prasad, 1974, 87; Wen *et al.*, 1982, 468; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 390x286 in engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 48-61, 30-36 dorsal idiosomal setae, measuring

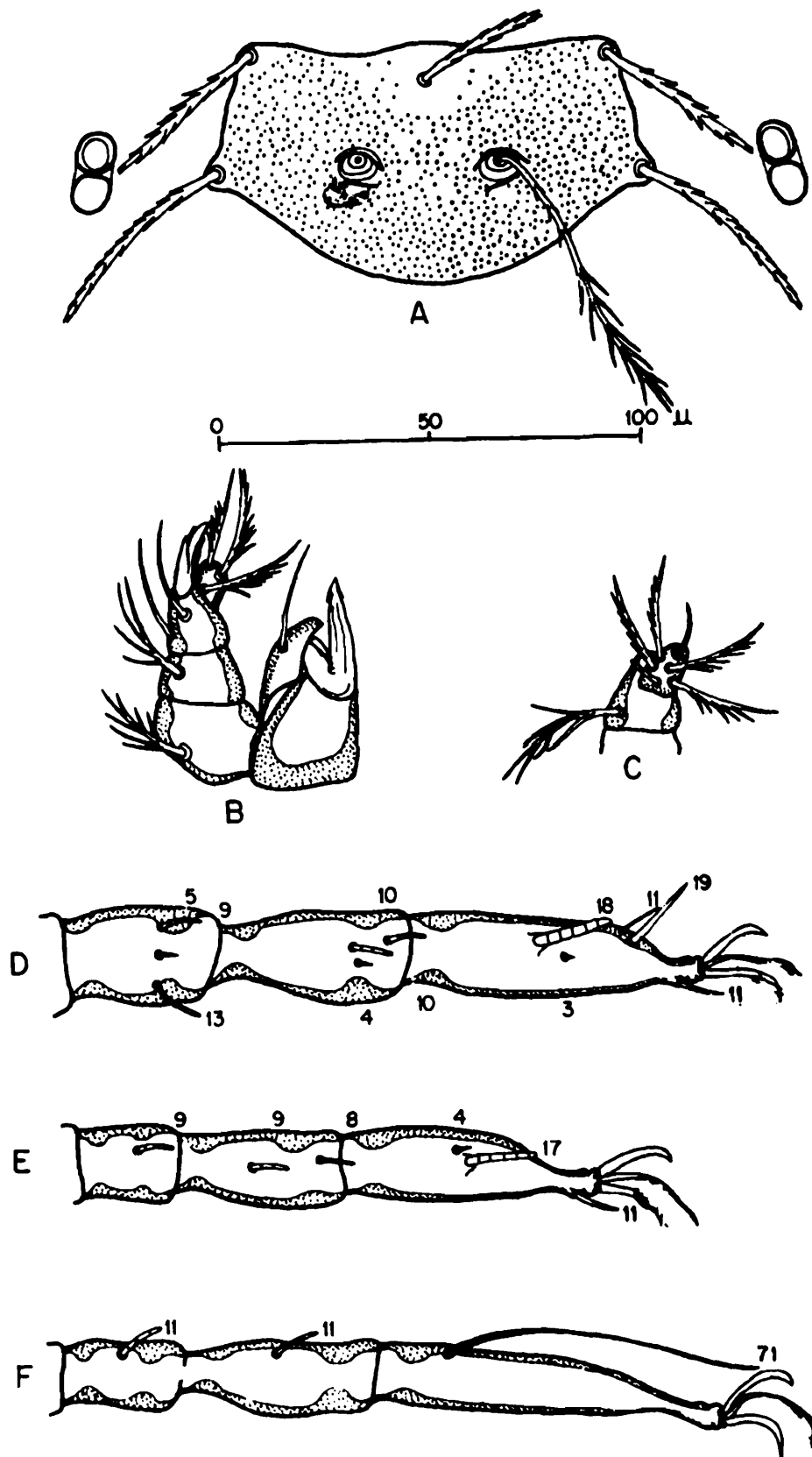


Fig. 87. *Neotrombicula anax*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

43-54, usually arranged : 6-6-6-6-4-2; 2 pairs of sternal setae, anterior 44-49, posterior 41-45; 18-24 preanal setae, 30-37; 8-14 postanal setae, 41-48; total idiosomal setae 62-76.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged, ventral prong often inconspicuous; galeala N; cheliceral blade (30) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, pentagonal with shallowly biconcave anterior margin; posterior margin convex, caudally rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; PL>AL>AM; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.49-1.78 (Original description : 1.52-1.66). Scutal measurements giving ranges of holotype and 11 paratypes after original description, followed by means and ranges of 10 NIV specimens in parentheses : AW 73-84 (76, 70-84); PW 90-106 (94, 85-107); SB 31-36 (30, 28-34); ASB 31-34 (30, 28-33); PSB 28-34 (29, 25-32); AP 29-34 (28, 25-30); AM 34-39 (38, 31-46); AL 42-48 (45, 40-51); PL 50-59 (56, 51-65); sens. 70, no variation recorded (75, 67-86).

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae; but, 2 genualae I. Measurements as follows : Ip = 872-956 (Original description : 910). Leg I : 305-333 (325); tarsus (66-68 x 18-24), tarsala (18-24). Leg II : 262-285 (260); tarsus (59-60 x 15-16), tarsala (17-20). Leg III : 300-342 (325); tarsus (79-80 x 12-14), mastitarsala (71).

Type data : Holotype and 11 paratypes, JAMMU and KASHMIR, Grugurdu, ex unidentified 'rats', 28.X.1949, S.L. Kalra, coll.

Type depository : Holotype and 1 paratype in SAM; paratypes in BM(NH), USNM, RML, Queensland Institute of Medical Research, School of Medicine - Sydney, ZSI and private collections.

New records : 67 records of collections in the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 3 ex *Rattus rattus gangutrianus*, 8.IV.1968; Tindi, 2440-2590m, 7 ex *Alticola roylei*, 19.IX.1968; same locality, 10 ex 5 *Apodemus flavicollis*, 17,18.IX.1968; same locality, 4 ex *R. r. gangutrianus*, 17.IX.1968; same locality, 25 ex *Ochotona roylei*, 20.IX.1968; Udaipur, 2800-3000m, 4 ex *A. roylei*, 12.IX.1968; Kinnaur District, Karcham, 1700m, 2 ex *Rattus rattoides*, 19.X.1967; Kulu District, Palchan, 1800-2290m, 6 ex *R. rattoides*, 4.X.1967. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 13 ex *A. flavicollis*, 13.X.1969; same locality, 1 ex *R. rattoides*, 3.X.1969; same locality, 12 ex 6 *Mus musculus*, 31.X-3.XI.1969; Rampore, 1400m, 1 ex *Cissa flavirostris*, 8.XI.1969; same locality, 3 ex *R. rattoides*, 5.XI.1969; same locality, 152 ex 9 *Rattus* sp., 8.XI.1969; same locality and date, 9 ex 2 *M. musculus*; same locality, 1 ex *Suncus murinus*, 5.XI.1969; Tangmarg, 600m, 1 ex *A. flavicollis*, 20.X.1969; Doda District, Bhadarwah, 1700m, 1 ex *M. musculus*, 17.XI.1969; Khilani, 1200-1400m, 9 ex 3 *M. musculus*, 19,20.XI.1969; Ladakh District, Batalik, 2600-2900m, 23 ex 2 *R. rattoides*, 27.VIII.1967; Bodhkharbu, 3200-3500m, 25 ex 2 *A. roylei*, 22.VIII.1967; same locality, 12

ex 3 *A. flavicollis*, 13,16.VIII.1968; same locality, 6 ex *M. musculus*, 21.VIII.1967; Kargil, 2440-2900m, 112 ex 6 *A. flavicollis*, 18.VIII.1967 and 29.VII.1968; same locality, 22 ex *R. rattoides*, 29.VII.1968; Leh, 3600m, 43 ex 2 *A. flavicollis*, 8.VIII.1968; Rajouri District, Naoshera, 750m, 18 ex *Tatera indica*, 9.XII.1969; same locality, 7 ex *M. musculus*, 7-10.XII.1969; same locality, 60 ex *S. murinus*, 9.XII.1969; Srinagar District, Sonamarg, 2740m, 4 ex *M. musculus*, 23.VIII.1968; Udhampur District, Kulwanda, 1700-1800m, 3 ex *R. rattoides*, 3.XII.1969; same locality, 1 ex *M. musculus*, 4.XII.1969. UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, 1 ex *R. r. gangutrianus*, 28.X.1967; Nainital District, Garjia, 400-500m, 1 ex *R. r. gangutrianus*, 17.XI.1967; Pithoragarh District, Tejam, 1100-1200m, 21 ex *A. roylei*, 19.IX.1967.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Audy and Womersley (1957) consider *N. anax* close to *N. kanzalwanensis* (Womersley, 1952) and *N. kashmirensis* (Womersley, 1952), but distinguish it in having 1 pair of humeral setae with 28-32 dorsal body setae (3 pairs with 48 in *N. kanzalwanensis*, and 1 pair with approximately 42 in *N. kashmirensis*). The NIV material is close to the type series, but shows a wider range of variation in the number and arrangement of body setae, and in the standard data. Wen et al. (1982) draw attention to the differences observed in the scutal shape of the Chinese specimens. This variation of posterior margin from caudally angled to broadly rounded has also been observed in the NIV material.

**99. *Neotrombicula cervulicola* (Ewing) new combination
(Fig. 88)**

Trombicula cervulicola Ewing, 1931, 13; Womersley, 1952, 125; Womersley and Audy, 1957, 260; Prasad, 1974, 93.

Trombicula (Trombicula) cervulicola, Wharton and Fuller, 1952, 63.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae (Womersley, 1952 : one pair), measuring 44; 34 dorsal idiosomal setae, measuring 38, arranged : 6-8-8-6-4-2 (Womersley, 1952 : 36, measuring 50, arranged : 8-8-8-6-4-2); 2 pairs of sternal setae; number of ventral setae not recorded; preanal measuring 25, postanal 35; total number of idiosomal setae not recorded.

Gnathosoma : Palpal setal formula B/B/NbB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (28) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subpentagonal with anterior margin straight or slightly convex; posterior margin convex; caudally rounded; AM base slightly anterior to level of AL bases; SB anterior to level of PL bases; PL>AM=AL; sensillae flagelliform with few short branches on distal 1/2; PW/SD = 1.26. Scutal measurements of 3 cotypes after Womersley (1952) :

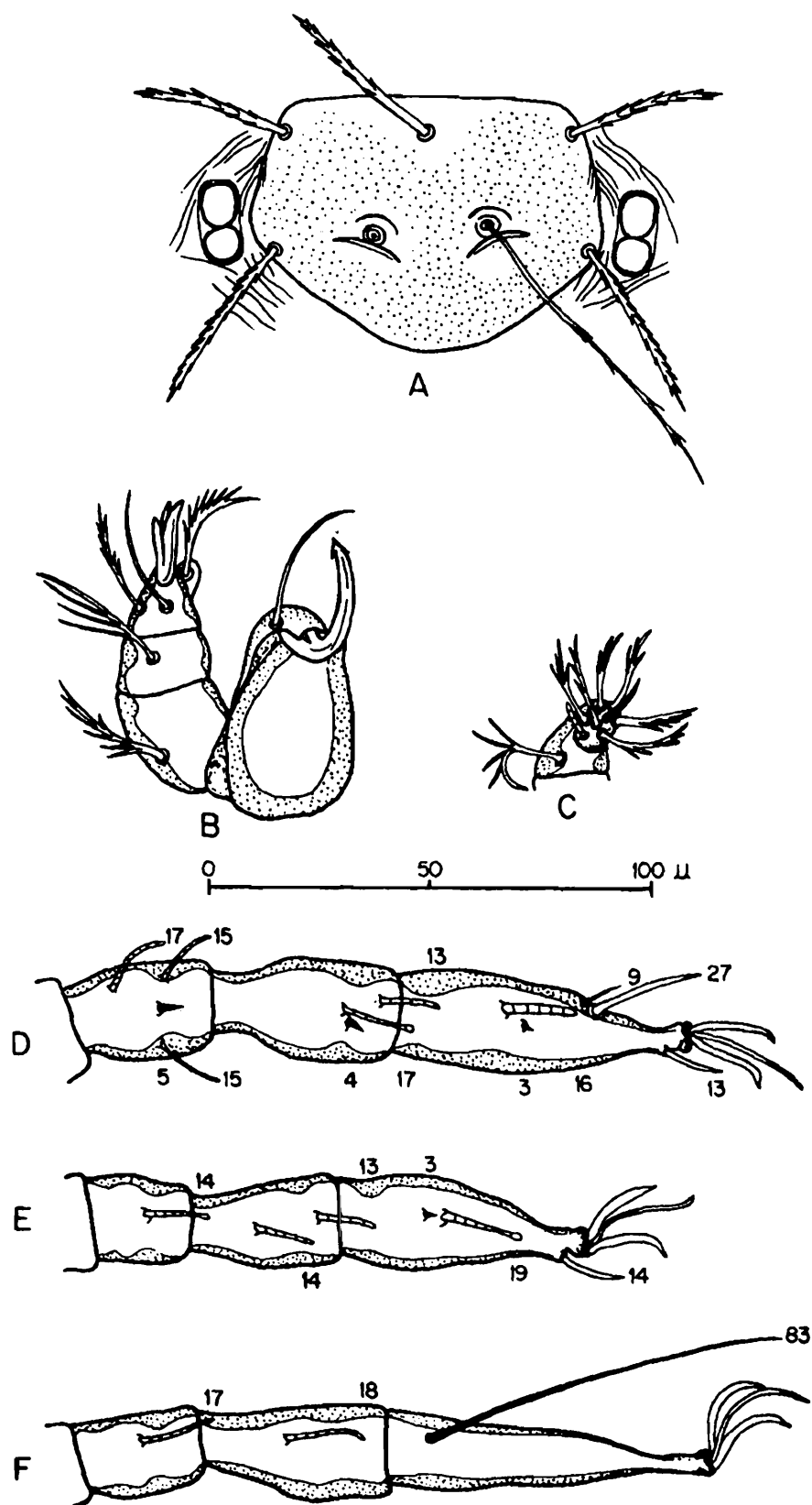


Fig. 88. *Neotrombicula cervulicola*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

AW 65 65 72; PW 72 68 82; SB 26 26 33; ASB 23 23 23; PSB 23 23 23; AP 26 26 33; AM 39 42 46; AL 39 39 46; PL 43 43 65; sens. 72 65 85.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. Ip and leg measurements not recorded. Leg I : tarsus (66x21), tarsala (16). Leg II : tarsus (56x21), spoon-tipped tarsala (19). Leg III : tarsus (73x14), mastitarsala (83).

Type data : 3 cotypes, UTTARANCHAL, Kumaon, Mukteshwar, ex *Cervulus aureus* (= *Muntiacus muntjak aureus*), III.1930, Cooper, coll.

Type depository : Cotypes in USNM.

Material examined : 3 cotypes on loan from USNM (2 cotypes have been remounted : II.1944).

Remarks : The above redescription is based on the literature and study of the cotypes. The original description is very sketchy. Womersley (1952) gives a clearer understanding of the species based on Dr. Wharton's examination of the cotypes. The palpal tarsal setation : 7B.S, and characteristic subpentagonal scutum warrant the transfer of this species to the genus *Neotrombicula*. The scutal data given by Womersley (1952) agrees closely with our measurements, but ASB = 30 and PSB = 28. There are 2 pairs of humeral setae with 6 setae in the 1st posthumeral row and lateral palpotibial seta is lightly barbed (not one pair with 8 setae in 1st posthumeral row and lateral palpotibial seta N, as reported by Womersley). The species name is based on the type host.

100. *Neotrombicula fujigmo* (Philip and Fuller)
(Fig. 89)

Trombicula fujigmo Philip and Fuller, 1950, 50.

Tragardhula fujigmo, Womersley, 1952, 28.

Trombicula (Neotrombicula) fujigmo, Wharton and Fuller, 1952, 58.

Neotrombicula fujigmo, Womersley and Audy, 1957, 267.

Neotrombicula (Neotrombicula) fujigmo, Vercammen-Grandjean, 1968b, 86.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 41-46; 40 dorsal idiosomal setae, measuring 38-45, arranged : 8-8-8(10)-10(8)-6 (45, measuring 48, arranged : 12-10-8+15 in Indian specimen); 2 pairs of sternal setae; 26 ventral setae, preanal measuring 25-32, postanal 38 (in Indian specimen : 56, preanal measuring 30, postanal 36); total idiosomal setae 70 (111 in Indian specimen).

Gnathosoma : Palpal setal formula B/B.NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (35) with distinct tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

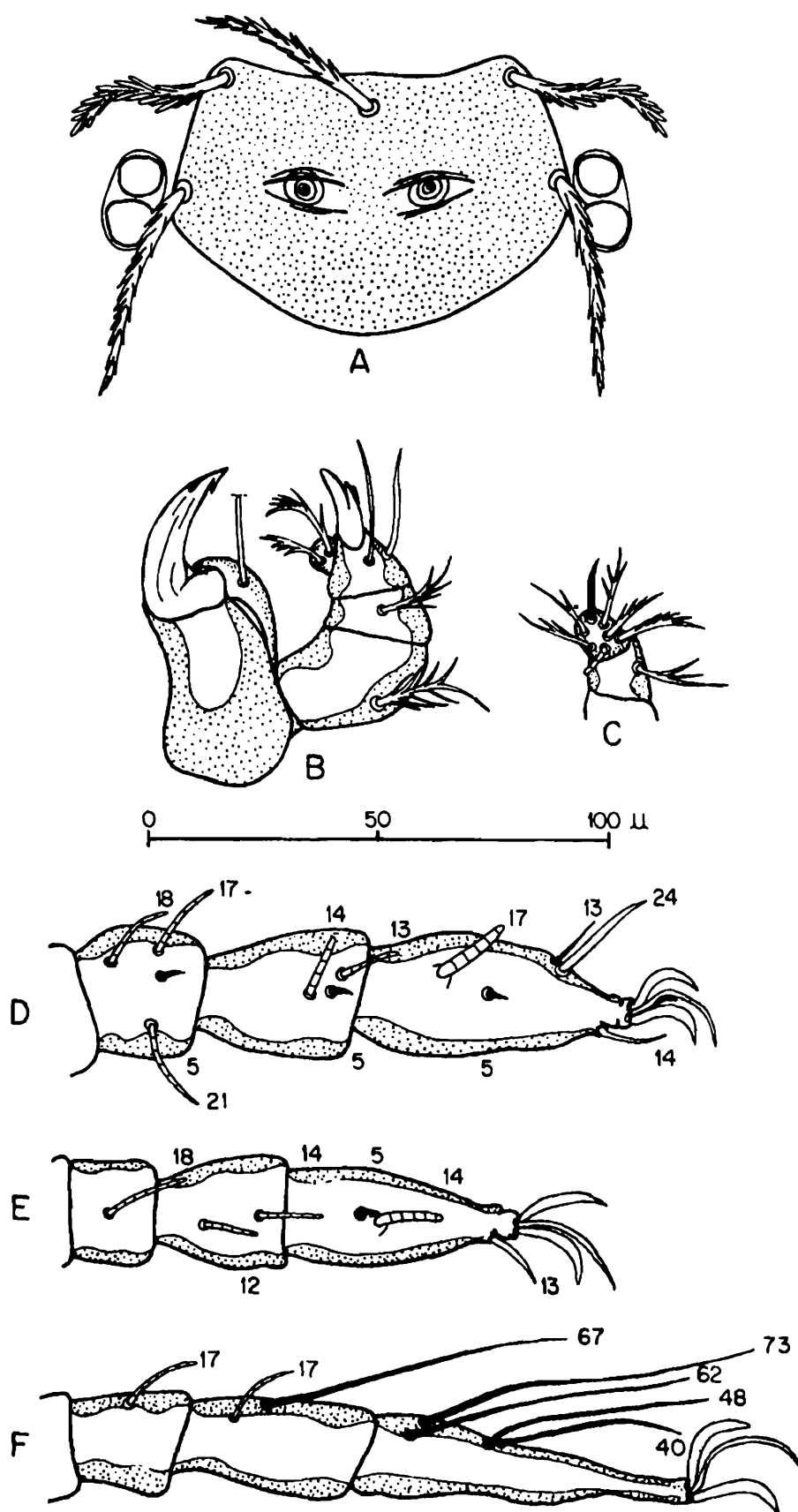


Fig. 89. *Neotrombicula fujigmo*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, caudally rounded; AM base posterior to level of AL bases; SB anterior to level to PL bases; $PL > AM > AL$; sensillary bases with antero-and postero-medial cuticular ridges; sensillae flagelliform with distal branches; $PW/SD = 1.31-1.41$. Scutal measurements of holotype and Indian specimen followed by means and ranges of type series in parentheses after original description : AW 57, 76 (61, 58-64); PW 80, 100 (81, 77-86); SB 26, 30 (27, 25-29); ASB 26, 30 (28, 26-29); PSB 32, 34 (31, 29-32); AP 28, 27 (27, 22-29); AM 41, 58 (42, 35-48); AL 38, 46 (37, 29-40); PL 45, 58 (46, 42-54); sens. 80, 87 (72, 64-80). Scutal measurements giving means of 2 paratypes followed by measurements of Indian specimen after Womersley (1952) : AW 60, 76; PW 81, 87; SB 27, 31; ASB 31, 31; PSB 31, 31; AP 25, 28; AM 42, 56; AL 36, 48; PL 46, 70; sens. 80,-.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae; but, leg III with mastitibala and 4 mastitarsalae. Measurements as follows : $Ip = 740$. Leg I : 260; tarsus (63x26), tarsala (17). Leg II : 220; tarsus (51x21), tarsala (14). Leg III : 260; mastitibala (67); tarsus (66x13), mastitarsalae (62, 73, 48, 40).

Type data : Holotype (USATC No.939.4) and 6 paratypes, BURMA, 12 miles North Myitkyina, ex *Crocidura vorax*, 14.IV.1945, USATC, coll.; 2 paratypes, same data, but 6 miles North Myitkyina, taken 10.III.1945; 8 paratypes, same data, but ex 3 *Rattus rattus sladeni*, taken 10,21,29.III.1945; 1 paratype, same data, but Myitkyina, ex 'rat', taken III.1945.

Type depository : Holotype in USNM; paratypes in USNM, BM(NH), RML and SAM.

Additional record : MANIPUR, Kanglatongbi, 1 ex *Rattus rattus bullocki*, 6.XII.1945, STRU, coll.

Material examined : 4 paratypes, BURMA, Myitkyina, on loan from USNM : USATC No.748.2, ex *Crocidura* (shrew), taken 10.III.1945; USATC No.797.1, ex *Rattus* sp., taken 21.III.1945; and USATC No.939.2 and 5, ex 2 *Crocidura vorax*, taken 14.IV.1945.

Remarks : The above redescription is based on the literature and study of the 4 paratypes examined. Philip and Fuller (1950) consider this species close to another new species they describe, *N. tamiya*. They distinguish *N. fujigmo* in having dorsal and lateral palpotibial setae and galeala N (barbed in *N. tamiya*), SB level with PL bases (posterior to level of PL bases in *N. tamiya*), and $PL > AM > AL$ ($PL > AL > AM$ in *N. tamiya*), with differences in standard data. They suggest that the unique Indian specimen may represent a distinct species. Womersley (1952), however, regards the Indian specimen as only a slight variant of *N. fujigmo*. Vercammen-Grandjean (1968b) places this species in the *bisignata* group, characterized by 2 genualae I and 0-3 mastitarsalae III. This placement is incorrect as there are 3 genualae I and 4 mastitarsalae III. The species name has been derived from a humorous slang term evolved by soldiers of the Allied Forces in the Far East to express their impatience to return home after V-J Day (August 15, 1945).

101. *Neotrombicula gayanoi* new species
(Fig. 90)

Description of species : Larva.

Idiosoma : Measuring 297-502 x 236-343 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 56-71; 40-46 dorsal idiosomal setae, measuring 47-60, arrangement variable, in holotype : 10-8-2-2-8-6-2-4-2; 2 pairs of sternal setae, anterior 42-49, posterior 41-47; 22-32 preanal setae, 30-44; 6-16 postanal setae, 43-50; total idiosomal setae 84-92.

Gnathosoma : Palpal setal formula B/B/bbB/7B.S; palpal claw 3-pronged; galeala b; cheliceral blade (37) with distinct tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with shallowly biconcave anterior margin; posterior margin convex, broadly rounded; AM base posterior to level of AL bases; SB slightly anterior to level of PL bases; PL>AM>AL; sensillary bases with antero-and postero-medial cuticular ridges; sensillae flagelliform with short branches on distal 1/2; PW/SD = 1.46-1.61. Scutal measurements of holotype followed by means and ranges of type specimens in parentheses : AW 72 (73, 69-78); PW 89 (90, 86-93); SB 36 (34, 32-36); ASB 30 (30, 28-32); PSB 31 (29, 26-31); AP 28 (29, 27-30); AM 46 (45, 42-50); AL 44 (45, 40-51); PL 61 (59, 55-63); sens. 77 (77, 75-83).

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. Measurements as follows : Ip = 828-881. Leg I : 280-302; tarsus (71x20), tarsala (16-18). Leg II : 244-274; tarsus (63x18), tarsala (16-19). Leg III : 282-317; tarsus (83x14), mastitarsala (62).

Type data : Holotype (NIV A82071.5) and 1 paratype, HIMACHAL PRADESH, Kulu District, Palchan, 1800-2290m, ex *Rattus rattoides*, 4.X.1967, NIV, coll.; 4 paratypes, same data, but JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, ex 3 *R. rattoides*, taken 6,7.XI.1969; 5 paratypes, same data, but ex 4 *Rattus* sp., taken 8.XI.1969.

Additional records : 35 records of collections in the Himalayan region by NIV field teams: HIMACHAL PRADESH, 2 specimens, same data as holotype; Chamba District, Chamba, 1070-1220m, 1 ex *Rattus rattus gangutrianus*, 8.XI.1969. JAMMU and KASHMIR: Baramulla District, Bandipore, 550m, 6 ex 2 *Mus musculus*, 1,2.XI.1969; Rampore, 110 ex 8 *R. rattoides*, 6,7.XI.1969; 94, same data, but ex 6 *Rattus* sp., taken 8.XI.1969; 2, same data, but ex *M. musculus*, taken 7.XI.1969; Doda District, Bhadarwah, 1700m, 26 ex 2 *R. rattoides*, 17.XI.1969; 1, same data, but ex *M. musculus*; Rajouri District, Naoshera, 750m, 13 ex 2 *Tatera indica*, 7,9.XII.1969; 3, same data, but ex *Millardia meltada*, taken 8.XII.1969; 77, same data, but ex 3 *Golunda ellioti*; Udhampur District, Phalata, 750m, 11 ex *T. indica*, 26.XI.1969; 3, same data, but ex 2 *M. musculus*; 6, same data, but ex *Mus platythrix*. UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, 1 ex *R. r. gangutrianus*,

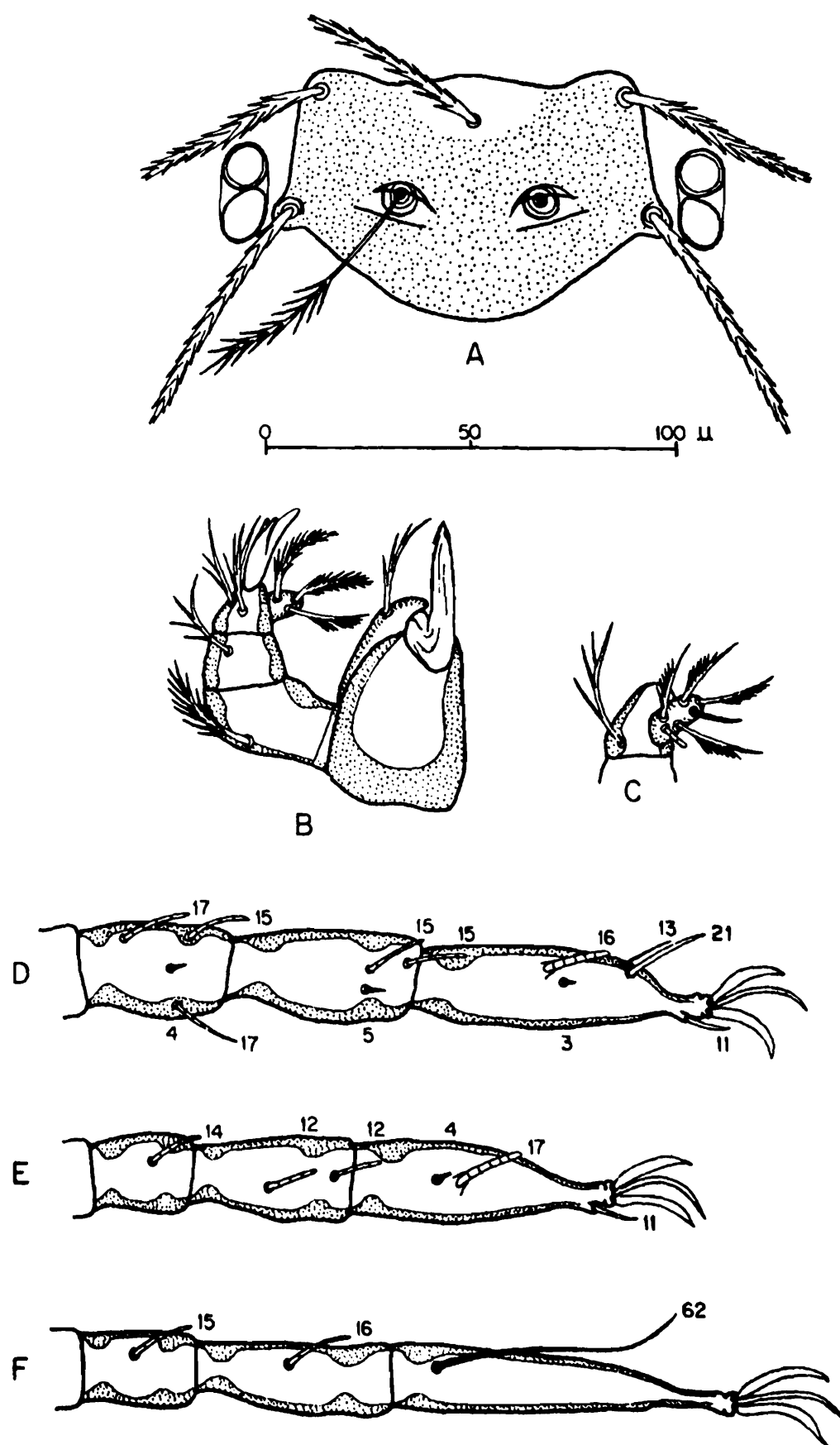


Fig. 90. *Neotrombicula gayanoi* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

28.X.1967; 2, same data, but ex *Bandicota bengalensis*; Pithoragarh District, Pithoragarh, 1500-2600m, 1 ex *R. r. gangutrianus*, 12.VIII.1970.

Remarks : *N. gayanoi* is close to *N. nagayoi* (Sasa *et al.*, 1950), from which it may be distinguished in having galeala barbed (N in *N. nagayoi*), dorsal and lateral palpotibial setae barbed (N in *N. nagayoi*), and higher Ip range (770-820 in *N. nagayoi*). The species name is an anagram of *nagayoi*, which it closely resembles.

102. *Neotrombicula guptai* Nadchatram
(Fig. 91)

Neotrombicula guptai Nadchatram, 1979, 75; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva. Colour in life not reported, probably orange or red.

Idiosoma : Measuring 168-600 x 130-400 in unengorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, measuring 42-53; 42-46 dorsal idiosomal setae, measuring 38-49, arrangement variable; 2 pairs of sternal setae, anterior 39-44, posterior 34-40; 18-28 preanal setae, 28-34; 6-16 postanal setae, 35-46; total idiosomal setae 74-90 (Original description: 36-38 dorsal idiosomal setae, measuring 37-40, arranged : 8-8-(2)-8-6(8)-4(2)-2; 14 preanal setae, 25-31; 12 postanal setae, 30-32; total idiosomal setae 70-72).

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (33-35) with distinct tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, broadly rounded; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases with antero-and postero-medial cuticular ridges; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.47-1.67 (Original description : 1.41-1.49). Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses after original description : AW 67 (70, 66-73); PW 81 (80, 76-85); SB 27 (28, 27-31); ASB 29 (29, 27-31); PSB 27 (27, 26-28); AP 27 (26, 22-28); AM 36 (36, 35-42); AL 36 (36, 34-38); PL 41 (43, 40-46); sens. 70 (74, 70-78). Scutal measurements giving means and ranges of 10 NIV specimens : AW 70, 66-81; PW 86, 74-98; SB 30, 28-34; ASB 29, 25-28; PSB 27, 23-32; AP 26, 24-29; AM 45, 40-49; AL 42, 39-44; PL 52, 48-56; sens. 77, 70-88.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. Measurements as follows : Ip = 740-830. Leg I : 254-294; tarsus (54x18), tarsala (17-19). Leg II : 226-252; tarsus (47x16), tarsala (14-16). Leg III : 256-184; tarsus (66x13), mastitarsala (82). Measurements after original description : Ip = 805-825. Leg I : 280-285; tarsus (72-76 x 19-20), tarsala (16). Leg II : 240-250; tarsus (60-62 x 17-18), tarsala (17). Leg III : 285-290; tarsus (85 x 13-15), mastitarsala (80-85).

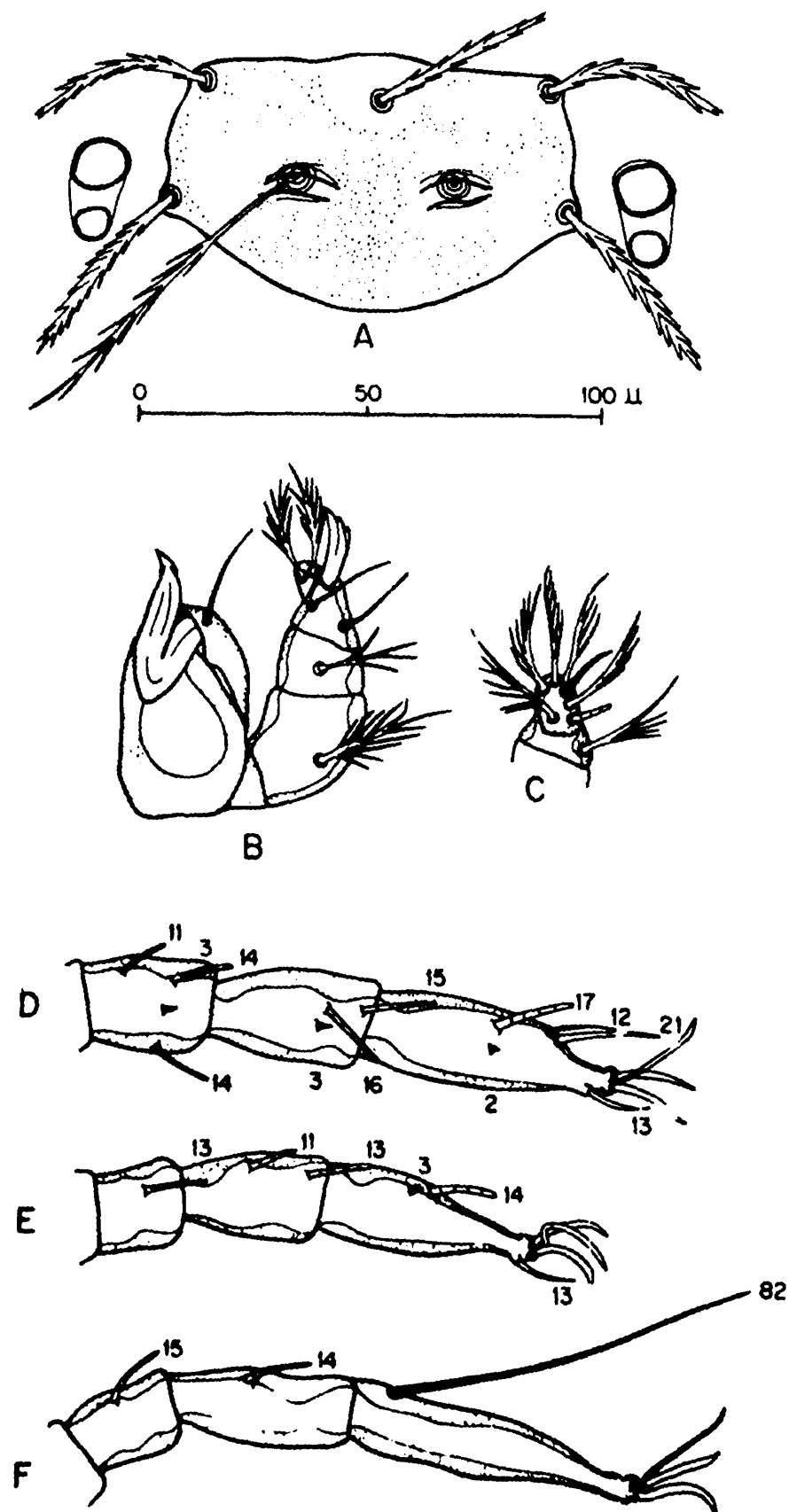


Fig. 91. *Neotrombicula guptai*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type data : Holotype (MZ111332) and 14 paratypes, UTTARANCHAL, Chamoli District, Gwaldam farm, ex unidentified 'rodent', XII.1973, ZSI, coll.

Type depository : Holotype and paratype at IMR; paratypes at USNM, BPBM, BM(NH), IA, and ZSI.

Additional records : 97 specimens, same data as type series.

New records : 38 records of collections in the Himalayan region by NIV field teams: HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 57 ex 9 *Apodemus flavicollis*, 17,18.IX.1968; 13, same data, but ex *Rattus rattus gangutrianus*, taken 17.IX.1968; 78, same data, but ex 3 *Crocidura* sp., taken 17,18.IX.1968; Udaipur, 2800-3000m, 2 ex *Alticola roylei*, 12.IX.1968; Kinnuar District, Karcham, 1700m, 11 ex *Rattus rattoides*, 19.X.1967; 1, same data, but ex *Mus platythrix*; Kulu District, Kothi, 2440m, 16 ex *R. rattoides*, 2.X.1967; Lahul District, Thiroth, 2850m, 3 ex *A. flavicollis*, 11.IX. 1968. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 14 ex 2 *R. rattoides*, 2,3.XI.1969; 3, same data, but ex 2 *Mus musculus*, taken 1,3.XI.1969; Rampore, 1400m, 10 ex 7 *R. rattoides*, 6,7.XI.1969; 32, same data, but ex 4 *Rattus* sp., taken 8.XI.1969; 10, same data, but ex *Suncus murinus*, taken 5.XI.1969; Doda District, Bhadarwah, 1700m, 1 ex *M. musculus*, 17.XI.1969; 1, same data, but ex *S. murinus*, taken 15.XI.1969. WEST BENGAL, Darjeeling District, Jorepokhri, 1200-2300m, 47 ex *Garrulax erythrocephalus*, 14.III.1969; Jalpaiguri District, Chunabhatti, 150-200m, 9 ex *Rattus brunneusculus*, 25.III.1969.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Nadchatram (1979) considers this species close to *N. kanzalwanensis* (Womersley, 1952) and *N. kashmirensis* (Womersley, 1952). He distinguishes *N. guptai* in having two pairs of humeral setae (one pair in other 2 species), fewer setae in 1st posthumeral row (12-14 in other 2 species), and smaller scutum with shallower posterior margin (PW measuring 90-95 and PSB 28 in *N. kanzalwanensis*; and PW 98-101 and PSB 34 in *N. kashmirensis*). The NIV specimens show a wider range of variation in the number and arrangement of body setae and standard measurements. The leg tarsal lengths are distinctly shorter than recorded in original description. The NIV material has not been collected in the type locality, but agrees with the diagnostic characters of the species. This species has been named in honour of Dr. S.K. Gupta, Zoologist, ZSI.

103. *Neotrombicula inflata* Mitchell and Nadchatram (Fig. 92)

Neotrombicula (Digenualae) inflata Mitchell and Nadchatram, 1966, 71; Mitchell *et al.*, 1966, 121.

Neotrombicula (Neotrombicula) inflata, Vercammen-Grandjean, 1968b, 86.

Neotrombicula inflata, Prasad, 1974, 87.

Redescription of species : Larva.

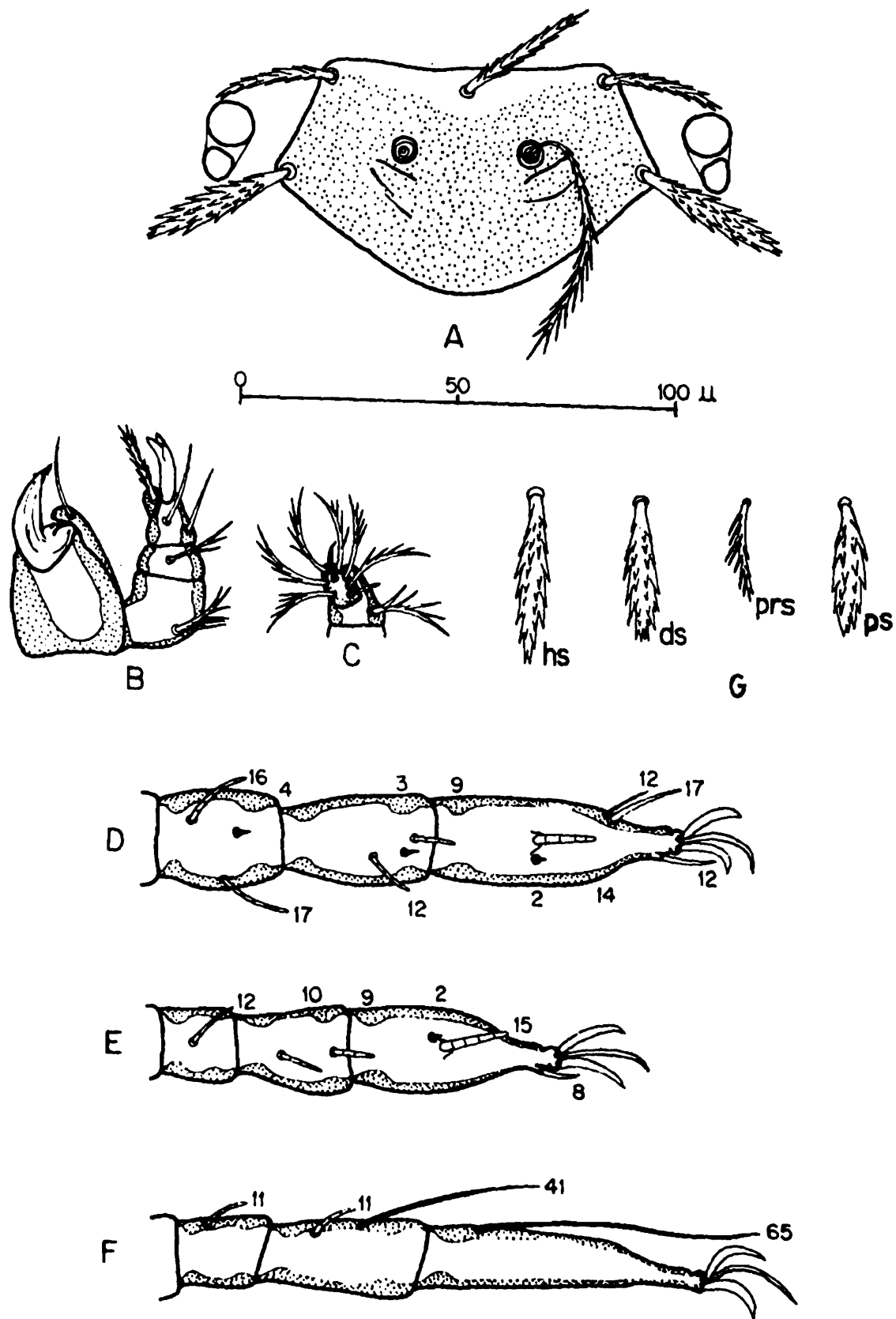


Fig. 92. *Neotrombicula inflata*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

Idiosoma : Measuring 207-407 x 183-341 in unengorged to engorged specimens (Original description : 350x270 in engorged holotype). Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, slightly expanded measuring 37-42 x 6; 22 slightly expanded dorsal idiosomal setae, measuring 34-39 x 6, arranged : 6-4(6)-4-4-2-(2); 2 pairs of unmodified sternal setae, anterior 30-33, posterior 26-33; 12-14 unmodified preanal setae, 23-29; 10-12 slightly expanded postanal setae, 27-40 x 7; total idiosomal setae 52.

Gnathosoma : Palpal setal formula B/b/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (24) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, broadly rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; PL setae slightly expanded, AM and AL setae unexpanded; PL>AM>AL; sensillary bases with posteromedial cuticular ridge; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.46-1.79 (Original description 1.61-1.83). Scutal measurements of holotype followed by means and ranges of 8 paratypes in parentheses after original description : AW 62 (65, 62-67); PW 86 (91, 86-95); SB 29 (30, 26-32); ASB 17 (20, 17-24); PSB 34 (34, 29-35); AP 24 (26, 22-29); AM 35 (33, 29-37); AL 26 (27, 24-30); PL 35 (37, 35-40); sens. 55 (53, 51-55). Scutal measurements giving means and ranges of 10 NIV specimens : AW 64, 61-68; PW 85, 80-93; SB 30, 28-32; ASB 22, 21-24; PSB 30, 28-32; AP 26, 25-28; AM 33, 32-34; AL 29, 28-30; PL 39X6, 36-41 x 6; sens. 58, 57-59.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae; but, 2 genualae I, tibia III 5B, tibiala, and mastitibiala. Measurements as follows : Ip = 612-688 (Original description : 650-700). Leg I : 216-245; tarsus (50-55 x 17-21), tarsala (14-17). Leg II : 187-208; tarsus (47-48 x 16-20), tarsala (10-15). Leg III : 209-243; mastitibiala (45-55); tarsus (62-63 x 13-14), mastitarsala (50-65).

Type data : Holotype (B6629-1) and 3 paratypes, MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Golunda ellioti*, 23.XII.1964, J. Spillett and G.B. Schaller, coll.; 1 paratype, same data, but ex *Rattus blanfordi*, taken 25.XII.1964; 1 paratype, same data, but ex *Mus booduga*, taken 24.XII.1964; 3 paratypes, same data, but ex *Mus musculus humourus*, taken 23,26.XII.1964; 2 paratypes, same data, but ex *Rattus rattus rufescens*, taken 22.XII.1964, J. Spillett, G.B. Schaller, C.J. Mitchell, coll.

Type depository : Holotype in BPBM; paratypes in BPBM, BM(NH), GWHF, USNM, IMR, RML, IA, ZSI, R. Traub and authors' collections.

New records : 4 records of collections in the Himalayan region by NIV field teams : JAMMU and KASHMIR, Rajouri District, Naoshera, 750m, 28 ex *Tatera indica*, 9.XII.1969; 19, same data, but ex 3 *G. ellioti*, taken 8,9.XII.1969.

Material examined : Holotype on loan from BPBM; and paratype (2567/17) at ZSI, ex *Mus musculus humourus*, taken 26.XII.1964.

Remarks : The above redescription is based on the original description, study of the holotype and paratype examined, and the NIV specimens. Mitchell and Nadchatram (1966) consider *N. inflata* similar to *N. hispanica* Kepka, 1960, in the palpal setal formula, nude galeala and modified dorsal body setae. They distinguish *N. inflata* in having 2 genualae I (3 in *N. hispanica*), 22 dorsal body setae (40 in *N. hispanica*), and mastitibiala III present (absent in *N. hispanica*). They further differentiate it in having the cheliceral blade with 2 ventral subapical teeth (not observed in our study), instead of one. The species name *inflata* refers to the modified idiosomal setae characteristic of this species.

104. *Neotrombicula kanzalwanensis* (Womersley)

Trombicula kanzalwanensis Womersley, 1952, 102.

Neotrombicula kanzalwanensis, Womersley and Audy, 1957, 267; Nadchatram, 1979, 75; Prasad, 1974, 88.

Redescription of species : Larva.

Idiosoma : Measuring 260x182 in unengorged type specimen. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 46; 50 dorsal idiosomal setae, measuring 42, arranged : 14-2-8-2-10-8-4-2; 2 pairs of sternal setae; 42 ventral setae, postanal setae measuring 45; total idiosomal setae 98.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, evenly rounded; AM base slightly posterior to level of AL bases; SB slightly posterior to level of PL bases; PL>>AM=AL; sensillae flagelliform with distal branches; PW/SD = 1.61-1.70. Scutal measurements of holotype and a paratype after original description : AW 70, 76; PW 90, 95; SB 31, 34; ASB 28, 28; PSB 28, 28; AP 25, 25; AM 42, 42; AL 42, 42; PL 56, 56; sens. 70, 70.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae; but, 2 genualae I. Measurements as follows : Ip = 790. Leg I : 270. Leg II : 240. Leg III : 280.

Type data : Holotype and 2 paratypes, JAMMU and KASHMIR, Ladakh District, Kanzalwan, ex 'rats', 10,11.X.1946, S.L. Kalra, coll.

Type depository : Holotype and paratypes in SAM.

Remarks : The above redescription is based only on the literature. Womersley and Audy (1957) have redescribed certain diagnostic characters of *N. kanzalwanensis*: palpal claw 3- (not 2-) pronged; humeral setae 1 pair, measuring 46 (not 3 pairs, measuring 53); palpal tarsal setation 7B.S; 2 genualae I, and mastitarsala III present. The species name is based on the type locality.

105. *Neotrombicula kashmirensis* (Womersley)

Trombicula kashmirensis Womersley, 1952, 120.

Neotrombicula kashmirensis, Womersley and Audy, 1957, 251; Lakshana, 1966, 258; Prasad, 1974, 88; Nadchatram, 1979, 75; **not** Fernandes *et al.*, 1988, 109.

Neotrombicula (Neotrombicula) kashmirensis, Traub *et al.*, 1967, 36.

Redescription of species : Larva.

Idiosoma : Measuring 520x429 in type specimen. Eyes 2/2, on ocular plate. One pair of humeral setae; 42 dorsal idiosomal setae, measuring 47, arranged : 12-10-8-6-4-2; 2 pairs of sternal setae; 36 ventral setae, preanal setae measuring approximately 30, postanal approximately 40; total idiosomal setae 84.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, broadly rounded; AM base slightly posterior to level of AL bases; SB slightly anterior to level of PL bases; PL>>AL>AM; sensillae flagelliform with distal branches; PW/SD = 1.58. Scutal measurements giving ranges of type series after original description: AW 81-84; PW 98-101; SB 34-36; ASB 28-31; PSB 34; AP 31; AM 39-45; AL 42-45; PL 53-56; sens. 84.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. The number of genualae I, however, have not been reported. Measurements as follows : Ip = 936. Leg I : 325. Leg II : 286. Leg III : 325.

Type data : Holotype and 3 paratypes, JAMMU and KASHMIR, Ladakh District, Khurdang, ex 'rat', ?.VI.1949, S.L. Kalra, coll.

Type depository : Holotype and paratypes in SAM.

Remarks : The above redescription is based on the literature alone. Lakshana (1966) has described *N. scorpionis* from Thailand, and considers it close to *N. kashmirensis* in scutal shape and absence of mastitarsala III. (Womersley and Audy, 1957, have corrected the original description, reporting the presence of mastitarsala III!). She distinguishes *N. kashmirensis* in having palpogenua seta barbed (nude in *N. scorpionis*), scutum larger (AW measuring 56, PW 75 and AP 25 in *N. scorpionis*), and larger number of dorsal body setae in a different arrangement (28, arranged : 8-8-6-4-2 in *N. scorpionis*). Nadchatram (1979) has described *N. guptai* from Uttaranchal, and considers it closely related to *N. kashmirensis*. He separates *N. guptai* in having 2 pairs of humeral setae, fewer setae in 1st posthumeral row and smaller scutum with a shallower posterior margin. Despite these comparisons with other species, certain diagnostic features and the relationship of *N. kashmirensis* to other species remain doubtful. The taxonomic status of this species will be better understood when

the number of genualae I is known. Womersley and Audy (1957) point out that the species name is to some extent a misnomer as the type specimens were collected in Shyock valley, 8 km below Khurdang Pass in Ladakh Province.

106. *Neotrombicula microti* (Ewing)
(Fig. 93)

Trombicula microti Ewing, 1928, 80; Philip and Fuller, 1950, 56; Schluger, 1955, 209; 1957, 55.

Trombicula (Neotrombicula) microti, Brennan and Wharton, 1950, 164; Wharton and Fuller, 1952, 59.

Neotrombicula (Digenualea) microti, Vercammen-Grandjean, 1960, 469; Vercammen-Grandjean and Kolebinova, 1985, 71; Megens, 1980, 14.

Neotrombicula microti, Traub *et al.*, 1967, 40; Gopachenko *et al.*, 1976, 1157; Vercammen-Grandjean *et al.*, 1973, 63.

Neotrombicula sp. A Fernandes *et al.*, 1988, 109.

Redescription of species : Larva. Colour in life red.

Idiosoma : Measuring 372-469 x 290-348 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 65-69; 38-46 dorsal idiosomal setae, measuring 62-71, irregularly arranged (Megens, 1980 : 20-36, measuring 43-64, arrangement in lectotype : 6-6-6-4-4-2); 2 pairs of sternal setae, anterior 58-60, posterior 53-57; 44-50 preanal setae, 40-46; 12-14 postanal setae, 56-66; total idiosomal setae 102-114 (Megens, 1980 : <90).

Gnathosoma : Palpal setal formula N/N/b(B)NB/7B.S; palpal claw 3-pronged; galeala b; cheliceral blade (52) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal with anterior margin shallowly biconvex; posterior margin convex, broadly rounded; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL>>AM>AL; sensillary bases with antero- and postero-medial cuticular ridges; sensillae flagelliform with barbs along length of shaft; PW/SD = 1.42-1.49. Scutal measurements of lectotype followed by means and ranges of 40 specimens in parentheses after Megens (1980) : AW 84 (75, 65-87); PW 110 (97, 82-106); SB 38 (28, 24-32); ASB 34 (35, 28-41); PSB 30 (29, 24-34); AP 31 (30, 26-36); AM 49 (53, 44-58); AL 47 (49, 35-57); PL 58 (45-72); sens. - (89, 66-113). Scutal measurements of 3 NIV specimens: AW 81, 82, 86; PW 106, 99, 102; SB 31, 28, 30; ASB 40, 39, 39; PSB 31, 30, 33; AP 37, 37, 35; AM 63, 57, 58; AL 62, 54, 60; PL 78, 80, 72; sens. 100, -, 104.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae; but, 2 genualae I, tibia I 9B, mastifemorala III, mastitibiala III, and 2 mastitarsalae III present. Measurements as follows : Ip = 964-1037 (Megens, 1980 : 687-891). Leg I : 328-359; tarsus (76-80 x 26), tarsala (20-21). Leg II : 294-311; tarsus (71x24), tarsala (17-

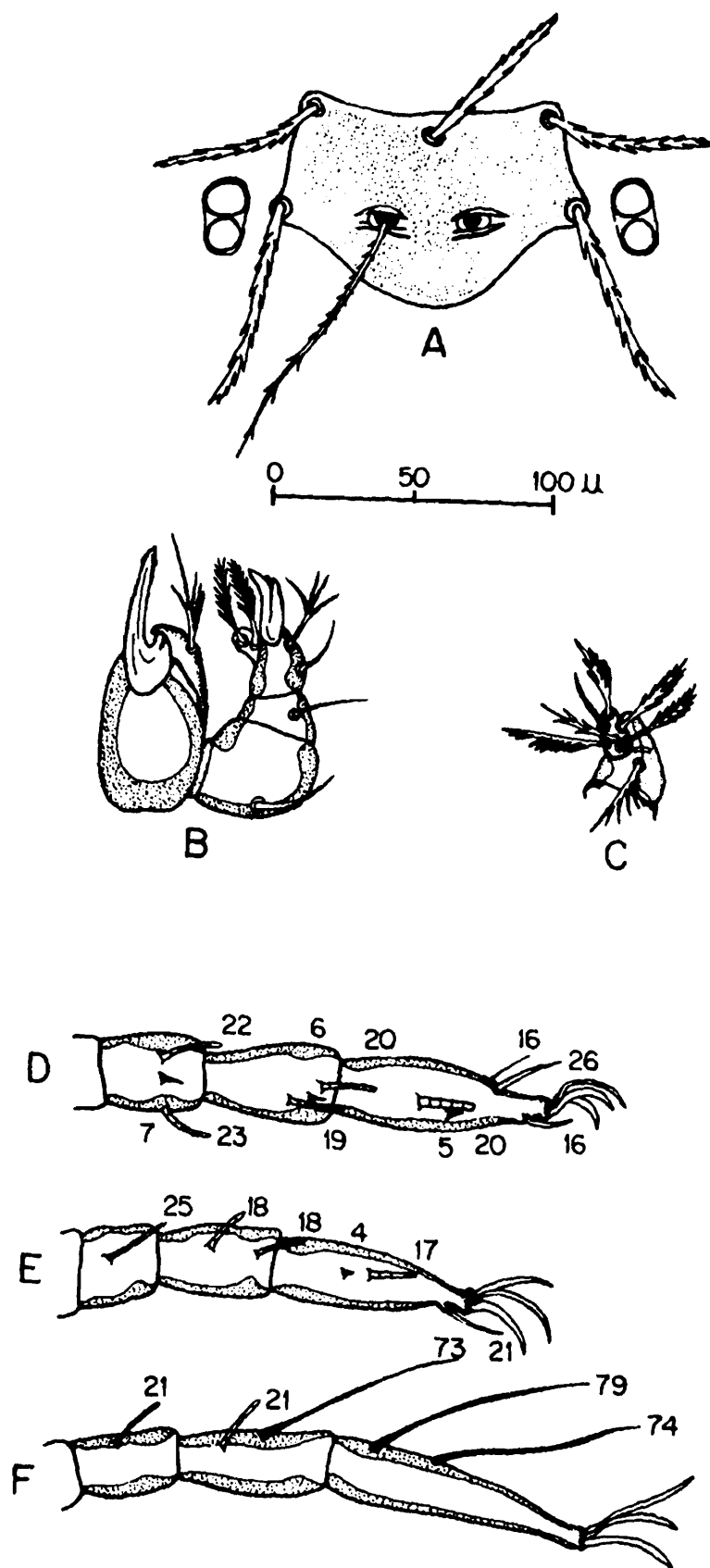


Fig. 93. *Neotrombicula microti*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

18). Leg III : 342-367; mastifemorale (66); mastitibiale (73); tarsus (96x16), mastitarsale (79, 74).

Type data : Lectotype (USNM #948), USA, Wyoming, Lincoln County, Gravel Creek, ex *Microtus richardsoni micropus*, 13.VIII.1931; name of collector not reported.

Type depository : Lectotype at USNM.

Additional records : JAMMU and KASHMIR, Gilgit Agency, mountain desert, 2424-3030m, ex *Suncus* sp. (= *Crocidura* sp.), VI-IX.1962-1965, UM and PMRC teams, coll.

New records : 3 records of collections in the Himalayan region by NIV field teams : UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 3 ex 2 *Rattus rattoides*, 4.7.X.1967; Dehra Dun District, Dehra Dun, 600-800m, 1 ex *Rattus rattus gangutrianus*, 29.X.1967.

Material examined : 2 specimens (B66684-4 and B66684-9) from PAKISTAN, Gilgit Agency, Kohishizar Gupis, 7750ft, ex *Crocidura*, taken 26.VIII.1964, UM and PMRC teams, coll., on loan from BPBM.

Remarks : The above redescription is based on the literature, study of specimens from Gilgit Agency and the NIV specimens. Traub *et al.* (1967) have recorded *N. microti* from Gilgit Agency which falls in Jammu and Kashmir, India, and not Pakistan, as reported. Goff (1975) has described *N. megensi* which he considers close to *N. microti*. He distinguishes *N. microti* in having sensillae distally barbed (nude in *N. megensi*), and a different arrangement of dorsal body setae (arranged : 8-8-8-4-4-2 in *N. megensi*). The Indian specimens differ by the greater number of dorsal body setae and higher Ip range, which led Fernandes *et al.* (1988) to consider them as an independent taxon. There is, however, close agreement in the scutal measurements and the diagnostic characters; hence, the Indian specimens are regarded as *N. microti*. The species name has been derived from the type host.

107. *Neotrombicula nagayoi* (Sasa *et al.*)

(Fig. 94)

Trombicula nagayoi Sasa, Hayashi, Sato, Miura and Asahina, 1950, 14.

?*Tragardhula nagayoi*, Womersley, 1952, 424.

Trombicula (Neotrombicula) nagayoi, Wharton and Fuller, 1952, 59.

Neotrombicula nagayoi, Womersley and Audy, 1957, 267; Schluger and Vysotzkaja, 1970, 156; Fernandes *et al.*, 1988, 109.

Neotrombicula kashmirensis (Womersley, 1952) : Fernandes *et al.* 1988, 109, in part.

Redescription of species : Larva.

Idiosoma : Measuring 281-482 x 203-336 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 52-57; 38-42

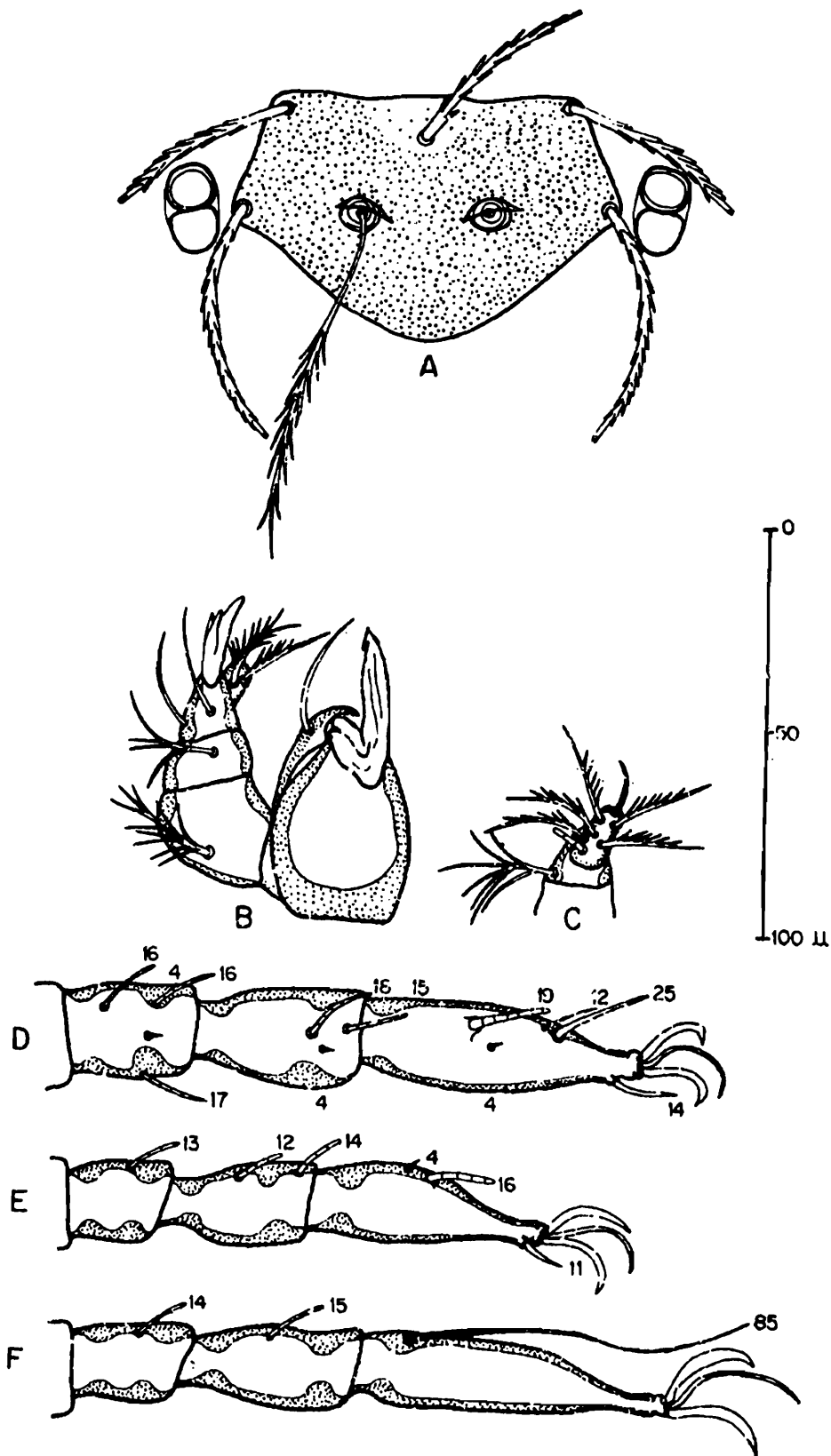


Fig. 94. *Neotrombicula nagayoi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

dorsal idiosomal setae, measuring 44-50, arrangement variable; 2 pairs of sternal setae, anterior 46-51, posterior 44-51; 26-30 preanal setae, 31-36; 10-12 postanal setae, 39-44; total idiosomal setae 84-86. Womersley (1952) : 44 dorsal idiosomal setae, arranged : 8-10-10-8-4-4; 28 ventral setae; total idiosomal setae 88. Schluger and Vysotzkaja (1970) : 36-48 dorsal idiosomal setae; and 32-38 ventral setae.

Gnathosoma : Palpal setal formula B/B/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (39) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, broadly rounded; AM base posterior to level of AL bases; SB level with or slightly anterior to PL bases; PL>>AM>AL; sensillary bases with anteromedial cuticular ridge; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.41-1.56. Scutal measurements after original description as reported by Womersley (1952) : AW 72; PW 89; SB 30; ASB 27; PSB 29; AP 31; AM 45; AL 41; PL 57; sens. 75. Scutal measurements giving means and ranges of 10 NIV specimens : AW 74, 70-78; PW 91, 88-98; SB 31, 29-33; ASB 29, 26-30; PSB 32, 30-34; AP 30, 28-35; AM 45, 40-51; AL 44, 40-49; PL 56, 51-66; sens. 73, 70-76.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. Measurements as follows : Ip = 770-820. Leg I : 260-282; tarsus (68x20), tarsala (15-19). Leg II : 236-250; tarsus (56x19), tarsala (15-17). Leg III : 274-290; tarsus (74x17), mastitarsala (85) (Schluger and Vysotzkaja, 1970 : Leg I : 192-214. Leg II : 166-177. Leg III : 207-229).

Type data : Described from Japan, ex *Microtus montebelli* and *Apodemus speciosus*.

Type depository : Not reported.

New records : 12 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Kinnaur District, Kalpa, 2590-2740m, 1 ex *Rattus rattoides*, 14.V.1968; Kulu District, Jibi, 1000-1922m, 6 ex 2 *R. rattoides*, 15.IV.1969; Palchan, 1800-2290m, 1 ex *R. rattoides*, 3.X.1967; Lahul District, Khoksar, 3050m, 60 ex *Rattus blanfordi*, 26.IX.1967; Mahasu District, Sarhan, 1300-2140m, 7 ex 2 *R. rattoides*, 5,7.V.1968. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 60 ex 2 *Rattus* sp., 8.IX.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 4 ex 2 *R. rattoides*, 4,7.X.1967; Chamoli District, Badrinath, 3100-3500m, 6 ex *Alticola roylei*, 4.VI.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. The Indian specimens agree closely with the standard data and diagnostic features reported for *N. nagayoi*, except for the difference in leg measurements recorded by Schluger and Vysotzkaja (1970). Hence, the Indian material is regarded as *N. nagayoi*. Fernandes *et al.* (1988) reported the NIV collection from UTTARANCHAL as *N. kashmirensis* (Womersley, 1952). *N. nagayoi* is very close to *N. kashmirensis*. The sketchy original descriptions and

inaccessibility of the type material of these 2 species, leaves their independent taxonomic status in much doubt.

108. *Neotrombicula nivalis* Kudryashova
(Fig. 95)

Neotrombicula nivalis Kudryashova, 1977, 52.

Redescription of species : Larva.

Idiosoma : Measuring 572-713 x 356-428 in engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 64-71; 28 dorsal idiosomal setae, measuring 53-64, arranged : 6-6-4-6-4-2; 2 pairs of sternal setae, anterior 51-51, posterior 46-52; 18-20 preanal setae, 35-40; 14-17 postanal setae, 46-54; total idiosomal setae 68-70. Original description : Humeral setae measuring 56-64; dorsal idiosomal setae measuring 42-56; 31 ventral setae, measuring 28-50.

Gnathosoma : Palpal setal formula B/B/NbB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (42) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly biconcave; posterior margin convex, caudal angle rounded; AM base posterior to level of AL bases; SB anterior to level of PL bases; PL>>AL>AM; sensillary bases with antero- and posteromedial cuticular ridges; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.39-1.5. Scutal measurements of holotype and 3 paratypes after original description : AW 76, 78, 76, 73; PW 90, 90, 90, 87; SB 29, 31, 28, 28; ASB 28, 29, 31, 31; PSB 28, 27, 25, 25; AP 28, 31, 28, 28; AM 36, -, 34, 36; AL 42, 45, 42, 42; PL 62, 62, 64, 59; sens. 67, -, -, -. Scutal measurements giving means and ranges of 10 NIV specimens : AW 83, 75-86; PW 96, 93-100; SB 32, 29-34; ASB 34, 32-35; PSB 34, 32-36; AP 31, 28-2; AM 44, 42-47; AL 48, 46-51; PL 65, 62-69; sens. 88, 80-99.

Legs : Similar to *N. autumnalis* (Shaw, 1790) in the number of ordinary and sensory setae. Measurements as follows : Ip = 979-1060 (Original description : 938-991). Leg I : 354-378; tarsus (93x22), tarsala (23-24). Leg II : 289-315; tarsus (73x19), tarsala (18-20). Leg III : 331-375; tarsus (99x16), mastitarsala (85).

Type data : Holotype (No. I-395-3842-43) and 6 additional larvae (paratypes?), IRAN, 20 km South of Mesched, 1100m, ex high altitude field-voles, 15-19.X.1970, V.M. Neronov and A. Farhang-Azad, coll.

Type depository : Type specimens in Zoological Museum, Moscow University.

New records : 11 records of collections from the Himalayan region by NIV field teams

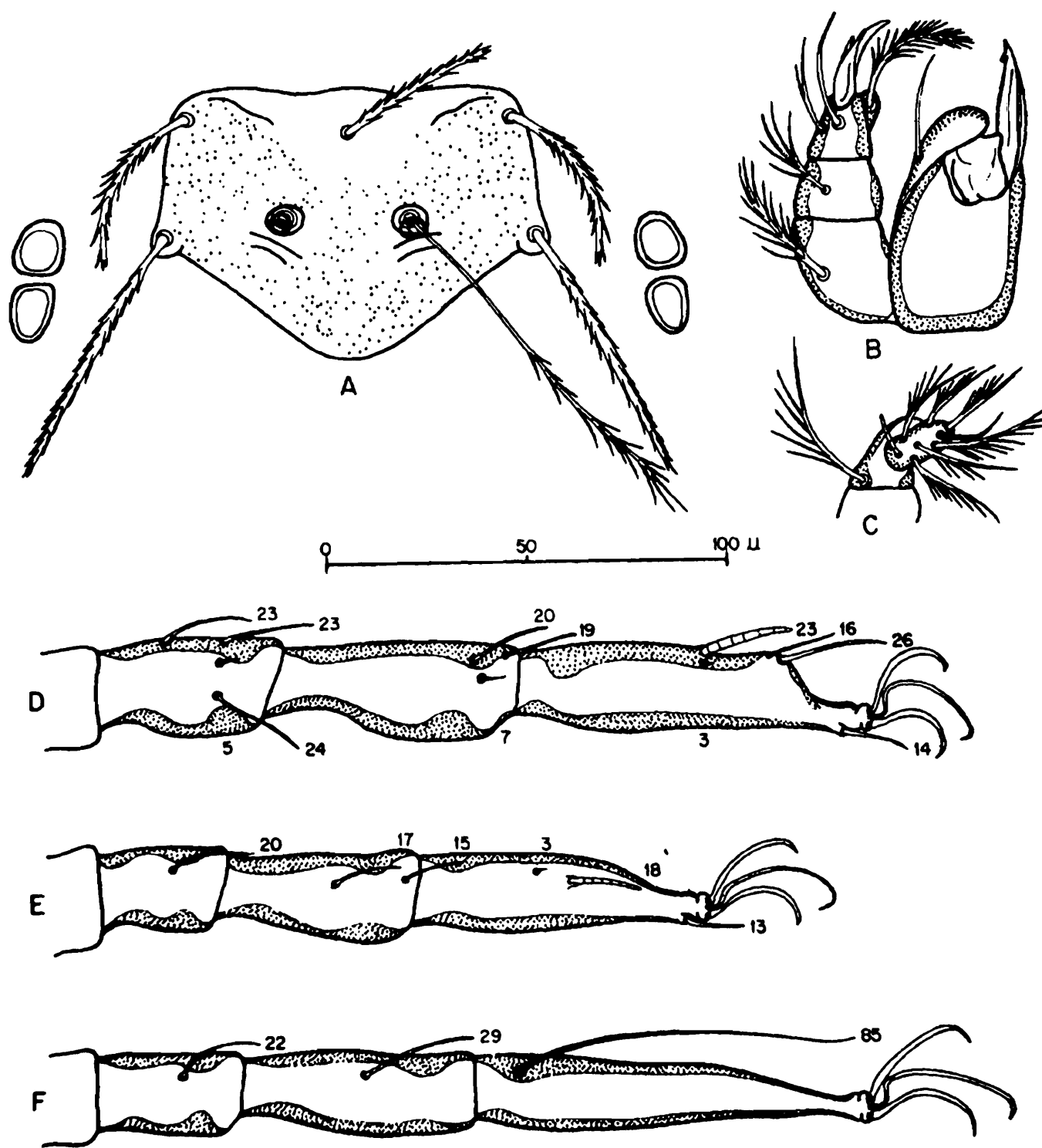


Fig. 95. *Neotrombicula nivalis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

: JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 22 ex 3 *Rattus rattoides*, 2,3.XI.1969; 1, same data, but ex *Mus musculus*, taken 2.XI.1969; 4, same data, but ex *Bandicota bengalensis*; 1, same data, but ex *Capra* sp., taken 1.XI.1969; Rampore, 1400m, 30 ex 2 *Rattus* sp. 8.XI.1969; 1, same data, but ex *Suncus murinus*, taken 5.XI.1969; Doda District, Bhadarwah, 1700m, 2 ex *Parus monticolus monticolus*, 15.XI.1969; Udhampur District, Kulwanda, 1700-1800m, 10 ex *R. rattoides*, 4.XII.1969.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Kudryashova (1977) considers this species close to *N. heptneri* Kudryashova, 1973. *N. nivalis* may be distinguished in having dorsal palpotibial seta nude (barbed in *N. heptneri*), fewer dorsal body setae (30-34 in *N. heptneri*), and shorter scutal setae (AM measuring 38-42, AL 40-48, and PL 62-70 in *N. heptneri*). The Indian specimens agree closely with the standard data and diagnostic features reported for this species. This is the first record of *N. nivalis* from India.

Genus *Trombiculindus* Radford

Trombiculindus Radford, 1948a, 126; Traub and Evans, 1951, 262; Hsu, 1964, 101; Goff, 1987, 101; Liao *et al.*, 1987, 129.

Trombiculindus (Plumisicola), Sinha, 1954, 333; Traub and Nadchatram, 1967b, 420 (synonymy of *Plumisicola* with subgenus *Trombiculindus*)

Trombicula (Trombiculindus), Wharton and Fuller, 1952, 61; Audy, 1954b, 127; Womersley and Audy, 1957, 258; Schluger *et al.*, 1963, 696.

Leptotrombidium (Trombiculindus), Domrow, 1960a 166; Vercammen-Grandjean, 1960, 469; 1968b, 76; Vercammen-Grandjean and Langston, 1971, 447; 1976, 613; Mitchell and Nadchatram, 1966, 68; Traub and Nadchatram, 1967b, 419; Nadchatram, 1984, 1107; Brown, 1992, 288.

Type species : *Trombiculindus squamosus* Radford, 1948, by monotypy and original designation.

Diagnosis : Trombiculini larvae parasitic on small mammals. Legs all 7-segmented; onychotriches absent. 1 or 2 genualae I, genuala II and genuala III; mastisetae absent. Palpal tarsus 7B; dorsal palpotibial seta branched (if nude, all palpal setae nude); palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap. Eyes 2/2. Scutum subrectangular with simple punctae and projection of posterior margin; SB level with or posterior to level of PL bases; AM seta submarginal; AL setae marginal; sensillae flagelliform, branched distally; PL and dorsal body setae expanded or foliate (often some post-anal setae also modified).

Remarks : There is little agreement in the literature regarding the taxonomic status of *Trombiculindus*. Several workers regard it as a subgenus of *Leptotrombidium* Nagayo *et al.*, 1916, to which it is closely related. Following Goff (1987) and Liao *et al.* (1987), *Trombiculindus* is accorded full generic status. Nadchatram (1984) records 37 nominal species, while Goff (1987) reports a more conservative 34 known species in this genus. No subgeneric distinction is recognized here. The distribution of *Trombiculindus* is restricted

to the Oriental region. 11 *Trombiculindus* species are reported here from India, 3 new to science.

109. *Trombiculindus squamosus* Radford
(Fig. 96)

Trombiculindus squamosus Radford, 1948a, 127; 1954, 263; Traub and Evans, 1951, 262; Sinha, 1954, 333.

Trombicula squamosa, Womersley, 1952, 141; Prasad, 1974, 98.

Trombicula (Trombiculindus) squamosus, Audy, 1957, 235.

Trombicula (Trombiculindus) squamosa, Womersley and Audy, 1957, 259; Wharton and Fuller, 1952, 61; Schluger, 1957, 67.

Leptotrombidium (Trombiculindus) squamosum, Domrow, 1960a, 163; Vercammen-Grandjean, 1968b, 76; Vercammen-Grandjean and Langston, 1976, 689; Fernandes *et al.*, 1988, 109.

Redescription of species : Larva. Colour in life red (?).

Idiosoma : Measuring 271-325 x 200-210 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of foliate humeral setae, measuring 79-90 x 58-66; 30-32 foliate dorsal idiosomal setae, measuring 60-91 x 38-74, arranged : 6(8)-6-6-6-4-2; 2 pairs of unexpanded sternal setae, anterior 57-62, posterior 52-57; 20-22 unexpanded preanal setae, 64-91; 18 foliate postanal setae, 94-100 x 68-74; total idiosomal setae 78.

Gnathosoma : Palpal setal formula N/N/NNN/7B (Womersley, 1952, 'in text', and Womersley and Audy, 1957 : dorsotibial palpal seta barbed!); palpal claw 3-pronged; galeala B; cheliceral blade (42) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB slightly anterior to or level with PL bases; PL setae foliate, AM and AL setae unexpanded; PL>AM>AL; sensillae flagelliform with basal barbs and branches on distal 1/2; PW/SD = 1.90-2.13 (Original description : 1.52!). Scutal measurements after original description and of lectotype after Vercammen-Grandjean and Langston (1976), followed by measurements of 1 paratype after Womersley (1952) in parentheses : AW 83, 86 (88); PW 100, 99 (100); SB 33, 38 (40); ASB 33, 32 (36); PSB 33, 20 (11); AP 28, 30 (31); AM 71, 74 (73); AL 71, 72 (67); PL 71, 76x48 (75x54); sens. 92, 94 (80). Scutal measurements giving means and ranges of 10 NIV specimens : AW 81, 75-88; PW 97, 92-107; SB 37, 34-40; ASB 30, 29-32; PSB 20, 19-23; AP 29, 28-30; AM 70, 68-74; AL 69, 66-72; PL 74X41, 71-76 X 40-42; sens. 95, 88-108.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Measurements of lectotype after Vercammen-Grandjean and Langston (1976) and of 1 paratype after Womersley (1952) in parentheses : lp = 944 (964). Leg I :

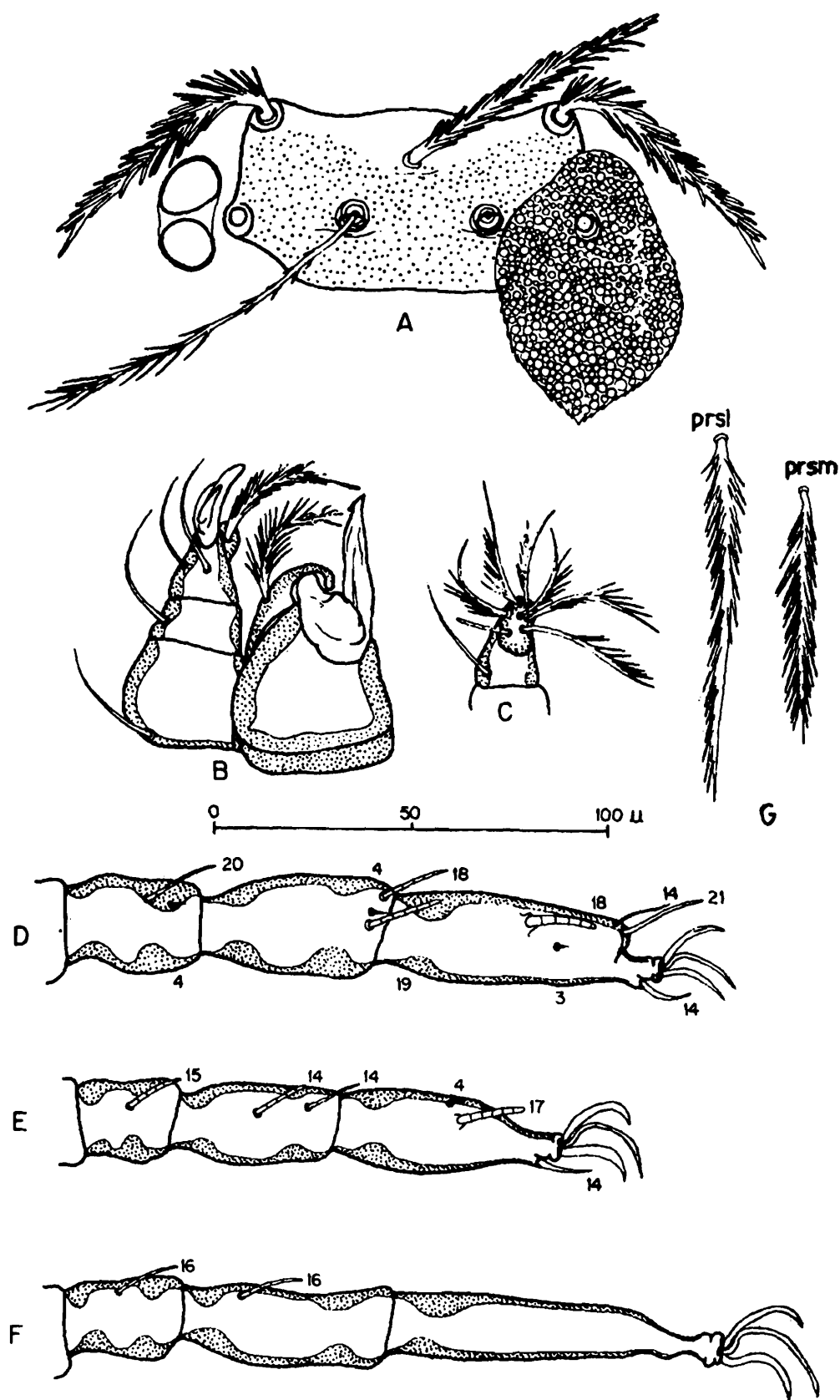


Fig. 96. *Trombiculindus squamosus*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

318 (312); coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, gennuala, microgennuala; tibia 8B, 2 tibialae, microtibiala; tarsus 21B, tarsala, microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 278 (292); coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, gennuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala, microtarsala, pretarsala. Leg III : 348 (360); coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, gennuala; tibia 6B; tarsus 15B. Measurements of NIV specimens as follows: Ip = 829-925. Leg I : 276-311; tarsus (69x23), tarsala (18). Leg II : 252-281; tarsus (56x21), tarsala (17). Leg III : 300-333; tarsus (84x15).

Type data : Lectotype (B.M. No. 1948-2-3-37), and 19 paratypes, UTTARANCHAL, Kumaon Hills, Ranikhet, ex *Rattus* sp., X.1946, S.L. Kalra, coll.

Type depository : Lectotype at BM(NH); paratypes at USNM, and in collections of Radford, Womersley, Kalra, and other acarologists.

New records : 12 records of collections from the Himalayan region by NIV field teams : UTTARANCHAL, Chamoli District, Gwaldam, 1500-2100m, 2 ex *Rattus rattoides*, 12.IV.1967; 1, same data, but ex *Rattus niviventer*, taken 9.IV.1967; 7, same data, but ex *Rattus fulvescens*, taken 10.IV.1967; Nainital District, Mukteshwar, 1400-2300m, 42 ex 4 *R. rattoides*, taken 13,14.XI.1966, and 25,26.XI.1967; 43, same data, but ex 4 *R. niviventer*, taken 13,14.XI.1966 and 26.XI.1967; 2, same data, but ex *R. fulvescens*, taken 13.XI.1966.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *T. squamosus* runs to couplet 2 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976). It is similar to *T. squamiferus* (Womersley, 1952), *T. manis* (Schluger, 1955) and *T. cardiosetosus* Hsu and Chen, 1964, in having a single gennuala I and palpo setal formula N/N/NNN. Vercammen-Grandjean and Langston (1976) characterize *T. squamosus* as having foliate PL and modified body setae with medial or peltate, and not basal, attachment. They describe these setae as peppered with circular concavities, each of which contains a small spicule. These spicules have not been observed in this study. Barring this difference, the NIV specimens agree closely with the description given in the literature. The species name, derived from the Latin meaning 'covered with scales', draws attention to the expanded scutal and body setae characteristic of *T. squamosus*.

110. *Trombiculindus aetherius* new species (Fig. 97)

Leptotrombidium (Trombiculindus) sp. A Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 316-511 x 232-395 in partially engorged specimens. Eyes 2/2,

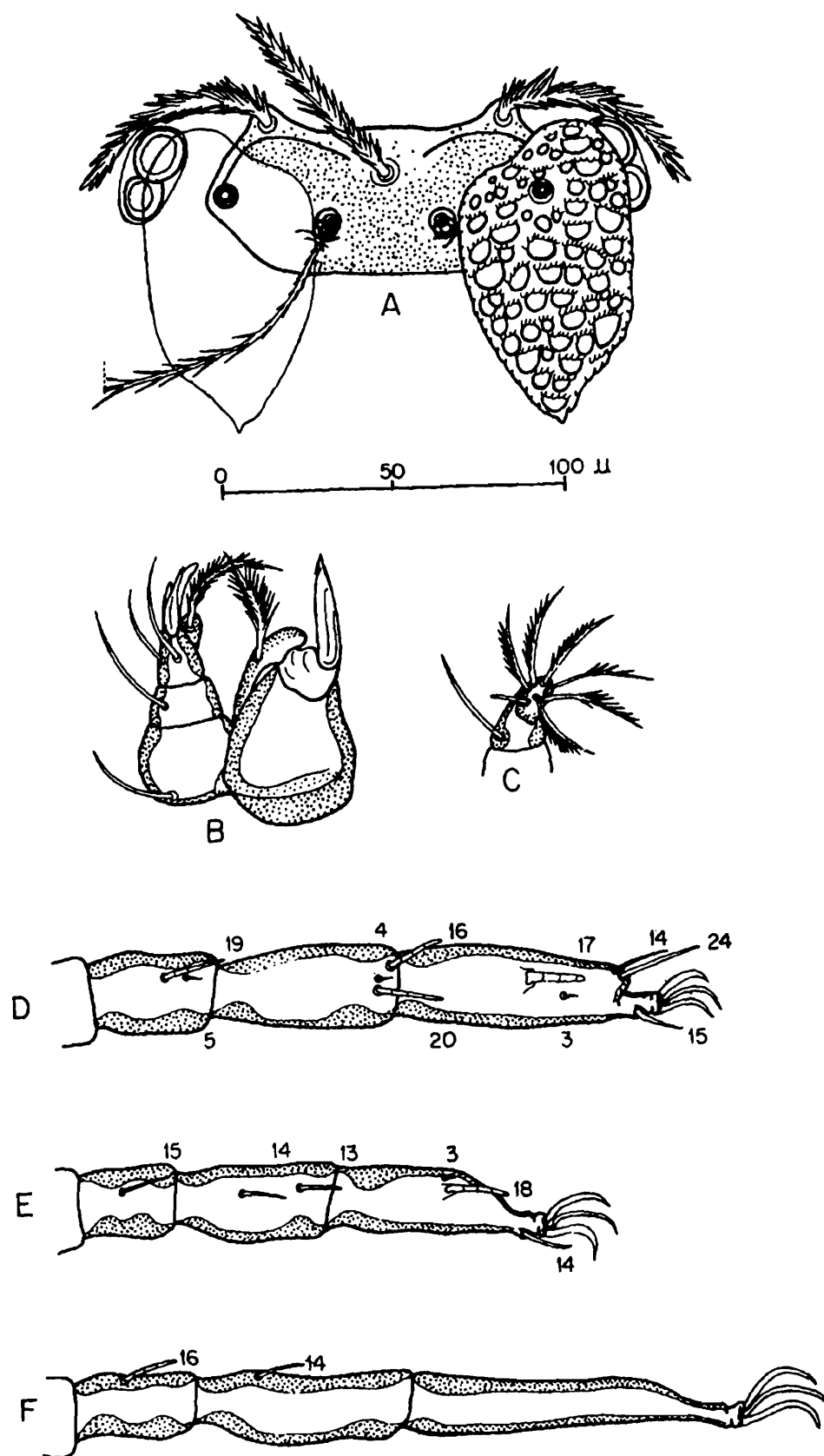


Fig. 97. *Trombiculindus aetherius* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

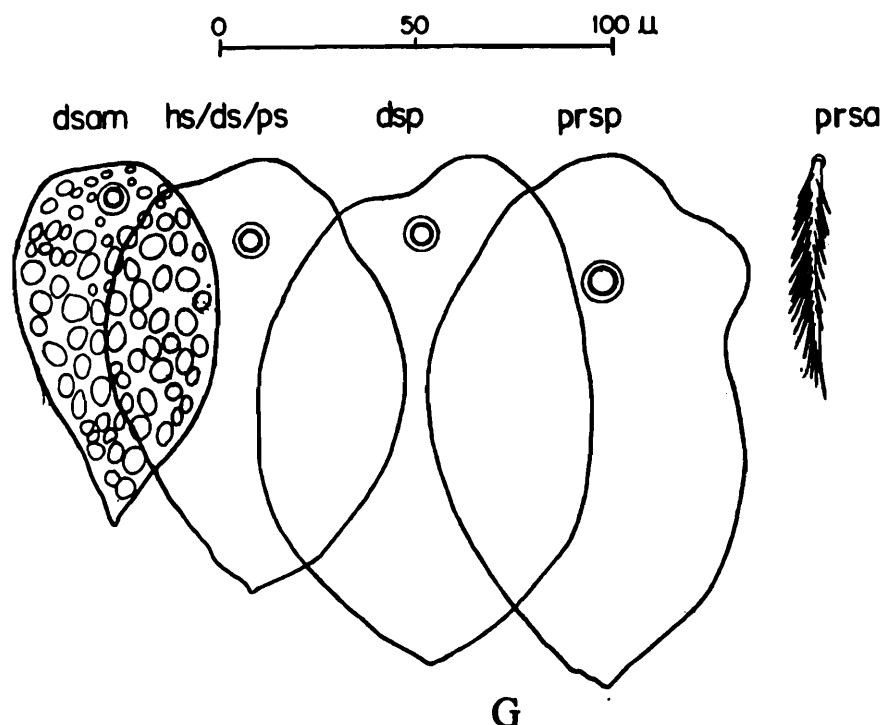


Fig. 97. *Trombiculindus aetherius* new species
G. selected idiosomal setae.

anterior slightly larger, on ocular plate. One pair of foliate humeral setae, measuring 106-110 x 73-76; 30 foliate dorsal idiosomal setae, measuring 88-134 x 50-86, anteromedian setae smaller, arranged : 6-6-6-6-4-2; 2 pairs of unexpanded sternal setae, anterior 67-73, posterior 46-54; 20-22 unexpanded preanal setae, 61-77; 2-4 foliate preanal and 4-6 foliate postanal setae, 110-136 x 73-95; total idiosomal setae 64-66.

Gnathosoma : Palpal setal formula N/N/NNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (41) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with shallowly concave anterior margin; posterior margin broadly rounded, medially truncate; anterolateral margins thickly sclerotized; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; PL > AL > AM; sensillae flagelliform with basal barbs and branches on distal portion, broken in all specimens examined; PW/SD = 1.77-1.94. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 72 (74, 68-78); PW 94 (96, 91-99); SB 33 (34, 32-36); ASB 34 (34, 31-35); PSB 16 (18, 16-19); AP 25 (25, 22-27); AM 64 (69, 64-73); AL 58 (64, 58-67); PL 86x52 (88x50, 84-93 x 48-56); sens. -, broken off in specimens extant.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae. Measurements as follows : Ip = 969-1072. Leg I : 308-349; tarsus (76x23), tarsala (17). Leg II : 293-326; tarsus (62x18), tarsala (18). Leg III : 348-397; tarsus (97x16).

Type data : Holotype (NIV AA26779.18), and 7 paratypes, WEST BENGAL, Darjeeling District, Darjeeling, 2134m, ex *Mus* sp., 22.III.1983, S. Fernandes, coll.

Additional records : 5 records of collections from the Himalayan region by NIV field teams : UTTARANCHAL, Almora District, Sukhidang, 250-1400m, 3 ex *Suncus murinus*, 4.III.1967; Nainital District, Bhimtal, 1200-1700m, 5 ex 2 *S. murinus*, 28.XI.1966; Mukteshwar, 1800-2300m, 1 ex *Rattus rattoides*, 13.XI.1966; 5, same data, but ex *Rattus niviventer*.

Remarks : *T. aetherius* will fall out at couplet 2 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. squamosus* Radford, 1948. *T. aetherius* is very close to this species in having a single genuala I, similar palpo setal formula, and cordiform dorsal body setae with peltate attachment. *T. aetherius* may be distinguished by the broadly rounded, medially truncate posterior scutal margin (biconvex in *T. squamosus*), and in having SB posterior to level of PL bases (anterior in *T. squamosus*). The species name derived from the Latin meaning 'ethereal', draws attention to the delicately sculpted foliate PL and body setae which give this remarkable species a celestial appearance!

111. *Trombiculindus cuneatus* Traub and Evans

Trombiculindus cuneatus Traub and Evans, 1951, 268; Audy *et al.*, 1953, 27; Sinha, 1954, 333.

Trombicula cuneata, Womersley, 1952, 139; Prasad, 1974, 94.

Trombicula (Trombiculindus) cuneata, Womersley and Audy, 1957, 258; Wharton and Fuller, 1952, 61.

Leptotrombidium (Trombiculindus) cuneatum, Traub and Nadchatram, 1967b, 419; Vercammen-Grandjean, 1968b, 76; Vercammen-Grandjean and Langston, 1976, 664.

Redescription of species : Larva.

Idiosoma : Measuring 280x180 in partially engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of foliate humeral setae, measuring 58-68 x 16-21; 28-30 foliate dorsal idiosomal setae, anterior measuring 48-58 x 15-18, anteromedian smaller, posterior 34x7, arranged : 8-6-6-4(6)-(4)-2; 2 pairs of unexpanded sternal setae; 14 unexpanded preanal setae, 30-45; 4-8 foliate postanal setae, 38-53 x 5-9 (Original description : about 18 unexpanded ventral setae); total idiosomal setae 52-56.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly concave; posterior margin almost straight; AM base posterior to level of AL bases, slightly anterior to level of PL bases; SB 13-14 posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; AM>PL>>AL after original description; but, Womersley (1952) for Imphal specimens, and Vercammen-Grandjean and Langston (1976) : PL>AM>>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.70-2.02. Scutal

measurements giving means of 16 type specimens after original description followed by measurements of holotype, paratype #3069 and paratype #546 in parentheses after Vercammen-Grandjean and Langston (1976) : AW 70 (71, 72, 63); PW 85 (84, 81, 78); SB 44 (43, 42, 43); ASB 26 (31, 30, 28); PSB 16 (14, 13, 18); AP 16 (15, 14, 13); AM 63 (64x6, 63x5, -); AL 31 (37x3, -, 36x3); PL 60 (68x21, 70x18, 63x17); sens. 68 (74, -, -). Scutal measurements of 2 Imphal specimens after Womersley (1952): AW 84, 84; PW 106, 112; SB 50, 50; ASB 34, 34; PSB 22, 22; AP 17, 17; AM 75, -; AL 36, 36; PL 84x28, 84x28; sens. -, -.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements of holotype and 2 paratypes after Vercammen-Grandjean and Langston (1976) : Ip = 704, 708, 697. Leg I : 240, 242, 234. Leg II : 222, 226, 215. Leg III : 242, 240, 248.

Type data : Holotype, North BURMA, Myitkyina, ex *Crocidura* sp., 29.XI.1944, USATC, coll.; 25 paratypes, same data, but ex *Crocidura* sp. and *Suncus* sp., taken XI.1944-II.1945.

Type depository : Holotype at USNM; paratypes at USNM, BM(NH), SAM and RML.

Additional records : MANIPUR, Palel, 55km South of Imphal, 2 ex *Suncus murinus*, XI.1945, STRU, coll.

Remarks : The above redescription is based only on the literature. *T. cuneatus* falls out in couplet 32 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. lepismatus* (Traub and Nadchatram, 1967). They distinguish *T. cuneatus* in having a lower Ip (977 in *T. lepismatus*), narrower PW (measuring 95 in *T. lepismatus*), and microtarsala II adjacent to tarsala II (proximal in *T. lepismatus*). *T. cuneatus* is close to *T. cuteanus* (Vercammen-Grandjean and Langston 1976), from which it differs in having a lower Ip (829 in *T. cuteanus*), palpo setal formula N/N/BNN (N/N/BNB in *T. cuteanus*), and microtarsala I distal to tarsala I (proximal in *T. cuteanus*). Vercammen-Grandjean and Langston (1976) describe the PL setae as proportionately one of the largest of the group, with 8-9 rows of short spicules at their largest width, and 20 in the median row, with certain rows confluent on their way to the apex. The species name draws attention to the spearhead-like modified PL and body setae. Vercammen-Grandjean and Langston remark that this name does not seem appropriate as the modified setae are lanceolate rather than leaf-like or cuneiform.

112. *Trombiculindus deccanensis* (Mitchell and Nadchatram) (Fig. 98)

Leptotrombidium (Trombiculindus) deccanense Mitchell and Nadchatram, 1966, 68; Mitchell *et al.*, 1966, 121; Vercammen-Grandjean and Langston, 1976, 630.

Leptotrombidium deccanense, Prasad, 1974, 84.

Redescription of species : Larva.

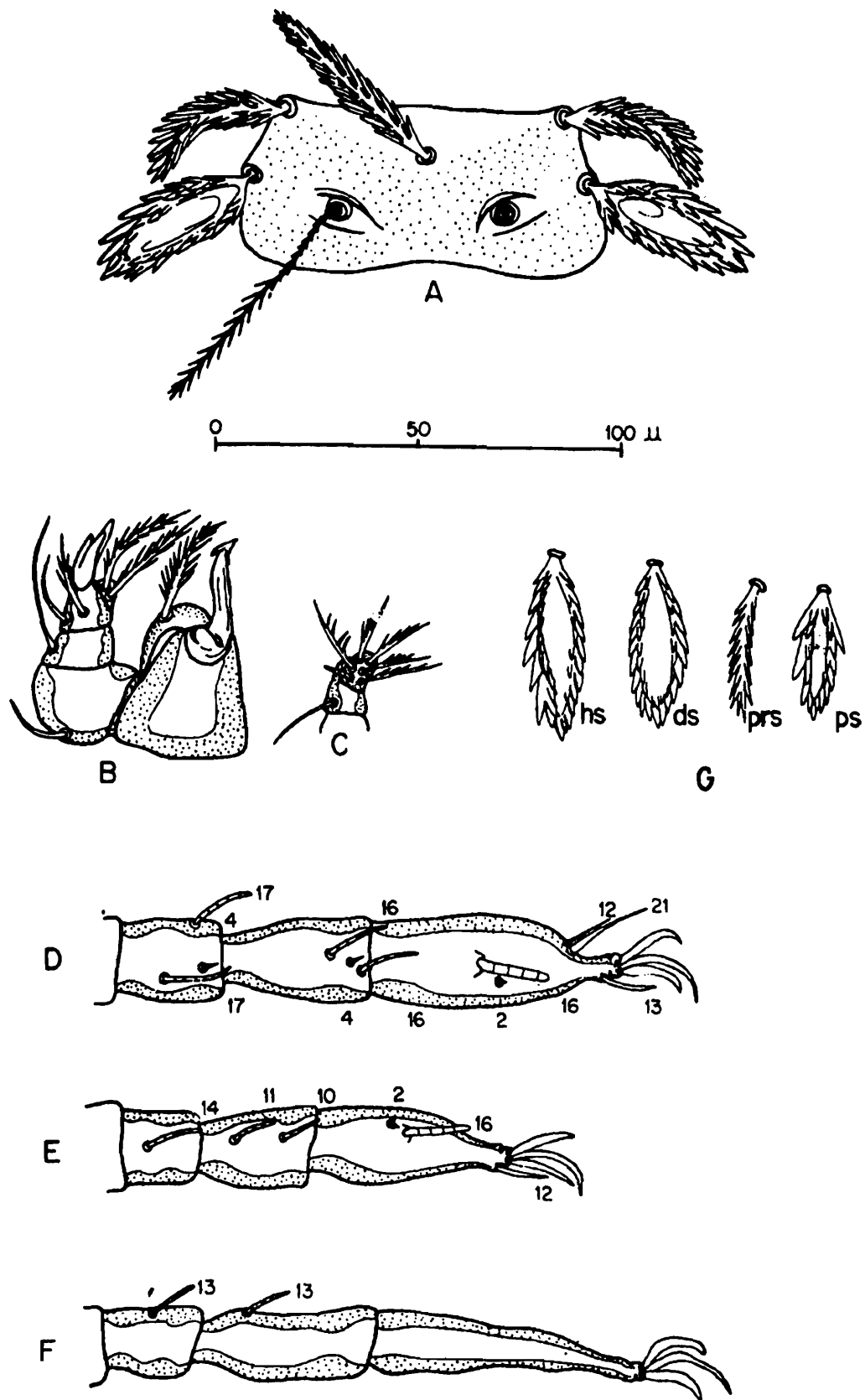


Fig. 98. *Trombiculindus deccanensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

Idiosoma : Measuring 425x400 in engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of foliate humeral setae, measuring 38-43 x 12-13; 56-62 foliate dorsal idiosomal setae, measuring 35-39 x 10-12, irregularly arranged, arrangement commencing: 12-4-10-10 or 6-10-10-10; 2 pairs of unexpanded sternal setae; 22-24 unexpanded preanal setae, 30-33; 34-38 foliate postanal setae, 28-32 x 8-10; total idiosomal setae 118-130 (Vercammen-Grandjean and Langston, 1976 : 82 dorsal idiosomal setae, measuring 33-38 x 10-13, arranged : 12-10-12-10-12-8-6-6-4-2; 24 preanal setae, 34-52; 22 postanal setae, 35x11; total idiosomal setae 134).

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (28-31) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subrectangular with anterior margin shallowly concave; posterior margin biconvex; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; AM>PL>AL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.95-2.31. Scutal measurements of holotype followed by means and ranges of 10 species in parentheses after original description : AW 71 (68, 66-71); PW 89 (84, 81-89); SB 43 (40, 37-43); ASB 30 (26, 23-30); PSB 15 (14, 12-15); AP 18 (18, 15-20); AM 54 (51, 48-54); AL 40 (38, 34-42); PL 44x13 (42x13, 36-44 x 12-14); sens. 65 (66, 64-72). Scutal measurements giving means of 2 paratypes after Vercammen-Grandjean and Langston (1976) : AW 68; PW 84; SB 40; ASB 28; PSB 15; AP 19; AM 50; AL 40; PL 44x13; sens. 78.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements after original description : Ip = 750. Leg I : tarsus (53-57 x 18-19), tarsala (16-18). Leg II : tarsus (48-51 x 17), tarsala (16-18). Leg III : tarsus (66-70 x 14-16). Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 768. Leg I : 263. Leg II : 230. Leg III : 275.

Type data : Holotype (BISHOP 6628) and 15 paratypes, MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Golunda ellioti*, 23.XII.1964, J. Spillett and G.B. Schaller, coll.

Type depository : Holotype at BPBM; paratypes at BPBM, IMR, BM(NH), USNM, ZSI, RML, IA, and collections of R. Traub, C.J. Mitchell, and M. Nadchatram.

Additional records : 7, same data as type series, but ex *Mus musculus humourus*, taken 23.XII.1964; 1, same data, but ex *Mus booduga booduga*; 12, same data, but ex 2 *Suncus stoliczkanus*, taken 23,27.XII.1964; 4, same data, but ex 3 *Rattus rattus rufescens*, taken 20,22.XII.1964, C.J. Mitchell, J. Spillett, and G.B. Schaller, coll.

Material examined : Holotype, on loan from BPBM.

Remarks : The above redescription is based on the literature and study of the holotype. *T. deccanensis* runs to couplet 11 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976). They consider this species close to *T. pruthi* Sinha, 1954, from which it differs in having a wider AP and the biconvex posterior scutal protrusion noticeably shorter. This protrusion is remarkable in being the widest portion of the scutum. Mitchell and Nadchatram (1966) distinguish *T. deccanensis* from *T. pruthi* by differences in the scutal shape and dimensions, and the number and arrangement of dorsal body setae. They describe the expanded PL setae as tapering at both ends, dorsoventrally compressed with well-sclerotized lateral margins; the margins bear 2 rows of 8-10 spines, which extend the length of the seta, the spines of the dorsal rows being shorter and closely adpressed. The species name is based on the collection locality - the Central Indian Highlands, known as the Deccan.

113. *Trombiculindus foliaceus* Traub and Evans

Trombiculindus foliaceus Traub and Evans, 1951, 262; Audy *et al.*, 1953, 27; Sinha, 1954, 333.

Trombicula foliacea, Womersley, 1952, 142; Prasad, 1974, 95.

Trombicula (Trombiculindus) foliacea, Wharton and Fuller, 1952, 61; Womersley and Audy, 1957, 258.

Leptotombidium (Tombiculindus) foliaceum, Vercammen-Grandjean, 1968b, 76; Vercammen-Grandjean and Langston, 1976, 651.

Leptotrombidium (Trombiculindus) foliatum, sic! Traub and Nadchatram, 1967b, 419.

Redescription of species : Larva.

Idiosoma : Measuring 430-650 x 240-520 in unengorged to engorged specimens. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of foliate humeral setae, measuring 72-76 x 31-34; 24-26 foliate dorsal idiosomal setae, measuring 60-67 x 26-35, arrangement commencing : 8-6-6 (Vercammen-Grandjean and Langston, 1976 : 28 dorsal idiosomal setae, anterior measuring 60-85 x 26-39, posterior 38-42 x 14-17, arranged : 8-6-6-6-2); 2 pairs of unexpanded sternal setae; 16 unexpanded preanal setae, 39-58; 4 foliate postanal setae, 53-54 x 22 (Original description : about 20 unexpanded ventral setae; Womersley, 1952 : approximately 16-20 unexpanded ventral setae); total idiosomal setae 50-54.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin almost straight; AM between 4-5 and SB between 17-18 posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; PL > AM >> AL; sensillae flagelliform with branches on distal 1/2; PW/SD = 1.91-2.15 (Vercammen-Grandjean and Langston, 1976 : 1.79-1.84). Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 68 (66, 63-68); PW 84 (82, 77-84); SB 39 (39, 35-42); ASB 25 (26, 25-28); PSB 14 (15, 14-16); AP 14 (13, 12-14); AM 53 (51, 49-53);

AL 35 (31, 28-35); PL 67 (66, 60-73); sens. 60 (-). Scutal measurements of holotype, 1 paratype and 1 Kanglatongbi specimen after Vercammen-Grandjean and Langston (1976) : AW 68, 66, 66; PW 84, 84, 83; SB 40, 40, 43; ASB 31, 30, 30; PSB 16, 15, 17; AP 14, 13, 13; AM 56x5.3, -, -. AL 35x3.4, 35x3.1, 36x2.5; PL 70x40, 74x36, 71x37; sens. 70, -, -.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements giving means of type series after original description, followed by measurements of holotype, 1 paratype and Kanglatongbi specimen in parentheses after Vercammen-Grandjean and Langston (1976) : Ip = 690 (754, 756, 752). Leg I = 230 (257, 260, 256). Leg II = 210 (235, 232, 232). Leg III = 250 (262, 264, 264).

Type data : Holotype (USATC No. 646-15), North BURMA, Shingbuiyang, ex *Crocidura* sp., 13.II.1945, USATC, coll.; 6 paratypes, same data, but taken II-III.1945.

Type depository : Holotype at USNM; paratypes at BM(NH), SAM and RML.

Additional records : MANIPUR, Palel, 55km South of Imphal, ex *Suncus murinus*, XI.1945, STRU, coll.; 1, same data, but Kanglatongbi, North of Imphal, taken 1.XI.1945.

Remarks : The above redescription is based only on literature. *T. foliaceus* runs to couplet 14 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976). They distinguish this species by its embossed, cordiform dorsal setae. They describe the PL, humeral and dorsolateral body setae as having 8 longitudinal crests or veins in their mid-width, with each crest bearing a series of short inconspicuous spicules. There are cells, corresponding to a concavity on the ventral surface, between each crest. The crests are confluent at the apex of the phyllode in a sort of delta, isolating a few cells. Vercammen-Grandjean and Langston further comment on the huge protrusion of the posterior scutal margin and the reduced AP, characteristic of *T. foliaceus*. The species name draws attention to the ovate modified PL and body setae, characteristic of this species.

114. *Trombiculindus fordi* (Womersley)

(Fig. 99)

Trombicula (*Neotrombicula*) *fordi* Womersley, 1952, 75; Audy *et al.*, 1953, 27.

Trombicula (*Trombiculindus*) *fordi*, Womersley and Audy, 1957, 258.

Leptotrombidium (*Trombiculindus*) *fordi*, Traub *et al.*, 1968, 370; Vercammen-Grandjean and Langston, 1976, 626; Brown, 1992, 290.

Trombicula fordi, Prasad, 1974, 95.

Redescription of species : Larva.

Idiosoma : Measuring 325-407 x 225-374 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of foliate humeral setae, measuring 54-56 x 10-11; 46 foliate dorsal idiosomal setae, measuring 43-51 x 9-11, arranged : 10-8-8-8-6-4-

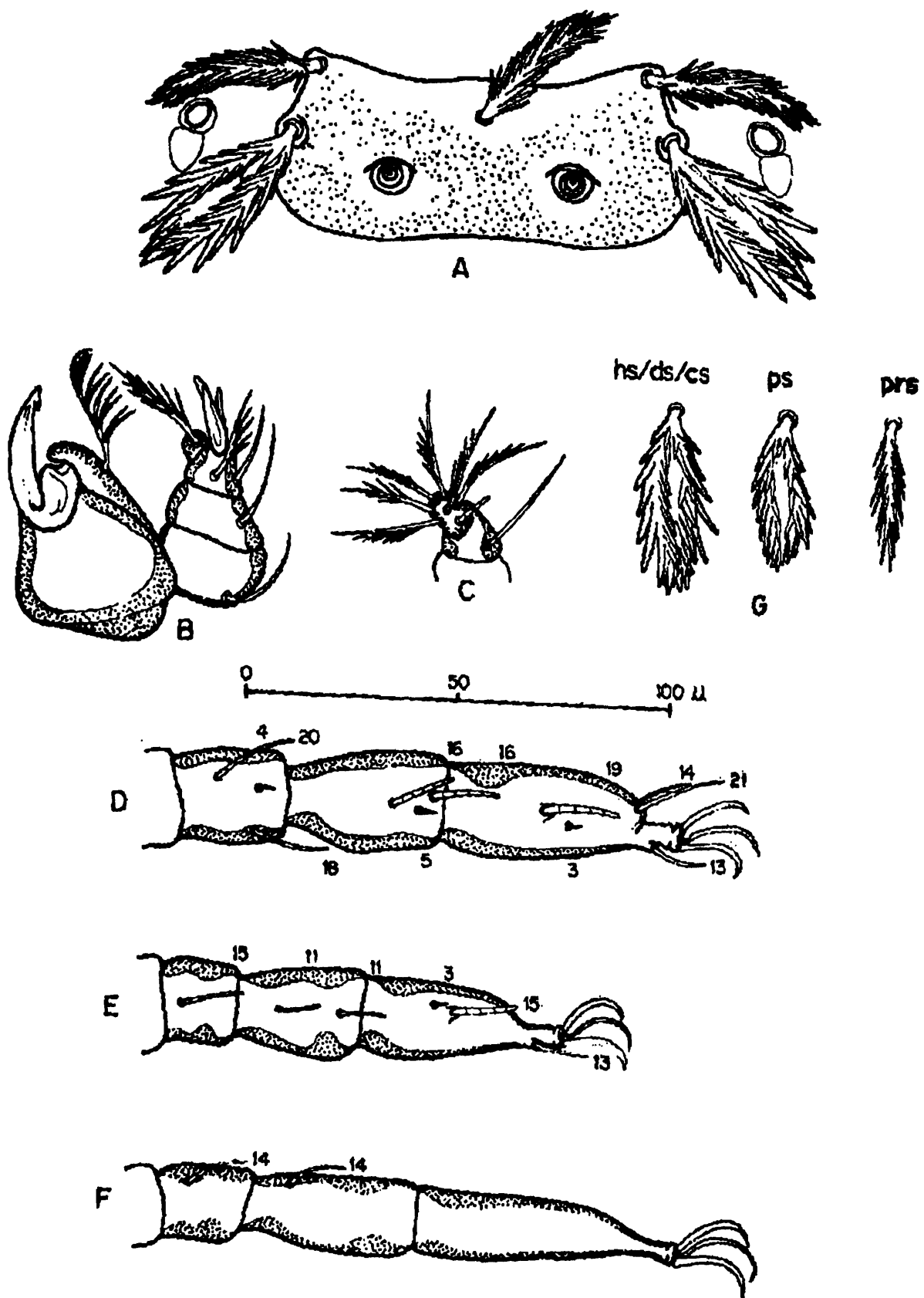


Fig. 99. *Trombiculindus fordii*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

2; 2 pairs of unexpanded sternal setae, anterior 52, posterior 39; 26 unexpanded preanal setae, 29-36; 12 foliate postanal setae, 35-47 x 5-8; total idiosomal setae 90.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (34) with ticuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; $PL > AM > AL$; sensillae flagelliform with basal barbs and branches on distal 2/3; $PW/SD = 1.70-1.83$. Scutal measurements giving means of 9 specimens after original description, followed by means of paratypes #2012.1 and #2012.2 in parentheses after Vercammen-Grandjean and Langston (1976) : AW 75 (65, 69); PW 84 (75, 81); SB 37 (31, 35); ASB 30 (27, 28); PSB 16 (17, 17); AP 20 (21, 21); AM 45 (42, 46); AL 44 (40, 42); PL 49 (50x10, 50x11); sens. 67 (74, 78).

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements after original description, followed by measurements of 2 paratypes in parentheses after Vercammen-Grandjean and Langston (1976) : $Ip = 693$ (-, 757). Leg I : 225 (260, 265). Leg II : 208 (228, 230). Leg III : 260 (-, 262). Measurements of the SAM specimen (#25135) : $Ip = 737$. Leg I : 260; tarsus (57x22), tarsala (19). Leg II : 224; tarsus (48x18), tarsala (15). Leg III : 253; tarsus (62x15).

Type data : Holotype and 6 paratypes, MANIPUR, Imphal, ex *Rattus rattus bullocki*, 1945, STRU, coll.

Type depository : Holotype at BM(NH); paratypes at BM(NH), USNM, and KECM.

Additional records : 2, same data as type series, but taken 20.XII.1945; common near Imphal, ex *Rattus* sp., 1945, STRU, coll.; common at Kanglatongbi, ex *Tupaia glis belangeri* and *Suncus murinus*, XII.1945, STRU, coll.

Material examined : 1 specimen on loan from M. Nadchatram, labelled : “ #25135 S. Aus. Mus. 9 - *Trombicula fordii* n. sp. - Det. H. Womersley” Collection data not recorded.

Remarks : The above redescription is based of the literature and study of the SAM specimen (#25135). *T. fordii* falls out in couplet 11 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. pruthi* Sinha, 1954. They distinguish *T. fordii* in having SB slightly posterior to level of PL bases (far posterior in *T. pruthi*), and $PL > AM > AL$ ($AM > PL > AL$ in *T. pruthi*). Vercammen-Grandjean and Langston describe the scutal shape as between that of *T. traubi* (Womersley, 1952) and *T. deccanensis* (Mitchell and Nadchatram, 1966). The pronounced protrusion of the slightly trilobate posterior scutal margin brings the SB between 4-5 posterior to the level of PL bases. The PL setae are wider than in *T. traubi* (measuring 10), of which the central zone is very wide (measuring 6 in the middle). This species has been named in honour of W.K. Ford, for his contribution to the Manipur and South Burma trombiculid studies of the Scrub Typhus Research Unit.

115. *Trombiculindus mehtai* new species
(Fig. 100)

Not *Leptotrombidium* (*Trombiculindus*) *mane* (Schluger, 1955) : Fernandes *et al.*, 1988. 109.

Description of species : Larva.

Idiosoma : Measuring 266-527 x 204-383 in partially engorged to engorged specimens. Eyes 2/2, anterior slightly larger, on ocular plate. Two pairs of foliate humeral setae, measuring 106x24; 40 foliate dorsal idiosomal setae, measuring 108-115 x 20-32, anteromedian setae smaller, arranged : 12-10-8-8-2; 2 pairs of unexpanded sternal setae, anterior 69-76, posterior 58-68; 28 unexpanded preanal setae, 59-76; 2 unexpanded median postanal setae, 77-78; 6 foliate postanal setae, posterior 86-88 x 27-28, lateral 112x24; total idiosomal setae 84.

Gnathosoma : Palpal setal formula N/N/NNB/7B; palpal claw 3-pronged; galeala B; cheliceral blade (46) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base far posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; PL>AM>>AL; sensillae flagelliform, broken off in specimens extant; PW/SD = 1.89-2.02. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 98 (92, 86-98); PW 107 (104, 100-107); SB 53 (49, 45-53); ASB 38 (39, 38-40); PSB 15 (16, 15-17); AP 24 (24, no variation recorded); AM 94 (91, 89-94); AL 54 (56, 54-58); PL 117x32 (114x32, 111-117 x 31-32); sens. -. .

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae. Measurements as follows : Ip = 929-960. Leg I : 298-321; tarsus (70x25), tarsala (20). Leg II : 275-286; tarsus (64x24), tarsala (15-18). Leg III : 341-354; tarsus (88x18).

Type data : Holotype (NIV A83450.22) and 3 paratypes, SIKKIM, Kyangnosla, 3200-3800m, ex *Pitymys sikimensis*, 15.IV.1969, NIV, coll.

Remarks : *T. mehtai* dead ends at couplet 1 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) in having a single genuala I and palpo setal formula N/N/NNB. It is similar to *T. squamosus* Radford, 1948, *T. cardiosetosus* Hsu and Chen, 1964, *T. squamiferus* (Womersley, 1952) and *T. manis* (Schluger, 1955) in having a single genuala I. *T. mehtai* may easily be distinguished in having palpo setal formula N/N/NNB (N/N/NNN in other 4 species). *T. mehtai* is very close to *T. lukoschusi* Goff 1987 in sharing the same palpo-setal formula, in having a single genuala I, and a similar number and form of body setae. *T. mehtai* may, however, easily be distinguished in having a higher Ip range (797-846 in *T. lukoschusi*), and larger PL and dorsal body setae (PL measuring 62-67 x 16-17, and dorsal body setae 42-64 x 13-14 in *T. lukoschusi*). This species has been named in honour of D.R. Mehta who pioneered trombiculid mite studies in India.

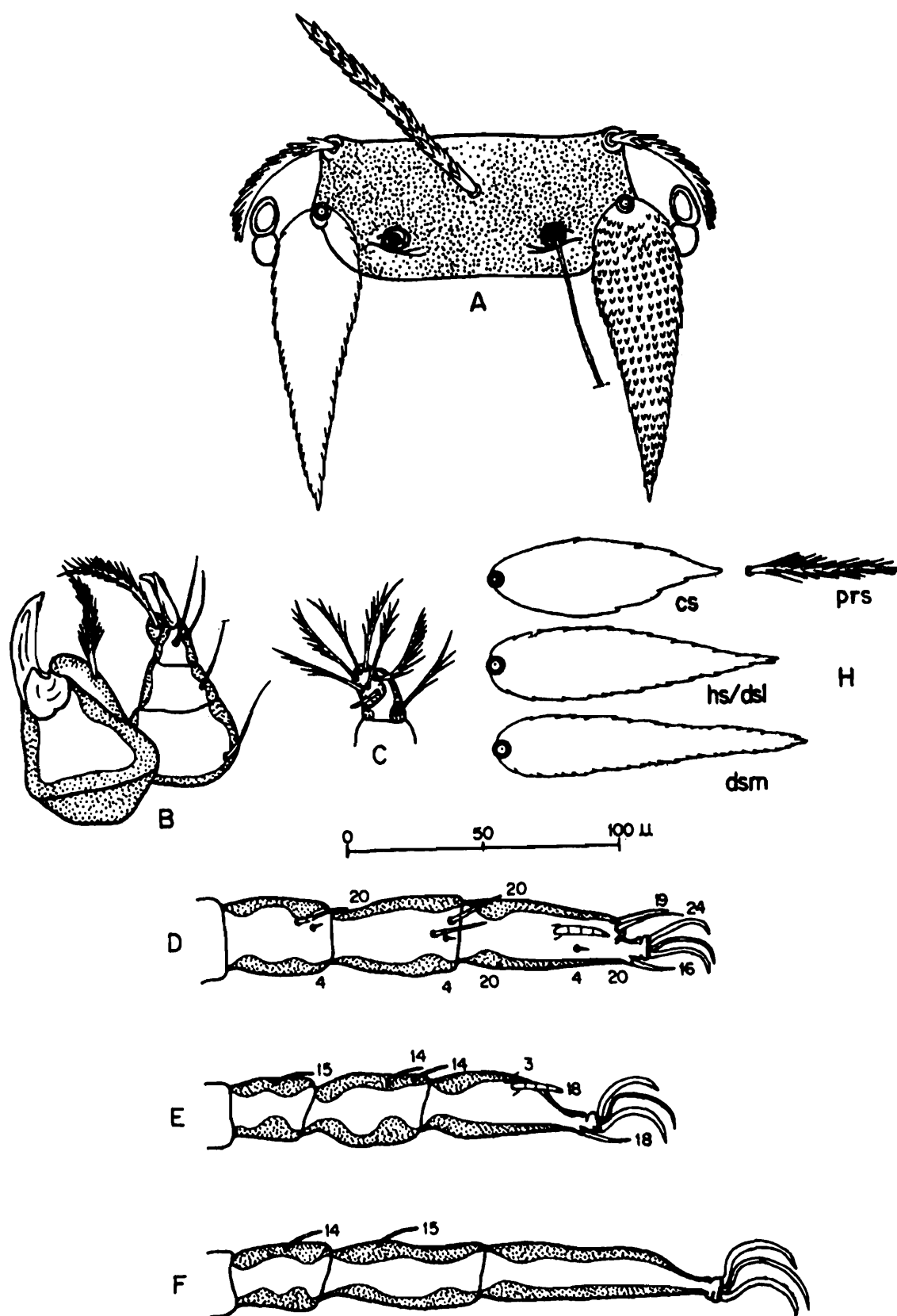


Fig. 100. *Trombiculindus mehtai* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

116. *Trombiculindus pruthi* Sinha

Trombiculindus pruthi Sinha, 1954, 332.

Trombicula (Trombiculindus) pruthi, Audy, 1957, 235.

Leptotrombidium (Trombiculindus) pruthi, Mitchell and Nadchatram, 1966, 68; Vercammen-Grandjean, 1968b, 77; Vercammen-Grandjean and Langston, 1976, 628.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of foliate humeral setae, measuring 52x10; 50 foliate dorsal idiosomal setae, measuring 42-48 x 9, arranged : 10-8-8-8-8-6-2; 2 pairs of unexpanded sternal setae; 22 unexpanded preanal setae, 36-40; 20 foliate postanal setae, 38-43 x 8-9; total idiosomal setae 98 (Original description : humeral setae measuring 43; 40 dorsal idiosomal setae, measuring 29, arranged : 10-8-8-6-6-2; 16 preanal setae; 12 postanal setae; total idiosomal setae 74).

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin biconvex; AM base posterior to level of AL bases; SB far posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; AM>PL>AL (Original description : AL>PL=AM); sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.73 (Original description : 2.59). Scutal measurements after original description followed by measurements of holotype after Vercammen-Grandjean and Langston (1976) : AW 72, 72; PW 83, 83; SB 36, 36; ASB 25, 34; PSB 7, 14; AP 14, 16; AM 50, 62; AL 54, 45; PL 50, 52X10; sens. 36, 68.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements after Vercammen-Grandjean and Langston (1976) : Ip = 716. Leg I : 245. Leg II : 214. Leg III : 257.

Type data : Holotype (No. 2397/18), MANIPUR, Madbung village off Kanglatongbi, Camp MS 117, ex *Herpestes urva*, 1.XII.1945, M.L. Roonwaal, coll.; 1 paratype, same data, but ex *Dremomys macmillani*, taken 12.XI.1945.

Type depository : Holotype and paratype at ZSI.

Material examined : Holotype at ZSI.

Remarks : The above redescription is based only on the literature. The holotype examined at ZSI is in poor condition. *T. pruthi* falls out at couplet 11 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. fordi* (Womersley, 1952). They characterize *T. pruthi* by its much reduced AP, the consequent pronounced protrusion of the bilobate scutal posteromargin, and the SB 15-16

posterior to the level of PL bases. They describe the foliate PL setae as wide as those of *T. traubi* (Womersley, 1952), measuring 10, with a clear central zone, 5.5 wide in the middle. Sinha (1954) considers *T. pruthi* close to *T. squamiferus* (Womersley, 1952), but distinguishes it in having 12 foliate ventral body setae (4-6 in *T. squamiferus*), and PL setae 3.75x longer than wide (3.5x in *T. squamiferus*). This species has been named in honour of Dr. H.S. Pruthi, who encouraged Sinha to take up trombiculid mite studies.

**117. *Trombiculindus squamiferus* (Womersley)
(Fig. 101)**

Trombicula squamifera Womersley, 1952, 140; Prasad, 1974, 98.

Trombiculindus squamifera, Sinha, 1954, 333.

Trombicula (Trombiculindus) squamifera, Womersley and Audy, 1957, 259.

Trombiculindus (Trombiculindus) squamifera, Hsu, 1964, 101.

Leptotrombidium (Trombiculindus) squamiferum, Vercammen-Grandjean and Langston, 1976, 693.

Redescription of species : Larva.

Idiosoma : Measuring 332-520 x 215-350 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. Two pairs of foliate humeral setae, measuring 110-138 x 41-42; 34-36 foliate dorsal idiosomal setae, anterior setae measuring 85-154 x 11-52, anterolateral setae larger, posterior setae measuring 72-78 x 48-54, arranged : 4-6-8-8-6-4(2); 2 pairs of unexpanded sternal setae, anterior 71-82, posterior 58-69; 26-30 unexpanded preanal setae, 54-85; 2-4 unexpanded anterior postanal setae, 77-86, 4-8 foliate postanal setae, lateral larger, 72-114 x 42-50; total idiosomal setae 80-90.

Gnathosoma : Palpal setal formula N/N/NNN/7B (Original description 'in text', and Womersley and Audy, 1957 : dorsotibial palpal seta barbed!); palpal claw 3-pronged; galeala B; cheliceral blade (44) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly concave; posterior margin shallowly biconvex (Vercammen-Grandjean and Langston, 1976: posterior margin bilobate); AM posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; PL>>AM>>AL; sensillae flagelliform with basal barbs and branches on distal portion, broken in types and specimens examined; PW/SD = 1.76-1.88. Scutal measurements of holotype and paratype after original description, and after Vercammen-Grandjean and Langston (1976) in parentheses : AW 95, 98 (94, 91); PW 118, 118 (109, 112); SB 48, 48 (47, 48); ASB 39, 39 (38, 40); PSB 28, 28 (20, 23); AP 28, 28 (27, 26); AM 76, 73 (78X5, 72X4); AL 48, 53 (54X5, 58X4); PL 112X42, 107X42 (99X40, 110X42); sens.-. Scutal measurements giving means and ranges of 10 NIV specimens : AW 86, 85-90; PW 110, 105-116; SB 46, 43-49; ASB 40, 39-43; PSB 20, 19-23; AP 21, 18-

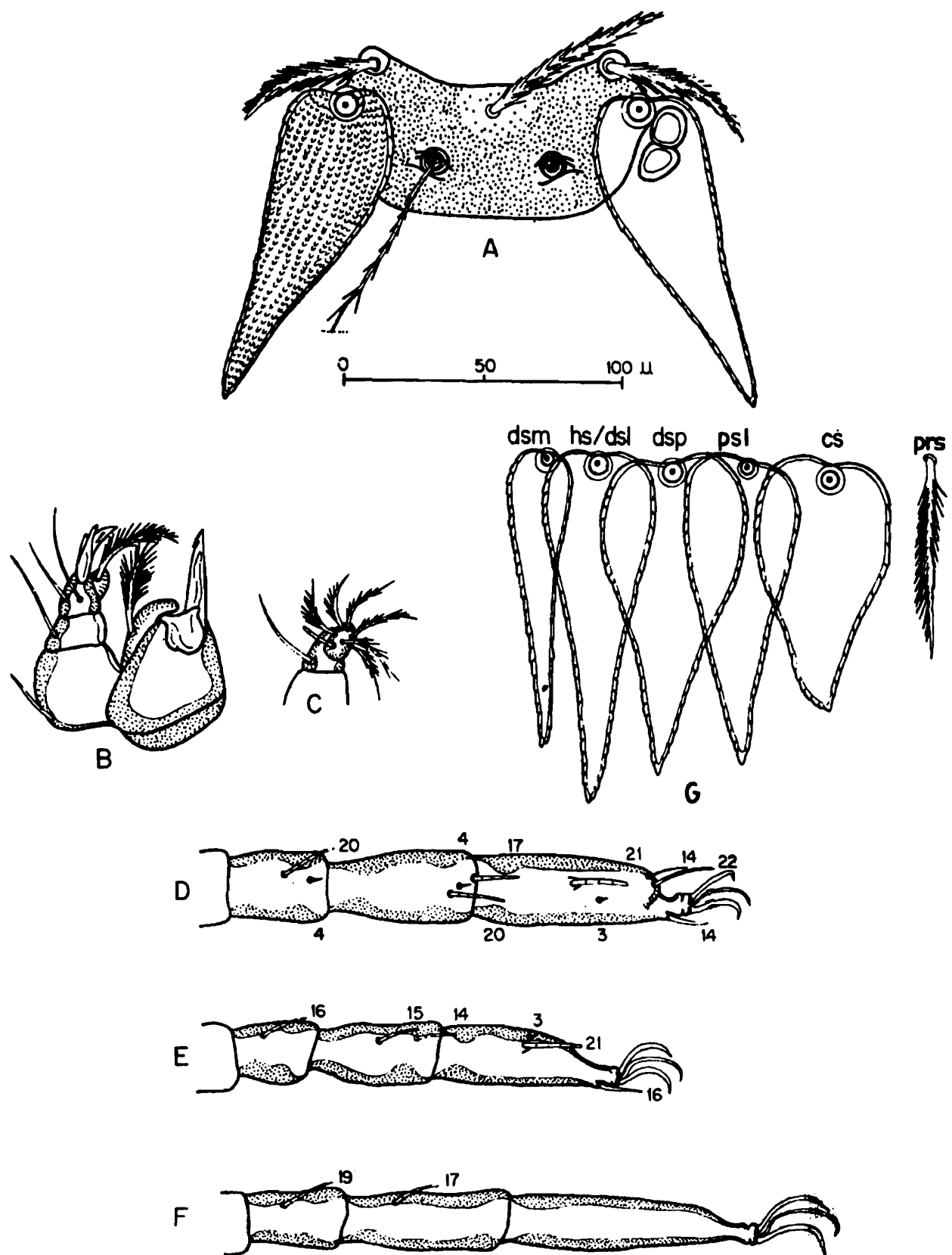


Fig. 101. *Trombiculindus squamiferus*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

23; AM 75x4, 71-75 x 4; AL 54x4, 52-56 x 4-5; PL 120x43, 102-132 x 40-45; sens. -, broken off in specimens extant.

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae. Measurements after original description followed by measurements after Vercammen-Grandjean and Langston (1976) in parentheses : Ip = 1170 (1118). Leg I : 390 (386). Leg II : 364 (342). Leg III : 416 (390). Measurements of NIV specimens : Ip = 1059-1088. Leg I : 349-362; tarsus (80x25), tarsala (20-21). Leg II : 322-332; tarsus (66x20), tarsala (21). Leg III : 388-397; tarsus (91x20).

Type data : Holotype and 1 paratype (Womersley and Audy (1957): holotype and 2 paratypes), JAMMU and KASHMIR, Baltal, ex *Alticola roylei*, 28.X.1945, S.L. Kalra, coll.

Type depository : Holotype and 1 paratype at SAM.

New records : 4 records of collections from the Himalayan region by NIV field teams : JAMMU and KASHMIR, Barmulla District, Rampore, 1400m, 15 ex 2 *Mus musculus*, 7.XI.1969; 2, same data, but Tangmarg, 600m, ex *Suncus murinus*, taken 19.X.1969; 2, same data, but Doda District, Bhadarwah, 1700m, ex *M. musculus*, taken 17.XI.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *T. squamiferus* falls out in couplet 4 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. manis* (Schluger, 1955). They separate *T. squamiferus* in having PL setae broadly foliate with length/width (l/w) ratio 2.6 (moderately expanded, 4.1 in *T. manis*), PW measuring 110 (95 in *T. manis*), and posterior margin medially concave (convex in *T. manis*). Vercammen-Grandjean and Langston describe the PL, humeral and dorsolateral setae as having 13 rows of small spicules on its larger width, the dorsomedian setae as gladiate with l/w ratio 7.0, and the postanal setae as cordiform with l/w ratio 1.5. Womersley (1952) considers *T. squamiferus* close to *T. cuneatus* Traub and Evans, 1951, but differing in the standard measurements, and the number and arrangement of body setae. The species name, derived from the Latin meaning 'scale bearing', draws attention to the foliate modified PL and body setae characteristic of *T. squamiferus*.

118. *Trombiculindus traubi* (Womersley)

Trombicula (*Neotrombicula*) *traubi* Womersley, 1952, 76; Audy *et al.*, 1953, 27.

Trombicula (*Trombiculindus*) *traubi*, Audy, 1954b, 143; 1957, 236; Womersley and Audy, 1957, 259.

Neotrombicula traubi, Radford, 1954, 260.

Leptotrombidium (*Trombiculindus*) *traubi*, Traub *et al.*, 1968, 370; Vercammen-Grandjean, 1968b, 77; Vercammen-Grandjean and Langston, 1976, 624; Brown, 1992, 290.

Trombicula traubi, Prasad, 1974, 99.

Trombicula plumose, Radford, 1953a, 231; 1954, 258; Vercammen-Grandjean and Langston, 1976, 624, synonymy.

Trombicula (Trombiculindus) plumose, Audy, 1954b, 143; 1957, 235.

Trombiculindus (Plumosicola) plumose, Sinha, 1954, 334.

Leptotrombidium (Trombiculindus) plumosum, Vercammen-Grandjean, 1968b, 77.

Redescription of species : Larva.

Idiosoma : Measuring 481x350 in partially engorged specimen. Eyes 2/2, anterior slightly larger, on ocular plate. One pair of foliate humeral setae, measuring 39-42 x 6; 50-60 foliate dorsal idiosomal setae, measuring 30-40 x 6, arrangement in holotype : 10-10-10-8-6-4-2; 2 pairs of unexpanded sternal setae; 24-34 unexpanded preanal setae, 23-25; 20-34 foliate postanal setae, 30-34 x 5; total idiosomal setae 110-124.

Gnathosoma : Palpal setal formula N/N/BNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subrectangular with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; AM>AL>PL; sensillae flagelliform with basal barbs and branches on distal 2/3; PW/SD = 1.72-1.90. Scutal measurements of holotype after original description and Vercammen-Grandjean and Langston (1976) followed by measurements of *Trombicula plumosa* after original description and Vercammen-Grandjean and Langston (1976) in parentheses : AW 64, 65 (70, 68); PW 76, 74 (76, 76); SB 34, 34 (33, 33); ASB 28, 27 (27, 28); PSB 15, 16 (13, 15); AP 22, 21 (26, 24); AM 42, 45 (40, 41); AL 39, 41 (40, 38); PL 36, 39x6 (43, 42x6); sens. 60, 68 (59, 71).

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae; but, 2 genualae I. Measurements of holotype after original description and Vercammen-Grandjean and Langston (1976), followed by measurements of *Trombicula plumosa* after Vercammen-Grandjean and Langston (1976) in parentheses : Ip = 718, 724 (722). Leg I : 273, 253 (256). Leg II : 215, 221 (216). Leg III : 230, 250 (250).

Type data : Holotype (No. 14), MANIPUR, Imphal, ex *Macaca assamensis*, VIII.1945, T.J. Lawrence, coll.

Type depository : Holotype at SAM.

Additional records : 3, same data as holotype, but taken XII.1945, STRU, coll. Type specimen of *Trombicula plumosa* : MANIPUR, Imphal, ex *Callosciurus pygerythrus pygerythrus*, 14.II.1946, J. Hake, coll.

Remarks : The above redescription is based only on the literature. *T. traubi* falls out in couplet 9 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. paniculatus* (Traub et al., 1968). They separate *T. traubi* in having a greater number of body setae (52-56 in *T. paniculatus*), and palpo setal

formula N/N/BNN (N/N/BNB in *T. paniculatus*). Vercammen-Gandjean and Langston consider *T. traubi* close to *T. fordi* (Womersley, 1952), from which it is distinguished in having smaller foliate PL setae (measuring 49-51 x 10-11 in *T. fordi*). They describe the PL setae as measuring 6 in width at their middle and possessing, like other dorsal body setae, a larger central clear zone (measuring 2.5 in the middle) than that of *T. paniculatus*. Vercammen-Grandjean and Langston have synonymized *Trombicula plumosa* Radford, 1953, with *Trombiculindus traubi* after comparing the type material of these species. They draw attention to the characteristic scutal setal formula of *T. traubi* : AM>AL>PL. But, according to the original description and their measurements : PL>AM>AL in *Trombicula plumosa*. There is, however, close agreement in diagnostic characters and other standard measurements, hence, the synonymy is accepted as valid. This species has been named to honour Dr. Robert Traub, in recognition of his outstanding contributions to Acarology.

119. *Trombiculindus varifolius* new species
(Fig. 102)

Leptotrombidium (Trombiculindus) sp. B Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 290-449 x 232-286 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. Two pairs of foliate humeral setae, measuring 81-89 x 37-40; 32 foliate dorsal idiosomal setae, measuring 82-104 x 25-52, arranged : 4-6-8-8-4-2; 2 pairs of unexpanded sternal setae, anterior 59-63, posterior 47-52; 36 unexpanded preanal setae, 49-58; 2 unexpanded median postanal setae, 64-73, 8 foliate postanal setae, lateral and posterior, 58-82 x 43-47; total idiosomal setae 86.

Gnathosoma : Palpal setal formula N/N/NNN/7B; palpal claw 3-pronged; galeala B; cheliceral blade (39) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subrectangular with anterior margin shallowly biconcave; posterior margin convex, medially truncate; AM base posterior to level of AL bases; SB posterior to level of PL bases; PL setae foliate, AM and AL setae unexpanded; PL>>AM>>AL; sensillae flagelliform with basal barbs and branches on distal portion, broken in all specimens examined; PW/SD = 1.58. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 83 (84, 80-89); PW 97 (98, 92-105); SB 41 (40, 34-44); ASB 37 (36, 33-39); PSB 21 (20, 18-23); AP 23 (22, 21-24); AM 57 (58, 55-60); AL 46 (45, 43-46); PL 95x40 (86x41, 76-95 x 38-42); sens. - (84 in 1 specimen, broken off in other specimens extant).

Legs : Similar to *T. squamosus* Radford in the number of ordinary and sensory setae. Measurements as follows : Ip = 974-985. Leg I : 321-327; tarsus (80x21), tarsala (20-22). Leg II : 297-304; tarsus (66x20), tarsala (20). Leg III : 356-358; tarsus (91x15).

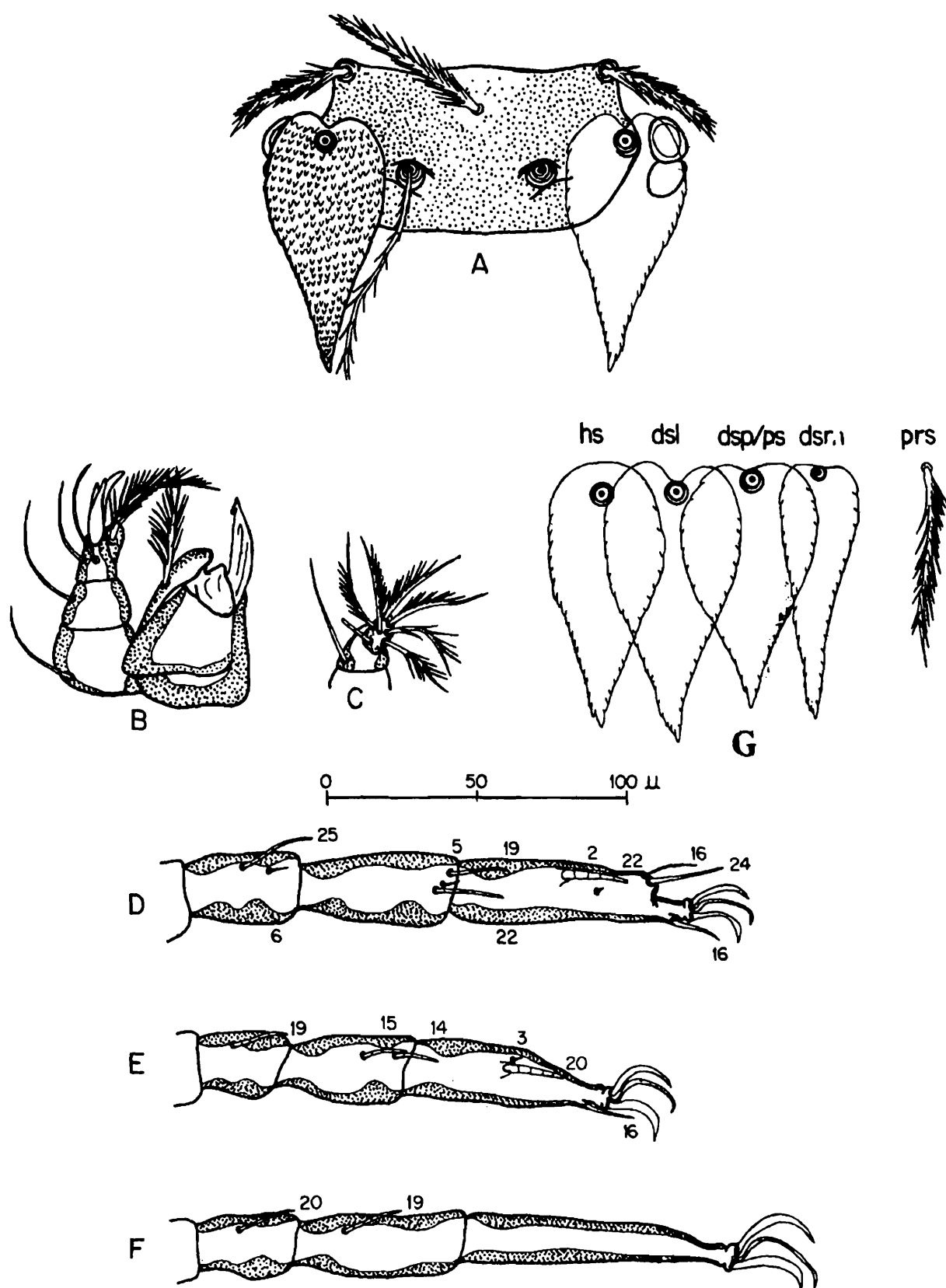


Fig. 102. *Trombiculindus varifolius* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

Type data : Holotype (NIV A92428.4) and 2 paratypes, JAMMU and KASHMIR, Doda District, Bhadarwah, 1700m, ex *Rattus rattoides*, 17.XI.1969, NIV, coll.; 3 paratypes, same data, but ex 2 *Mus musculus*.

Additional records : 4 records of collections from the Himalayan region by NIV field teams: 1, same data as holotype, but ex *Rattus rattus rufescens*; 3, same data, but ex 3 *M. musculus*, taken 15,16.XI.1969.

Remarks : *T. varifolius* will fall out at couplet 4 of the key to species of the subgenus *Trombiculindus* given by Vercammen-Grandjean and Langston (1976) along with *T. squamiferus* (Womersley, 1952) and *T. manis* (Schluger, 1955). *T. varifolius* may be separated from *T. squamiferus* in having a lower Ip range (1076-1118 in *T. squamiferus*), lower PW/SD ratio (1.76-1.88 in *T. squamiferus*), and smaller PL setae (measuring 99-124 x 40-45 in *T. squamiferus*). *T. varifolius* differs from *T. manis* in having a lower Ip range (1131 in *T. manis*), posterior scutal margin medially truncate (medially convex in *T. manis*), and sensillae with basal barbs and distal branches (nude in *T. manis*). *T. varifolius* closely resembles *T. lukoschusi* Goff, 1987, from which it may be separated in having palpo setal formula N/N/NNN (N/N/NNB in *T. lukoschusi*), a higher Ip range (797-846 in *T. lukoschusi*), and a lower PW/SD ratio (2.09-2.44 in *T. lukoschusi*). the species name draws attention to the diverse foliate PL and body setae, characteristic of *T. varifolius*.

Genus *Trombigastia* Vercammen-Grandjean and Brennan

Trombigastia Vercammen-Grandjean and Brennan, 1957, 486; Vercammen-Grandjean and Nadchatram, 1965, 317; Nadchatram and Dohany, 1974, 58; Goff, 1982c, 204; Domrow and Lester, 1985, 19.

Type species : *Trombigastia cadei* Vercammen-Grandjean and Brennan, 1957, by original designation.

Diagnosis : Trombiculini larvae parasitic on bats. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 3 genualae I; tarsus I with supplementary sclerotized bar; tarsala II approximately 2x>tarsala I; mastitibiala III and mastitarsala III with basal barbs may be present. Palpal tarsus 7B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap. Eyes 2/2. Scutum subtrapezoidal, lightly punctate with lateral margins concave; scutal setae marginal; sensillae narrowly expanded, inserted anterior to level of PL bases.

Remarks : Vercammen-Grandjean and Brennan (1957) proposed the hybrid generic name *Trombigastia* for a group of bat-infesting chiggers with narrowly expanded sensillae that appeared intermediate between Schoengastiini and Trombiculini. Goff (1982c) briefly outlines the revisions of this taxon and concurs with Nadchatram and Dohany (1974) in according *Trombigastia* generic status. Subsequently, Goff *et al.* (1987) described *T. guangdongensis* from the Peoples Republic of China, bringing to 17 the species currently recognized in the genus. Two new Indian *Trombigastia* species are reported here, the first record of the genus from India.

120. *Trombigastia abdita* new species

(Fig. 103)

Description of species : Larva.

Idiosoma : Measuring 360-407 x 270-318 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 33-38; 28-30 dorsal idiosomal setae, measuring 28-34, arranged : 6-6-6-6(4)-4-2; 2 pairs of sternal setae, anterior 22-27, posterior 22-26; 18 preanal setae, 17-19; 16 postanal setae, 21-23; total idiosomal setae 72-74.

Gnathosoma : Palpal setal formula B/B/BbB/7B; palpal claw 3-pronged; galeala N; cheliceral blade (21) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with biconcave anterior margin; posterior margin biconvex; AM base level with AL bases; SB anterior to level of PL bases; $AL > PL = AM$; sensillae lanceolate with moderately elongate barbs on distal 3/4; $PW/SD = 1.36-1.61$. Scutal measurements of holotype followed by means and ranges of type specimens in parentheses : AW 45 (43, 41-45); PW 66 (62, 60-66); SB 18 (18, 17-18); ASB 29 (30, 29-31); PSB 12 (12, 12-14); AP 33 (35, 32-37); AM 34 (32, 30-34); AL 37 (37, 36-40); PL 34 (32, 30-36); sens. 58 (60, 57-64).

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. $Ip = 608-663$. Leg I : 220-240; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (66x20) 20B, tarsala (31-14), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 187-204; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (52x18) 16B, tarsala (15-17), microtarsala, pretarsala. Leg III : 201-219; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala, mastitibiala (28); tarsus (62x15) 13B, mastitarsala (30) with basal barbs.

Type data : Holotype (NIV AA57.2) and 9 paratypes, ORISSA, Bhubaneshwar, Khandagiri, ex *Rhinopoma hardwickei*, 13.XI.1972, H.N. Kaul, coll.

Additional records : 8, same data as type series.

Remarks : *Trombigastia abdita* appears most similar to *T. harrisoni* (Womersley, 1952) and *T. platypygia* (Vercammen-Grandjean, 1963). The presence of mastitibiala III and mastitarsala III serve to distinguish *T. abdita* from these species. *T. abdita* may further be distinguished from *T. harrisoni* in having $AL > AM = PL$ ($PL > AM = AL$ in *T. harrisoni*), and a lower Ip (754 in *T. harrisoni*). *T. abdita* also differs from *T. platypygia* in the number of

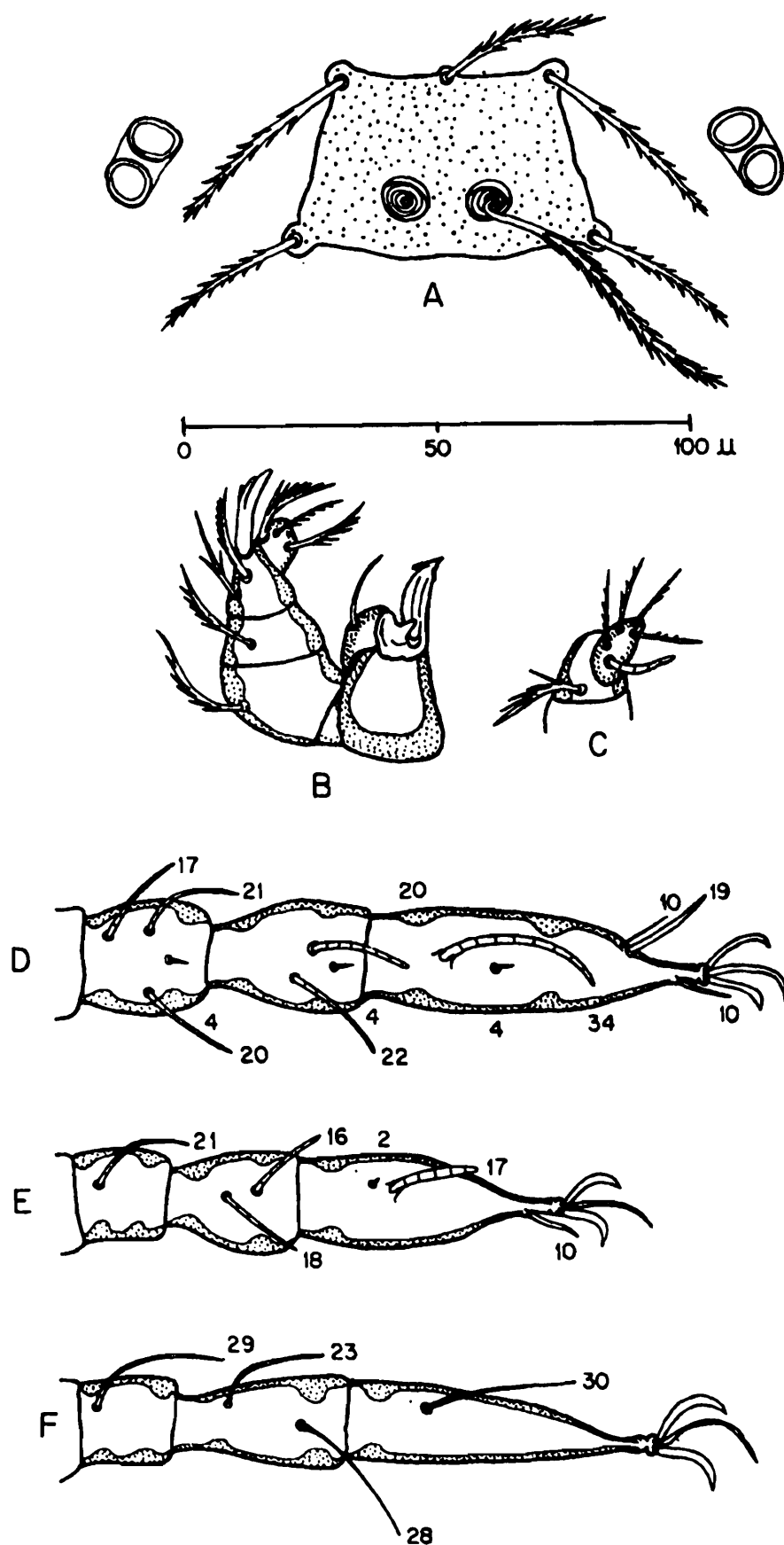


Fig. 103. *Trombigastia abdita* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

dorsal body setae (34 in *T. platypygia*) and in having $AL > AM$ ($AL > AM$ in *T. platypygia*). The species name is derived from the Latin meaning 'hidden'. The specimens were earlier misidentified as *Chiroptella insolli* (Philip and Traub, 1950) and *Chiroptella* sp. I in the NIV collection.

121. *Trombigastia tristernala* new species
(Fig. 104)

Description of species : Larva.

Idiosoma : Measuring 407-534 x 303-383 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, free on cuticle. One pair of humeral setae, measuring 41-48; 34 dorsal idiosomal setae, measuring 37-52, arranged: 6-6-6-6-4-2; 3 pairs of sternal setae, anterior 35, median 28-31, posterior 28; preanal setae, 25-26; postanal setae, 28-33; total idiosomal setae.

Gnathosoma : Palpal setal formula B/B/BbB/7B; palpal claw 3-pronged; galeala N; cheliceral blade (24) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with shallowly sinuous anterior margin; posterior margin biconvex; AM base posterior to level of AL bases; SB anterior to level of PL bases; $PL > AM = AL$; sensillae broken off in type specimens; $PW/SD = 1.38-1.61$. Scutal measurements of holotype, followed by means and ranges of type series in parentheses : AW 50 (53, 50-55); PW 71 (69, 66-71); SB 15 (18, 15-19); ASB 29 (28, 26-30); PSB 20 (19, 18-20); AP 44 (37, 34-44); AM 44 (44, 43-46); AL 44 (44, 43-44); PL 52 (52, no variation recorded); sens. -.

Legs : Similar to *T. abdita* n.sp. in the number of ordinary and sensory setae; but, tibia III 8B, tibiala; tarsus III 14B. Measurements as follows: Ip = 776-825. Leg I: 285-312; tarsus (81x20), tarsala (33). Leg II: 227-239; tarsus (62x19), tarsala (18). Leg III: 264-274; tarsus (72x15).

Type data : Holotype (NIV A96061.5) and 4 paratypes, UTTARANCHAL, Almora District, Katarmal, 1300m, ex *Hipposideros armiger*, 19.VIII.1970, NIV, coll.

Remarks : *T. tristernala* may be distinguished from other known *Trombigastia* species in having 3 pairs of sternal setae. It appears similar to *T. guangdongensis* Goff *et al.*, 1987, from which it may be separated by the normal clawlike empodia (expanded distally, padlike in *T. guangdongensis*), in having 34 dorsal body setae (28 in *T. guangdongensis*), and AM base posterior to level of AL bases (level with AL bases in *T. guangdongensis*). The species name draws attention to the 3 pairs of sternal setae characteristic of this species.

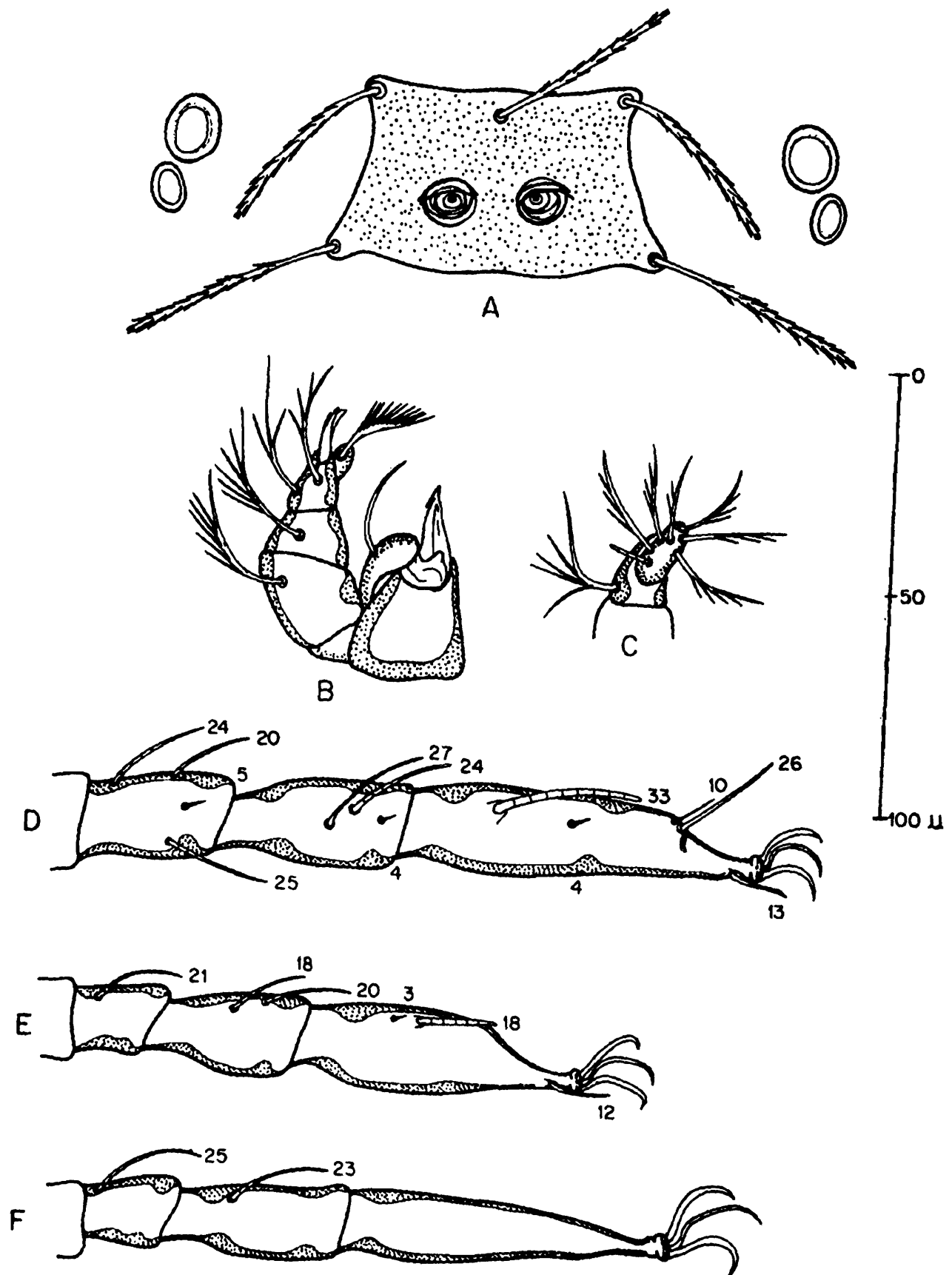


Fig. 104. *Trombigastia tristernala* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Tribe **Schoengastiini** Vercammen-Grandjean, 1960Genus ***Schoengastia*** Oudemans

Schoengastia Oudemans, 1910a, 86; Vercammen-Grandjean, 1960, 469; 1968b, 88; Vercammen-Grandjean and Langston, 1976, 78; Goff, 1980a, 321; 1982b, 147; Nadchatram and Dohany, 1974, 50; Nadchatram *et al.*, 1980, 268; Domrow and Lester, 1985, 14.

Radfordiana Womersley, 1952, 242; Goff, 1978, 886; Goff, 1982b, 147, synonymy.

Type species : *Thrombidium vandersandei* Oudemans, 1905, by original designation.

Diagnosis : Schoengastiini larvae parasitic on reptiles, birds and mammals. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Usually 3, sometimes 4, genualae I, genuala II and III; tibiala III; mastitarsala III (sometimes with basal barbs). Palpal tarsus 7B.S; palpal claw 3-pronged; galeala N; cheliceral blade long, with dorsal row of teeth and tricuspid cap. Eyes 2/2, on ocular plate. Scutum subpentagonal with posterior margin deeply convex; punctae simple; scutal setae marginal; usually AL>PL>AM; sensillae broadly clavate to globose, head with minute setules.

Remarks : Vercammen-Grandjean (1968b) included 5 subgenera in the genus *Schoengastia*, considering *Radfordiana* Womersley, 1952, an independent genus. Vercammen-Grandjean and Langston (1976) proposed a 6th subgenus *Priomesochela* with *S. lavoipierrei* (Jadin and Vercammen-Grandjean, 1952) as type for *Schoengastia* species armed with medium instead of long cheliceral blades. Nadchatram *et al.* (1980) reviewed the genus *Schoengastia* and presented keys to the 25 species known from the Asiatic-Pacific region. Goff (1982b) redefined the genus, synonymizing *Radfordiana* with *Schoengastia*. He regards the variation in the number of prongs of the palpal claw insufficient basis for even subgeneric distinction, and presents a revised key to the 32 known species. Subsequently, Goff (1982e) described *S. lanceolata* and *S. ruberi*, Nadchatram and Wooster (1985) *S. crossi*, Goff *et al.* (1986) *S. sulawesisensis*, and Brown and Goff (1988) *S. baguionensis*. With the description below of an additional species, the number of *Schoengastia* species presently recognized is 38, 4 of which are reported from India. Following Goff (1982b), no subgeneric distinctions are recognized in this genus.

122. ***Schoengastia kanhaensis*** Mitchell and Nadchatram
(Fig. 105)

Schoengastia kanhaensis Mitchell and Nadchatram, 1966, 75; Mitchell *et al.*, 1966, 121; Prasad, 1974, 89; Goff, 1982b, 150.

Schoengastia (Schoengastia) kanhaensis, Nadchatram *et al.*, 1980, 269.

Redescription of species : Larva. Colour in life bright red.

Idiosoma : Measuring 500x420 in engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 42-46; 30-34 dorsal idiosomal setae, measuring

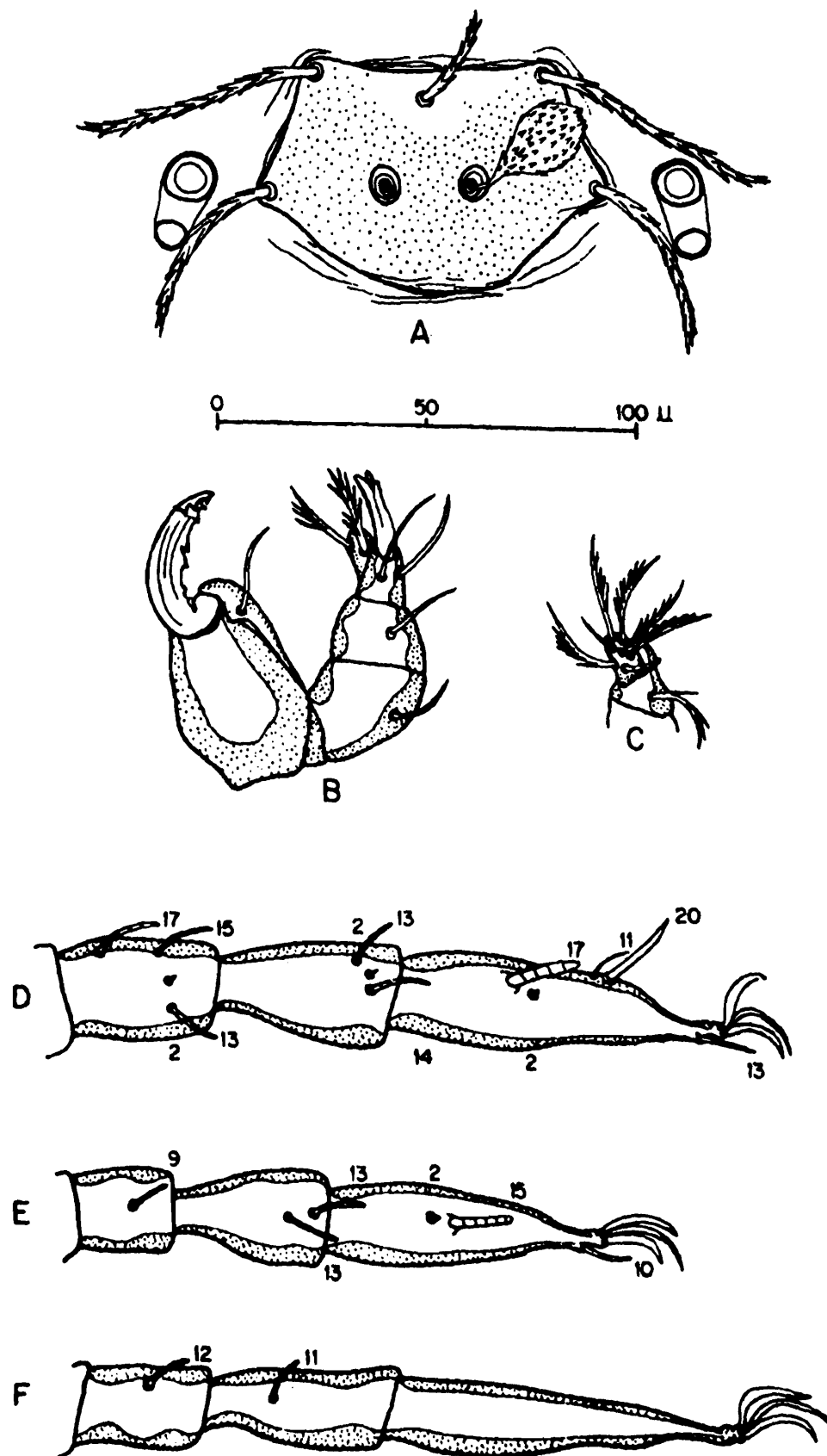


Fig. 105. *Schoengastia kanhaensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

38-43, arranged : 10(8+2)-8-6-4(6)-4(2)-(2); 2 pairs of sternal setae, anterior 40, posterior 32; 15-16 preanal setae, 27-31; 8-10 postanal setae, 34-40; total idiosomal setae 60-66.

Gnathosoma : Palpal setal formula N/N/NNB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade elongate (35-38), curved, bearing 6-7 dorsal teeth and 2-3 ventral teeth; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, with shallowly concave anterior margin; posterior margin deep, broadly rounded; AM base slightly posterior to AL bases; SB anterior to level of PL bases; AL>PL>>AM; sensillae capitate, head with fine setules; PW/SD = 1.36-1.44. Scutal measurements of holotype followed by means and ranges of 9 paratypes after original description : AW 54 (53, 52-56); PW 80 (79, 75-80); SB 21 (20, 19-21); ASB 30 (28, 26-30); PSB 29 (27, 24-29); AP 31 (28, 25-29); AM 26 (26, 25-29); AL 58 (62, 58-70); PL 49 (53, 49-58); sens. 31x14 (31x15, 29-31 x 14-16).

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 900-1100. Leg measurements not recorded. Leg I : coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (74-78 x 16-20) 22B, tarsala (17-18), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae, tarsus (63-67 x 15-19) 16B, tarsala (15-16), microtarsala, pretarsala. Leg III : coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (81-85 x 12-15) 15B (Original description : tarsus III 13B, lightly barbed mastitarsala similar to that described for *S. palmata* Domrow, 1962).

Type data : Holotype (#6631) and 22 paratypes, MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Mabuya dissimilis*, 1.XI.1964, G.B. Schaller, coll. Additional material in 70% alcohol.

Type depository : Holotype in BPBM; paratypes in IMR, BM(NH), USNM, ZSI, RML, GWHF, IA, R. Traub and authors' collections.

Material examined : Holotype on loan from BPBM, and 1 paratype (#2577/17) at ZSI.

Remarks : The above redescription is based on the original description and study of the holotype and paratype (#2577/17). *S. kanhaensis* runs to couplet 24 of the key to *Schoengastia* species given by Goff (1982b) along with *S. obtusispura* Wang 1962. He distinguishes *S. kanhaensis* in having a narrower scutum (AW>70, PW>90 in *S. obtusispura*). Mitchell and Nadchatram (1966) consider this species close to *S. cantonensis* (Liang *et al.*, 1957) and *S. propria* Audy and Womersley, 1957. They distinguish *S. kanhaensis* in lacking nude mastitarsala III (present in other 2 species). They further separate it from *S. cantonensis* by the nude palpopfemoral seta (barbed in *S. cantonensis*); and from *S. propria* in having 3 genualae I (5 in *S. propria*). Nadchatram *et al.* (1980) in table 1 (p. 269) cite *Bandicota indica* as host

of *S. kanhaensis*. This needs confirmation as the Thai records are ex *Rattus rattus* and black plate (p. 280), while the Indian record is from *Mabuya dissimilis*. The species name is derived from the type locality.

123. *Schoengastia propria* Audy and Womersley
(Fig. 106)

Scongastia propria sic! Audy and Womersley, 1957, 366.

Scheongastia propria, Prasad, 1974, 90; Goff, 1982b, 150.

Schoengastia (Schoengastia) propria, Nadchatram *et al.*, 1980, 169.

Redescription of species : Larva.

Idiosoma : Measuring 500x245 in engorged specimen. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 39-43; 30 dorsal idiosomal setae, measuring 36-37, arranged : 10-6-6-4-2-2; 2 pairs of sternal setae, anterior 38, posterior 36; 22-26 preanal setae, 26-28; 10 postanal setae, 34-41; total idiosomal setae 68-72.

Gnathosoma : Palpal setal formula b/N/NNb/7B.S; palpal claw 3-pronged; galeàla N; cheliceral blade (32) with 1 ventral and 4-5 dorsal teeth; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, with anterior margin shallowly concave; posterior margin deep, broadly rounded; AM base slightly posterior to level of AL bases; SB slightly posterior to level of PL bases; AL>PL>AM(?); sensillary bases with pronounced anteromedial cuticular ridge; sensillae capitate, head apparently lacking setules; PW/SD = 1.54-1.57. Scutal measurements of holotype and 1 paratype after original description, followed by measurements of paratype (CORU 43061) in parentheses : AW 48, 51, (49); PW 71, 76, (74); SB 15, 15, (15); ASB 26, 27, (27); PSB 20, 22, (20); AP 25, 26, (24); AM -, -, (-); AL 68, 61? (68); PL 51, 48? (53); sens. 29x16, -, (28x15).

Legs : Similar to *S. kanhaensis* Mitchell and Nadchatram, 1966, in the number of ordinary and sensory setae; but, genu I 4B, 4 genualae (or 3B, 5 genualae), microgenuala; tarsus III 14B, mastitarsala. Measurements as follows : Ip = 813. Leg I : 281; tarsus (69-70 x 22-24), tarsala (17-19). Leg II : 248; tarsus (59x20), tarsala (13-14). Leg III : 284; tarsus (81x16), mastitarsala (59).

Type data : Holotype (CORU 43862) and 3 paratypes, MAHARASHTRA, Bombay, ex *Natrix piscator*, 4.V.1956, Haffkine Institute, coll.

Type depository : Holotype in ZSI; paratypes in BM(NH), USNM, and Audy's collection.

Material examined : 1 paratype (CORU 43061) loaned by M. Nadchatram.

Remarks : The above redescription is based on the original description and study of

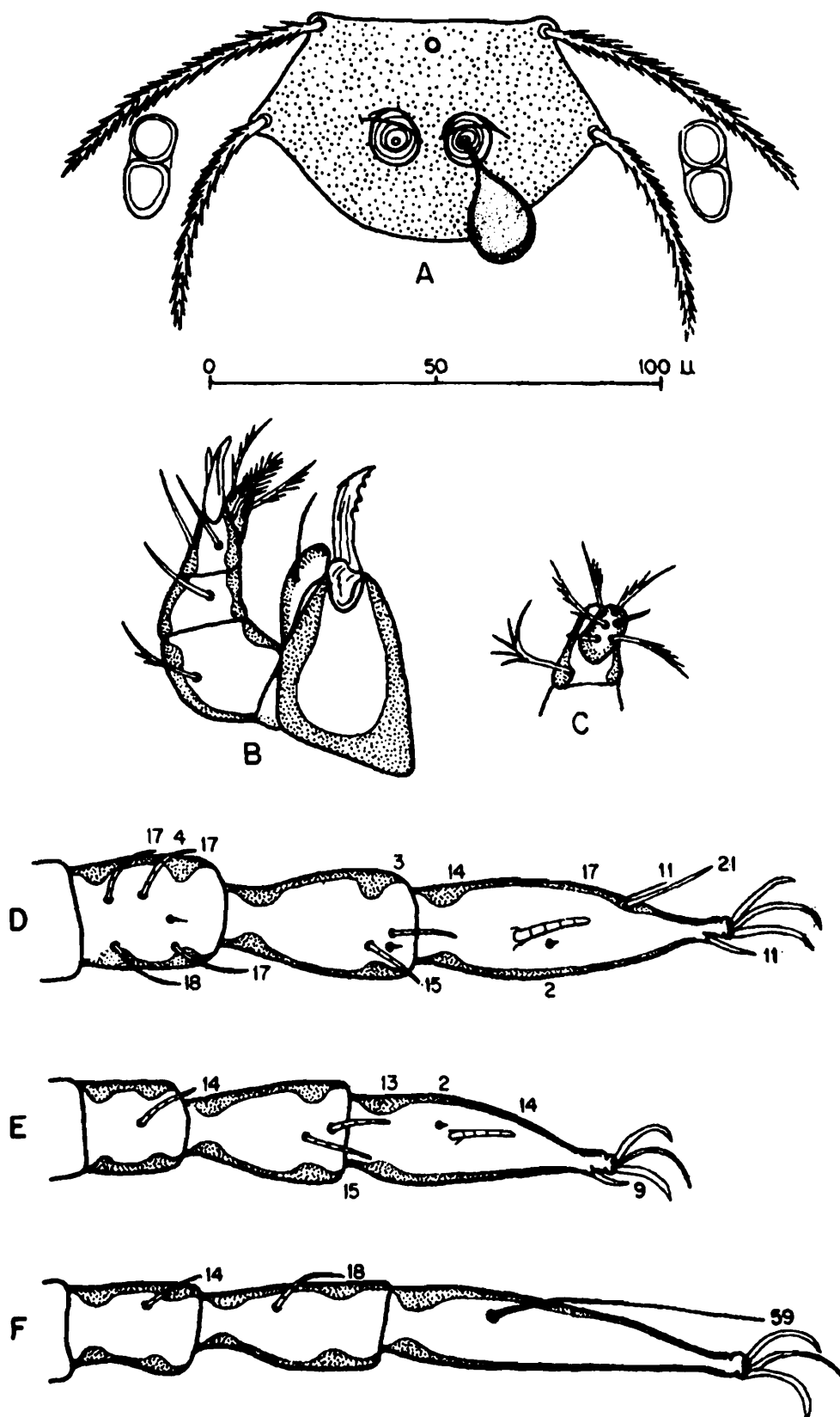


Fig. 106. *Schoengastia propria*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

paratype (CORU 43061). Audy and Womersley (1957) have distinguished this species from all other known *Schoengastia* species in having 4-5 genualae I, instead of 2 genualae I. Their recorded measurement of tarsus III given as (60x18) is apparently in error (original illustration (fig.8) : tarsus III>I and II). This has been confirmed in our study. The type host was originally misidentified as *Coluber karelini*, and later corrected to *Natrix piscator* by Prof. G.H. Ball. The AM setae are missing in the type specimens, hence the AM measurement has not been reported. *S. propria* runs to couplet 26 of the key to *Schoengastia* species given by Goff (1982b), and is distinguished in having 4 genualae I. The species name, derived from the Latin meaning "characteristic of", draws attention to the multiple genualae I. Audy and Womersley (1957) remark that such multiple genualae I are known to occur besides only in members of genus *Hannemania* Oudemans, 1911.

124. *Schoengastia pseudoschuffneri* (Walch)
(Fig. 107)

Trombicula pseudoschuffneri Walch, 1927, 922.

Schoengastia (Schoengastia) pseudoschuffneri, Womersley, 1952, 167; Nadchatram *et al.*, 1980, 269.

Schoengastia pseudoschuffneri, Goff, 1981b, 369; 1982b, 150; 1986a, 93.

Schongastia pseudoschuffneri, sic! Audy *et al.*, 1953, 27; Womersley and Audy, 1957, 271; Prasad, 1974, 90.

Redescription : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 39; 32 dorsal idiosomal setae, measuring 39, arranged : 8-6(8)-6-6(4)-4-2; 2 pairs of sternal setae; 16 preanal setae, 29; 8 postanal setae, 39; total idiosomal setae 62.

Gnathosoma : Palpal setal formula b/b/NNb/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (32) with 1 ventral and 7-8 dorsal teeth; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate with shallowly concave anterior margin; posterior margin deep, broadly rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; AL>PL>AM; sensillae capitate, head with spiked setules; PW/SD = 1.45-1.69. Scutal measurements giving ranges of 5 Batavian specimens, followed by ranges of 39 Indian and Burmese specimens in parentheses after Womersley (1952) : AW 51-64 (51-58); PW 74-83 (74-86); SB 22 (19-22); ASB 26 (26-32); PSB 22-24 (22-26); AP 29 (29-35); AM 26-29 (29-38); AL 64-70 (70-86); PL 52-54 (54-64); sens. 32x13 (32x13).

Legs : Similar to *S. kanhaensis* Mitchell and Nadchatram, 1966, in the number of ordinary and sensory setae; but, tarsus III 14B, mastitarsala with basal barbs. Measurements reported as follows : Leg I : tarsus (68x21), tarsala (19). Leg II : tarsus (68x21), tarsala (16). Leg III : tarsus (91x16), mastitarsala (52).

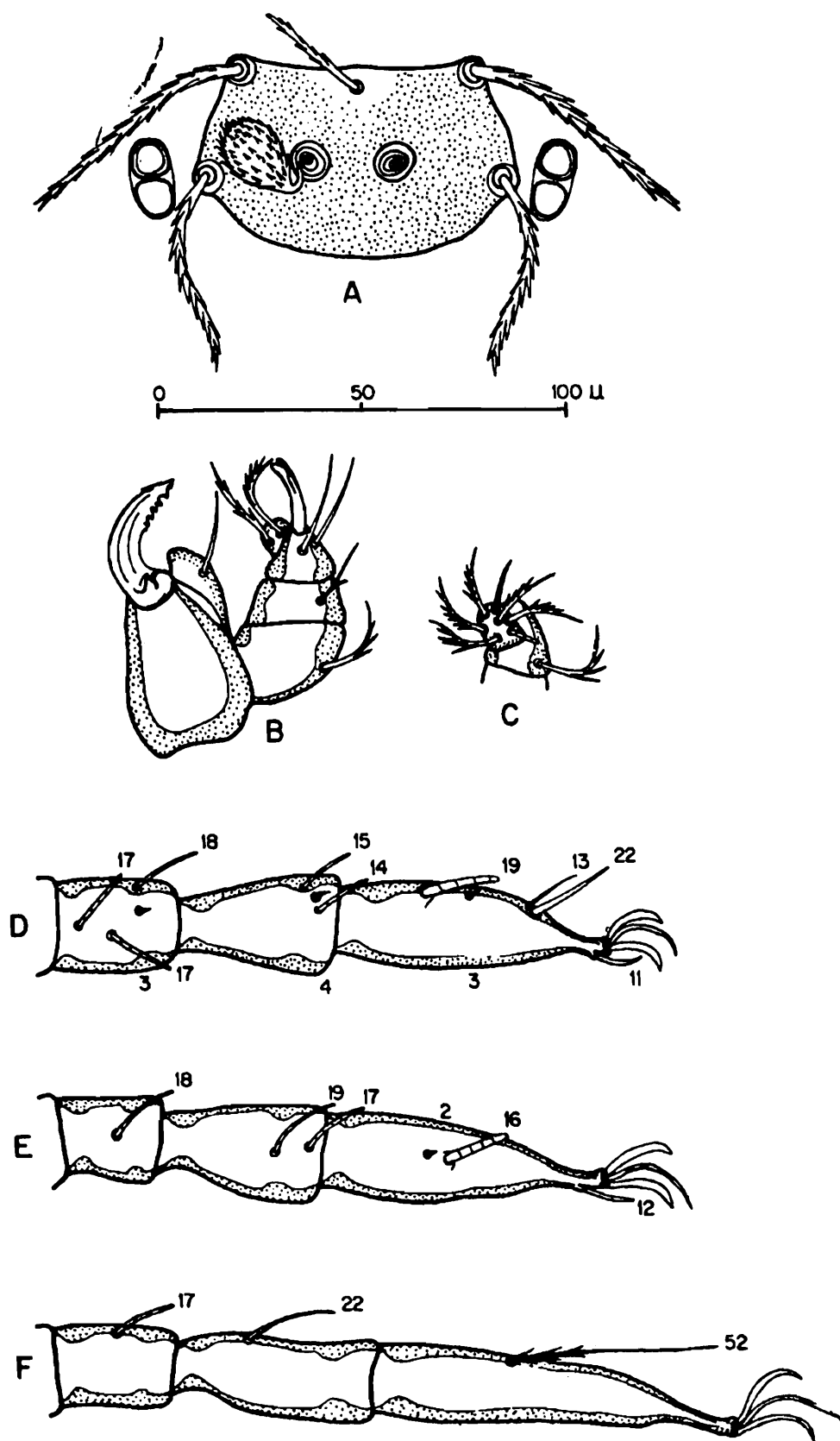


Fig. 107. *Schoengastia pseudoschuffneri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type data : Originally described from INDONESIA, Celebes, Lampong District, Macassar, ex 'rats'

Type depository : Not reported.

Additional records : MANIPUR, Imphal, 4 ex *Rattus rattus bullocki* (= *Rattus rattus brunneusculus*), 7.XI.1945, STRU, coll.

Material examined : 2 specimens from INDONESIA, Java (Batavia), ex *Rattus rattus diardi*, 1.VIII.1948, name of collector not recorded, on loan from USNM.

Remarks : The above redescription is based on the literature and study of the 2 Batavian specimens. *S. pseudoschuffneri* runs to couplet 31 of the key to *Schoengastia* species given by Goff (1982d) along with *S. huxolli* Nadchatram *et al.*, 1980. He distinguishes *S. pseudoschuffneri* in having 16 preanal and 8 postanal setae (23-25 and 14-16 in *S. huxolli*). Nadchatram *et al.* (1980) and Goff (1982b) follow Womersley (1952) in reporting SB level with PL bases. The SB appear distinctly anterior to PL bases in our study. Goff (1981b) has described *S. nadchatrami*, separating *S. pseudoschuffneri* from it in having 32 dorsal body setae (52 in *S. nadchatrami*), and unmodified AL and PL setae (palmate in *S. nadchatrami*). Goff *et al.* (1986a) described *S. sulawesiensis*, distinguishing *S. pseudoschuffneri* from it by the number and arrangement of dorsal body setae (36, arranged : 10-8-8-6-4 in *S. sulawesiensis*), the number of ventral setae (42 in *S. sulawesiensis*), and in having AM seta measuring 22-30 (32-39 in *S. sulawesiensis*). Nadchatram *et al.* (1980) have recorded man as host (table 1, p.269) for this species. This requires confirmation, as the literature indicates this species has been taken only on rodents. They have also followed Womersley (1952) in mistakenly ascribing the Imphal record to Burma, instead of INDIA, Manipur State.

125. *Schoengastia tuberculatae* new species (Fig. 108)

Description of species : Larva.

Idiosoma : Measuring 237-360 x 175-258 in partially engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 37-40; 25-28 dorsal idiosomal setae, measuring 32-37, arranged : 8(7)-6-6-4-2-(2); 2 pairs of sternal setae, anterior 30-37, posterior 29-33; 16-20 preanal setae, 25-31; 6-8 postanal setae, 28-35; total idiosomal setae 56-60.

Gnathosoma : Palpal setal formula b/N/NNb(B)/7B.S; palpal claw 3-ptonged; galeala N; cheliceral blade (31) with 1 ventral and 7 dorsal teeth; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate with anterior margin shallowly concave; posterior margin deep, broadly rounded; AM base posterior to level of AL bases; SB anterior to level of PL bases; AL>PL>AM; sensillary bases with antero- and posteromedial cuticular ridges; sensillae

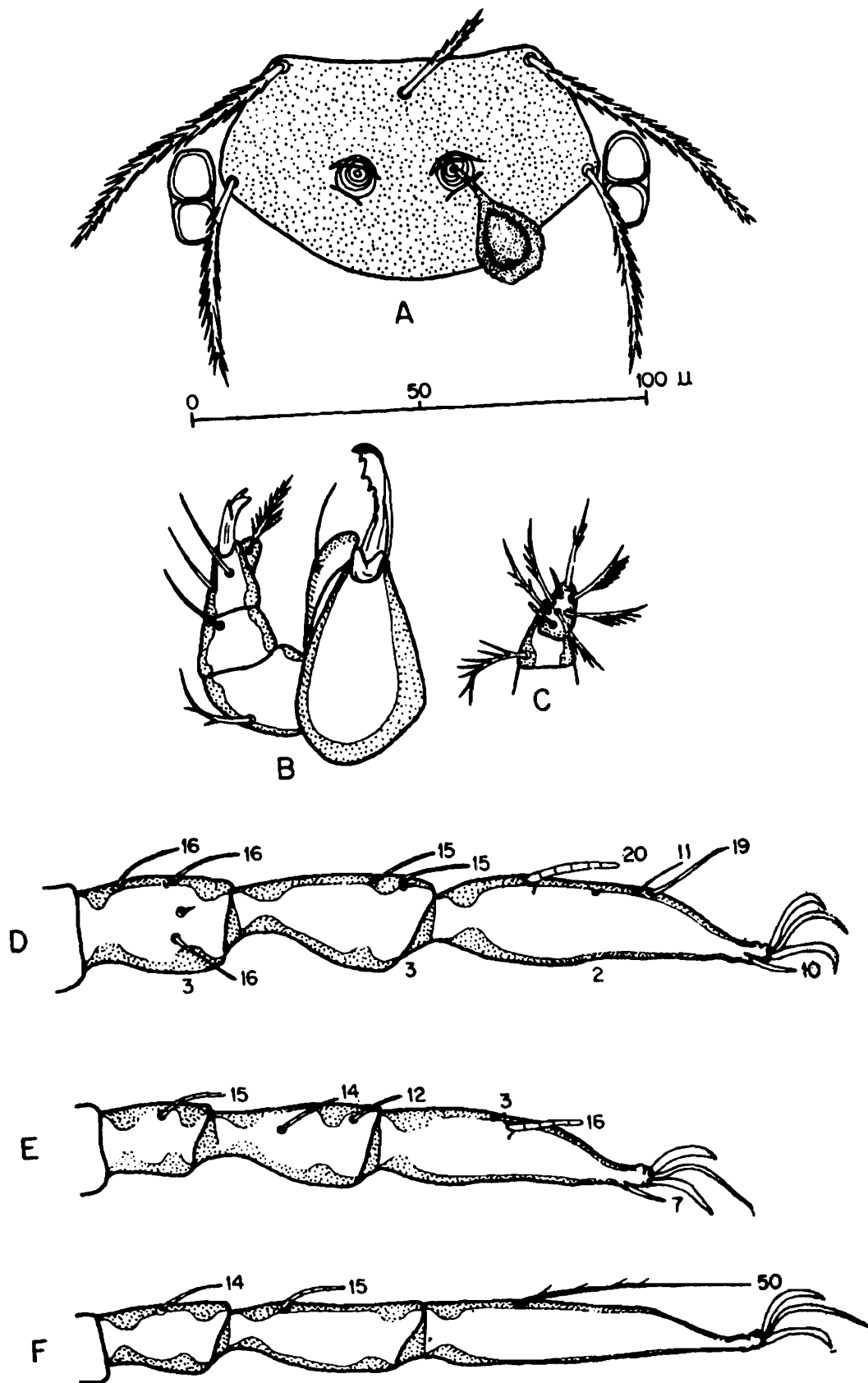


Fig. 108. *Schoengastia tuberculatae* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

capitate, head apparently lacking setules; PW/SD = 1.52-1.61. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 60 (58, 56-61); PW 78 (78, 76-82); SB 19 (20, 19-21); ASB 25 (26, 25-27); PSB 24 (24, 23-24); AP 26 (27, 25-28); AM 28 (28, 26-30); AL 64 (64, 63-67); PL 45 (45, 42-47); sens. 29x15 (28x15, 26-29 x 15).

Legs : Similar to *S. kanhaensis* Mitchell and Nadchatram, 1966, in the number of ordinary and sensory setae; but, tarsus III 14B, mastitarsala with basal barbs. Measurements as follows : Ip = 778-805. Leg I : 280-283; tarsus (73x17), tarsala (19-20). Leg II : 234-252; tarsus (61x15), tarsala (15-16). Leg III : 263-272; tarsus (75x13), mastitarsala (50).

Type data : Holotype (NIV A86239.5) and 6 paratypes, UTTARANCHAL, Uttarkashi District, Sukhrala, 1400-1800m, ex *Agama tuberculata*, 28.VI.1969, NIV, coll.

Remarks : *S. tuberculatae* will run to couplet 27 of the key to *Schoengastia* species given by Goff (1982b) along with *S. cantonensis* Liang *et al.*, 1957 with sensillary bases distinctly anterior to level of PL bases (inadvertently given as posterior to PL bases in the key!). *S. tuberculatae* may be separated in having a larger scutum (AW measuring 47, and PW 67 in *S. cantonensis*). *S. tuberculatae* is close to *S. ruberi* Goff 1982e, from which it may be distinguished in having palpal genual seta nude (branched in *S. ruberi*), fewer body setae (numbering 70-72 in *S. ruberi*), and lower Ip range (1014-1043 in *S. ruberi*). The species is named after the host of the type series.

Genus *Ascoschoengastia* Ewing

Ascoschoengastia Ewing, 1946a, 71; Vercammen-Grandjean, 1968b, 92; Vercammen-Grandjean and Langston, 1976, 53, in part; Nadchatram and Dohany, 1974, 50; Lester 1984, 493, in part; Domrow and Lester, 1985, 19, in part.

Type species : *Neoschoengastia malayensis* Gater, 1932, by monotypy and original designation.

Diagnosis : Schoengastiini larvae parasitic on rodents and other small mammals. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium, onychotriches absent; three genualae I, genuala II and III; tibiala III, subterminala and parasubterminala I; mastitarsala III often present. Palpal tarsus 6B; palpal setae generally weakly barbed or nude; palpal claw 2- or 3-pronged; cheliceral blade with tricuspid cap; galeala N. Eyes 2/2 or 1/1; scutum small, subquadrate with anterolateral shoulders and convex or biconvex posterior margin; scutal punctae simple; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases little more than their diameter apart; sensillae fusiform to clavate, head with short or long spiked setules.

Remarks : Audy (1956a) proposed a new subgenus *Laurentella* to accomodate the *indica* group of *Euschoengastia sensu lato*. The subgenus *Laurentella* and *Ascoschoengastia* were separated essentially on the basis of the PL setae being inserted on or off the scutum. Another point of distinction was the nature of the anterolateral shoulders - being pronounced in *Laurentella* and slight in *Ascoschoengastia*.

The discovery of 10 *Ascoschoengastia* species infesting the nasal passages of mammals in East New Guinea by Nadchatram (1970a), led Nadchatram and Dohany (1974) to review the status of the two subgenera and propose the synonymy of *Laurentella* with *Ascoschoengastia*. They also consider the genus *Ascoschoengastia* congeneric with *Microtrombicula*, pointing out that in the absence of sensillae, the two genera are almost indistinguishable.

Vercammen-Grandjean *et al.* (1973) have reported nine subgenera with palpal tarsal setation 6B in the genus *Ascoschoengastia*. While, Vercammen-Grandjean and Langston (1976) cite *Microtrombicula* Ewing, 1950, and *Scapuscutala* Vercammen-Grandjean, 1960, among these. Lester (1984) and Domrow and Lester (1985) have gone a step further and proposed the synonymy of *Microtrombicula* with *Ascoschoengastia*. Their taxonomic arrangement is not followed here.

Five *Ascoschoengastia* species are reported here from India, including a new species.

126. *Ascoschoengastia guptai* Kulkarni
(Fig. 109)

Ascoschoengastia (Laurentella) guptai Kulkarni, 1974, 454.

Redescription of species : Larva. Colour in life pale yellow.

Idiosoma : Measuring 285-447 x 169-339 in partially engorged to engorged specimens. Eyes 2/2, anterior well-defined, posterior often inconspicuous, (Original description : 1/1). One pair of humeral setae, measuring 35-38; 32-39 dorsal idiosomal setae, measuring 30-35, arranged : 8(9)-8(7-10)-6(5-8)-6(4)-2(4)-2; 2 pairs of sternal setae, anterior 20-22, posterior 22-23; 19-20 preanal setae, 17-22; 13-14 postanal setae, 25-30; total idiosomal setae 70-82.

Gnathosoma : Palpal setal formula B/B/b(N)b(N)B/6B (Original description : B/B/NNB/6B); palpal claw 3-pronged; galeala N; cheliceral blade (31-33) with tricuspid cap; gnathobase minutely punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subquadrate with anterolateral shoulders; anterior margin shallowly biconcave; posterior margin convex; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae elongate, fusiform, head with setules; PW/SD = 1.35-1.38. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 56 (57, 52-63); PW 73 (73, 70-77); SB 24 (25, 24-26); ASB 24 (24, 24-26); PSB 30 (28, 28-30); AP 28 (27, 24-28); AM 28 (29, 28-31); AL 24 (24, 23-24); PL 35 (37, 35-38); sens. 42x7 (43x7, 42-45x7).

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 604-647. Leg I : 213-224; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae (Original description : 5B, 2 genualae), microgenuala; tibia 8B, 2 tibialae, microtibiala (not reported in original description);

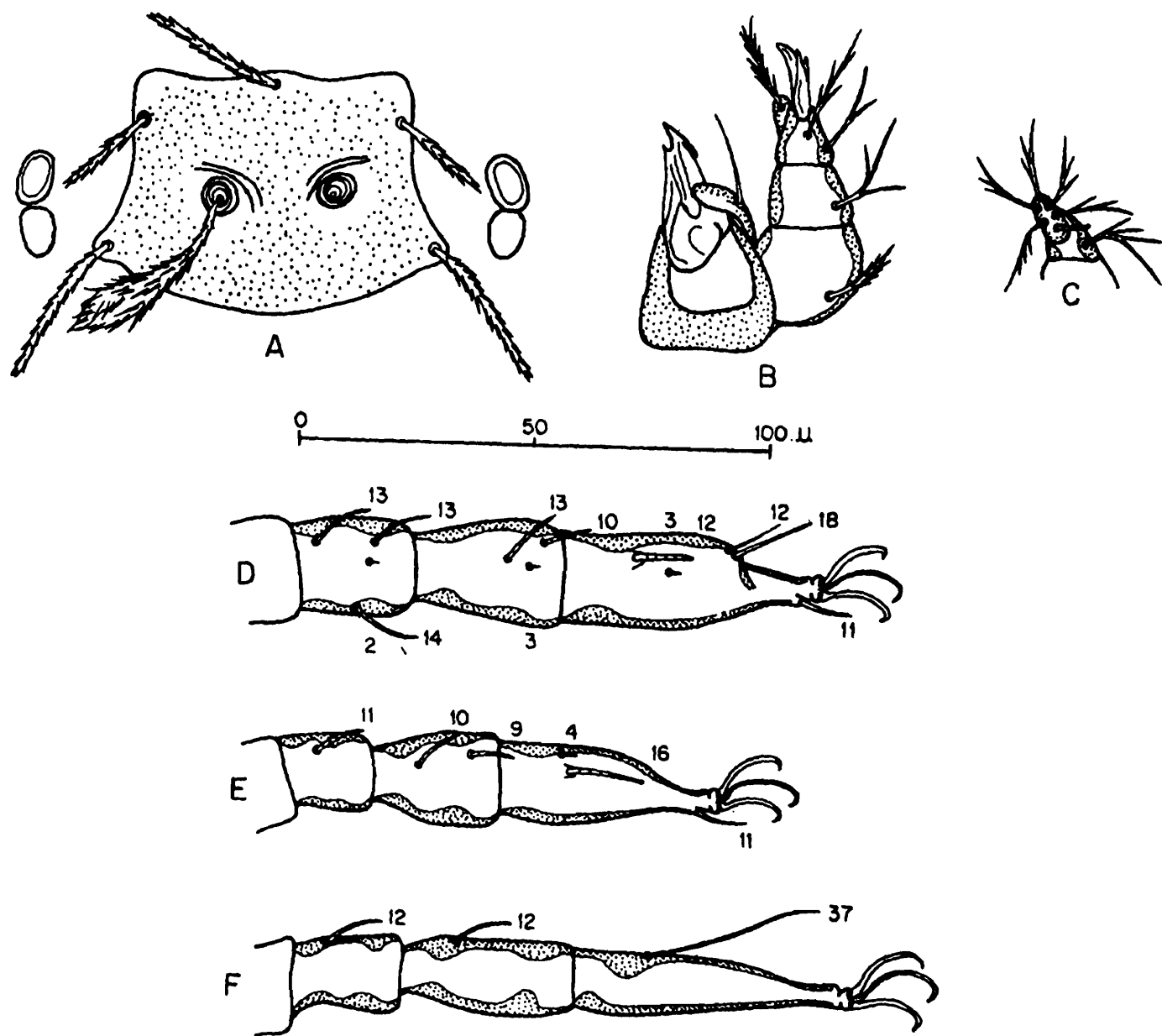


Fig. 109. *Ascoschoengastia guptai*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

tarsus (49-52 x 20) 21B, tarsala (10-12), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 178-196; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae (Original description : 4B, 3 tibialae); tarsus (42-45 x 17) 14B, tarsala (14-16), microtarsala, pretarsala. Leg III : 213-227; coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (56-59 x 12) 13B, nude mastitarsala (35-38).

Type data : Holotype (VRC A-96314) and 2 paratypes, MAHARASHTRA, Pune District, Mulshikhurd, ex *Suncus murinus*, 31.III.1970, S.M. Kulkarni, coll. 2 paratypes, same data, but taken 28.II.1970; 2 paratypes, same data, but taken 29.I.1971; 5 paratypes, same data, but taken 30.IV.1971; 1 paratype, same data, but ex *Rattus rattus rufescens*, taken 28.II.1970; 1 paratype, same data, but ex *Rattus rattus satarae*, taken 18.IV.1970; Bhor, Shirgaon, 1 paratype, ex *S. murinus*, 21.III.1970; 3 paratypes, same data, but taken 23.III.1971; Bhor, Nighudgarh, 2 paratypes, ex *R. r. rufescens*, 14.II.1970; Panshet, Muse, 1 paratype, ex *S. murinus*, 14.III.1970; Sinhgarh, Atkarwadi, 10 paratypes, ex *S. murinus*, 12.IV.1970; 2 paratypes, same data, but taken 14.V.1971.

Type depository : Holotype at NIV; paratypes at NIV, IM, BM(NH), RML and IMR.

Additional material : MAHARASHTRA, Pune District, approximately 140 ex *S. murinus*, *Funambulus tristriatus*, *R. r. rufescens*, *R. r. satarae* and *Rattus blanfordi*, I.1970 - IX.1971, S.M. Kulkarni, coll.

Remarks : Kulkarni (1974) has compared this species to *A. kitajimai* (Fukuzumi and Obata, 1953), being separated in having fewer scutal punctae and dorsolateral palpal seta nude, not barbed. *A. guptai* may further be distinguished in having fusiform sensillae and mastitarsala present on leg III (sensillae clavate and mastitarsala III absent in *A. kitajimai*).

He also compares *A. guptai* to *A. sellnicki* Audy and Womersley, 1957, being separated in having a greater number of dorsal body setae (18-24 in *A. sellnicki*), different palpal setal formula (b/N/NNb in *A. sellnicki*, tarsala II longer (measuring 10 in *A. sellnicki*), and PW and PL setae distinctly smaller (measuring 89 and 44 in *A. sellnicki*); *A. guptai* may further be distinguished by its fusiform sensillae (lanceolate in *A. sellnicki*).

This species has been named in honour of Dr. N.P. Gupta, former NIV Director.

127. *Ascoschoengastia indica* (Hirst) (Fig. 110)

Schoengastia indica Hirst, 1915, 187.

Trombicula muris Walch, 1922, 530; Walch 1927, 924, **synonymy**; Krishnan *et al.*, 1949c, 67; Mehta, 1937, 353.

Neoschoengastia indica, Gater, 1932, 143.

Trombicula indica, Mehta, 1937, 353; Soman, 1954, 389.

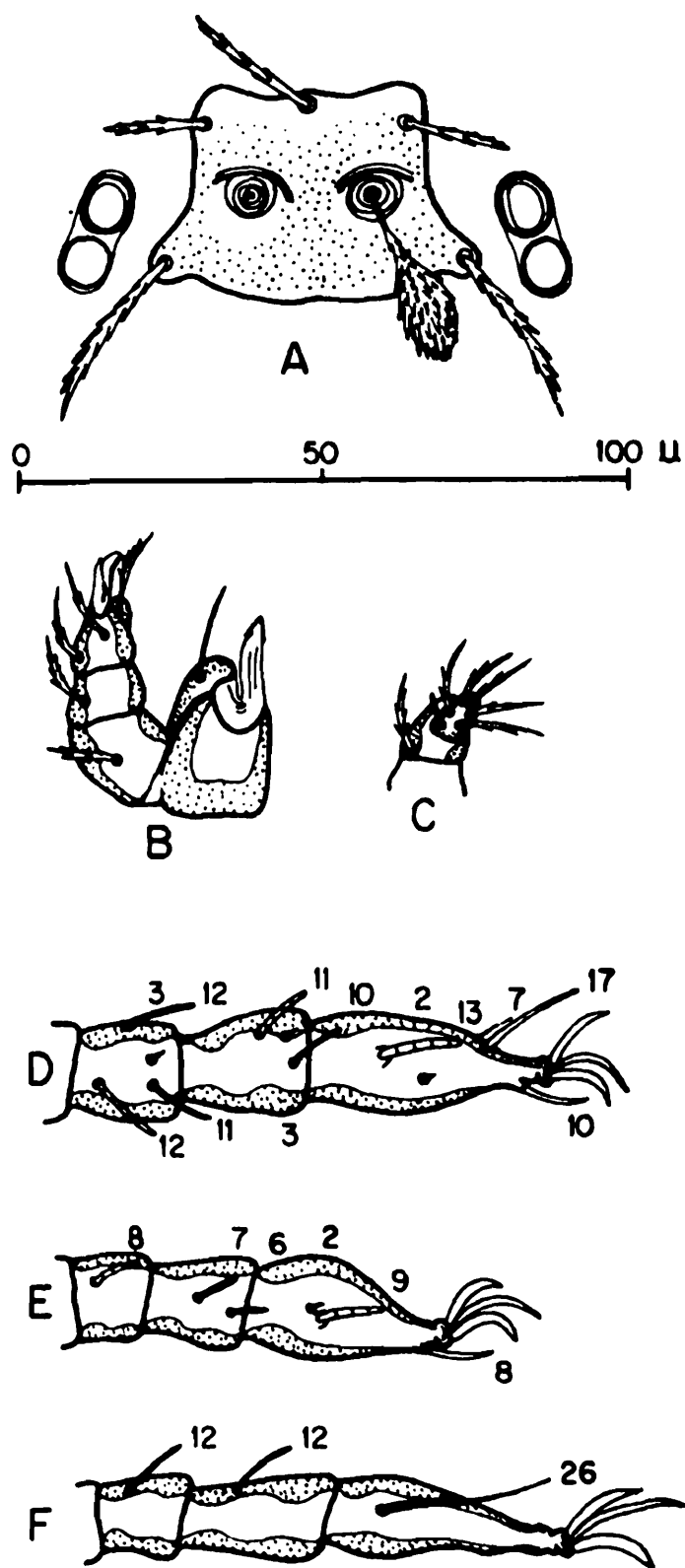


Fig. 110. *Ascoschoengastia indica*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Ascoschoengastia indica, Wharton, 1946, 151; Kaul *et al.*, 1978, 19; Fernandes *et al.*, 1988, 108.

Euschoengastia indica, Fuller, 1948, 101; Wharton and Fuller, 1952, 77; Audy *et al.*, 1953, 21.

Schoengastia (Ascoschoengastia) indica, Womersley, 1952, 208.

Euschoengastia (Laurentella) indica, Audy, 1956a, 5.

Ascoschoengastia (Laurentella) indica, Womersley and Audy, 1957, 279; Joshee, 1964, 45; Mitchell *et al.*, 1966, 119; Kulkarni, 1979, 17; Kulkarni *et al.*, 1979, 1.

Ascoschoengastia (Ascoschoengastia) indica, Vercammen-Grandjean, 1968b, 93.

Neoschoengastia cockingsi Radford, 1946, 262; Womersley, 1952, 208, **synonymy**.

Laurentella indica, Schluger *et al.*, 1960a, 178.

Shongastia indica, **sic!** Varma and Mahadevan, 1971, 817; Prasad, 1974, 88.

Schongastia (Ascoschongastia) indica, **sic!** Kochhar, 1972, 138.

Achongastia indica, **sic!** Varma and Mahadevan, 1972, 635.

Redescription of species : Larva. Colour in life cream to pale orange.

Idiosoma : Measuring 310-394 x 182-200 in engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 31-34; 32-34 dorsal idiosomal setae, measuring 24-29, arranged : 8-6-6-6-4(6)-2; 2 pairs of sternal setae, anterior 13-16, posterior 16-18; 24 preanal setae, 16-17; 8-12 postanal setae, 21-22, (Womersley, 1952 : 26 ventral setae); total idiosomal setae 70-78.

Gnathosoma : Palpal setal formula b/b(N)/N(b)N(b)b/6B; palpal claw 2-pronged; galeala N; cheliceral blade (19-25) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subquadrate with anterolateral shoulders; anterior margin shallowly biconcave; posterior margin convex with median indentation; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae clavate, head with relatively large setules; PW/SD = 1.22-1.37. Ranges of scutal measurements of 41 specimens from Burma after Womersley (1952) : AW 34-42; PW 50-59; SB 18-22; ASB 21-25; PSB 18-20; AP 22-29; AM 22-28; AL 17-20; PL 28-34; sens. 28-36. Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 38, 36-42; PW 52, 49-59; SB 20, 19-23; ASB 20, 19-21; PSB 19, 17-23; AP 24, 22-28; AM 24, 22-27; AL 18, 17-18; PL 29, 26-31; sens. 29x10, 27-31 x 10.

Legs : Similar to *A. guptai* Kulkarni, 1974, in the number of ordinary and sensory setae. Leg III with nude mastitarsala (Wharton, 1946 : 2 mastitarsalae III; Womersley, 1952 : distal mastitarsala indistinctly branched, frequently appearing nude). Measurements as follows : Ip = 459-526. Leg I : 165-189; tarsus (38x16), tarsala (13). Leg II : 132-156; tarsus (30x16), tarsala (9). Leg III : 162-181; tarsus (38x12), mastitarsala (26).

Type data : Holotype, WEST BENGAL, Calcutta, ex *Bandicota bengalensis* (= *Nesokia bengalensis*), date of collection not reported, S. Hirst, coll.

Type depository : Type larva at BM(NH), not traceable at present.

Additional records : ANDAMAN and NICOBAR, Car Nicobar, 22 ex 2 *Rattus rattus*, X.1950, C.A. Gibson-Hill, coll. ASSAM and ARUNACHAL PRADESH, ex rodents and insectivores, 1968-1969, R.K. Kochhar, coll. HIMACHAL PRADESH, Kasauli and Sabathu, Simla hills, ex *R. rattus*, VI-XI.1935, D.R. Mehta, coll. JAMMU and KASHMIR, Mehandar, ex *Suncus murinus* (?) and *R. rattus*, VII.1948-IX.1951, S.L. Kalra, coll. KARNATAKA, Bangalore and Mysore, and MADHYA PRADESH, Jabalpur, ex *R. rattus*, XI.1946-IX.1947, S.L. Kalra, coll.; MADHYA PRADESH, Mandla District, Kanha National Park, ex *Rattus rattus rufescens*, 2.XII.1964, C.J. Mitchell, J. Spillet and G.B. Schaller, coll. MAHARASHTRA, Bombay, ex *Rattus* sp., II.1947-XI.1949, D.W. Soman, coll.; same locality, ex *R. rattus*, V.1958-XII.1959, A.K. Joshi, coll.; Nagpur, 10 ex *R. rattus*, VI.1967-IV.1968, S.R. Shrivastva, coll.; Western Ghats, Pune District, approximately 1250 ex *S. murinus*, *R. r. rufescens*, *Rattus rattus satarae*, and *Mus musculus*, I.1970-IX.1971, S.M. Kulkarni, coll. MANIPUR, Imphal, ex *R. r. rufescens*, *Tupaia glis* and *Herpestes* sp., IV.1945-V.1946, STRU, coll. ORISSA, Ganjam, Singpur, 13 ex *Rattus rattus arboreus*, 22.XI.1972, H.N. Kaul, coll. RAJASTHAN, Kota District, 30 ex *R. r. rufescens*, 27,28.X.1971, H.N. Kaul, coll. SIKKIM and WEST BENGAL, Himalayan foot-hills, 110-1228m, ex rodents and insectivores, 1966-1967, R.N. Varma, coll.; WEST BENGAL, Calcutta, Barrackpore, ex *R. rattus*, 1947-1948, K.V. Krishnan, coll.; Barrackpore and Singur, ex *R. rattus* and *Tatera indica*, V.1950-1952, M.G.R. Varma, coll.; Sunderbani, same hosts, 1947-1949, S.L. Kalra, coll.

New records : GOA, Mollem, 2 ex *Rattus rattus wroughtoni*, 16.II.1984, Stan Fernandes, coll. KARNATAKA, Shimoga District, Hennagere, North Kanara District, Mavingundi, 41 ex 29 *R.r. wroughtoni*, 29.IX-2.XI.1966, NIV, coll. MAHARASHTRA, Bombay, 63 ex *Rattus norvegicus*, 31.I.1985, Stan Fernandes, coll.; Satara District, Mahableshwar, 125 ex *R. r. wroughtoni*, 12.XII.1984, P.K. Deshmukh, coll. 45 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kangra District, Dadh, 1080-1110m, 222 ex 2 *Rattus rattus gangutrianus*, 14.IX.1967; 3 same data, but ex *S. murinus*; Dharamsala, 920-1760m, 9 ex *R. r. gangutrianus*, 17.IX.1967; Simla District, Nalagarh, 500-600m, 16 ex *R. r. gangutrianus*, 4.IV.1969; 1 same data, but ex *R. r. rufescens*, taken 6.IV.1969. JAMMU and KASHMIR, Rajouri District, Naoshera, 750m, 1 ex *M. musculus*, 9.XII.1969; Udhampur District, Phalata, 750m, 1 ex *Rattus* sp., 23.XI.1969. UTTARANCHAL, Almora District, Phurkia, approximately 2450m, 6 ex *Rattus rattus rattoides*, 3.X.1967; Dehra Dun District, Asarodi, 600-750m, 6 ex *R. r. gangutrianus*, 5.VI.1970; 11 same data, but ex *Rattus* sp., taken 2.VI.1970; Dehra Dun, 600-800m, 34 ex 5 *R. r. gangutrianus*, 28,29.X.1967; 5 same data, but ex *B. bengalensis*, taken 28.X.1967; Satyanarayan, 300m, 36 ex 2 *R. r. gangutriaus*, 30.VI,2.VII.1970; Pauri Garhwal District, Dogadda, 1700-1900m, 79 ex 4 *R. r. gangutrianus*, 12,13.XI.1967; Shrinagar, 550m, 9 ex *R. r. gangutrianus*, 24.X.1967; Nainital District, Garjia, 400-500m, 33 ex 6 *R. r. gangutrianus*, 15-19.XI.1967; Haldwani, 400-1100m, 3 ex 2 *R. r. gangutrianus*, 5.XII.1966; 8 same data, but taken 23.II.1967; Ranibag, 650m, 14 ex 2 *R. r. gangutrianus*, 25.VIII.1970; Tanakpur, 250m, 246 ex 3 *R. r. gangutrianus*, 6.IX.1967; Pithoragarh District, Goucher, 750-1500m, 2 ex *R. r. gangutrianus*, 6.VIII.1970; Tehri

District, Ghansali, 900-1100m, 6 ex *R. r. gangutrianus*, 21.V.1969; Munikireti, 450m, 4 ex 2 *Funambulus pennanti*, 25.X.1967. WEST BENGAL, Jalpaiguri District, Chunabhatti, 150-200m, 371 ex 3 *Rattus rattus brunneusculus*, 25.III.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Wharton (1946), while making detailed observations on the morphology and development of *A. indica*, remarks that the geographical distribution of this species is typical of the family - it is present in restricted localities over a large geographical area. Audy *et al.* (1953) and Audy (1956a) confirm this widespread distribution, especially on rodents (including house rats), in the Asiatic-Pacific area. They further suggest the possible involvement of *A. indica* in the transmission of rickettsiae between rats.

Wharton (1946) and Womersley (1952) draw attention to the characteristic arrangement of the first posthumeral row of dorsal body setae - the submedian pair is inserted well in front of the others, level with the humeral setae.

Audy (1954) notes the extraordinary resemblance between *A. indica* and *Microtrombicula munda* Gater, 1932. Due to the close convergence of characters in their larvae, the two taxa could easily be confused if the sensillae are missing.

128. *Ascoschoengastia katarmalensis* new species
(Fig. 111)

Description of species : Larva.

Idiosoma : Measuring 240x154 in partially engorged holotype. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 46; 52 dorsal idiosomal setae, measuring 29-33, arranged : (8+5)-(7+3)-6-6-6-5; 2 pairs of sternal setae, anterior 18, posterior 24; 20 preanal setae, 20-21; 14 postanal setae, 24-28; total idiosomal setae 92.

Gnathosoma : Palpal setal formula B/b/bbB/6B; palpal claw 3-pronged; galeala N; cheliceral blade (37) with dorsal subapical tooth; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subquadrate with anterolateral shoulders; anterior margin shallowly biconvex; posterior margin shallowly convex; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae lanceolate, head with coarse setules; PW/SD = 1.4. Scutal measurements of holotype : AW 50; PW 58; SB 25; ASB 21; PSB 20; AP 19; AM 30; AL 24; PL 42; sens. 39x9.

Legs : Similar to *A. guptai* Kulkarni 1974 in number of ordinary and sensory setae. Measurements as follows : Ip = 597. Leg I : 212; tarsus (54x24), tarsala (15). Leg II : 179; tarsus (43x20), tarsala (14). Leg III : 206; tarsus (57x18), mastitarsala (17+, broken in holotype).

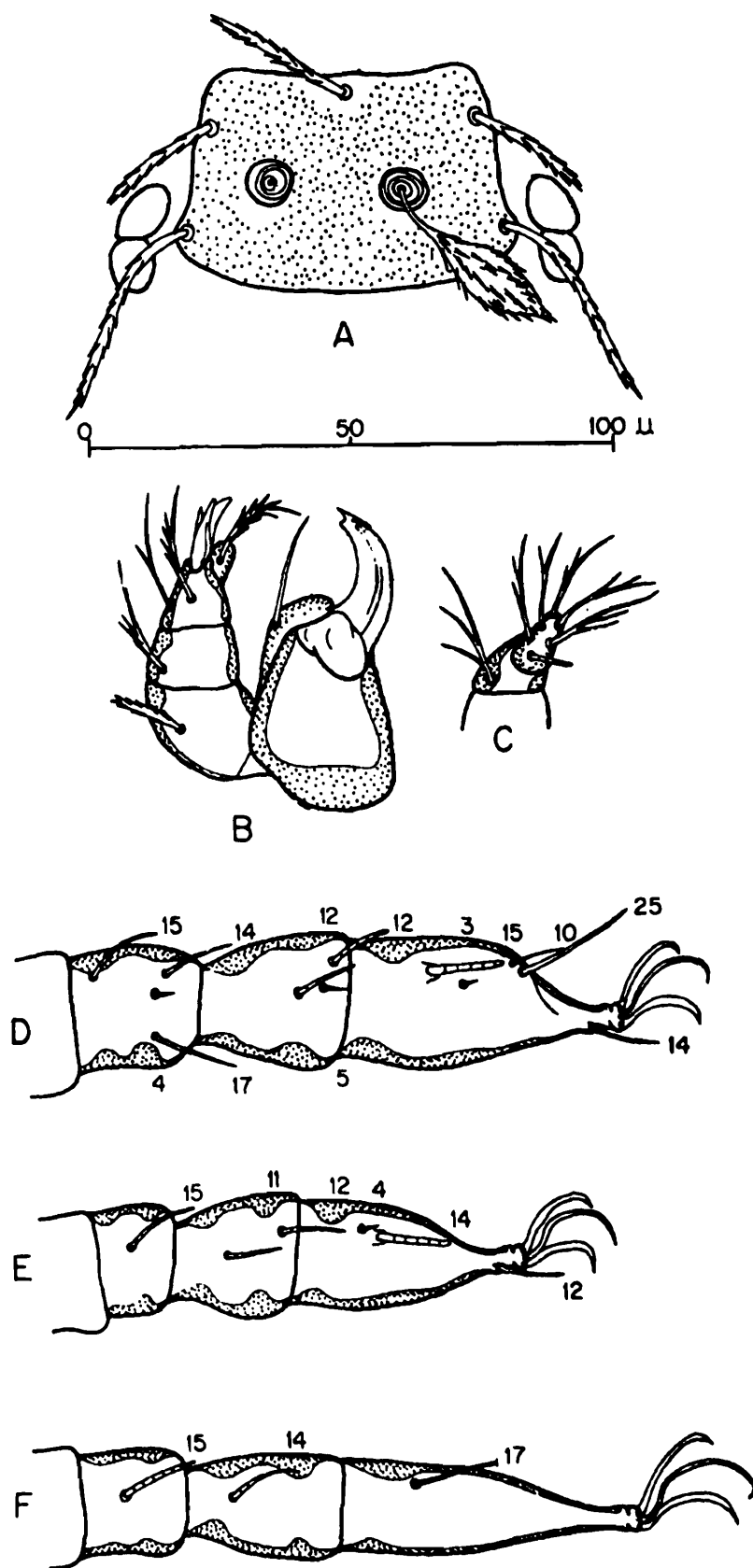


Fig. 111. *Ascoschoengastia katarmalensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type Data : Holotype (NIV A-96061.21), UTTARANCHAL, Almora District, Katarmal, 1300m, ex *Hipposideros armiger*, 19.VIII.1970, NIV, coll.

Remarks : *A. katarmalensis* appears most similar to *A. narai* Takada, 1979, recorded from bat host in Honshu, Japan, in the shape of the scutum and in the presence of mastitarsala III. It may easily be separated in having eyes 2/2 (1/1 in *A. narai*), 52 dorsal idiosomal setae (34-38 in *A. narai*), pretarsala II present (lacking in *A. narai*), and 2 pairs of sternal setae (3 pairs in *A. narai*).

This is the first *Ascoschoengastia* species recorded from a bat host in India. The parasitope has not been specified in the collection records, but an intranasal parasitope may be inferred from the excessive idiosomal engorgement, weak branching of body and leg setae, reduced scutal sclerotization and poorly developed dentition (Goff, 1979c, 1981a).

The species name has been derived from the type locality, Katarmal.

129. *Ascoschoengastia leechi* Domrow (Fig. 112)

Ascoschoengastia (Laurentella) leechi Domrow, 1962b, 590; Domrow and Nadchatram, 1964, 478.

Ascschoengastia (Asoschoengastia) leechi, Vercammen-Grandjean, 1968b, 93.

Ascschoengastia leechi, Wang and Liao, 1981, 220; Wen *et al.*, 1982, 468.

Ascoschoengastia sp. B Fernandes *et al.*, 1988, 108.

Redescription of species : Larva.

Idiosoma : Measuring 330 x 220 in engorged specimen. Eyes 2/2, well defined, on ocular plate (Original description : Eyes weak). One pair of humeral setae, measuring 36-43; 41-44 dorsal idiosomal setae, measuring 27-34, arranged : 8-4(5)-6-3-6-6-4-4-(2) (Domrow, 1962b, and Domrow and Nadchatram, 1964, report 34-37 dorsal body setae in Laotian and Thai specimens with arrangement commencing : 8(9-11)-4(3-5)-6; Wang and Liao (1981) record 34-40 in Chinese specimens with arrangement commencing : 8(9)-6(4)-6); 2 pairs of sternal setae, anterior 18-21, posterior, 20-23; 30 preanal setae, 18-23; 12-14 postanal setae, 25-28; total idiosomal setae 89-94.

Gnathosoma : Palpal setal formula b/b/bbb/6B (Original description : b/N(b)/bN(b)b/6B); palpal claw 3-pronged (Original description : 2-pronged; Wang and Liao, 1981 : 3-pronged); galeala N; cheliceral blade (27-29) with dorsal subapical tooth; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subquadrate with anterolateral shoulders; anterior margin shallowly biconcave; posterior margin slightly convex; AM base anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillae clavate, head with fairly long spiked setules; PW/SD = 1.23-1.34. Scutal measurements of HT and PT, followed by mean of

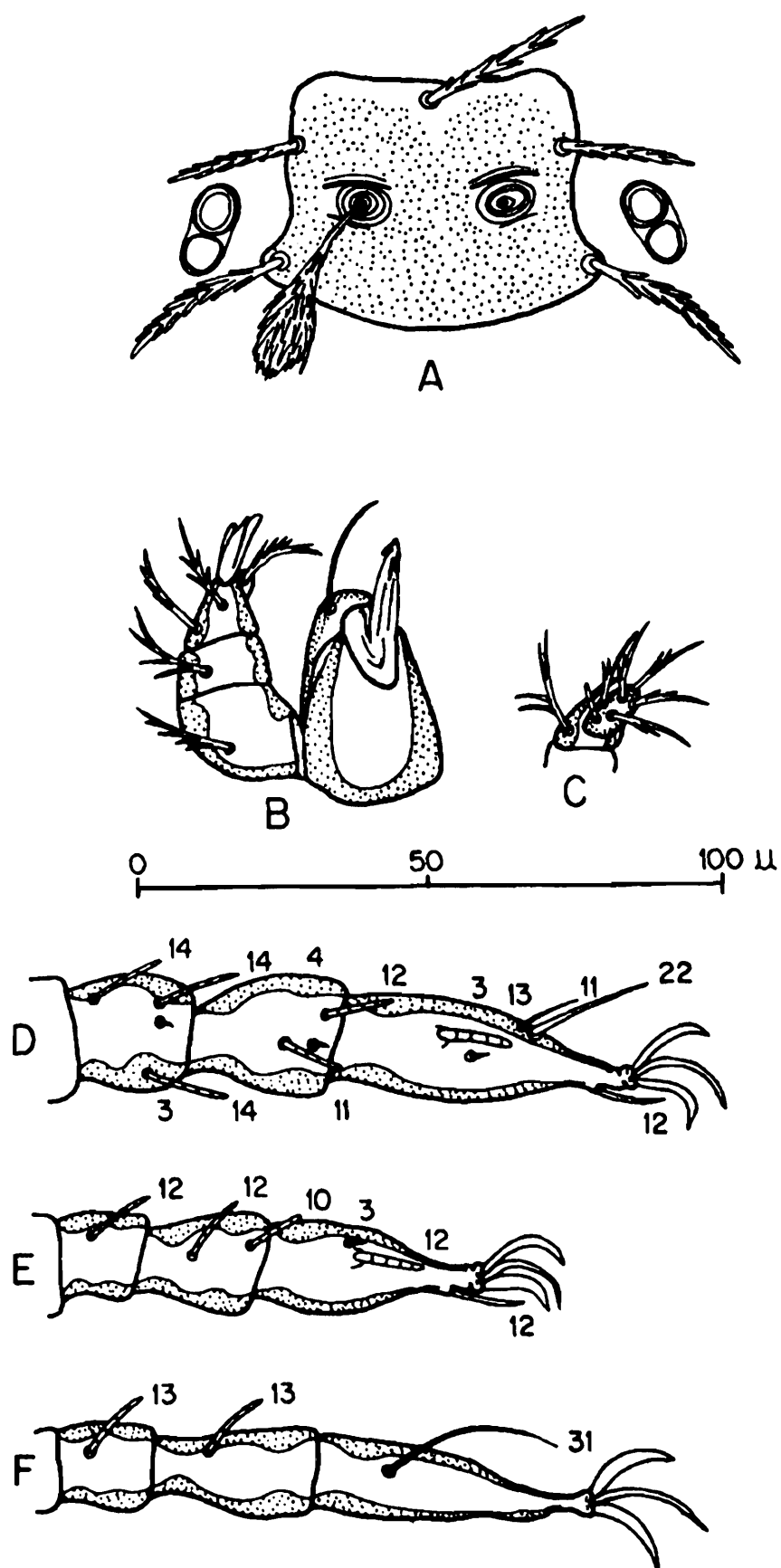


Fig. 112. *Ascoschoengastia leechi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

several specimens from Laos after original description : AW 48,46,48; PW 57,52,55; SB 22,21,22; ASB 21,21,22; PSB 23,23,24; AP 19,21,20; AM 29,-,27; AL 22,-,20; PL 36,-, 34; sens. -, -,25x9. Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 48, 45-51; PW 56, 52-60; SB 23, 21-24; ASB 22, 20-24; PSB 22, 21-23; AP 21, 20-22. AM 28, 27-31; AL 23, 22-26; PL 37, 32-42; sens. 33x9, 31x8-36x10.

Legs : Similar to *A. guptai* Kulkarni, 1974, in the number of ordinary and sensory setae. Microtarsala I inserted distal to tarsala as reported by Domrow and Nadchatram (1964) (Original illustration: proximal to tarsala I). Measurements as follows : Ip = 548-602 (Wang and Liao, 1981: 497). Leg I : 146-213, tarsus (51-53 x 18-20), tarsala (13). Leg II : 168-180; tarsus (36 x 16-17), tarsala (12-13). Leg III : 184-209; tarsus (47-51 x 13), mastitarsala (31).

Type data : Holotype, LAOS, Ban Theuong, 1052m, ex *Rattus edwardsi edwardsi*, 27.VIII.1960, R. Leech and M. Nadchatram, coll.; paratype, same data, but Thateng, 1220m, ex *Dremomys rufigenis*, taken 24.VII.1960.

Type depository : Holotype and paratype deposited in USNM.

Additional records : This species has been recorded from Laos and Thailand by Domrow and Nadchatram (1964) and more recently from China by Wang and Liao (1981).

New records : 80 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kangra District, Dharamsala, 1220-1830m, 33 ex *Rattus rattus gangutrianus*, 16.IX.1967; Kinnaur District, Karcham, 1700m, 6 ex *Rattus rattoides*, 19.X.1967; Kulu District, Bhui, 1100-1550m, 16 ex 2 *R. rattoides*, 11.X.1967; Jibi, 1000-1922m, 34 ex *R. rattoides*, 15.IV.1969; Manali, 1820-1860m, 49 ex 2 *R. rattoides*, 8,9.VIII.1970; 52 ex *Rattus* sp., same locality, 9.VIII.1970; Palchan, 1800-2290m, 27 ex 5 *Rattus rufescens*, 2.X.1968; 2 ex *R. r. gangutrianus*, same locality, 27.VIII.1970; 2 ex *R. rattoides*, same locality, 3.X.1967; 1 ex *Mus musculus*, same locality, 1.X.1968; Lahul District, Kirting, 2680-3250m, 2 ex *Alticola roylei*, 24.IX.1968; Mahasu District, Baghi, 2700-2760m, 9 ex *R. rattoides*, 11.VII.1970; Sarhan, 1300-2140m, 14 ex *R. rattoides*, 5.V.1968; Sungri, 2650-2750m, 33 ex 2 *R. rattoides*, 17,18.VII.1970; Simla District, Simla, 1700-2000m, 27 ex 2 *R. rattoides*, 29.X.1967; 11 ex 2 *R. rattoides*, same locality, 4.XI.1967; 51 ex *Bandicota bengalensis*, same locality, 29.X.1967. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 19 ex 4 *R. rattoides*, 16.XI.1969; Tangmarg, 600m, 1 ex *R. rattoides*, 19.X.1969; Doda District, Bhadarwah, 1700m, 3 ex 2 *R. rattoides*, 15,17.XI.1969; Rajouri District, Naoshera, 750m, 7 ex *M. musculus*, 8.XII.1969; Udhampur District, Dehari, 750-900m, 1 ex *Suncus murinus*, 1.XII.1969; Kulwanda, 1700-1800m, 15 ex *R. rattoides*, 3.XII.1969. UTTARANCHAL, Almora District, Loharghat, 1700-2100m, 38 ex *R. rattoides*, 11.III.1967; Phurkia, approximately 2450m, 73 ex 3 *R. rattoides*, 4,8.X.1967; Chamoli District, Dogalbita, 2300-3800m, 26 ex *R. rufescens*, 9.VII.1970; same locality, 94 ex 6 *R. rattoides*, 10,11.V.1969; 29 ex same host, locality, but 8.VII.1970; Gwaldam, 150-2100m, 3 ex *R. rattoides*, 11.IV.1967; Kailbinayak, 2100-4400m, 2 ex *R. r. gangutrianus*, 14.X.1967; Dehra Dun District, Dehra Dun, 600-800m, 5 ex 2 *R. r. gangutrianus*, 28,29.X.1967; Kanasar, 1800-2300m, 17 ex 3 *R.*

rattoides, 29.31.III.1968; Mussoorie, 1400-2300m, 12 ex 3 *R. rattoides*, 8.XI.1967; Sahaspur, 600m, 1 ex *S. murinus*, 2.IV.1968; Pauri Garhwal District, Dogadda, 700-900m, 12 ex *R. r. gangutrianus*, 11.XI.1967; 9 ex *S. murinus*, same locality, 12.XI.1967; Nainital District, Mukteshwar, 1400-2300m, 10 ex 3 *R. rattoides*, 28.IV, 1.V, 26.XI.1967; 6 ex *R. niviventer*, same locality, 26.XI.1967; Pithoragarh District, Goucher (Thal), 750-1200m, 1 ex *S. murinus*, 3.III.1967; Tehri District, Chirbatia, 1800-3200m, 5 ex 2 *R. rattoides*, 26.V.1969, 23.VI.1970; Uttarkashi District, Sakhi, 2700m, 73 ex 7 *R. rattoides*, 4-7.VI.1969; Harsil, 2600m, 18 ex 2 *R. r. gangutrianus*, 14.VI.1967; Kuthanur 1700-3200m, 20 ex *Rattus* sp., 20.VI.1969; Sukhrala, 1400-1800m, 1 ex *R. rattoides*, 28.VI.1969.

Remarks : Domrow (1962b) compares *A. leechi* to *A. octavia*, another new species he describes. He distinguishes *A. leechi* in having the dorsal setal pattern commencing : 8-4-6-2 (8-2-8-6 in *A. octavia*), and by the claviform sensillae (subglobose in *A. octavia*). After study of two topotypes from Laos and the Thai specimens, Domrow and Nadchatram (1964) correct the apparent error in the position of microtarsala I given in the original illustration. Vercammen-Grandjean (1968b), from the study of the original description alone, places this species in the *malayensis* group (with 2-pronged palpal claw), rather than the *ocellifera* group (with 3-pronged palpal claw). The palpal claw is 3-pronged in the Indian specimens, as reported for the Chinese specimens by Wang and Liao (1981) and Wen *et al.* (1982). This is the first record of *A. leechi* from India. The species has been named in honour of the collector R. Leech.

130. *Ascoschoengastia roluis* (Traub and Audy) (Fig. 113)

Euschoengastia roluis Traub and Audy, 1954, 79; Wattal *et al.*, 1967a, 352.

Euschoengastia (Laurentella) roluis, Audy, 1956a, 13.

Laurentella roluis, Schluger *et al.*, 1960a, 182.

Ascoschoengastia (Laurentella) roluis, Mitchell *et al.*, 1966, 120; Srivastava and Wattal, 1975a, 154.

Ascoschoengastia (Ascoschoengastia) roluis, Vercammen-Grandjean, 1968b, 93.

Ascoschongastia roluis, sic! Prasad, 1974, 76.

Ascoschoengastia sp. A Fernandes *et al.*, 1988, 108.

Redescription of species : Larva.

Idiosoma : Measuring approximately 600x350 in partially engorged specimens. Eyes 1/1, reduced, free on cuticle. One pair of humeral setae, measuring 31-40; 20-24 dorsal idiosomal setae, measuring 25-36, arranged : 6-4(6)-4(2)-4-4(2)-(2); 2 pairs of sternal setae, anterior 13-17, posterior 16-20; 16 preanal setae, 15-22; 6-12 postanal setae, 21-28; total idiosomal setae 48-58.

Gnathosoma : Palpal setal formula b/b/bb(N)b/6B (Original description : b/B/bbb/5B);

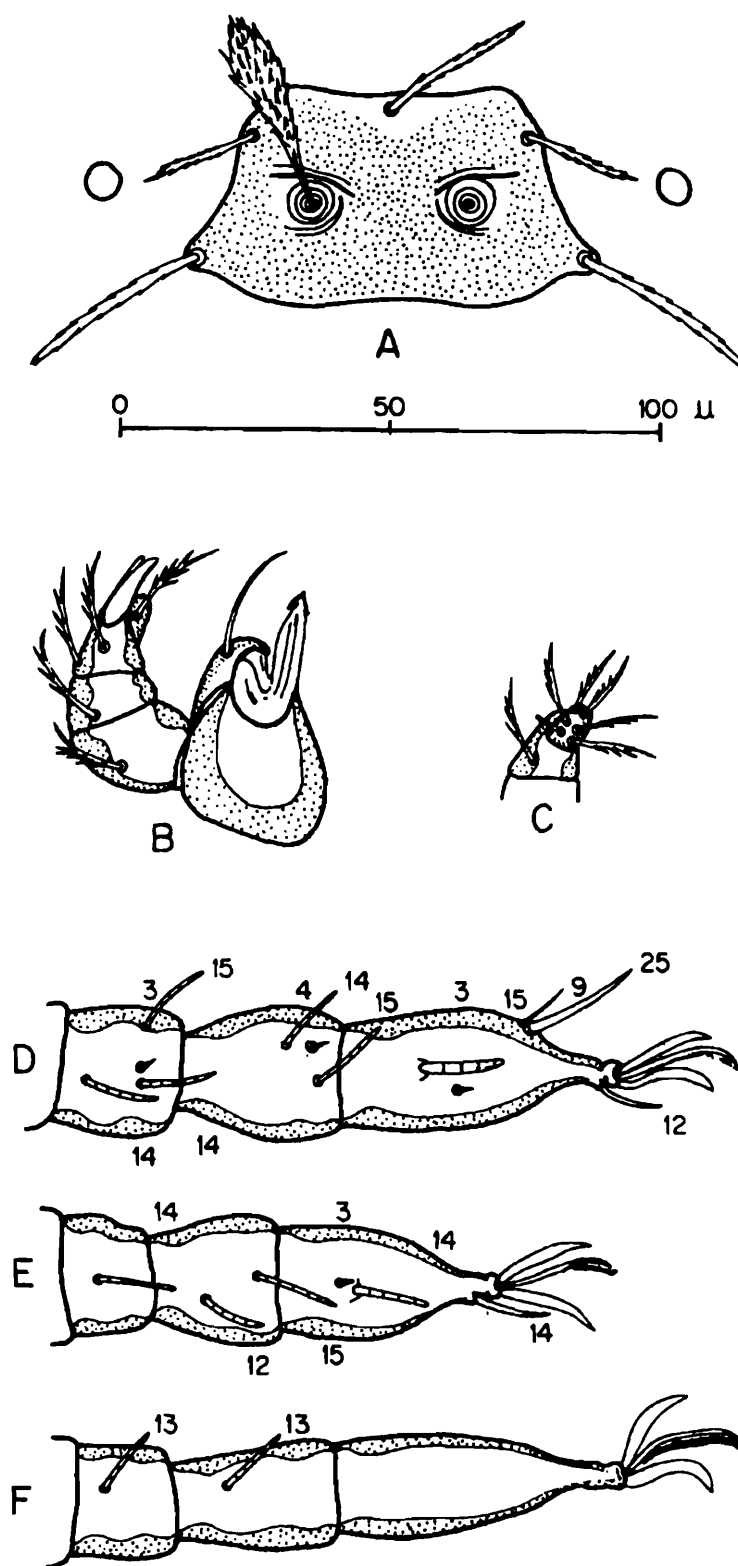


Fig. 113. *Ascoschoengastia roluis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

palpal claw 2-pronged; galeala N; cheliceral blade (26) with tricuspid cap; gnathobase minutely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subquadrate with anterolateral shoulders; anterior margin shallowly biconcave; posterior margin slightly convex with median indentation; AM base anterior to level of AL bases; SB anterior to level of PL bases; $PL > AM > AL$; sensillae clavate, head with fairly long spiked setules; $PW/SD = 1.28-1.37$. Scutal measurements of holotype followed by means and ranges of 14 paratypes in parentheses after original description : AW 43 (43, 39-47); PW 59 (59, 55-63); SB 18 (19, 17-21); ASB 23 (23, 21-25); PSB 23 (22, 20-24); AP 23 (25, 23-27); AM 28 (31, 28-34); AL 21 (21, 19-23); PL 35 (35, 31-39). Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 44, 40-49; PW 59, 53-65; SB 23, 21-24; ASB 22, 20-24; PSB 21, 20-23; AP 22, 20-25; AM 26, 22-32; AL 19, 18-21; PL 33, 30-38; sens. 32×9 , $29-36 \times 9-10$.

Legs : Similar to *A. guptai* Kulkarni, 1974, in the number of ordinary and sensory setae; but, tarsus III 14B, lacking mastitarsala. Measurements as follows : $Ip = 491-604$. Leg I : 179-212; tarsus (51×22), tarsala (15). Leg II : 148-183; tarsus ($34-41 \times 16-21$), tarsala (11-14). Leg III : 164-209; tarsus (53×19).

Type data : Holotype (USNM 2112) and 14 paratypes, BORNEO, Mt. Kinabalu, Bundu Tuhan, 1220m, ex *Chiropodomys legatus*, 31.VII.1951, R. Traub, coll.

Type depository : Holotype and 3 paratypes in USNM; 11 paratypes in BM(NH), RML, SAM, CNHM, other institutions and Traub collection.

Additional records : MADHYA PRADESH, Mandla District, Kanha National Park, 533-791m, 1 ex *Rattus rattus rufescens*, 22.XII.1964, C.J. Mitchell, J. Spillett and G.B. Schaller, coll.; UTTARANCHAL, Nainital District, 160 ex *Rattus rattus*, VIII.1967, NICD, coll.; HIMACHAL PRADESH, Dharamsala, 25 ex *R. rattus*, IX.1968, NICD, coll.

New records : GOA, Mollem, approximately 260 specimens ex 2 *Rattus rattus wroughtoni*, 26.VIII. 1983 and 16.II.1984, Stan Fernandes, coll. KARNATAKA, Shimoga District, Kondagalale and Hennagere, 14 ex 9 *R. r. wroughtoni*, 30.IX-18.X.1966, NIV, coll. MAHARASHTRA, Pune District, Khandala jungle, 1 ex *Rattus rattus satarae*, 10.I.1970, S.M. Kulkarni, coll. 4 records of collections from the Himalayan region by NIV field teams : UTTARANCHAL, Almora District, Phurkia, approximately 2450m, 5 ex *Rattus rattoides*, 7.X.1967; Chamoli District, Kailbinayak, 2100-4400m, 2 ex *Rattus rattus gangutrianus*, 14.X.1967; Nainital District, Tanakpur, 250m, 16 ex 2 *R. r. gangutrianus*, 6.IX.1967.

Remarks : Traub and Audy (1954) compare *A. roluis* to *A. lorius* (Gunther, 1939). They distinguish *A. roluis* in having a genuala and tibiala, but no tarsala on leg III (Leg III with only tarsala, and that conspicuous in *A. lorius*), and eye 1/1, reduced (2/2, on ocular plate in *A. lorius*). They separate it from *A. indicella* (Traub and Audy, 1954) in having a larger scutum with PW measuring 59 (48 in *A. indicella*), AM and PL setae longer than half the breadth of the scutum (shorter than half scutal breadth in *A. indicella*), dorsal body setae

22-26 in number with arrangement commencing : 2-6-4 (32-34, commencing : 2-8-6 in *A. indicella*), and PSB subequal to ASB (PSB>ASB in *A. indicella*).

The specimen (NIV A92685) from Pune District, Khandala, earlier misidentified as *A. indica*, is a typical *roluis*.

Genus *Doloisia* Oudemans

Doloisia Oudemans, 1910a, 87; Domrow and Nadchatram, 1962, 577; Vercammen-Grandjean, 1968b, 96; Nadchatram and Dohany, 1974, 48; Hushcha, 1983, 20.

Traubacarus Audy and Nadchatram, 1957, 187; Domrow and Nadchatram, 1962, 577, **synonymy**.

Type species : *Doloisia synoti* Oudemans, 1910a, by monotypy and original designation.

Diagnosis : Schoengastiini larvae usually infesting nasal passages of rats, and occasionally bats. Weakly sclerotized; fully engorged larvae swelling grossly, resulting in ventral displacement of gnathosoma and even scutum. Legs 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; coxa I unisetose or multisetose; coxae II and III always multisetose; 2 genualae I; tibiala III absent; parasubterminala sometimes weakly barbed. Palpal tarsus 3B or 4B; palpal claw strong, 3-pronged (sometimes 2-pronged); cheliceral blade with accessory dorsal subapical tooth and distinct tricuspid cap; galeala N. Eyes usually absent, if present 1/1. Scutum poorly defined, with forward projection of anterior margin; lateral and posterior margins often covered by cuticular striations; PL setae inserted either on or off scutum; usually PL>AM>AL; sensillae subglobose to globose, rarely otherwise modified, head with spiked setules.

Remarks : Oudemans (1910a) proposed the genus *Doloisia* with the type species *D. synoti*, collected from a bat *Synotis* sp. in Germany. The site of infestation was not recorded at that time. The genus *Traubacarus* Audy and Nadchatram, 1957, was raised for intranasal species having PL setae extrascutal and coxa I unisetose. Liang (1959) described *D. guangdongensis* (PL setae inserted on scutum and coxa I bisetose) and *Traubacarus brachypus* (PL setae extrascutal and coxa I unisetose) collected from nasal cavities of *Bandicota nemorivaga* in Guangdong, China. Domrow and Nadchatram (1962) described 3 new intranasal species from *Rattus* spp. in Sarawak and Laos. One of these, *D. hooperi*, with PL setae inserted on scutum and coxa I unisetose, led the authors to propose the synonymy of *Traubacarus* with *Doloisia*. Yunker and Brennan (1962) proposed *Kymocta* as a subgenus of *Doloisia*, which Brennan (1968) elevated to generic status on the basis of palpal tarsus 5B and absence of the accessory dorsal tooth on the cheliceral blade. Nadchatram (1983) discusses the relationship between *Kymocta* and *Doloisia* and regards the retention of the generic status of the former as a matter of conjecture.

Two subgenera are presently recognized : *Doloisia* and *Trisetosia* Vercammen-Grandjean, 1968. The nominate subgenus is characterized by palpal tarsus 4B (3B in *Trisetosia*).

Two Indian *Doloisia* species are reported here, one new to science, both in the nominate subgenus.

131. *Doloisia (Doloisia) bhati* new species
(Fig. 114)

Description of species : Larva.

Idiosoma : Measuring 670 x 435 in grossly engorged holotype, with distinct medial constriction posterior to coxa III. Eyes not discernable. Two pairs of humeral setae, measuring 55-61; 41-42 dorsal idiosomal setae, measuring 44-55, irregularly arranged, arrangement in holotype : (6+3)-(8+2)-10-6-4-2; 2 pairs of sternal setae, anterior 33-35, posterior, 42-44; 22 preanal setae, 26-30; 18-22 postanal setae, 43-50; total idiosomal setae 89-94.

Gnathosoma : Palpal setal formula B/B(b)/N(b)bB(N)/4B; palpal claw strong, 3-pronged, axial and ventral accessory prongs sharply curved; galeala N; cheliceral blade (21) strongly flexed with accessory dorsal subapical tooth and distinct tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, with cuticular striations covering lateral margins anterior to SB and entire posterior margin; anterior margin convex, acute angled; posterior margin almost straight; PL setae inserted on scutum; AM base anterior to level of AL bases, SB nearer to level of AL than PL bases; AL setae with a weak barb; AM and PL setae with short barbs; PL>AM>AL; sensillae abruptly capitate, head with spiked setules. PW/SD = 1.48-1.62. Scutal measurements of holotype followed by paratype : AW 33, 28; PW 62, 63; SB 30, 30; ASB 21, 19; PSB 21, 20; AP 31, 32; AM 31, 32; AL 10, 9; PL 53, 50; sens. 33x16, 31x14.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 836-863. Leg I : 288-294; coxa with 5-7 branched setae (5-7B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (64x25) 17B, tarsala (28-29), microtarsala, subterminala, pretarsala; parasubterminala weakly barbed. Leg II : 250-255; coxa 7-8B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (66x23) 15B, tarsala (22-24), microtarsala, pretarsala. Leg III : 298-314; coxa 10-13B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B; tarsus (86x19) 15B.

Type data : Holotype (NIV A83570.7) and 1 paratype (NIV A83570.4), UTTARANCHAL, Chamoli District, Dogalbita, 2300-2500m, ex *Ochotona roylei*, 11.V.1969, NIV, coll.

Remarks : Among the 35 known species of *Doloisia*, *D. bhati* appears most similar to *D. nasicola* Domrow and Nadchatram, 1962, and *D. skljadi* Hushcha, 1983. *D. bhati* may be distinguished from *D. nasicola* in having coxa I 5-7B and coxa II 7-8B (3B and 5B in *D. nasicola*), parasubterminala weakly barbed (nude in *D. nasicola*), and 2 pairs of sternal setae (3 pairs in *D. nasicola*). *D. bhati* differs from *D. skljadi* in having palpal claw 3-pronged (2-pronged in *D. skljadi*), sensillae abruptly capitate (fusiform in *D. skljadi*), and idiosomal setae free on cuticle (inserted on sclerotized platelets in *D. skljadi*).

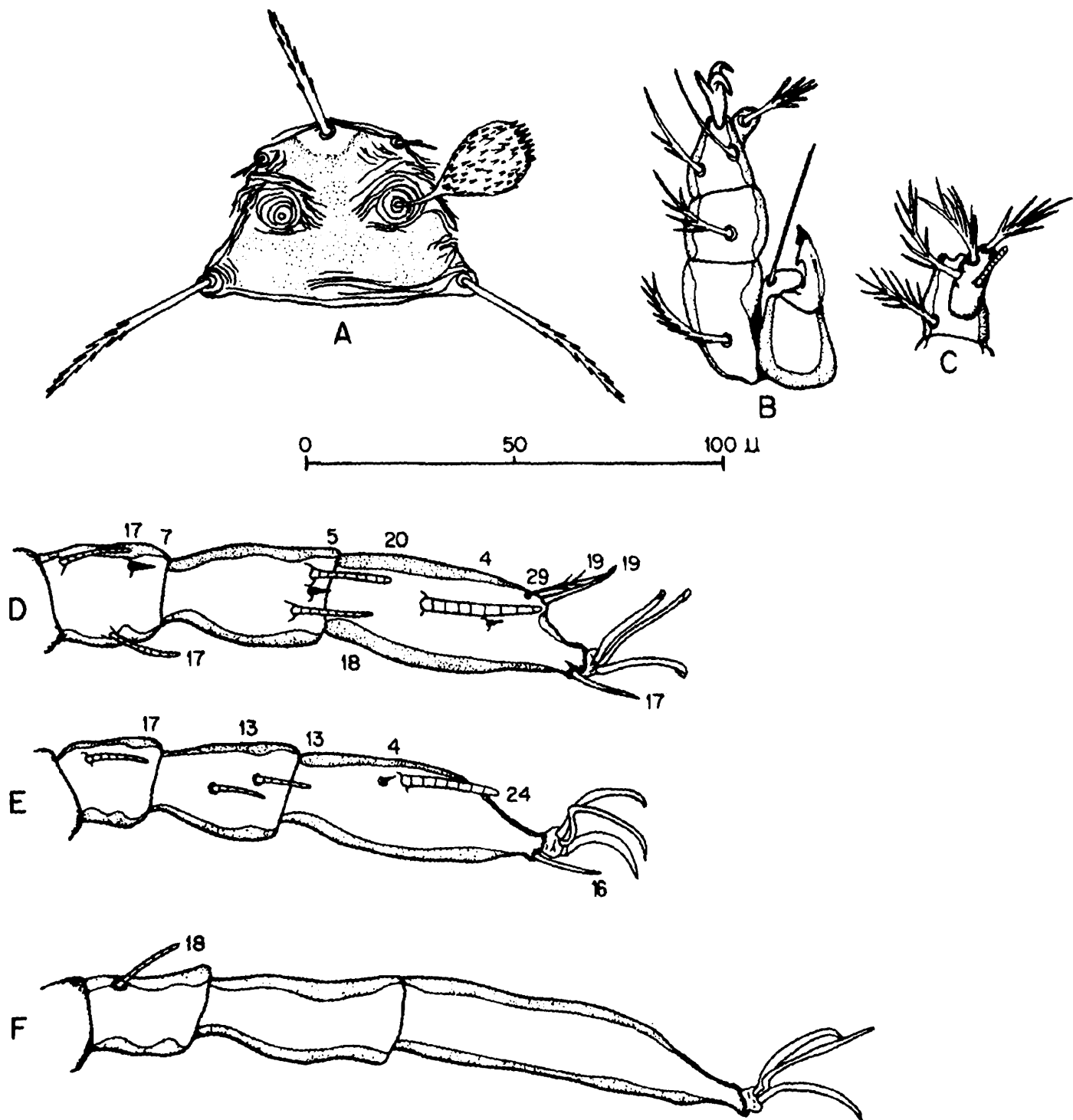


Fig. 114. *Doloisia bhati* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

The parasitope was not recorded for *D. bhati*. But, following Goff (1983), the reduced sclerotization, excessive idiosomal engorgement and short cheliceral blade length observed in this species suggest an intranasal parasitope.

This species is dedicated to Dr. H.R. Bhat, retired Director Grade Scientist, NIV, in recognition of his contribution to the field of acarology.

132. *Doloisia (Doloisia) manipurensis* (Radford)

Neoschoengastia manipurensis Radford, 1946b, 260.

Doloisia manipurensis, Fuller, 1948, 108; Wharton and Fuller, 1952, 72; Audy *et al.*, 1953, 27; Audy, 1954b, 159; Chen, 1960, 42; Chen and Hsu, 1965, 293; Lakshana, 1973, 20.

Schoengastia (Ascoschoengastia) manipurensis, Womersley, 1952, 204.

Traubacarus manipurensis, Audy and Nadchatram, 1957, 210; Womersley and Audy, 1957, 283; Prasad, 1974, 92.

Doloisia (Doloisia) manipurensis, Vercammen-Grandjean, 1968b, 97; Nadchatram, 1970a, 2.

Redescription of species : Larva.

Idiosoma : Measurements of idiosoma not reported. Eyes not discernable. Two pairs of humeral setae, measuring 38; 26 dorsal idiosomal setae, measuring 30-32, arranged : 8-6-6-4-2; 2 pairs of sternal setae; 18 preanal setae, 22; 18 postanal setae; total idiosomal setae 70.

Gnathosoma : Palpal setal formula B/b/NNb/4B (Audy and Nadchatram, 1957) : in text - lateral tibial seta barbed; but, in illustration - nude); palpal claw 3-pronged, with strong, curved axial prong and smaller accessory prongs; galeala N; cheliceral blade sharply flexed, with accessory dorsal subapical tooth and distinct tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Anterior margin sinuous; posterior margin somewhat flattened; AM base anterior to level of AL bases; PL setae extrascutal; AL and PL setae apparently nude; AM seta with few barbs; PL>AM>AL; sensillae clavate, head with few long apical setules. Scutal measurements of lectotype after original description, followed by measurements after Audy and Nadchatram (1957) : AW 25, 24; PW 74, 62; SB 21, 22; ASB 23, 22; PSB 20, (17?); AP 32, 35; AM 20, 26; AL 17, 18; PL 27, 35; sens. 38, 36x9.

Legs : Similar to *D. bhati* n. sp. in the number of ordinary and sensory setae; but, coxa I 1B, parasubterminala I with a weak barb; coxa II 3B; and coxa III 6B. Measurements reported : Leg I : tarsus (54x20), tarsala (18). Leg II : tarsus (43x-), tarsala (17). Leg III : tarsus (55x15).

Type data : Lectotype (BM-1948-2-3-21), MANIPUR, Imphal, ex *Rattus bowersi*(?), 13.VI.1945, Sergeant J. Hake, coll.

Type depository : Lectotype in BM(NH).

Remarks : The above redescription is based only from the literature. Radford (1946b) gives a sketchy description of this species, reporting PL setae inserted on scutum and the host as *Rattus rattus rufescens*.

Womersley (1952) tentatively placed this species in the genus *Schoengastia* Oudemans, 1910, subgenus *Ascoschoengastia* Ewing, 1946. Following Fuller (1948), he proposed its transfer to *Dolisia* Oudemans, 1910, if this genus could be validly separated from *Schoengastia* when the adults became known.

Based on the study of the lectotype, Audy and Nadchatram (1957) have given a more complete redescription of this species. They describe the PL setae as extrascutal and suggest that the host is more likely *Rattus bowersi* from an afforested ravine at Kanglatongbi near Imphal. They had transferred *manipurensis* to their new genus *Traubacarus* because of the extrascutal PL setae, unisetose coxa I and probable intranasal habitat of this species.

Liang and Huang (1959) described *D. sinensis* from China, which Chen and Hsu (1965) synonymized with *D. maipurensis*.

Lakshana (1973) has recorded *D. manipurensis* from Thailand ex *Rattus surifer* and *Cannomys badius*. But, there has been no additional record of this species from India. The species name has been derived from the type locality.

Genus *Helenicula* Audy

Euschoengastia (Helenicula) Audy, 1954b, 152.

Helenicula, Womersley and Audy, 1957, 245; Vercammen-Grandjean, 1968b, 100; Nadchatram and Traub, 1971, 562; Nadchatram and Dohany, 1974, 48; Domrow and Lester, 1985, 59.

Type species : *Neoschoengastia lanius* Radford, 1946, by original designation.

Diagnosis : Schoengastiini larvae parasitic on mammals, usually rats and shrews, and occasionally on birds. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; 1-2 genualae I, genuala II and III; tibiala III; mastitarsala III absent; tarsala I usually distal or level with subterminala. Palpal tarsus 4/5B; palpal femoral and genual setae strongly barbed; palpal claw 3-pronged; cheliceral blade with tricuspid cap; galeala N/B; Eyes 2/2, anterior distinct, free on cuticle; Scutum subtrapezoidal with convex posterior margin; scutal punctae simple; AM posterior to level of AL bases; usually AL>PL>AM; SB position variable in relation to PL bases; SB close together, interspace less than diameter of a single sensillary base; sensillae globose, head with minute setules.

Remarks : Audy (1954b) proposed the subgenus *Helenicula* in the genus *Euschoengastia* for the *globulare*-group¹ of Womersley (1952). Womersley and Audy (1957) raised *Helenicula* to generic status. Vercammen-Grandjean (1967) proposed the subgenus *Euryphylla* to

accommodate two South American species with modified dorsal idiosomal setae. Nadchatram and Traub (1971) redefined the genus, presenting a key for the identification of 28 Old World species. 7 *Helenicula* species are reported here from India, 2 new to science. One new species with expanded dorsal idiosomal setae is described below. It is a typical *Helenicula* in all other respects, and hence, following Nadchatram and Traub (1971), no subgeneric distinction is made for the Indian species. The genus has been named in honour of Audy's daughter, Helen ("a mite of a daughter", when Audy proposed the subgenus).

133. *Helenicula lanius* (Radford)
(Fig. 115)

Neoschoengastia lanius Radford, 1946b, 261.

Schoengastia (*Ascoschoengastia*) *lanius*, Womersley, 1952, 179.

Euschoengastia lanius, Wharton and Fuller, 1952, 78; Audy *et al.*, 1953, 27.

Euschoengastia (*Helenicula*) *lanius*, Audy, 1954b, 153.

Helenicula lanius, Womersley 1957, 109; Womersley and Audy, 1957, 281; Nadchatram and Traub, 1971, 564; Prasad, 1974, 83; Fernandes *et al.*, 1988, 108.

Helenicula (*Helenicula*) *lanius*, Vercammen-Grandjean, 1968b, 100.

Neoschoengastia covelli Radford, 1953a, 233; Nadchatram and Traub, 1971, 577, **synonymy**.

Schongastia lanius, **sic!** Varma and Mahadevan, 1971, 821.

Schongastia (*Ascoschongastia*) *lanius*, **sic!** Kochhar, 1972, 138.

Redescription of species : Larva. Colour in life light orange.

Idiosoma : Measuring 190-550 x 150-390 in unengorged to engorged specimens. Eyes 2/2, anterior larger, distinct, free on cuticle. 2 pairs of humeral setae, distinct in unengorged specimens, merged with 1st posthumeral row in engorged specimens, measuring 43-47; 34-40 dorsal idiosomal setae, measuring 32-40, arrangement variable, summarized after Nadchatram and Traub (1971). as follows : (6-7)-(6-7)-(6-8)-8-4-4(2)-2-(2); 2 pairs of sternal setae, anterior 46-49, posterior 32-35; 22-26 preanal setae, 26-32; 10-14 postanal setae, 30-40; total idiosomal setae 74-88.

Gnathosoma : Palpal setal formula B/B/bb(B)B/5B; palpal claw 3-pronged; galeala N; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin biconcave; posterior margin deeply rounded, medially truncate; AM base posterior to level of AL bases; SB close together, posterior to level of PL bases; scutal setae strongly barbed; AL>PL>AM; PW/SD = 1.62-1.78; sensillae globose, head with minute setules. Scutal measurements of holotype after original description, followed by means of 11 Imphal specimens after Womersley

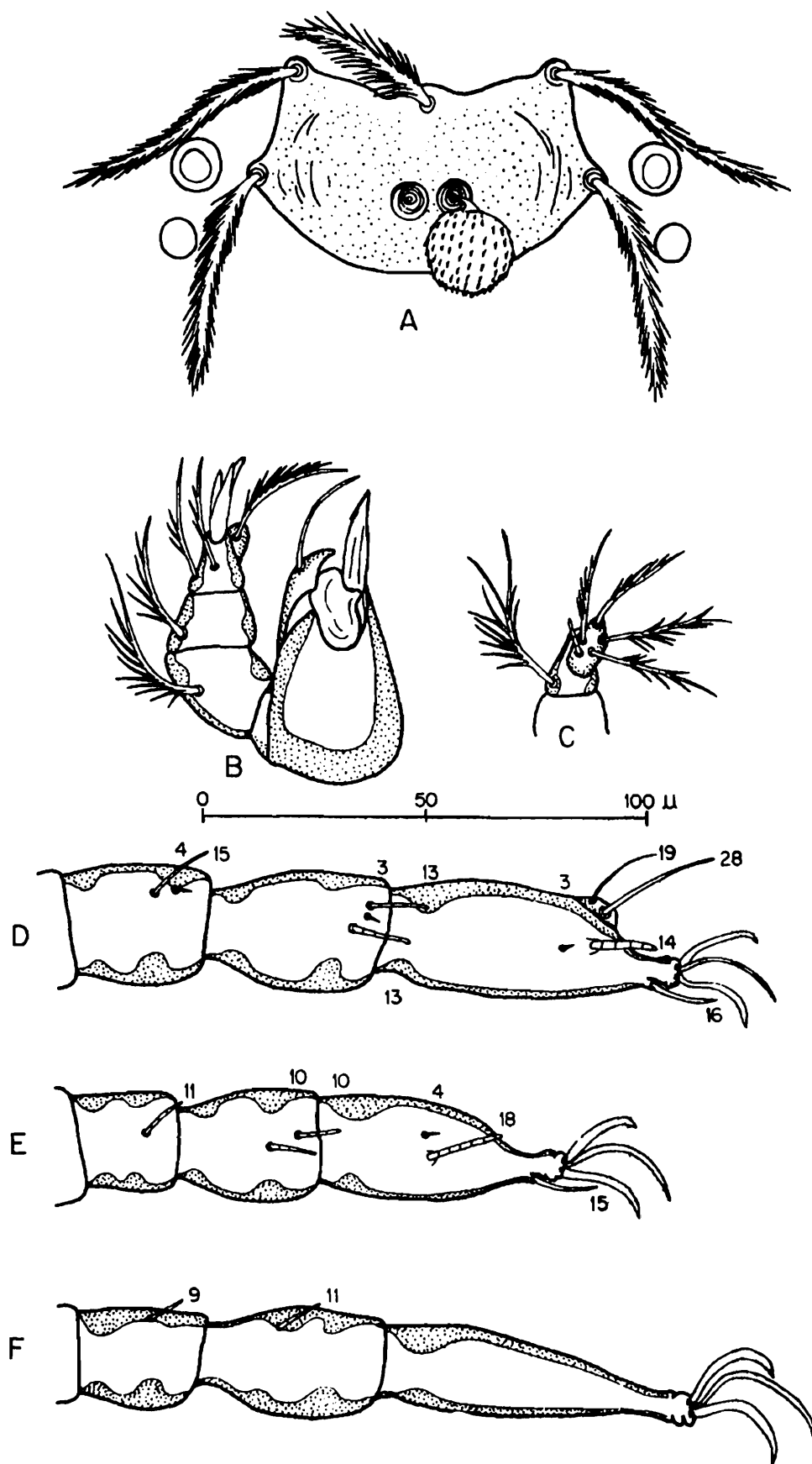


Fig. 115. *Hellenicula lanius*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

(1952), and observed ranges of 21 specimens from India, Pakistan and Nepal after Nadchatram and Traub (1971) in parentheses : AW 55 (57, 52-61); PW 63 (71, 63-80); SB 13 (9, 9-13); ASB 24 (26, 24-30); PSB 15 (13, 12-15); AP 15 (18, 15-22); AM 27 (32, 27-39); AL 40 (56, 40-56); PL 51 (45, 44-51); sens. - (29x19, 29-32 x 19-22). Scutal measurements giving means and ranges of 10 NIV specimens : AW 55, 52-60; PW 73, 71-75; SB 10, 9-11; ASB 29, 27-31; PSB 15, 13-16; AP 22, 19-24; AM 36, 31-38; AL 59, 56-66; PL 53, 48-60; sens. 24x18, 23-26 x 17-20.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 675-740. Leg I : 245-270; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, genuala, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (67x26) 22B, tarsala (13-14), microtarsala, subterminala, parasubterminala, pretarsala; tarsala proximal to subterminala. Leg II : 200-220; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (55x23) 16B, tarsala (16-18), microtarsala, pretarsala. Leg III : 230-250; coxa 2B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (57-69x16-20) 15B.

Type data : Holotype, MANIPUR, Imphal, Ukrul Road, ex *Lanius nasutus*, 11.II.1945, Sergeant J. Hake, coll.

Type depository : Holotype in BM(NH).

Additional records : MANIPUR, Imphal, ex *Rattus rattus bullocki*, *Rattus niviventer mentosus*, *Rattus manipulus*, *Diomys crumpi*, *Mus* sp., *Bandicota bengalensis*, *Suncus murinus*, *Muntiacus muntjak*, *Herpestes* sp., *Sciuridae* spp., XI.1945-III.1946, STRU, coll.; same data, but ex *Callosciurus erythraeus erythraeus*, taken 14.II.1946, Sergeant J. Hake, coll. (holotype of *H. covelli*). SIKKIM and WEST BENGAL, East Himalayan foot-hills, 110-1228m, ex 'rodents and insectivores', 1966-1967, R.N. Varma, coll. CAR NICOBAR (after Nadchatram and Traub, 1971, host and collection data not recorded). ARUNACHAL PRADESH and ASSAM, ex *S. murinus*, *Rattus rattus brunneusculus* and other rodents, 1968-1969, R.K. Kochhar, coll.

New records : 17 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 2 ex *Rattus rattus gangutrianus*, 8.VI.1968; Tindi, 2440-2590m, 3 ex *Ochotona roylei*, 20.IX.1968; Kulu District, Kothi, 2440m, 4 ex 3 *Rattus rattoides*, 2,4.X.1967. JAMMU and KASHMIR, Baramulla District, Rampore, 1400m, 26 ex 2 *R. rattoides*, 6.XI.1969; 8 ex 3 *Rattus* sp., 8.XI.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 140 ex *R. rattoides*, 4,7,8.X.1967; Chamoli District, Kailbinayak, 2100-4400m, 15 ex *R. r. gangutrianus*, 14.X.1967; Dehra Dun District, Dehra Dun, 600-800m, 1 ex *R. r. gangutrianus*, 28.X.1967; 1, same data, but ex *B. bengalensis*.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *H. lanius* runs to couplet 23 of the key to *Helenicula* species of the Old World

given by Nadchatram and Traub (1971) along with *H. miyagawai* (Sasa *et al.*, 1951). They distinguish *H. lanius* in having smaller AP (measuring 26 in *H. miyagawai*), tarsala I proximal to subterminala (level with subterminala in *H. miyagawai*), lower Ip (845 in *H. miyagawai*), and fewer dorsal idiosomal setae (approximately 46 in *H. miyagawai*). Further differences cited are in the number and arrangement of idiosomal setae, the dimensions of scutum and scutal setae, and dimensions of legs. They synonymize *H. covelli* (Radford, 1953), described essentially on the basis of 2 pairs of humeral setae and nude palpotibial setae, with *H. lanius*. They point out that differences in engorgement levels result in apparent variation in arrangement of dorsal idiosomal setae, and that Radford erred in reporting palpotibial setae as nude. Womersley and Audy (1957) note that the record of *H. mutabilis* (Gater, 1932) on rats in Imphal by Audy (1947) and Audy *et al.* (1953) was based on a misidentification. This material is a mixture of *H. lanius* and *H. kohlsi*. Nadchatram and Traub (1971) have reported *H. lanius* from Car Nicobar (p. 578), but have inadvertently ascribed this record to *H. comata* (Womersley, 1952) in Table 2 (p. 594).

134. *Helenicula comata* (Womersley)

Schoengastia (*Ascoschoengastia*) *comata* Womersley, 1952, 178.

Euschongastia (*Helenicula*) *comata*, sic! Audy, 1954b, 153.

Helenicula comata, Womersley, 1957, 109; Audy and Womersley, 1957, 280; Nadchatram and Traub, 1971, 591; Prasad, 1974, 82.

Helenicula (*Helenicula*) *comata*, Vercammen-Grandjean, 1968b, 101.

Redescription of species : Larva.

Idiosoma : Measuring 364x260 in unengorged specimen. Eyes 2/2, anterior larger, on ocular plate. 1 pair of humeral setae; 98-110 dorsal idiosomal setae, measuring 28, arranged : 16-10-12-14-12-14-14-8-6-4; 2 pairs of sternal setae; approximately 60 ventral setae; total idiosomal setae 164-176.

Gnathosoma : Palpal setal formula B/B/bbB(N)/4B (Vercammen-Grandjean, 1968b : 5B); palpal claw 3-pronged (Original description : 2-pronged); galeala B; cheliceral blade with ticuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Anterior margin lightly sinuous; posterior margin deeply rounded, medially truncate; SB close together, posterior to level of PL bases; AP small with PL bases closer to AL bases than to posterior scutal margin; AL>>PL>AM; PW/SD = 1.67-1.82. Scutal measurements after original description, after Womersley (1957) and after Nadchatram and Traub (1971) : AW 59, 59, 56; PW 70, 70, 73; SB 10, 10, -; ASB 28, 28, -; PSB 12, 14, -; AP 20, 18, (20-24); AL 42, 42, 55; PL 31, 31, 36; sens. 30x18, 30x18, -.

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I level with subterminala; coxa III 1B. Measurements as follows : Ip = 600-640. Leg I : 220. Leg II : 182; (Vercammen-Grandjean, 1968b : genuala absent!); tarsala II>I. Leg III : 220; tarsus (50-55 x 12-14).

Type data : Holotype and 2 paratypes, PHILIPPINES, Clarke Field, ex 'unknown' host, 1945, G.M. Kohls, coll.

Type depository : Holotype and paratypes in SAM.

Additional records : JAMMU and KASHMIR, Kanzalwan, 4 ex 'rats', X.1946, S.L. Kalra, coll.

Remarks : The above redescription is based only on the literature. Vercammen-Grandjean (1968b) has placed *H. comata* in his *lanius*-group of the nominate subgenus. Based on his study, he reports palpal tarsal setation as 5B and genuala II absent. Nadchatram and Traub (1971) cite palpal tarsal setation as 4B and genuala II present, after their study of a paratype from SAM. Our study of *H. lanius* (Radford, 1946) reveals that the palpal tarsal setation is 4B and genuala II is present. Hence, we would rather agree with the latter report. Nadchatram and Traub (1971) consider *H. comata* close to *H. pilosa* (Abbonec and Tauffleib, 1957), from which it may be separated in having lower Ip (approximately 730 in *H. pilosa*), and fewer dorsal idiosomal setae (130 or more in *H. pilosa*). *H. comata* runs to couplet 16 of the key to *Helenicula* species of the Old World given by Nadchatram and Traub (1971) along with *H. kohlsi* (Philip and Woodward, 1946), from which it differs by the larger number of dorsal idiosomal setae (numbering <90 in *H. kohlsi*), and in having dorsal palpal tibial seta barbed (sparsely barbed or nude in *H. kohlsi*).

Nadchatram and Traub (1971) report *H. comata* from Nicobar (p. 594). This record apparently refers to *H. lanius* rather than *H. comata*, as is clear in the text (p. 578).

135. *Helenicula globularis* (Walch)

(Fig. 116)

Trombidium (?*Trombicula*) *globulare* Walch, 1927, 929.

Schoengastia (*Ascoschoengastia*)? *globulare*, Womersley, 1952, 175.

Helenicula globulare, Womersley, 1957, 107; Womersley and Audy, 1957, 280; Prasad, 1974, 82; Kulkarni, 1979, 20; Kulkarni *et al.*, 1979, 10.

Helenicula globularis, Nadchatram and Traub, 1971, 564.

Redescription of species : Larva.

Idiosoma : Measuring 396x426 in engorged specimen. Eyes 2/2, anterior distinct, free on cuticle. 1 pair of humeral setae, measuring 37-46; 38-40 dorsal idiosomal setae, measuring 29-35, arranged : 8(10)-6-6-8-6-2-2; 2 pairs of sternal setae, anterior 38-45, posterior 30-31; 20 preanal setae, 23-26; 12-16 postanal setae, 31-37; total idiosomal setae 76-82.

Gnathosoma : Palpal setal formula B/B/bbB/5B; palpal claw 3-pronged after original description (Womersley, 1952 : 2-pronged); galeala B; cheliceral blade (33) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

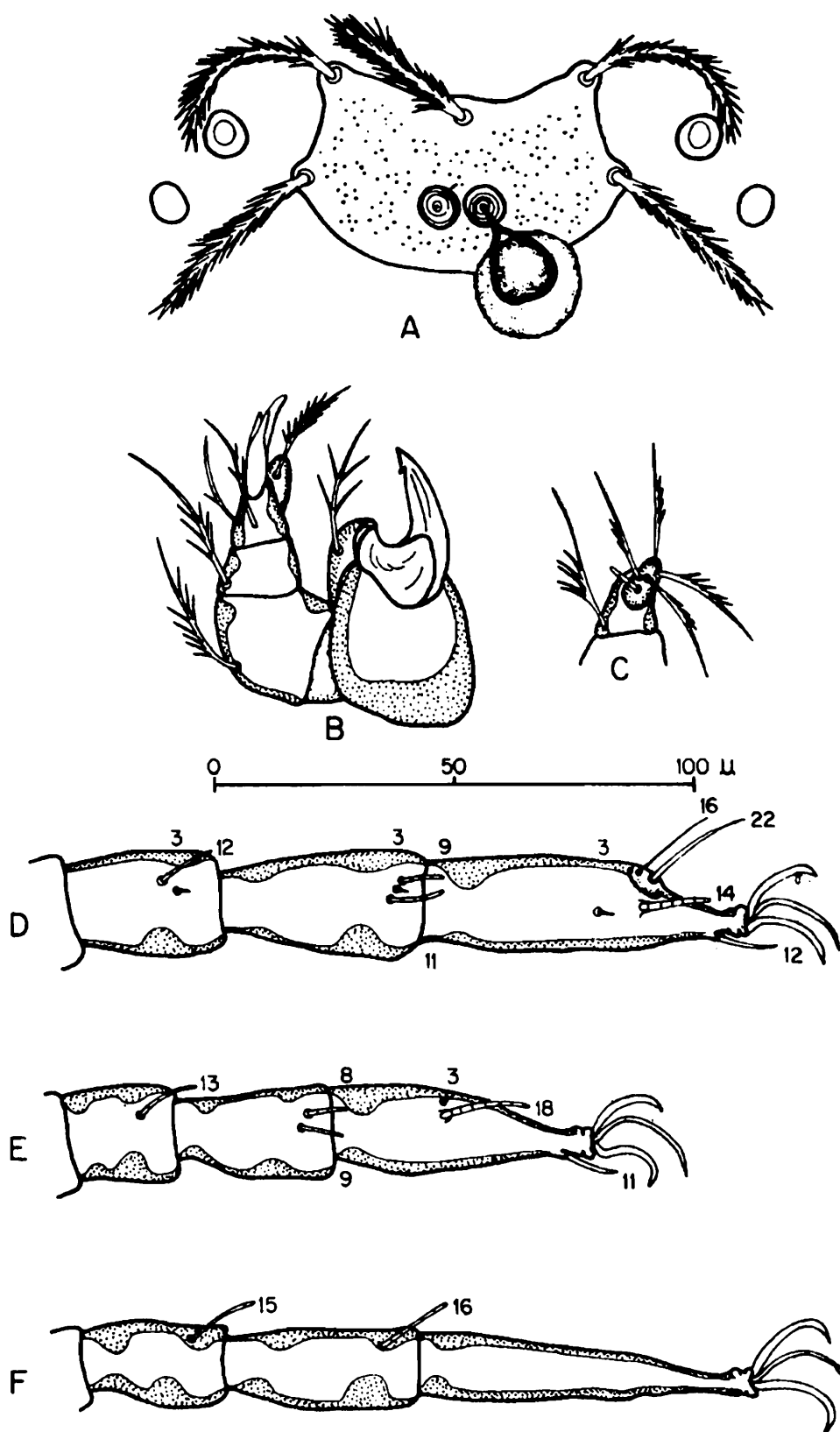


Fig. 116. *Helenicula globularis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin lightly sinuous; posterior margin deep, convex; SB close together, posterior to level of PL bases; $AL=PL>AM$ (original description : $PL>AL$, but apparently subequal in illustration); $PW/SD = 1.61-1.71$; sensillae globose, head with minute setules (Original description : measuring 25×15). Scutal measurements of Imphal specimen after Womersley (1952), followed by means and ranges of 10 NIV specimens in parentheses : AW 58 (54, 51-60); PW 74 (67, 64-72); SB 11 (10, 9-12); ASB 22 (28, 24-29); PSB 13 (12, 10-15); AP 22 (21, 18-23); AM - (33, 31-36); AL - (41, 37-47); PL - (42, 39-45); sens. - (24×20 , $23-27 \times 19-20$).

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I proximal to subterminala (Nadchatram and Traub, 1971 : distal); coxa III 3/4B (Original description : 2B, but 3B in illustration). Measurements as follows : Ip = 738-812 (Nadchatram and Traub, 1971 : 710). Leg I : 262-282; tarsus (70×20), tarsala (14). Leg II : 208-240; tarsus (54×18), tarsala (18). Leg III : 266-290; tarsus (70×11) (Nadchatram and Traub, 1971 : 85×18).

Type data : Described from specimens collected ex 'rat', Macassar (South Celebes).

Type depository : Not reported.

Additional records : MANIPUR, Imphal, 1 ex *Rattus rattus bullocki* (= *Rattus rattus brunneusculus*), 17.XII.1945 (Audy *et al.*, 1953 : 17.XI.1945), STRU, coll. MAHARASHTRA, Pune District, approximately 50 ex *Rattus rattus satarae* and 2 *Suncus murinus*, 11.XI.1970 and 10.II.1971, S.M. Kulkarni, coll.

Material examined : 3 specimens of *H. globularis* on a single slide together with 3 specimens of *Walchiella lacunosa* (Gater, 1932) on loan from M. Nadchatram : SINGAPORE, P. Tioman, ex *Rattus sabanus*, VII.1985, Dept. of Zoology - University of Singapore, coll. 1 specimen on loan from M. Nadchatram : PHILIPPINE ISLANDS, ex *Rattus mindanensis*, III.1966, W.F. Pippin, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens from MAHARASHTRA. *H. globularis* runs to couplet 25 of the key to *Helenicula* species of the Old World given by Nadchatram and Traub (1971) along with *H. olsuffevi* (Schluger, 1955), having coxa III 3/4B. *H. globularis* may be distinguished by the posterior scutal margin being deep and more rounded posterior to level of PL bases (shallow and evenly convex in *H. olsuffevi*).

136. *Helenicula kohlsi* (Philip and Woodward) (Fig. 117)

Neoschoengastia kohlsi Philip and Woodward, 1946, 159.

Schoengastia (Ascoschoengastia) kohlsi, Womersley, 1952, 176.

Euschoengastia (Helenicula) kohlsi, Audy, 1954b, 153.

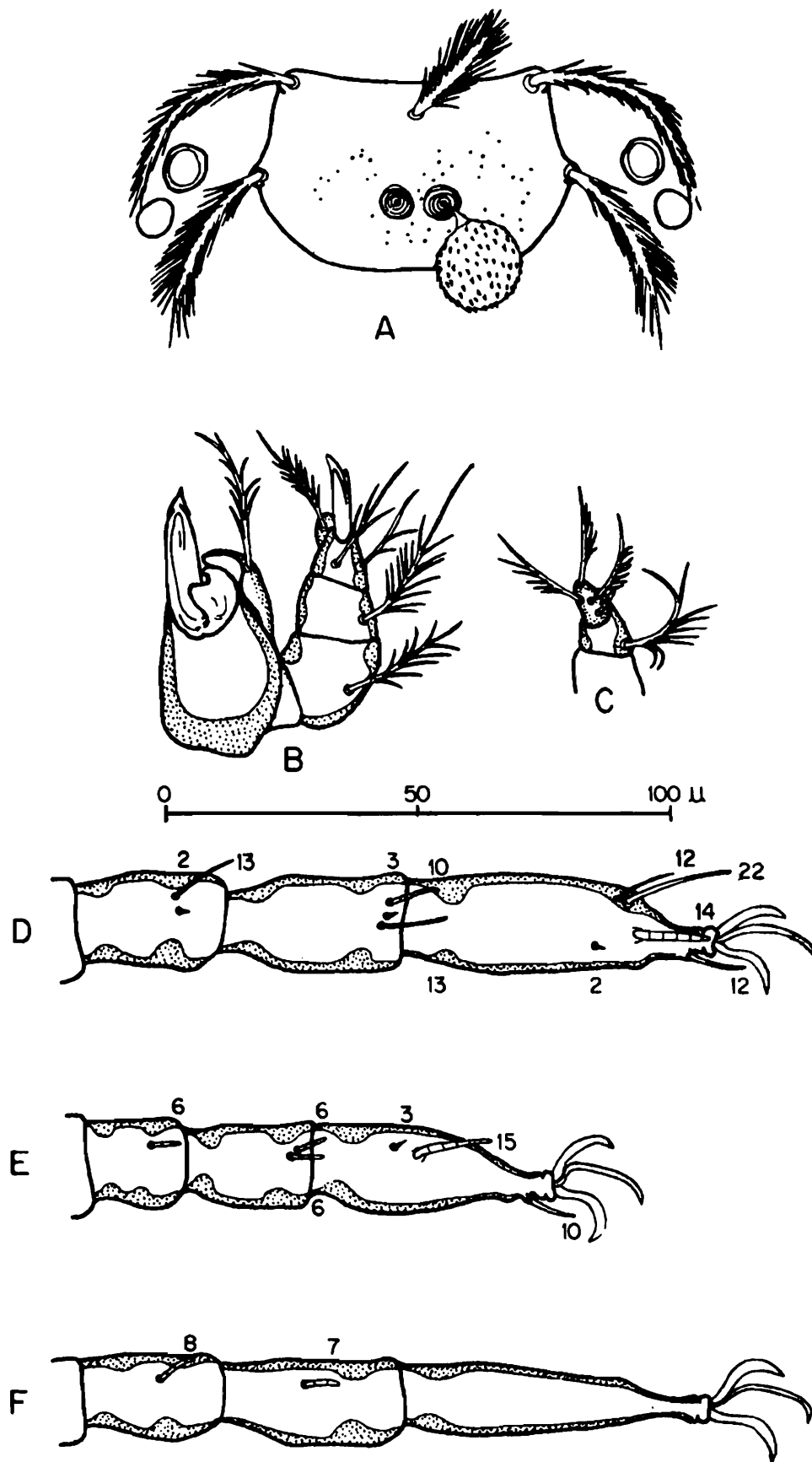


Fig. 117. *Helenicula kohlsi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Helenicula kohlsi, Womersley, 1957, 109; Womersley and Audy, 1957, 281; Mitchell *et al.*, 1966, 120; Nadchatram and Traub, 1971, 564; Prasad, 1974, 82; Domrow and Lester, 1985, 59; Fernandes *et al.*, 1988, 108.

Helenicula (Helenicula) kohlsi, Vercammen-Grandjean, 1968b, 101.

Shongastia kohlsi, sic! Varma and Mahadevan, 1971, 821.

Schongastia (Ascoschongastia) kohlsi, sic! Kochhar 1972, 138.

Redescription of species : Larva.

Idiosoma : Measuring 250-600 x 160-450 in unengorged to engorged specimens. Eyes 2/2, anterior larger, distinct, free on cuticle. 1 pair of humeral setae, measuring 35-45; wide variation in number of dorsal idiosomal setae, 52-84, after Traub and Nadchatram (1971) (Original description : 50-66; Womersley, 1952 : approximately 84; Schluger *et al.*, 1960 : 72-84), measuring 28-30, arrangement variable : (12-16)-(8-13)-(10-13)-(10-12)-(8-14)+(14-20); 2 pairs of sternal setae, anterior 31, posterior 25; 30-41 preanal setae, 20-26; 22-30 postanal setae, 26-31; total idiosomal setae 110-160.

Gnathosoma : Palpal setal formula B/B/b(N)b(N)B/4B (Vercammen-Grandjean, 1968b : 5B); palpal claw 3-pronged; galeala B; cheliceral blade (30) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin almost straight; posterior margin deeply rounded, medially truncate; SB close together, posterior to level of PL bases; scutal setae strongly barbed; AL>PL>AM; PW/SD = 1.59-1.88; sensillae globose, head with minute setules. Scutal measurements of holotype followed by ranges of 11 paratypes after original description : AW 50, 48-56; PW 62, 60-66; SB 9, 8-11; ASB -, PSB 7, 7-10; AP 19, 18-21; AM 22, 20-28; AL 44, 42-48; PL 33, 32-40; sens. 20x16, 20-29 x -. Observed ranges of scutal measurements of 28 specimens from Hong Kong, India, Philippines, Pakistan and Nepal after Nadchatram and Traub (1971) : AW 48-56; PW 63-73; SB 9-12; ASB 24-30; PSB 7-16; AP 19-24; AM 23-32; AL 45-60; PL 34-42. Scutal measurements giving means and ranges of 10 NIV specimens : AW 49, 46-53; PW 64, 61-68; SB 9, 8-10; ASB 27, 25-30; PSB 12, 11-13; AP 20, 18-23; AM 26, 24-29; AL 47, 41-53; PL 36, 32-40; sens. 23x17, 22-25 x 15-18.

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I distal to subterminala; coxa III 1B. Measurements as follows : Ip after Nadchatram and Traub (1971) = 630-640, but 580-640 in summary table (p. 565). Leg I : 220-230; tarsus (57-63x19-24), tarsala (11-14). Leg II : 190; tarsus (44-49x18-21), tarsala (15-17). Leg III : 220; tarsus (60-61 x 14-16).

Type data : Holotype and 9 paratypes, PHILIPPINES, Mindoro, San Jose, ex *Rattus mindanensis mindanensis*, 2.IV.1945, 31st and 38th Malaria Survey Units, coll.

Type depository : Holotype and paratype at USNM; paratypes at SAM, RML and authors' collections.

Additional records : MANIPUR, Imphal, ex *Rattus rattus bullocki*, *Hadromys humei*, *Rattus manipulus*, *Diomys crumpi*, *Bandicota bengalensis*, *Tupaia glis*, *Anourosorex squamipes*, *Muntiacus muntjak* and *Sciuridae* spp., XI.1945 - III.1946, T.J. Lawrence and STRU, coll. MADHYA PRADESH, Kanha National Park, 1 ex *Suncus stoliczkanus*, 2 ex *Rattus blanfordi*, 81 ex 7 *Mus musculus humourus*, 118 ex 7 *Mus booduga booduga*, 20-26.XII.1964, C.J. Mitchell, J. Spillett and G.B. Schaller, coll. SIKKIM and WEST BENGAL, East Himalayan foot-hills, 110-1228m, ex 'rodents and insectivores', 1966-1967, R.N. Varma, coll. MAHARASHTRA, Pune District, approximately 200 ex *Suncus murinus*, *Rattus rattus satarae*, and *R. blanfordi*, XII.1970 - II.1971, S.M. Kulkarni, coll. RAJASTHAN, Sirohi District, Mt. Abu, 1 ex *Rattus cutchicus rajput*, 18.XI.1971, H.N. Kaul, coll.; 88, same data, but Kota District, Darah Game Sanctuary, ex *Rattus rattus rufescens*, taken 30.X.1971.

New records : ORISSA, Ganjam District, Singpur, 1 ex *Rattus rattus arboreus*, 23.XI.1972, H.N. Kaul, coll. GOA, Brittona, 5 ex *S. murinus*, 16.XII.1983, S. Fernandes, coll. GUJARAT, Jhankvav, 34 ex *S. murinus*, 27.X.1984, S. Fernandes, coll. 31 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Mahasu District, Nirith, 980m, 1 ex *S. murinus*, 26.X.1967. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 17 ex 3 *Rattus rattoides*, 2,3.XI.1969; 3, same data, but ex *M. musculus*, 2.XI.1969; 1, same data, but ex *S. murinus*, 3.XI.1969. UTTARANCHAL, Chamoli District, Kailbinayak, 2100-4400m, 29 ex 3 *Rattus rattus gangutrianus*, 14,20.X.1967; 23, same data, but ex *B. bengalensis*, 15.X.1967; Dehra Dun District, Dehra Dun, 600-800m, 158 ex 7 *R. r. gangutrianus*, 28-31.X.1967; 43, same data, but ex 2 *B. bengalensis*, 28.X.1967; 4, same data, but ex *S. murinus*, 31.X.1967; Nainital District, Bhimtal, 1200-1700m, 8 ex 2 *R. r. gangutrianus*, 24, 27.XI.1966; Garjia, 400-500m, 35 ex 5 *R. r. gangutrianus*, 17-19.XI.1967; Haldwani, 400-1100m, 1 ex *R. r. gangutrianus*, 7.XI.1967; Tehri District, Munikireti, 450m, 8 ex 2 *Funambulus pennanti*, 25.X.1967; 1, same data, but ex *Mus platythrix*, 26.X.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *H. kohlsi* runs to couplet 16 of the key to *Helenicula* species of the Old World given by Nadchatram and Traub (1971) along with *H. comata* (Womersley, 1952). It differs in having fewer dorsal idiosomal setae (numbering 100-110 in *H. comata*), and dorsal palpal tibial seta sparsely barbed or nude (always barbed in *H. comata*). Nadchatram and Traub (1971) have suggested that *H. comata* may subsequently prove to be a synonym of *H. kohlsi*. They also compare *H. kohlsi* to *H. pilosa* (Abbonec and Tauffleib, 1957), from which it may be distinguished by having fewer dorsal idiosomal setae (numbering ≥ 130 in *H. pilosa*), and lower Ip (730 in *H. pilosa*).

137. *Helenicula mattei* new species (Fig. 118)

Helenicula sp. B Fernandes et al., 1988, 108.

Description of species : Larva.

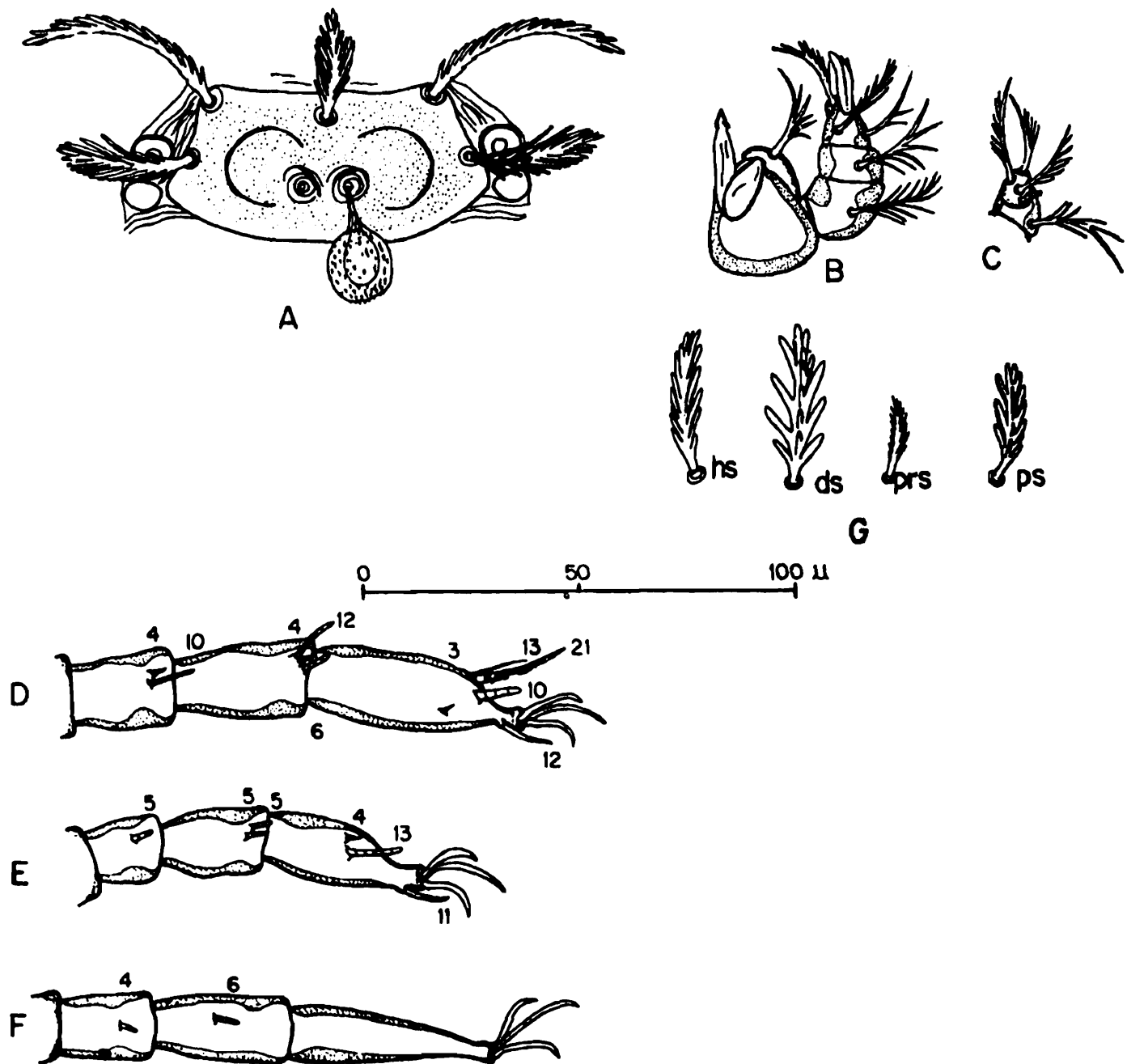


Fig. 118. *Helenicula mattei* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

Idiosoma : Measuring 263-424 x 180-330 in unengorged to engorged specimens. Eyes 2/2, anterior larger, distinct, free on cuticle. 1 pair of humeral setae, distinct in unengorged specimens, merged with 1st posthumeral row in engorged specimens, stout with heavy barbules, measuring 31-35; 84-96 dorsal idiosomal setae, expanded, spicate, measuring 27-35, irregularly arranged, arrangement in holotype : 12-10-10-10-2-10-10-10-2+8; 2 pairs of sternal setae, finely ciliated, anterior 29-33, posterior 15-16; 30-36 preanal setae, finely ciliated, 15-21; 20-28 postanal setae, similar to dorsal idiosomal setae, 23-29; total idiosomal setae 140-166.

Gnathosoma : Palpal setal formula B/B/bb(N)B/4B; palpal claw 3-pronged; galeala B; cheliceral blade (25) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin shallowly concave; posterior margin angled beyond level of PL bases, convex, medially truncate; AM base posterior to level of AL bases; SB close together, posterior to level of PL bases; AM and PL setae stout, strongly barbed, with heavy barbules; AL setae more slender, sparsely barbed; AL>>PL>AM; PW/SD = 1.77-1.83; sensillae globose, head with minute setules. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 52 (55, 52-57); PW 65 (70, 65-77); SB 10 (11, 10-12); ASB 23 (22, 21-23); PSB 13 (12, 11-13); AP 17 (16, 15-18); AM 25 (24, 23-25); AL 49 (47, 39-55); PL 31 (30, 30-31); sens.-(26x15, -).

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I level with or distal to subterminala; coxa III 1B. Measurements as follows : Ip = 609-648. Leg I : 217-230; tarsus (50x18), tarsala (10). Leg II : 183-194; tarsus (37x15), tarsala (13). Leg III : 209-224; tarsus (48-50x 2-13).

Type data : Holotype (NIV A81606.6), UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, ex *Rattus rattus gangutrianus*, 29.X.1967, NIV, coll.; 3 paratypes, same data, but ex 2 *R. r. gangutrianus*, taken 28.X.1967.

Remarks : *H. mattei* will run to couplet 1 of the key to *Helenicula* species of Old World given by Nadchatram and Traub (1971) along with *H. nepalensis* Nadchatram and Traub, 1971, having dorsal idiosomal setae modified. It differs in having palpal tarsal setation 4B (5B in *H. nepalensis*), dorsal idiosomal setae expanded, spicate (expanded, lanceolate in *H. nepalensis*), and single pair of humeral setae (2 pairs in *H. nepalensis*). This species has been named in honour of the late Dr. Matthew Lederle S.J., former Jesuit Provincial of Goa-Poona Province. This work has been possible, in no small measure, because of his inspiration and unstinted support.

138. *Helenicula miyagawai* (Sasa, Kumada and Miura)
(Fig. 119)

Euschoengastia miyagawai Sasa, Kumada and Miura, 1951, 19; Wharton and Fuller, 1952, 79.

Euschoengastia (Helenicula) miyagawai, Audy, 1954b, 153.

Helenicula miyagawai, Womersley, 1957, 109; Nadchatram and Traub, 1971, 564; Fernandes *et al.*, 1988, 108.

Helenicula (Helenicula) miyagawai, Vercammen-Grandjean, 1968b, 100.

Redescription of species : Larva.

Idiosoma : Measuring 208-407 x 174-313 in unengorged to partially engorged specimens. Eyes 2/2, anterior larger, distinct, free on cuticle. 2 pairs of humeral setae, distinct in unengorged specimens, merged with 1st posthumeral row in engorged specimens; measuring 47-63; 42-46 dorsal idiosomal setae, measuring 40-50, arrangement commencing : 6-8-8(10)-8, the rest irregular (Nadchatram and Traub, 1971 : In 2 Japanese specimens extant, humeral and dorsal idiosomal setae number 49-50, arranged : 11(12)-8(6)-9-10-4-4-2-2); 2 pairs of sternal setae, anterior 47-50, posterior 29-34; 20-26 preanal setae, 30-33; 10-14 postanal setae, 35-37; total idiosomal setae 80-94.

Gnathosoma : Palpal setal formula B/B/bbB/5B; palpal claw 3-pronged (Nadchatram and Traub (1971): 3-5 pronged); galeala N (Vercammen-Grandjean, 1968b: B); cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin biconcave; posterior margin deeply rounded; AM base posterior to level of AL bases; SB close together, posterior to level of PL bases; scutal setae strongly barbed; AL>PL>>AM (Nadchatram and Traub, 1971 : PL>AL>>AM, in Japanese specimens); PW/SD = 1.83-2.08; sensillae globose, head with minute setules. Scutal measurements of holotype after original description, followed by measurements of 2 Japanese specimens (No. 48 and 50) after Nadchatram and Traub (1971): AW 62, 70, 70; PW 81, 84, 90; SB 8, 12, 11; ASB 28, 32, 32; PSB 11, 14, 12; AP 26, 21, 24; AM 40, 40, 44; AL 61, 55, 58; PL 57, 60, 65; sens. 31, 30x25, -. Scutal measurements giving means followed by ranges of 9 NIV specimens : AW 56, 53-60; PW 76, 71-80; SB 11, 9-12; ASB 30, 28-32; PSB 15, 14-16; AP 24, 22-26; AM 37, 34-40; AL 61, 57-65; PL 58, 53-60; sens. 25x18, 24-26 x 17-19.

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I proximal to subterminala (Nadchatram and Traub, 1971: level with subterminala). Measurements as follows : Ip = 835-855. Leg I : 300-310; tarsus (67x25), tarsala (14-16). Leg II : 250-255; tarsus (56x23), tarsala (18-19). Leg III : 280-295; tarsus (65-75 x 18-26).

Type data : Described originally from Japan.

Type depository : Not reported in the literature.

New records : 2 records of collections from the Himalayan region by NIV field teams: UTTARANCHAL, Dehra Dun District, Dehra Dun, 600-800m, 6 ex *Rattus rattus gangutrianus*, 29.X.1967. HIMACHAL PRADESH, Chamba District, Tindi, 2440-2590m, 3 ex *Ochotona thibetana*, 20.IX.1968.

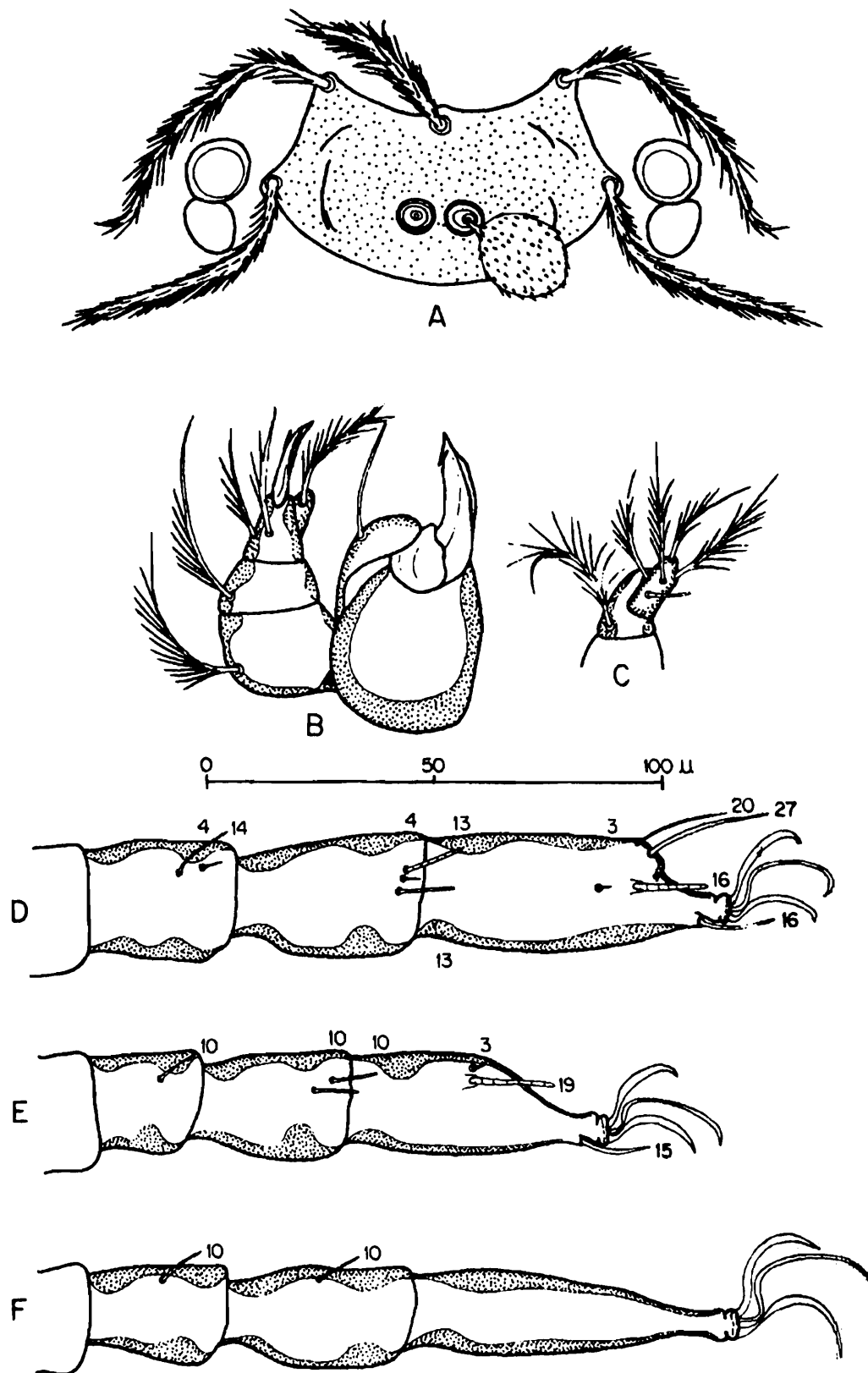


Fig. 119. *Helenicula miyagawai*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *H. miyagawai* runs to couplet 23 of the key to *Helenicula* species of the Old World given by Nadchatram and Traub (1971), along with *H. lanius* (Radford, 1946). The points of distinction between these 2 closely related species have been noted above in the remarks on *H. lanius*. In their description of *H. wagamiya*, Nadchatram and Traub (1971) consider it very close to *H. miyagawai*. They distinguish *H. wagamiya* primarily in having palpo setal formula B/B/bNB/5B and Ip 717-737. Sasa and Jameson (1954) regarded *H. covelli* (Radford, 1953) as a doubtful synonym of *H. miyagawai*. Nadchatram and Traub (1971) have, however, synonymized the former with *H. lanius*. The Indian specimens are close to *H. lanius* in AW and PW dimensions (mean measurements : AW 57, and PW 71 in *H. lanius*), and in having tarsala I proximal and not level with subterminala. *H. miyagawai* is very close to *H. lanius*, and may prove to be its synonym.

139. *Helenicula nadchatrami* new species
(Fig. 120)

Helenicula sp. A Fernandes *et al.*, 1988, 108.

Description of species : Larva.

Idiosoma : Measuring 508x350 in partially engorged holotype. Eyes 2/2, anterior distinct, free on cuticle. 1 pair of humeral setae, distinct in unengorged specimens, merged with 1st posthumeral row in engorged specimens, measuring 41-46; 40-44 dorsal idiosomal setae, measuring 27-34, arrangement commencing : 8-6-6, the rest irregular; 2 pairs of sternal setae, anterior 35-42, posterior 25-32; 30 preanal setae, 23-25; 16 postanal setae, 26-32; total idiosomal setae 90-96.

Gnathosoma : Palpal setal formula B/B/b(N)NB/5B; palpal claw 3-pronged; galeala B; cheliceral blade (36) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin sinuate; posterior margin deeply rounded; AM base posterior to level of AL bases; SB close together, posterior to level of PL bases; scutal setae strongly barbed; AL>PL>AM; PW/SD = 1.74; sensillae globose, head with minute setules. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 56 (54, 51-57); PW 75 (70, 67-75); SB 12 (10, 9-12); ASB 27 (28, 26-29); PSB 17 (16, 15-17); AP 24 (23, 21-25); AM 34 (33, 31-36); AL 47 (48, 44-53); PL 40 (40, 36-44); sens. 29x18 (26x18, 23-29 x 17-18).

Legs : Similar to *H. lanius* (Radford, 1946) in the number of ordinary and sensory setae. Tarsala I proximal to subterminala; coxa III 1B. Measurements as follows : Ip = 760-786. Leg I : 279-289; tarsus (72x21), tarsala (18). Leg II : 210-226; tarsus (56x16); tarsala (19). Leg III : 267-276; tarsus (71-75x13-14).

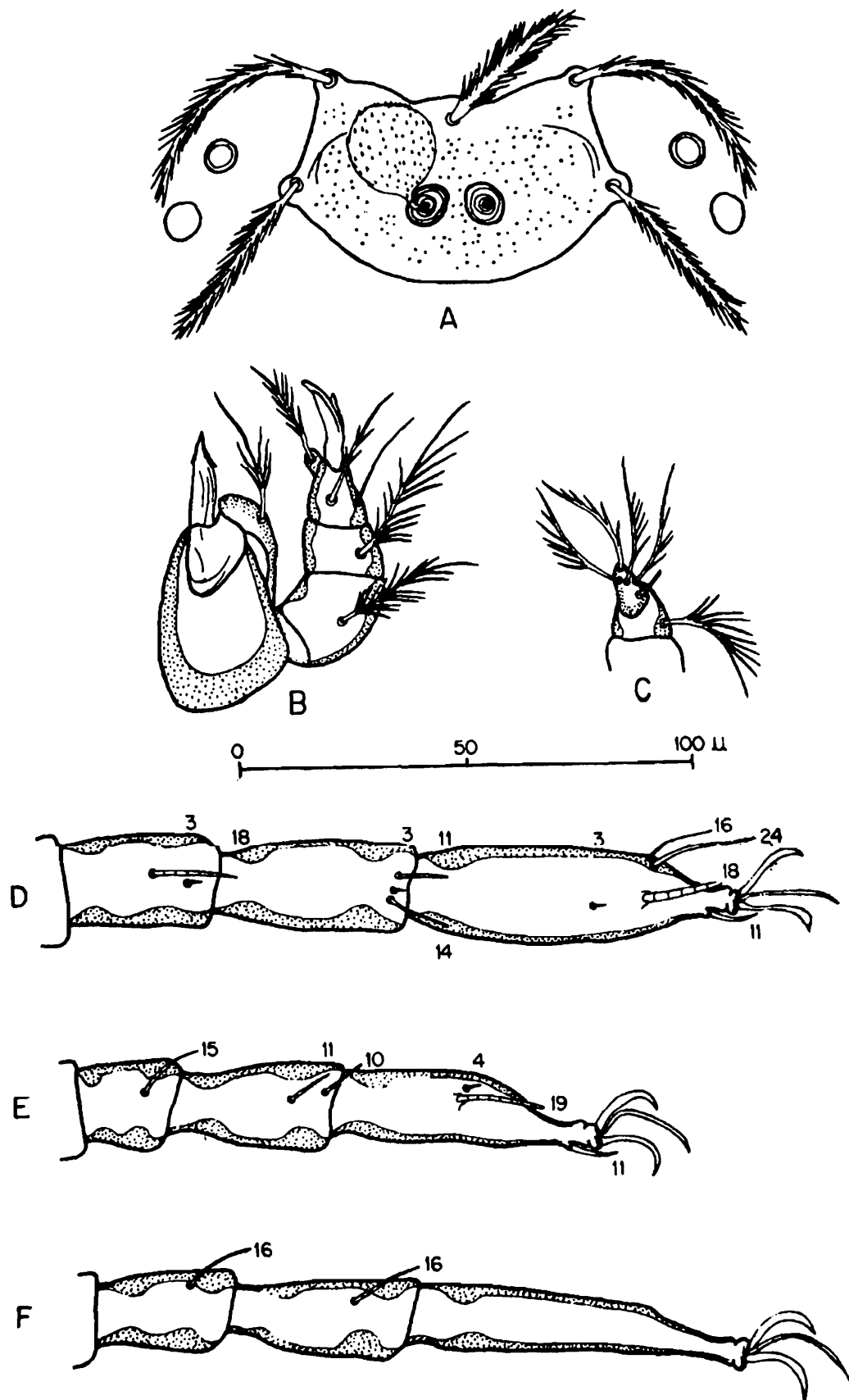


Fig. 120. *Helenicula nadchatrami* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Type data : Holotype (NIV A72438.12), UTTARANCHAL, Nainital District, Haldwani, 400-1100m, ex *Rattus rattus gangutrianus*, 5.XII.1966, NIV, coll.; 9 paratypes, same data, but ex 2 *R. r. gangutrianus*.

Additional records : 6, same data as paratypes.

Remarks : *H. nadchatrami* will run to couplet 13 of the key to *Helenicula* species of the Old World given by Nadchatram and Traub (1971) along with *H. vercammengrandjeani* (Abbonec and Tauffleib, 1957). It is readily distinguishable in having tarsala I inserted proximal to subterminala (distal in *H. vercammengrandjeani*), genuala II present (absent in *H. vercammengrandjeani*), and palpo-setal formula B/B/b(N)NB/5B (B/B/BbB/5B in *H. vercammengrandjeani*). This species has been warmly dedicated to M. Nadchatram with sincere gratitude for his invaluable guidance, and in recognition of his tremendous contribution to trombiculid research over more than 3 decades. The generous loan of several Indian specimens from his vast collection is gratefully acknowledged.

Genus *Herpetacarus* Vercammen-Grandjean

Herpetacarus Vercammen-Grandjean, 1960, 469; 1966, 631; 1968b, 90; Nadchatram and Dohany, 1974, 53; Kolebinova and Vercammen-Grandjean, 1980, 415; Domrow and Lester, 1985, 14.

Type species : *Ascoschoengastia causisola* Jadin and Vercammen-Grandjean, 1952, by monotypy and original designation.

Diagnosis : Schoengastiini larvae parasitic on reptiles and small mammals. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent; 3 genualae I, 1 genuala II and III; tibiala III present. Palpal tarsus 6B.S, 7B, or 7B.S; palpal claw 3-pronged; cheliceral blade with apical tricuspid cap; galeala N or b. Eyes 2/2, well-developed. Scutum wider than long with convex posterior margin; scutal punctae simple; anterolateral shoulders absent; sensillary bases wide apart; sensillae lanceolate to narrowly clavate, head with spiked setules; PL setae usually longest of scutal setae.

Remarks : Vercammen-Grandjean (1960) erected this genus for a Schoengastine group that could not be properly classified among the *Euschoengastia*, *Schoengastia* or *Ascoschoengastia*. Most species in this group parasitized reptiles, hence the generic name *Herpetacarus* (*acari* of reptiles). This genus comprises 4 subgenera : *Herpetacarus* with palpal tarsal setation 7B.S; *Abonnencia* Vercammen-Grandjean, 1960, with 7B; *Cricacarus* Vercammen-Grandjean, 1966, with 6B.S; and *Lukoschuskaia* with 7B.S, characterized by the presence of an additional pair of mediolateral setae inserted between the AL and PL scutal setae. 2 Indian *Herpetacarus* species are reported here, both in the nominate subgenus.

140. *Herpetacarus (Herpetacarus) longisetosa* (Hiregaudar) (Fig. 121)

Schongastia (Ascoschongastia) longisetosa sic! Hiregaudar, 1957, 313, **nomen nudum**.

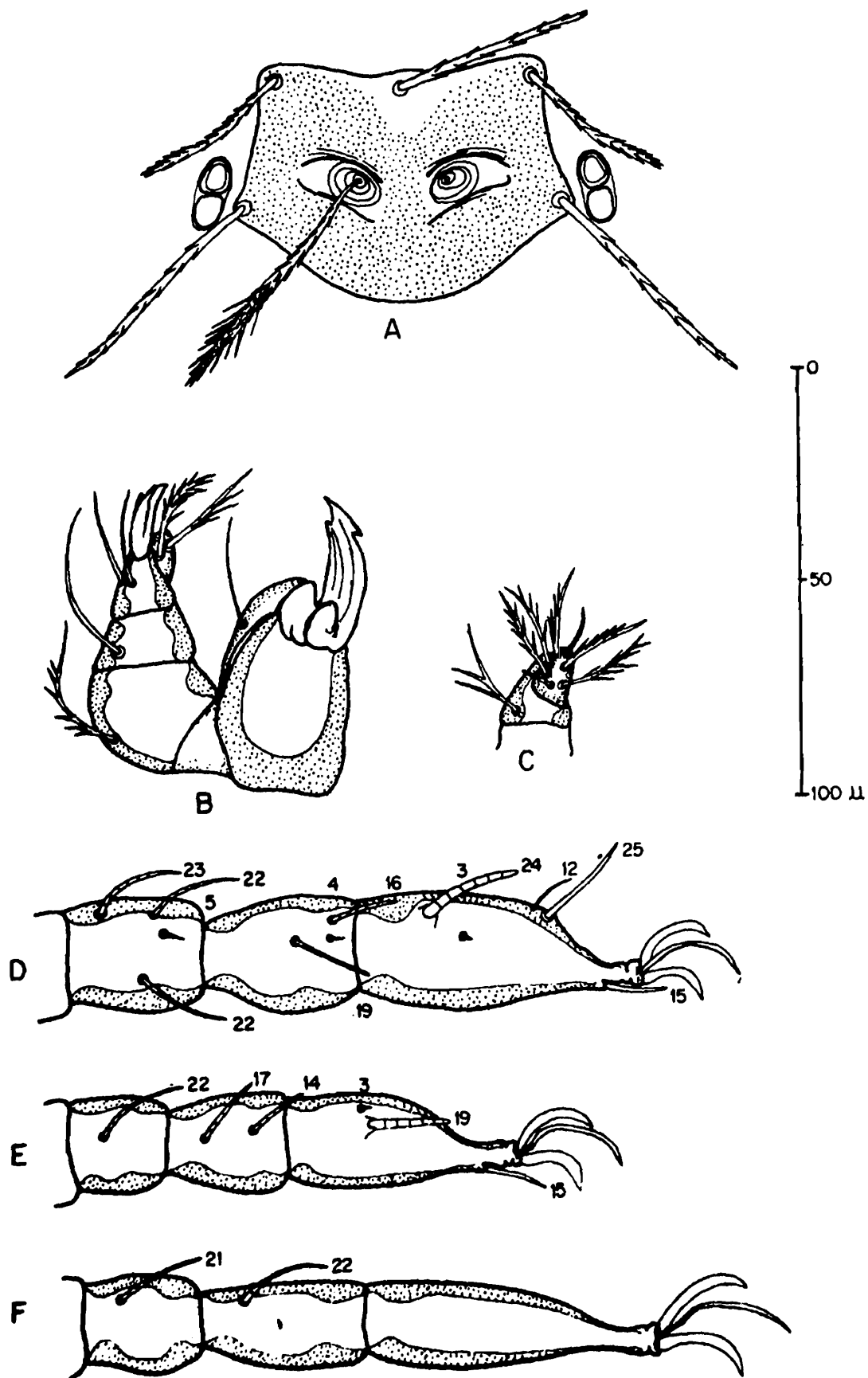


Fig. 121. *Herpetacarus longisetosa*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Schongastia longisetosa, sic! Hiregaudar, 1958, 22, original description; Joshee, 1964, 46.

Herpetacarus (Cricacarus) longisetosa, Vercammen-Grandjean, 1966, 649; Kulkarni and Mahadev, 1973, 352; Kulkarni, 1979, 20; Kulkarni *et al.*, 1979, 10.

Herpetacarus (Herpetacarus) longisetosa, Vercammen-Grandjean, 1966, 674.

Herpetacarus longisetosa, Prasad, 1974, 83.

Redescription of species : Larva. Colour in life pale white.

Idiosoma : Measuring 280x180 in partially engorged specimen. Eyes 2/2, on ocular plate. 1 pair of humeral setae, measuring 52-54; 48-52 dorsal idiosomal setae, measuring 42-47, usually arranged : 8-8(10)-8(10)-10-6-4-4; 2 pairs of sternal setae, anterior 33-40; posterior 31-35; 28-30 preanal setae, 23-24; 12-20 postanal setae, 35-42; total idiosomal setae 100-104.

Gnathosoma : Palpal setal formula B/N(b)/N(b)NB/7B.S; palpal claw 3-pronged; galeala N; cheliceral blade (37) with dorsal subapical tooth and distinct tricuspid cap; gnathobase well punctate, bearing a pair of branched setae.

Scutum : Densely punctate with shallowly biconcave anterior margin; posterior margin rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases with pronounced antero- and postero-medial cuticular ridges; sensillae elongate, fusiform, head with setules (long spikelets distally); PW/SD = 1.34-1.48. Scutal measurements of holotype and 1 paratype after original description, followed by holotype after Vercammen-Grandjean (1966), and mean of 5 Bombay specimens after Joshee (1964) : AW 63, 64, 68, 63; PW 77, 79, 78, 76; SB 26, 27, 26, 24; ASB 32, 30, 32, 28; PSB 22, 25, 26, 28; AP 32, 33, 34, 31; AM 49, 47, 50, 49; AL 36, 38, 41, 34; PL 55, 56, 58, 56; sens. 49x-, 50x-, 54x3, 47x-. Scutal measurements giving means and ranges of 10 NIV specimens : AW 64, 60-76; PW 76, 73-82; SB 24, 21-26; ASB 29, 26-31; PSB 26, 23-28; AP 31, 27-34; AM 49, 45-60; AL 38, 35-43; PL 55, 51-60; sens. 52x3, 48-60 x 2-3.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 748-827 (Original description : 990; Vercammen-Grandjean, 1966 : 820). Leg I : 258-292 (Original description : 330; Vercammen-Grandjean, 1966 : 286); coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (67x28) 21B, tarsala (24), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 226-250 (Original description : 315; Vercammen-Grandjean, 1966 : 246); coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (55x23) 16B, tarsala (19), microtarsala, pretarsala. Leg III : 261-285 (Original description : 345; Vercammen-Grandjean, 1966 : 288); coxa 1B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (69x20) 15B.

Type data : Holotype (No. 2476/18) and 3 paratypes, MAHARASHTRA, Bombay, Bombay Veterinary College (now Haffkine Institute) Compound, ex *Naja naja*, VII.1956, L.S. Hiregaudar, coll.

Type depository : Type series at ZSI.

Additional records : MAHARASHTRA, Bombay and suburbs (Bhandup), ex (*Rattus rattus*, *Bandicota bengalensis*, and *Bandicota indica*?) hosts not specified, V-VIII.1958 and VIII-XII.1959, A.K. Joshee, coll.; Pune District, approximately 3800 ex *Suncus murinus*, *Millardia meltada*, *Millardia kondana*, *Rattus rattus rufescens*, *Rattus rattus satarae*, *Mus platythrix*, and *Mus booduga*, I.1970-IX.1971, S.M. Kulkarni, coll. GOA, approximately 1100 ex *S. murinus*, 18.X.1983-4.V.1984, S. Fernandes, coll.

Material examined : Specimens of *H. longisetosa* from TMC-3, a colony of this species maintained at NIV. Kulkarni and Mahadev (1973) initiated this colony from approximately 100 fed larvae from Pune District, Khandala, taken on *S. murinus*, 6.VIII.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Hiregaudar (1958) considers this species close to *H. bidentata* (Womersley, 1952) in the scutal shape, but distinguishes it by the higher standard measurements (AW measuring 54, PW 70, ASB 23, PSB 22, AP 27, and Ip 745 in *H. bidentata*). *H. longisetosa* further differs in having palpal femoral seta B (N in *H. bidentata*), scutal surface not covered by cuticular striations (cuticular striations present in *H. bidentata*), and a greater number of idiosomal setae (58 in *H. bidentata*). According to Hiregaudar, this species also bears some resemblance to *Walchiella lacunosa* (Gater, 1932), but differs in the scutal shape. Based on the original description, Vercammen-Grandjean (1966) placed this species in the subgenus *Cricacarus* of the genus *Herpetacarus* (p. 649). In the addendum (p. 674), however, he transfers it to the nominate subgenus, based on his study of the holotype. The higher Ip and leg measurements of the holotype in the original description probably include the coxal measurements. The NIV specimens show close agreement to the standard measurements given by Vercammen-Grandjean (1966). The original record is from the common cobra *Naja naja*, but all subsequent records are from small mammals. Joshee (1964) suggests that the natural host of this species may be rodents and that, only incidentally, the reptile taking shelter in rat burrows may have been infested. Following Vercammen-Grandjean (1966), this species is placed in the nominate subgenus.

141. *Herpetacarus (Herpetacarus) schlugeri* (Radford) new combination
(Fig. 122)

Euschoengastia schlugeri Radford, 1953b, 210; Audy and Domrow, 1957, 147; Womersley and Audy, 1957, 250; Vercammen-Grandjean and Langston, 1976, 885.

Redescription of species : Larva. Colour in life pale white.

Idiosoma : Measuring 528-580 x 363-465 in engorged specimens. Eyes 2/2, on ocular plate. 1 pair of humeral setae, measuring 48-53; 44-52 dorsal idiosomal setae, measuring 46-49, usually arranged : 8-12(10)-10(8)-8(6), the rest irregular (Original description : approximately 58, measuring 65, arranged : 8-12-12-6-8-8-4); 2 pairs of sternal setae,

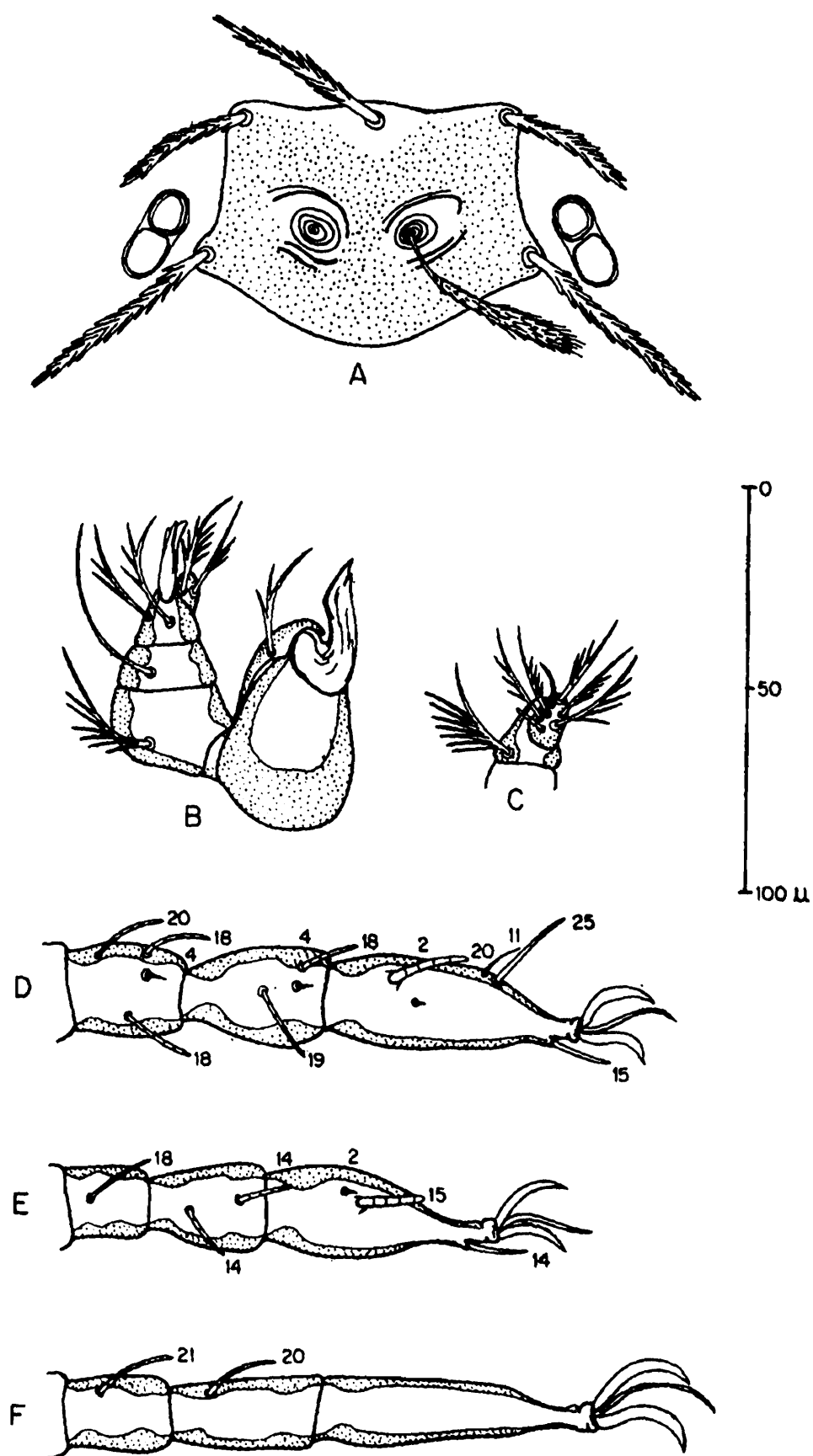


Fig. 122. *Herpetacarus schlugeri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

anterior 34-41, posterior 30-40; 36-44 preanal setae, 22-25; 16-22 postanal setae, 35-42 (Original description: approximately 52 ventral setae); total idiosomal setae 92-120.

Gnathosoma : Palpal setal formula B/N(b)/bN(b)B(b)/7B.S (Original description : B/N/BBB/?; in the original illustration, fig. 6, the palpal tarsus bears a subterminala); palpal claw 3-pronged; galeala b; cheliceral blade (34-36) with dorsal subapical tooth and tricuspid cap; gnathobase well punctate, bearing a pair of branched setae.

Scutum : Densely punctate with shallowly biconcave anterior margin; posterior margin rounded; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases with pronounced antero - and postero-medial cuticular ridges; sensillae narrowly clavate, head with setules; PW/SD = 1.37-1.50. Scutal measurements of holotype after original description, followed by means and ranges of 10 NIV specimens in parentheses : AW 80 (67, 63-70); PW 87 (79, 74-83); SB 24 (23, 20-26); ASB 20 (30, 27-33); PSB - (26, 23-29); AP 30 (33, 30-36); AM 65 (49, 45-54); AL 50 (39, 33-42); PL 65 (55, 52-59); sens. 44 (46x5, 45-49 x 4-5).

Legs : Similar to *H. longisetosa* (Hiregaudar, 1958) in the number of ordinary and sensory setae. Measurements as follows : Ip = 750-818. Leg I : 266-287; tarsus (62-66 x 22-25), tarsala (18-21). Leg II : 220-245; tarsus (51-58 x 21-22), tarsala (15-16). Leg III : 264-286 tarsus (67-74 x 15-18).

Type data : Holotype, TAMIL NADU, Chedleth forest, ex 'rat', 31.VIII.1947, S.L. Kalra, coll.

Type depository : Not reported in the literature.

New records : KARNATAKA, Shimoga District, Hennagere, 27 ex *Rattus rattus wroughtoni*, 5-19.X.1966, NIV, coll; 3 same data, but North Kanara District, Mavingundi, taken 1.XI.1966. MAHARASHTRA, Pune District, Mulshi, 650m, 1 ex *Millardia kondana*, 30.VI.1971, S.M. Kulkarni, coll. GOA, 37 ex *Suncus murinus*, *Rattus blanfordi* and *Bandicota bengalensis*, 19.VIII.1983-21.II.1984, S. Fernandes, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Radford (1953b) described *schlugeri* in the genus *Euschoengastia*, giving a brief description with illustrations of scutum, palp and cheliceral blade. Several diagnostic features including the palpal tarsal setation have, however, not been reported. Audy and Domrow (1957), in a revision of *Euschoengastia*, regard *schlugeri* as belonging to a monotypic group of this genus. Chen *et al.* (1958) described a new variety *Euschoengastia schlugeri fukiensis* ex *Rattus edwardsi*, from China, Pingtang Island, Fukien. Vercammen-Grandjean (1968b) raised *fukiensis* to full species and transferred it to genus *Herpetacarus*, subgenus *Cricacarus*. Vercammen-Grandjean and Langston (1976) consider the placement of *schlugeri* in *Euschoengastia* as doubtful (*incertae sedis*). The type specimen is not traceable. The NIV specimens from Goa and Karnataka have been taken in ecogeographical areas similar to the type locality. Their scutal shape agree closely with the original description and illustration of

schlugeri. In the original description, the AW and PW measurements are higher, the ASB 20 and PSB nil with SD reported as 58! The palpotarsal setation 7B.S and other diagnostic characters described above warrant the transferral of this species to *Herpetacarus*. *H. schlugeri* is very close to *H. longisetosa* (Hiregaudar, 1958) and, in the absence of sensillae, the 2 species are difficult to differentiate. *H. schlugeri* may be distinguished in having sensilla narrowly clavate (fusiform with long spikelets distally in *H. longisetosa*), and galeala b (N in *H. longisetosa*). This species has been named in honour of Dr. E.G. Schluger in recognition of her work on chiggers in Siberia. *H. schlugeri* is placed in the nominate subgenus.

Genus *Neoschoengastia* Ewing

Neoschoengastia Ewing, 1929b, 187; Womersley and Heaslip, 1943, 72; Womersley, 1952, 266; Womersley and Audy, 1957, 281; Brennan, 1951, 577; Wharton and Fuller, 1952, 84; Audy, 1954b, 155; Vercammen-Grandjean, 1960, 469; 1968b, 103; Vercammen-Grandjean *et al.*, 1973, 52; Nadchatram and Dohany, 1974, 49; Domrow, 1978, 85; Domrow and Lester, 1985, 31.

Type species : *Schoengastia americana* Hirst, 1921, by monotypy and original designation.

Diagnosis : *Schoengastiini* larvae parasitic on birds. Palpal tarsus 7B.S; palpal claw 3-pronged; galeala B; cheliceral blade with tricuspid cap. Eyes 2/2, on ocular plate. Scutum subquadrate with anterolateral shoulders and cuticular striations overlapping posterior 1/2; AL>PL>AM; sensillary bases with pronounced anterolateral cuticular ridge; sensillae globose to clavate, head with minute setules. Legs all 7-segmented; usually 3 genualae I; parasubterminala I absent; genu II 3B or 4B; coxa III usually multisetose; mastitarsala III or long, sparsely barbed seta usually present. Onychotriches present or absent on claws.

Remarks : Audy (1954b) points out the great range of variation in this genus. He suggests that scutal submergence by cuticular striations might be a perplexing example of convergence due to bird parasitization. Vercammen-Grandjean *et al.* (1973) recognize 2 subgenera : *Hypogastia* Vercammen-Grandjean, 1968, with palpal tarsus 7B and pedigeneal number 4-3-3; and the nominate subgenus with palpal tarsus 7B.S and pedigeneal number 4-4-3. A single *Neoschoengastia* species has been reported from India, in the nominate subgenus.

142. *Neoschoengastia (Neoschoengastia) thomasi* (Radford)

Paraschoengastia thomasi Radford, 1946, 262.

Neoschoengastia thomasi, Brennan, 1951, 577; Womersley, 1952, 266; Wharton and Fuller, 1952, 87; Audy *et al.*, 1953, 29; Nadchatram, 1967, 146; Schluger and Bels'kaja, 1972, 67; Prasad, 1974, 87.

Neoschoengastia (Neoschoengastia) thomasi, Vercammen-Grandjean, 1968b, 105.

Redescription of species : Larva.

Idiosoma : Measuring 210x200 in unengorged holotype. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 56; 22 dorsal idiosomal setae, measuring

46, arranged : 6-6-6-2(4)-(2); 2 pairs of sternal setae; 12 preanal setae, 26; 12 postanal setae; total idiosomal setae 52.

Gnathosoma : Palpal setal formula B/B/BbB/7B.S; palpal claw 3-pronged; galeala B; cheliceral blade (34) with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Subquadrate with anterolateral shoulders; densely punctate anteriorly with fewer punctae along posterior margin; anterior margin shallowly biconcave; parallel cuticular striations anterior to SB uniting to form pronounced semicircular ridge, and overlapping posterior 1/2 of scutum; AL bases submarginal, anterior to level of AM base; SB anterior to level of PL bases; scutal setae bushy with long barbs; AL=PL>AM; sensillae globose, head with minute setules; PW/SD = 1.46-1.54. Scutal measurements of holotype after original description, followed by Nadchatram (1967) : AW 44, 48; PW 63, 71; SB 26, 28; ASB 20, 21; PSB 23, 25; AP 34, 33; AM 37, 36; AL 51, 56; PL 54, 54; sens. 29x-, 28x22.

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches present on claws. Leg I : coxa 1B; trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (85x25) 17B, tarsala, microtarsala, subterminala, pretarsala; parasubterminala absent. Leg II : coxa 1B; trochanter 1b; basifemur 2B; telofemur 4B; genu 4B, genuala; tibia 6B, 2 tibialae; tarsus (78x20) 13B, tarsala, microtarsala, pretarsala. Leg III : coxa 3B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus (108x17) 13B, long mastitarsala with basal barbs.

Type data : Holotype, MANIPUR, Imphal, Urukul Road, ex *Lanius nasutus*, 11.II.1945, Sergeant J. Hake, coll.

Type depository : Holotype in BM(NH).

Additional records : MANIPUR, ex 'hawk', 'babbler', 'laughing thrush', *Saxicola caprata*, *Rhodophila ferrea*, and 2 unidentified birds, II.1945, STRU, coll.

Remarks : The above redescription is based on the literature. Womersley (1952) described a new species *N. entomyza* which he regarded as very close to, and perhaps a synonym of *N. thomasi*. He mistakenly reports the year of collection of the holotype as 1946 instead of 1945. Radford's manuscript was received for publication on 14.I.1946; hence, the date of collection cannot be 11.II.1946. Nadchatram (1967) based his redescription on the study of the holotype. The leg measurements have, unfortunately, not been reported. He considers *N. thomasi* close to *N. longipes* Nadchatram, 1967, and *N. entomyza*, from which it differs in having lateral palpotibial seta barbed (N in other 2 species), in the number and arrangement of dorsal body setae (28, arranged : 6-6-4-6-4-2 in *N. longipes* and 24, arranged : 8-6-4-4-2 in *N. entomyza*), in measurements of scutal setae (AM measuring 35, AL 68, and PL 57 in *N. longipes* and AM 31, AL 36, and PL 46 in *N. entomyza*), in having punctae on both anterior and posterior scutal regions (only posterior region in *N. longipes* and only anterior region in *N. entomyza*), and in ratio of length/ height of leg tarsi I-III : 3.4, 3.9, and 6.3 (5.3,

6.0, and 10.0 in *N. longipes*; and 3.3, 3.5, and 6.0 in *N. entomyza*). *N. thomasi* is further separated from *N. longipes* in having AL bases submarginal (marginal in *N. longipes*). Schluger and Bels'kaja (1972) describe a new species *N. lucida*, which they consider close to *N. thomasi*. *N. thomasi* differs in having 22 dosal body setae with arrangement commencing : 6-6 (30-34, commencing : 8-6 in *N. lucida*). Domrow and Lester (1985) point out that the illustration (fig. 17) by Nadchatram (1967) of this species appears rather to represent *N. stuthidia* Womersley, 1952, which they synonymize with *N. posekanyi* Wharton and Hardcastle, 1946. Radford has named this species to honour Captain H.M. Thomas R.A.M.C., who assisted with collections at the Scrub Typhus Research Laboratory at Imphal.

Genus *Riedlinia* Oudemans

Riedlinia Oudemans, 1914, 88; Fuller, 1952, 199; Womersley and Audy, 1957, 269; Vercammen-Grandjean and Nadchatram, 1965, 317; Vercammen-Grandjean, 1968b, 107; Nadchatram and Dohany, 1974, 52.

Type species : *Riedlinia coeca* Oudemans, 1914, 88, by original description and monotypy.

Diagnosis : Schoengastiini larvae parasitic on bats with neosomatic peri-rostral scapular thickening. Legs all 7-segmented, terminating in a pair of stout claws and a clawlike empodium; empodia slightly expanded to spatulate distally; onychotriches absent; 3 genualae I; tarsi I-III with supplementary sclerotized bars. Palpal tarsus 7B; palpal claw 3-pronged; galeala N; cheliceral blade stout, with tricuspid cap. Eyes absent. Scutum subtrapezoidal, sparsely punctate; sensillae slightly expanded to narrowly clavate.

Remarks : The genus *Riedlinia* was revised by Fuller (1952) and later redefined by Vercammen-Grandjean (1964) to include 3 subgenera : *Trombigastia* Vercammen-Grandjean and Brennan, 1957, *Ascoschoengastiodes* Vercammen-Grandjean and Fain, 1958, and the nominate subgenus. Vercammen-Grandjean and Nadchatram (1965) reinstated the genus *Trombigastia* with *Ascoschoengastiodes* as subgenus. They redefined the genus *Riedlinia*, proposing subgenus *Neosomia* characterized by peniscutum bearing only 3 setae, 2 genualae III and femorala III. Subsequently, Nadchatram (1966) transferred the monotypic subgenus *Neosomia* to *Chiroptella* Vercammen-Grandjean, 1960. Vercammen-Grandjean (1968b) reverted to his earlier position, considering *Trombigastia* a subgenus of *Riedlinia*. But, following Nadchatram and Dohany (1974), *Trombigastia* and *Riedlinia* are here regarded as independent genera. Of the 5 *Riedlinia* species presently known, the type species has been reported from India.

143. *Riedlinia coeca* Oudemans

Riedlinia coeca Oudemans, 1914, 88; Wharton and Fuller, 1952, 87; Fuller, 1952, 199; Audy, 1954b, 160; Womersley and Audy, 1957, 269; Nadchatram and Dohany, 1974, 52; Prasad, 1974, 88.

Riedlinia (Riedlinia) coeca, Vercammen-Grandjean 1964, 318; 1968b, 108.

Reidlinia coeca, sic! Womersley, 1952, 21.

Redescription of species : Larva.

Idiosoma : Measuring 560x580 in engorged lectotype. Neosomatic perirostral scapula thickening present. Eyes absent. One pair of humeral setae, measuring 32; 24 dorsal idiosoma setae, anterior measuring 50-56, posterior 22-25, arranged : 6-8-6-6-2-2; 2 pairs of sterna setae; 16 preanal setae, 24-33; 14 postanal setae, 40; total idiosomal setae 60.

Gnathosoma : Palpal setal formula B/N/NNB/7B; lateral palpotibial seta very long; palpa claw 3-pronged; galeala N; cheliceral blade stout, with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subtrapezoidal with biconcave anterior margin; posterior margin poorly visible, overlapped by cuticular folds; intersensillary craters present posterolateral to sensillary bases; AM base level with AL bases; SB anterior to level of PL bases; PL>AL>AM; sensillae missing in type specimens; PW/SD = 1.63-1.68. Scutal measurements of type specimen after Fuller (1952), followed by lectotype and paratype after Vercammen-Grandjean (1964) : AW 35, 36, 35; PW 45, 47, 44; SB 17, 16, 17; ASB 16, 18, 17; PSB -, 10, 10; AP 25, 27, 26; AM -, 24, -; AL 25, -, 26; PL 36, 35, 40.

Legs : All 7-segmented, terminating in a pair of stout claws and a clawlike empodium; empodia expanded distally, spatulate; onychotriches absent. Coxae I-III unisetose. Tarsi I-III with supplementary sclerotized bars. Measurements and specialized setae reported as follows : Ip = 499-526. Leg I : 170-184; 3 genualae, microgenuala; 2 tibialae, microtibiala; tarsala, microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 156-165; genuala; 2 tibialae; tarsala, microtarsala, pretarsala. Leg III : 173-177; genuala, tibiala.

Type data : Lectotype and several type specimens, MAHARASHTRA, Pune District, Khandala, ex *Rhinolopus* sp., 25.X.1911; name of collector not reported.

Type depository : Lectotype and type specimens at RMNH.

Remarks : The above redescription is based only on the literature. Vercammen-Grandjean (1964) has given a fairly detailed redescription of this species with comparison of the standard data and palpal setal formulae of the 4 other known *Riedlinia* species. He clarifies that the scutum is trapezoidal and not pentagonal as reported earlier by Oudemans (1914), Fuller (1952), and Womersley (1952). He reports 2 well-marked zones of muscular insertion on the scutum (= intersensillary craters). The sensillae of this species are not known (Fuller, 1952), but deduced to be narrowly expanded/clavate (Womersley and Audy, 1957). Audy (1954b) points out that the type locality is in India, and not Malaya as Wharton and Fuller (1952) inadvertently report. The species name, derived from the Latin meaning "blind", draws attention to the absence of eyes in *R. coeca*.

Genus *Schoutedenichia* Jadin and Vercammen-Grandjean

Schoutedenichia Jadin and Vercammen-Grandjean, 1954, 195. Vercammen-Grandjean, 1958, 9; 1960, 469; 1967, 131; 1968b, 95. Nadchatram and Dohany, 1974, 52; Domrow and Lester, 1985, 59.

Type species : *Schoutedenichia fulleri* Jadin and Vercammen-Grandjean, 1954, by original designation.

Diagnosis : Schoengastiini larvae usually parasitic on small mammals. Legs all 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. 2 genualae I; tibiala III and mastitarsala III absent. Palpal tarsus 4B, 4B.S or 5B; palpal claw 3-pronged; galeala nude to weakly branched. Eyes 2/2 or 1/1. Scutum trapezoidal; SB widely set; sensillae clavate to globose, head with setules.

Remarks : Vercammen-Grandjean (1958) revised the genus *Schoutedenichia*, which is essentially African, listing 41 species and subspecies. Vercammen-Grandjean (1960) has included 8 subgenera in the genus, differentiating them primarily on the basis of the palpal tarsal setation, dentation of the cheliceral blade, and scutal aspect. Vercammen-Grandjean (1968b) considers this genus closely related to *Doloisia* Oudemans, 1910, and *Cheladonta* Lipovsky *et al.*, 1955. He distinguishes 2 groups in the nominate subgenus : the *fulleri* group with palpal tarsal setation 4B, and the *humsdeni* group with 4B.S. Seven *Schoutedenichia* species are reported here from India, including a new combination and 2 species new to science. They are all placed in the nominate subgenus.

144. *Schoutedenichia* (*Schoutedenichia*) *capillata* (Radford) new combination

Ascoschoengastia capillata Radford, 1953a, 235; Audy, 1954b, 155.

Redescription of species : Larva.

Idiosoma : Measurements not reported. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, measuring 30; 74 dorsal idiosomal setae, measuring 20, arranged : 12-4-10-12-12-8-8-4-4; 2 pairs of sternal setae; approximately 60 ventral setae; total idiosomal setae approximately 142.

Gnathosoma : Palpal setal formula B/B/NNN/4B.S(?); palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Squat, rectangular scutum with anterior margin shallowly biconcave; lateral margins with medial concavity; posterior margin shallowly biconvex; AM base slightly posterior to or level with AL bases; PL setae extrascutal; PL>AL=AM; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with fine setules. Scutal measurements of unique holotype after original description : AW 56; PW 60; SB 30; ASB 22; PSB 8; AP 30; AM 20; AL 20; PL 30; sens. 42x-.

Legs : Legs all 7-segmented; coxae I-III unisetose. Number of ordinary and sensory setae, and leg measurements not reported.

Type data : Holotype, MADHYA PRADESH, Jabalpur District, Jabalpur (= Jubbulpore), ex *Rattus* sp., IV.1947, S.L. Kalra, coll.

Type depository : Holotype in Radford's collection.

Remarks : The above redescription is based only on the literature. The sketchy original description does not record the diagnostic characters necessary to decide its precise taxonomic status. The scutal description and illustrations, however, suggest a transfer to the genus *Schoutedenichia*, in the nominate subgenus. *S. capillata* is close to *S. nagpurensis* Srivastva and Wattal, 1975a, from which it may be distinguished in having ventral palpal tibial seta nude (barbed in *S. nagpurensis*), narrower SB (measuring 48 in *S. nagpurensis*), and in lacking cuticular striations of muscular attachments adjacent to coxa I (present in *S. nagpurensis*). As the PL setae are extrascutal, the PSB and AP measurements reported in the original description need clarification.

145. *Schoutedenichia (Schoutedenichia) gangutriani* new species
(Fig. 123)

Schoutedenichia sp. A Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 456-457 x 311-344 in engorged specimens. Eyes 2/2, on ocular plate. Two pairs of humeral setae, measuring 31-36; 40-44 dorsal idiosomal setae, measuring 21-29, arrangement commencing : 8-8, the rest irregular; 2 pairs of sternal setae, anterior 24-26, posterior 25-27; 16-20 preanal setae, 17-19; 12-18 postanal setae, 22-31; total idiosomal setae 80-88. Humeral, dorsal and postanal setae inserted on circular sclerotized plates, 4-7 diameter, other idiosomal setae free on cuticle.

Gnathosoma : Palpal setal formula B/B/NNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade (25) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base level with AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with coarse setules; PW/SD = 2.20-2.44. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 58 (63, 55-70); PW 81 (91, 81-111); SB 42 (46, 42-53); ASB 22 (22, 19-25); PSB 14 (16, 14-17); AP 34 (38, 34-47); AM 27 (25, 22-31); AL 27 (24, 22-27); PL 38 (34, 29-38); sens. 38x13 (38x13, 37-38 x 12-15).

Legs : All 7-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 679-751. Leg I : 235-261; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (62x18) 20B, tarsala (14-15), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 206-228; coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (53x16) 15B, tarsala (16-18), microtarsala, pretarsala. Leg III : 238-262; coxa 1B (rarely 2B); trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B; tarsus (67x14) 14B.

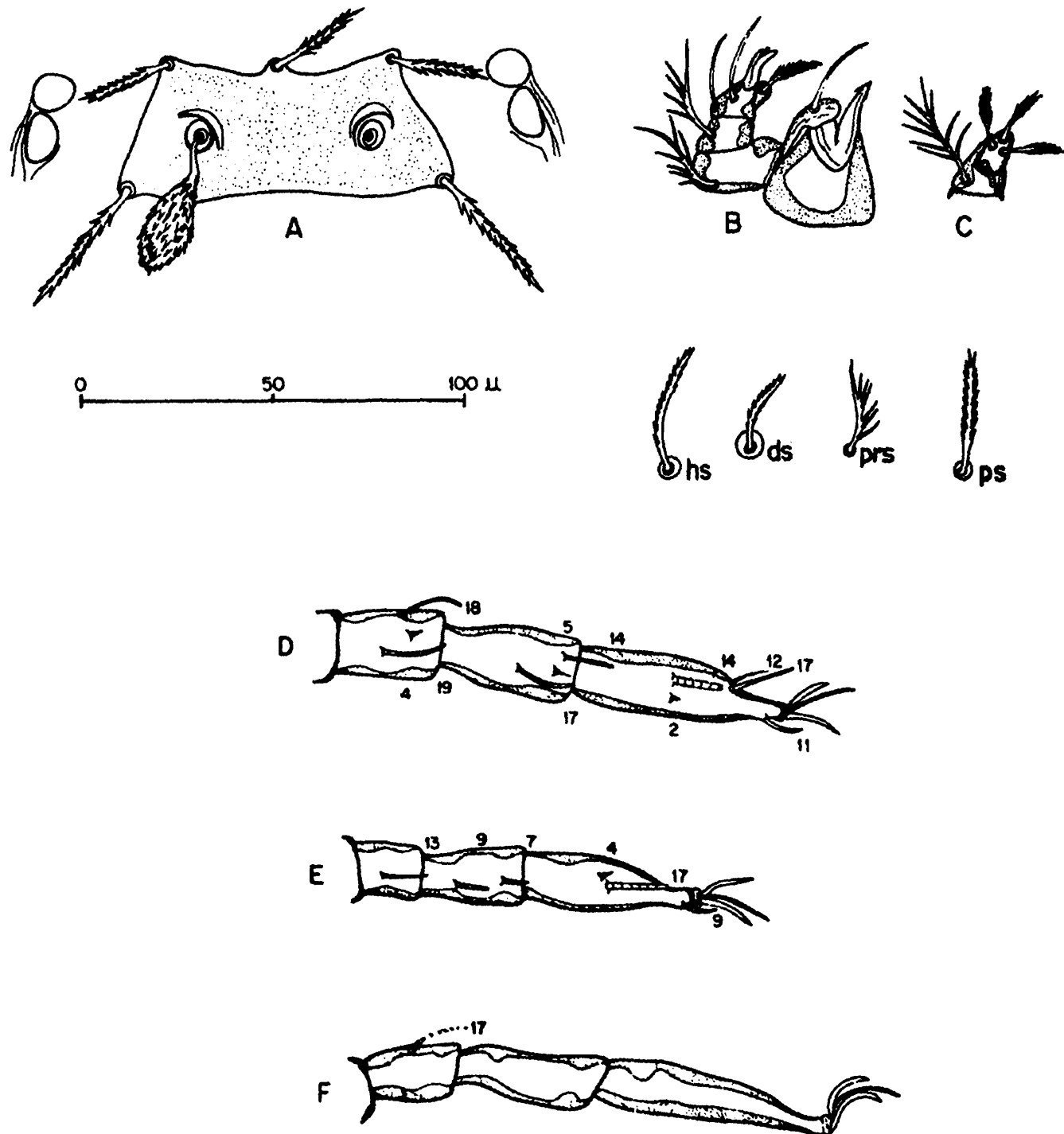


Fig. 123. *Schoutedenichia gangutriani* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

Type data : Holotype (NIV A74775.4) and 3 paratypes, UTTARANCHAL, Chamoli District, Chamoli, 1100-1500m, ex 2 *Rattus rattus gangutrianus*, 26.V.1967, NIV, coll.; 3 paratypes, same data, but Karnaprayag, 750-1100m, taken 14.V.1967.

Additional records : 4 records of collections in the Himalayan region by NIV field teams : HIMACHAL PRADESH, Simla District, Nalagarh, 500-600m, 1 ex *Suncus murinus*, 9.IV.1969. UTTARANCHAL, Pauri Garhwal District, Rudraprayag, 600-900m, 5 ex 2 *R. r. gangutrianus*, 18, 21.V.1967; 3, same data, but Tehri District, Ghansali, 900-1100m, taken 21.V.1969.

Remarks : *S. gangutriani* resembles *S. schalleri* Mitchell and Nadchatram 1966, from which it may be separated in having PL>AM>AL (AM>PL>AL in *S. schalleri*), fewer body setae (numbering 114-130 in *S. schalleri*), and coxa III usually 1B (2B in *S. schalleri*). The species name is based on the type host.

146. *Schoutedenichia* (*Schoutedenichia*) *goffi* new species
(Fig. 124)

Ascoschoengastia (*Ascoschoengastia*) sp. 2 (indet.) : Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 20.

Description of species : Larva.

Idiosoma : Measuring 222-407 x 167-232 in partially engorged to engorged specimens. Eyes 2/2, subequal, on ocular plate. One pair of humeral setae, measuring 29-32; 40 dorsal idiosomal setae, measuring 28-37, arranged : 8-8-8-6-4-4-2; 2 pairs of sternal setae, anterior 32-36, posterior 20-25; 16-24 preanal setae, 18-20; 12-18 postanal setae, 23-25; total idiosomal setae 74-88.

Gnathosoma : Palpal setal formula B/B/NNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade (28) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate with anterior margin shallowly biconcave; posterior margin biconvex with deep median indentation; AM base slightly anterior to or level with AL bases; SB anterior to level of PL bases; AL setae long, plumose; AL>PL>AM; sensillary bases with anteromedial cuticular ridge; sensillae globose, head with fine setules; PW/SD = 1.55. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 52 (49, 45-52); PW 72 (65, 58-72); SB 30 (28, 26-30); ASB 21 (23, 21+25); PSB 24 (23, 22-26); AP 34 (34, 30-38); AM 19 (20, 19-23); AL 51 (54, 48-58); PL 34 (34, 32-35); sens. 27x18 (27x18, 25-28 x 17-18).

Legs : Similar to *S. gangutriani* n. sp. in the number of ordinary and sensory setae; but, coxa III 4B (rarely 5B). Measurements as follows : Ip = 728-764. Leg I : 249-268; tarsus (58x19), tarsala (11-14). Leg II : 218-233; tarsus (48x17), tarsala (14-16). Leg III : 254-267; tarsus (64x13).

Type data : Holotype (NIV A95595.1) and 1 paratype, MAHARASHTRA, Pune District,

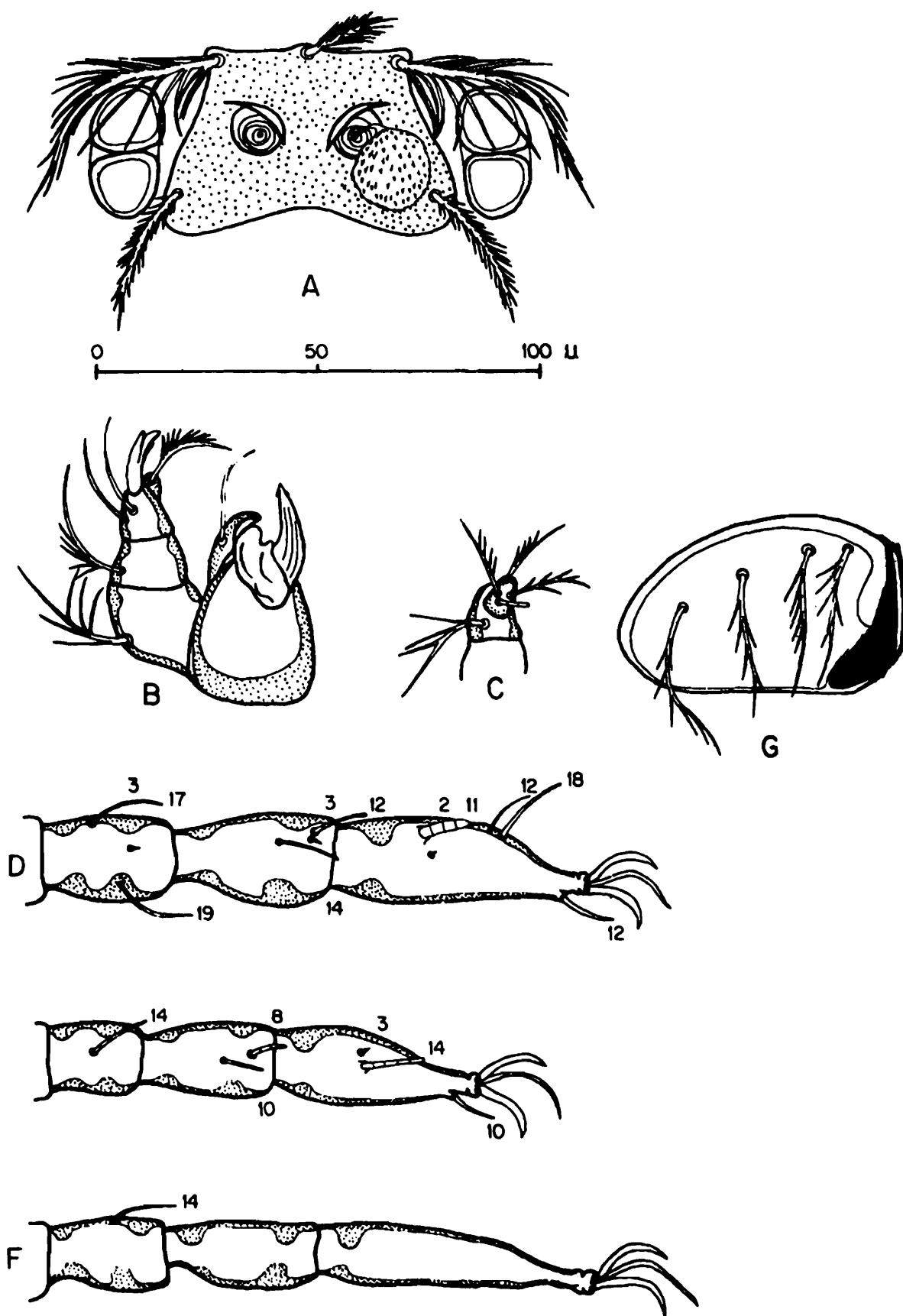


Fig. 124. *Schoutedenichia goffi* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Bhor, Shirgaon, 850m, ex *Suncus murinus*, 20.V.1971, S.M. Kulkarni, coll.; 7 paratypes, same data, but ex 2 *S. murinus*, taken 21.V.1970.

Additional records : 11, same data as holotype, but Sinhgarh, Atkarwadi, 650m, ex 2 *S. murinus*, taken 9.V.1970 and 10.III.1971.

Remarks : *S. goffi* resembles *S. montchadskyi* Muljarskaja, 1971, but differs in having a larger number of body setae (50 in *S. montchadskyi*), coxa III 4B (3B in *S. montchadskyi*), and AL setae plumose (palmate in *S. montchadskyi*). This species is named in honour of Dr. Lee Goff, Chair of the Forensic Sciences Program, Chaminade University of Honolulu and Emeritus Professor, Department of Entomology, University of Hawaii at Manoa, Honolulu, USA, in gratitude and recognition of his outstanding contribution to modern acarology and to forensic entomology.

147. *Schoutedenichia (Schoutedenichia) jubbulporensis* (Womersley)

Trombicula jubbulporensis Womersley, 1952, 119.

Schoutedenechia jubbulporensis, Audy, 1956c, 84; Womersley and Audy, 1957, 283; Vercammen-Grandjean, 1958, 61; Domrow, 1962a, 357; Mitchell and Nadchatram, 1966, 73; Prasad, 1974, 90; Srivastva and Wattal, 1975a, 155.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes not reported. One pair of humeral setae; 36 dorsal idiosomal setae, measuring 30, arranged : 8-6-6-6-6-4 (Vercammen-Grandjean, 1958 : 42, arranged : 8-6-6-6-6-6-4); 2 pairs of sternal setae; number of preanal and postanal setae not reported.

Gnathosoma : Palpal setal formula B/B/NNB/4B.S; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Anterior margin shallowly biconcave; posterior margin biconvex; AM base level with AL bases; SB anterior to level of PL bases; PL > AM > AL; sensillae missing in holotype; PW/SD = 2.18. Scutal measurements of unique holotype after original description : AW 56; PW 87; SB 45; ASB 28; PSB 12; AP 50; AM 25; AL 22; PL 50; sens. -.

Legs : Similar to *S. gangutriani* n. sp. in the number of sensory setae. Number of ordinary setae not recorded, but coxa I-III unisetose. Measurements not reported.

Type data : Holotype, MADHYA PRADESH, Jabalpur District, Jabalpur (= Jubbulpore), ex 'rat', IV.1947, S.L. Kalra, coll.

Type depository : Holotype in SAM.

Remarks : The above redescription is based only on the literature. Womersley (1952) described *Trombicula jubbulporensis* from a unique specimen that has inadvertently been

damaged. Audy (1956c) transferred this species to genus *Schoutedenichia*, confirming the absence of tibiala III. Vercammen-Grandjean (1958) has detailed some important palpal and leg characters, which, he claims, are based on the description and illustration given by Womersley. The diagnostic features presently known are sufficient to confirm the placement of this species in the nominate subgenus of genus *Schoutedenichia*, but not for an understanding of the species and its relationship to other members of the group. The species name is based on the type locality.

148. *Schoutedenichia (Schoutedenichia) nagpurensis* Srivastva and Wattal
(Fig. 125)

Schoutedenichia nagpurensis Srivastva and Wattal, 1975a, 152; 1975b, 318.

Ascoschoengastia (Ascoschoengastia) sp. 1 (indet.) : Kulkarni *et al.*, 1979, 10; Kulkarni, 1979, 20.

Redescription of species : Larva.

Idiosoma : Measuring 245-362 x 232-290 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, measuring 42-48; 60-72 dorsal idiosomal setae, measuring 29-36, irregularly arranged, arrangement commencing : (6-7)-(2-3)-(9-10)-(2-4); 2 pairs of sternal setae, anterior 35-39, posterior 34-39; 22-26 preanal setae, 22-28; 26-36 postanal setae, 27-41; total idiosomal setae 116-140 (Original description : 80-86 dorsal idiosomal setae; 72-78 ventral setae; total idiosomal setae 160-172).

Gnathosoma : Palpal setal formula B/B/NNB/4B.S; palpal claw 3-pronged; galeala N; cheliceral blade (26-30) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base slightly anterior to level of AL bases; PL setae extrascutal; PL>AL=AM; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with fine setules. Scutal measurements of holotype followed by means and ranges of 16 type specimens in parentheses after original description : AW 72 (64, 55-73); PW 109 (100, 80-125); SB 54 (48, 43-55); ASB 27 (28, 27-30); PSB 12 (13, 10-15); AP 44 (43, 34-52); AM 24 (22, 20-25); AL 25 (23, 20-25); PL 40 (38, 35-42); sens. 38 (40, -). Scutal measurements giving means and ranges of 10 NIV specimens : AW 60, 55-69; PW 92, 74-107; SB 46, 42-53; ASB 26, 26-28; PSB 13, 11-14; AP 41, 35-47; AM 26, 24-28; AL 27, 24-30; PL 41, 40-43; sens. 39x10, 35-42 x 9-11.

Legs : Similar to *S. gangutriani* n. sp. in the number of ordinary and sensory setae. Srivastva and Wattal (1975a) report a pair of thickly striated chitinized plates on the sternum in front of coxa I. These structures are, rather, cuticular striations of muscular attachments (Goff, personal communication). Measurements as follows : Ip = 738-813. Leg I : 262-290; tarsus (65-70 x 18-21), tarsala (14-16). Leg II : 218-247; tarsus (52-55 x 16-18). tarsala (17-19). Leg III : 258-276; tarsus (66-67 x 14-18).

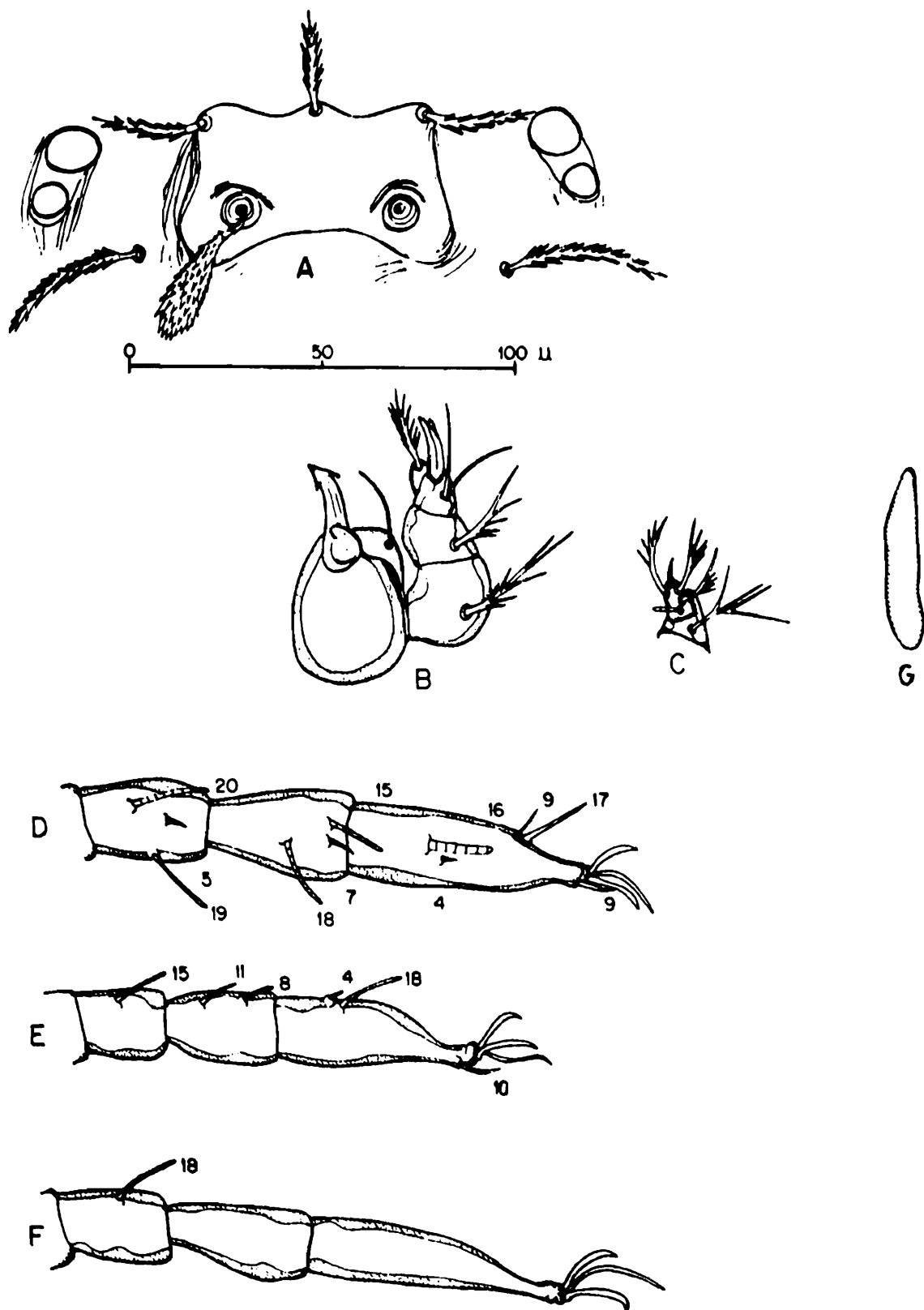


Fig. 125. *Schoutedenichia nagpurensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. cuticular striations of muscular attachments.

Type data : Holotype (NICD-C-63/1), MAHARASHTRA, Nagpur District, Nagpur, ex *Rattus norvegicus*, 24.VI.1967, S.P. Srivastva, coll.; 8 paratypes, same data, but ex *Rattus rattus*, taken 18.VI.1967; 3 paratypes, same data, but taken 23.VI.1967; 12 paratypes, same data, but taken 13.IV.1968; 2 paratypes, same data, but ex *Mus musculus*, taken 16.IV.1968; 20 paratypes, same data, but ex *Suncus murinus*, taken 17.IV.1968; 32 paratypes, same data, but ex *R. rattus*, taken 17.IV.1968.

Type depository : Holotype at NICD; paratypes at NICD and IM.

Additional records : 60 specimens from type locality and hosts, collection dates not reported, S.P. Srivastva, coll.

New records : MAHARASHTRA, Pune District, 74 ex *Millardia kondana*, *Rattus blanfordi*, *Rattus rattus rufescens*, *Mus platythrix* and *S. murinus*, 7.II.1970 to 5.VI.1971, S.M. Kulkarni, coll. RAJASTHAN, Kota and Sirohi Districts, 14 ex *R. r. rufescens*, *Rattus cutchicus rajput*, and *S. murinus*, 30.X, 16.XI.1971, H.N. Kaul, coll. ORISSA, Belangir District, 1 ex *R. cutchicus*, 1.XII.1972, H.N. Kaul, coll.; 1, same data, but ex *R. blanfordi*, taken 2.XII.1972.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Srivastva and Wattal (1975a) consider this species close to *S. jubbulporensis* (Womersley, 1952) and *S. schalleri* Mitchell and Nadchatram, 1966. They distinguish *S. nagpurensis* from the former by the number of body setae, and from the latter by the shape and size of the scutum, number of setae on coxa III and by the combination of other characters. The NIV specimens agree closely with the original description, but the number of body setae is much lower. This species is very close to *S. capillata* (Radford, 1953) and may subsequently prove to be its synonym. The species name is based on the type locality.

149. *Schoutedenichia* (*Schoutedenichia*) *nausheraensis* (Womersley)

Schoengastia (*Ascoschoengastia*) *nausheraensis*, Womersley, 1952, 202.

Schoutedenichia nausheraensis, Audy, 1956c, 84; Womersley and Audy, 1957, 284; Domrow, 1962a, 357; Prasad, 1974, 90.

Schoutedenichia (*Schoutedenichia*) *nausheraensis*, Vercammen-Grandjean, 1958, 59.

Redescription of species : Larva.

Idiosoma : Measurements not reported. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 30; approximately 40 dorsal idiosomal setae, measuring 30, arranged : 10-8-8-2-6-4-2 (Vercammen-Grandjean, 1958 : 50, measuring 18-28, arranged : 10-2-8-2-8-6-6-6-2); 2 pairs of sternal setae; 26-28 ventral setae; total idiosomal setae approximately 72-76 (Vercammen-Grandjean, 1958 : 22 preanal setae, 16; 20 postanal setae, 18; total idiosomal setae 98).

Gnathosoma : Palpal setal formula B/B/NNB/4B.S; palpal claw 3-pronged; galeala N;

cheliceral blade with subapical dorsal tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Lightly punctate with biconcave anterior margin; posterior margin almost straight (Vercammen-Grandjean, 1958 : biconvex); AM base slightly anterior to level of AL bases; SB anterior to level of PL bases; PL>AM>AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate (Vercammen-Grandjean, 1958 : pyriform), head with fine setules; PW/SD = 1.52-1.56. Scutal measurements giving ranges after original description, followed by measurements after Audy (1956c) : AW 48-53, 51; PW 64-70, 68; SB 34-39; 37; ASB 21-22, 22; PSB 21-22, 22; AP 34-36, 34; AM 20 (no variation recorded), 20; AL 20 (no variation recorded), 20; PL 30-32, 30; sens. 36x13 (no variation recorded), 36x-.

Legs : Similar to *S. gangutriani* n. sp. in the number of sensory setae. Number of ordinary setae not reported, but coxa III 3B. Measurements as follows : Ip = 572. Leg I : 195. Leg II : 169. Leg III : 208.

Type data : Holotype and 11 paratypes, JAMMU and KASHMIR, Naoshera, ex 'mouse', 14.V.1949, S.L. Kalra, coll.

Type depository : Not reported.

Remarks : The above redescription is based only on the literature. Audy (1956c) transferred this species to the genus *Schoutedenichia* based on his study of the type specimens. Vercammen-Grandjean (1958) has detailed some important palpal and idiosomal setal characters in his redescription. He reports one pair of humeral setae with 10 setae in the 1st posthumeral row. In the illustration (fig. 28C), however, there are apparently 2 pairs of humeral setae with 8 setae in the 1st posthumeral row. He considers this species close to *S. jubbulporensis* (Womersley, 1952), distinguishing it in having coxa III 3B (1B in *S. jubbulporensis*) and different in scutal measurements. The species name is based on the type locality.

150. *Schoutedenichia (Schoutedenichia) schalleri* Mitchell and Nadchatram
(Fig. 126)

Schoutedenichia schalleri Mitchell and Nadchatram, 1966, 48; Mitchell *et al.*, 1966, 119; Prasad, 1974, 91; Srivastva and Wattal, 1975a, 155.

Redescription of species : Larva.

Idiosoma : Measuring 300-360 x 240-290 in engorged specimens. Eyes 2/2, subequal, on ocular plate. Two pairs of humeral setae, measuring 26-30; 54-60 dorsal idiosomal setae, measuring 17-23, arranged : 8(6)-6(8)-9-2-10+(19-25); 2 pairs of sternal setae, anterior 35, posterior 26; 23-27 preanal setae, 14-18; 28-36 postanal setae, 20-24; total idiosomal setae 114-130. Humeral, dorsal and postanal setae inserted on circular sclerotized plates, 5-8 in diameter; other idiosomal setae free on cuticle.

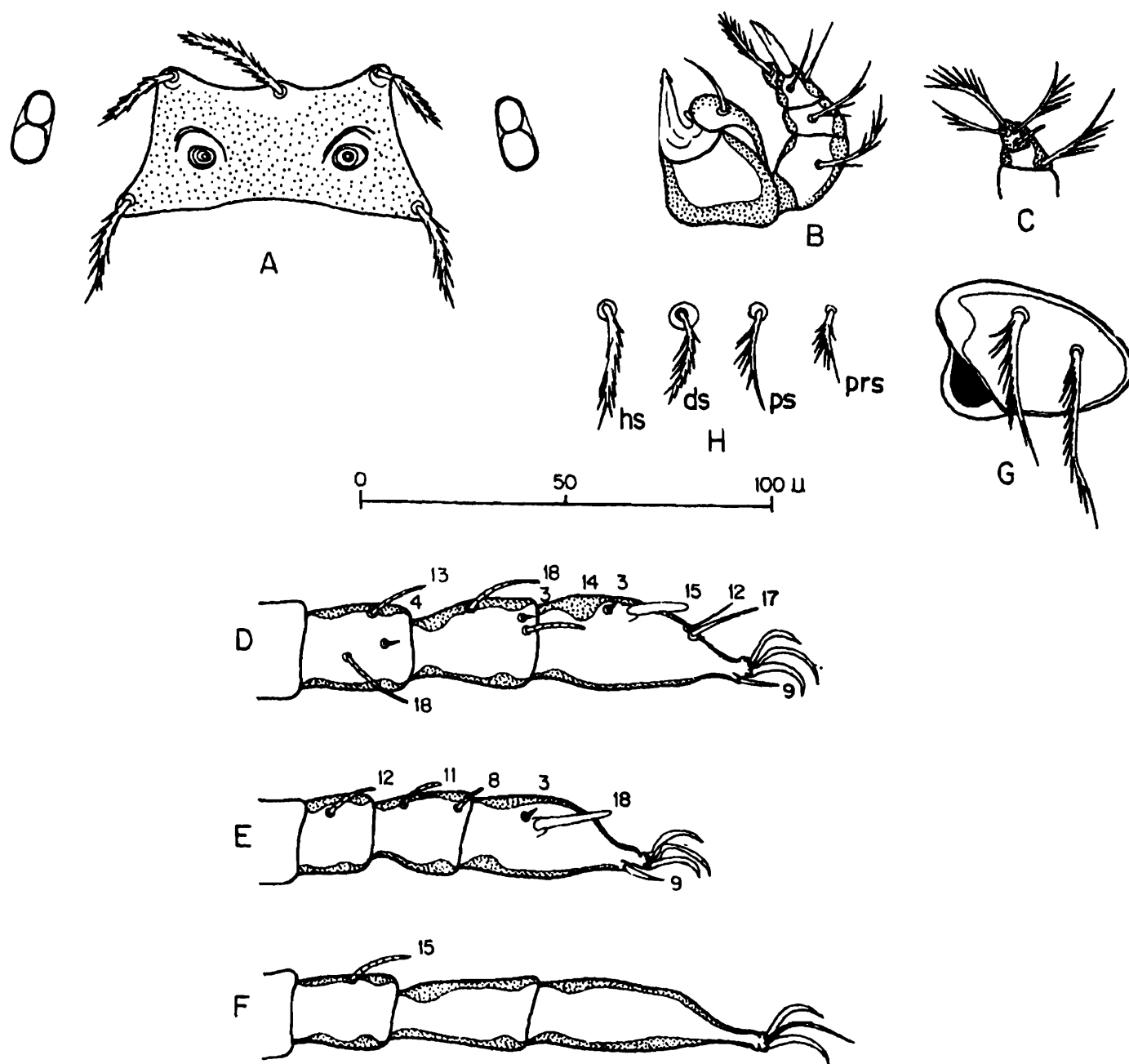


Fig. 126. *Schoutedenichia schalleri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. coxa III; H. selected idiosomal setae.

Gnathosoma : Palpal setal formula B/B/NNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade (24-26) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate with biconcave anterior margin; posterior margin shallowly biconcave; AM base slightly posterior to level of AL bases; SB anterior to level of PL bases; AM>PL>AL; sensillary bases with anteromedial cuticular ridge; sensillae missing in type specimens; PW/SD = 1.78-1.84. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 49 (50, 46-56); PW 71 (73, 68-81); SB 34 (37, 34-41); ASB 23 (23, 23-25); PSB 17 (17, 14-19); AP 35 (36, 32-40); AM 31 (28, 26-31); AL 20 (19, 17-20); PL 25 (23, 21-25); sens. -.

Legs : Similar to *S. gangutriani* n. sp. in the number of ordinary and sensory setae; but, coxa III 3B (2B on right, 3B on left in 1 specimen). Measurements as follows : Ip = 630-670. Leg I : tarsus (46-52 x 18-23), tarsala (15-17). Leg II : tarsus (40-44 x 16-20). Leg III : tarsus (53-57 x 13-18).

Type data : Holotype (B6630), MADHYA PRADESH, Mandla District, Kanha National Park, 540-840m, ex *Suncus stoliczkanus*, 23.XII.1964, J. Spillelt and G.B. Schaller, coll.; 2 paratypes, same data, but taken 27.XII.1964.

Type depository : Holotype in BPBM, paratypes in IMR.

Specimen examined : Holotype on loan from BPBM.

Remarks : The above redescription is based on the literature and study of the holotype. Mitchell and Nadchatram (1966) consider this species close to *S. jubbulporensis* (Womersley, 1952), *S. centralwantunga* (Mo et al., 1959) and *S. angolensis*, Schluger et al., 1960. Domrow (1962a) has synonymized the latter species with *S. centralwantunga*, distinguishing *S. schalleri* by the combination of its characters. They inadvertently report AM>AL>PL, but their standard measurements rightly indicate AM>PL>AL. The species has been named for Dr. George B. Schaller whose collecting efforts in Kanha Park have resulted in several contributions to the knowledge of the ectoparasite fauna of the area.

Genus *Walchiella* Fuller

Walchiella Fuller, 1952, in Wharton and Fuller, 1952, 95; Fuller, 1952, 220; Domrow, 1962f, 105; 1978, 89; Vercammen-Grandjean, 1960, 469; 1968b, 89; Nadchatram and Dohany, 1974, 52.

Euschoengastia (*Walchiella*), Audy, 1954b, 153.

Euschongatia (*Walchiella*), sic! Audy and Domrow, 1957, 121; Womersley and Audy, 1957, 274.

Type species : *Trombicula oudemansi* Walch, 1922, by original designation and monotypy.

Diagnosis : Schoengastiini larvae parasitic on small mammals. Legs 7-7-7 or 7-6-6 segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent.

3 genualae I; tarsus I with supplementary sclerotized bar, microtarsala I on or near proximal bar; mastitarsala III absent. Palpal tarsus 7B.S; palpal claw 2- or 3-pronged; galeala N; cheliceral blade with tricuspid cap and sometimes additional dorsal tooth. Eyes 2/2, usually weak. Scutum subtrapezoidal with simple punctae; AL setae marginal; PL setae usually shortest; SB set wide apart; sensillae clavate, head with setules.

Remarks : Audy and Domrow (1957) describe the origin and clarify the taxonomic status of *Walchiella*, considering it provisionally a subgenus of *Euschoengastia* Ewing, 1938, *sensu lato*. They distinguish 2 species groups on the basis of the leg segmentation. Domrow (1962f), following Vercammen-Grandjean (1960) and Domrow (1960b), accorded *Walchiella* generic status, providing a key to the 9 recognized species. He confirmed the ascription of the genus to Fuller alone as correct. Subsequently, Nadchatram and Lakshana (1965) described a new species distinctive in having PL setae the longest of the scutal setae. Of the 10 *Walchiella* species currently recognized, all from the Asiatic-Pacific region, 2 have been reported from India.

151. *Walchiella oudemansi* (Walch)
(Fig. 127)

Trombicula oudemansi Walch, 1922, 563; Mehta, 1937, 353; Sen and Fletcher, 1962, 513.

Schoengastia (*Schoengastia*) *oudemansi*, Womersley, 1952, 152 (not the chelicer fig. 32C).

Walchiella oudemansi, Fuller, 1952, 221; Wharton and Fuller, 1952, 95; Domrow, 1962f, 105.

Euschoengastia (*Walchiella*) *oudemansi*, Audy, 1954b, 153.

Euschongastia (*Walchiella*) *oudemansi*, sic! Audy and Domrow, 1957, 137; Womersley and Audy, 1957, 275.

Schongastia oudemansi, sic! Prasad, 1974, 89.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes 2/2, subequal, free on cuticle. One pair of humeral setae, measuring 32; 28 dorsal idiosomal setae, measuring 22-27, arranged : 6-6-6-6-4; 2 pairs of sternal setae; 34 preanal setae, 16; 12 postanal setae, 25; total idiosomal setae 80.

Gnathosoma : Palpal setal formula b(N)/b/bbb/7B.S; palpal claw 3-pronged (ventral prong inconspicuous); galeala N; cheliceral blade (32) with 3 widely set recurved teeth and tricuspid cap; cheliceral base with sclerotized posterolateral flange; gnathobase lightly punctate, coxae incompletely fused, bearing a pair of branched setae.

Scutum : Moderately punctate, subtrapezoidal with slightly sinuate anterior margin; posterior margin shallowly biconcave; AM base posterior to level of AL bases; SB anterior to level of PL bases; AM>AL>PL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with conspicuous setules; PW/SD = 1.42-1.54. Scutal measurements giving ranges of

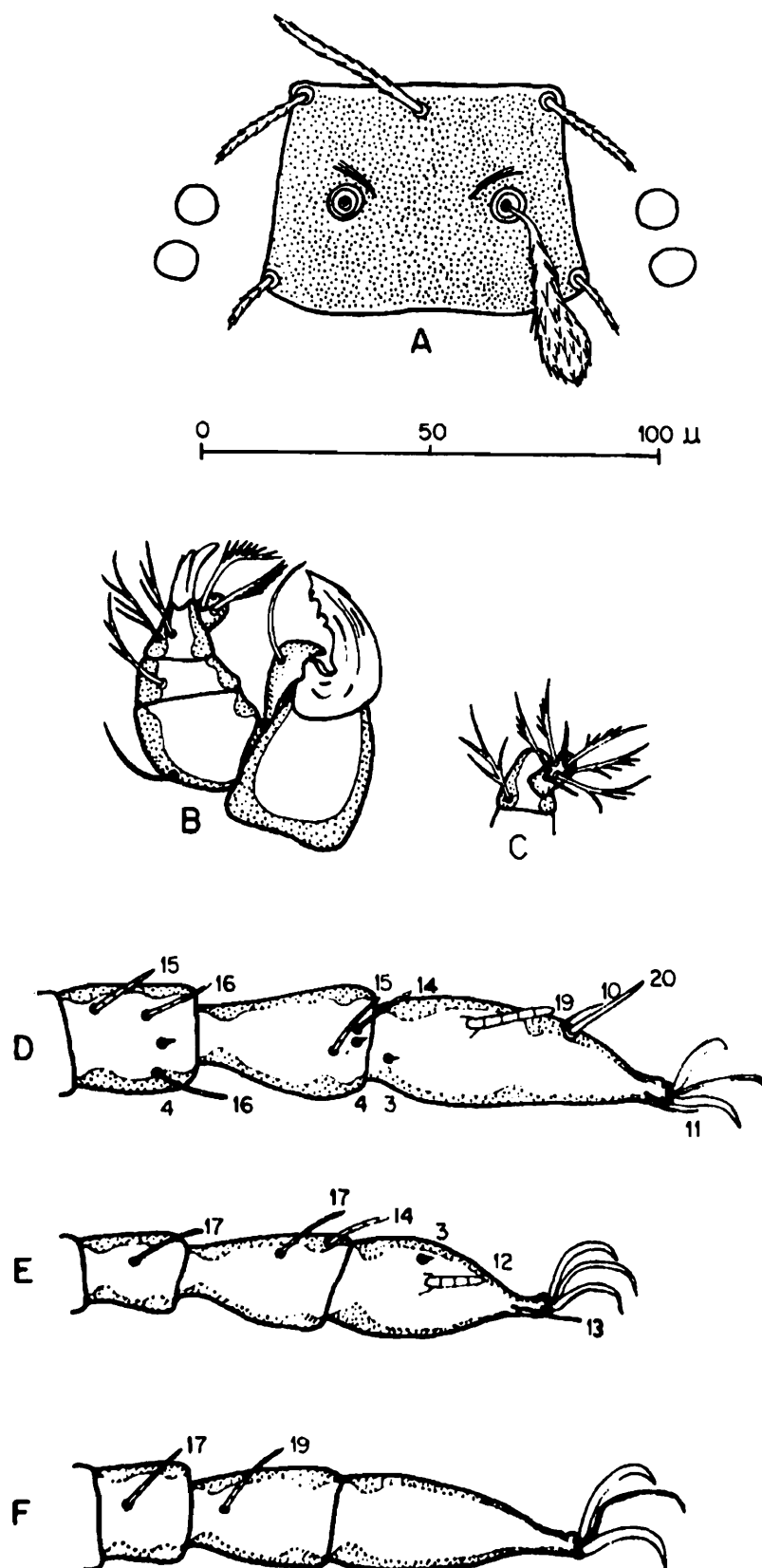


Fig. 127. *Walchiella oudemansi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

25 specimens after Womersley (1952) : AW 48-58; PW 64-74; SB 29-35; ASB 26, no variation recorded; PSB 19-22; AP 32-37; AM 32-35; AL 19-26; PL 13-16; sens. 38x10, only one determination.

Legs : 7-6-6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Measurements recorded as follows : Leg I : coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus with supplementary sclerotized bar (66x22) 22B, tarsala (19), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (42x22) 16B, tarsala (12), microtarsala, pretarsala. Leg III : coxa 1B; trochanter 1B; femur 4B; genu 3B, genuala; tibia 6B, tibiala; tarsus (54x20) 14B.

Type data : Holotype, SUMATRA, Deli ex 'rat', date of collection and collector's name not recorded.

Type depository : Holotype in RMNH.

Additional records : HIMACHAL PRADESH, Simla Hills, Kasauli and Sabathu, ex 'rats', VI.1935 to V.1936, D.R. Mehta, coll.

Material examined : 4 specimens on loan from USNM : 3 from Papua New Guinea, ex *Rattus mardax*, 29.31.IV.1944; 1 specimen from North Borneo, ex *Rattus argentiventer*, 22.I.1963; collectors' names not recorded.

Remarks : The above redescription is based on the literature and study of specimens examined. *W. oudemansi* runs to couplet 5 of the key to *Walchiella* species given by Domrow (1962f), characterized by dentate cheliceral blade. Womersley (1952) has mistakenly illustrated the cheliceral blade of *Walchiella impar* (Gunther, 1939) in fig. 32D, which is without a widely set dorsal row of teeth (Womersley and Audy, 1957). Audy (1954b) has pointed out that *W. oudemansi*, the type species of *Walchiella*, is a dominant chigger on ground-living small mammals in the Malaysian forests. Mehta (1937) has recorded this species from the Simla Hills. He states that this species has been previously reported by Hirst (1915) ex *Rattus rattus* from Calcutta as a new species *Schoengastiella bengalensis*! He further adds that *W. oudemansi* does not appear in large numbers till August and then disappears entirely with the advent of the cold weather. This species has not been encountered in the NIV collections. *W. oudemansi* is reported here from India with some reservation. It appears more plausible that Mehta's record from Simla Hills refers to *S. bengalensis*, although Sen and Fletcher (1962) and Prasad (1974) continue to ascribe the record to *W. oudemansi*. This species has been named in honour of Dr. A.C. Oudemans, a pioneer of modern acarology.

152. *Walchiella lewthwaitei* (Womersley)
(Fig. 128)

Schoengastia (*Schoengastia*) *lewthwaitei* Womersley, 1952, 154.

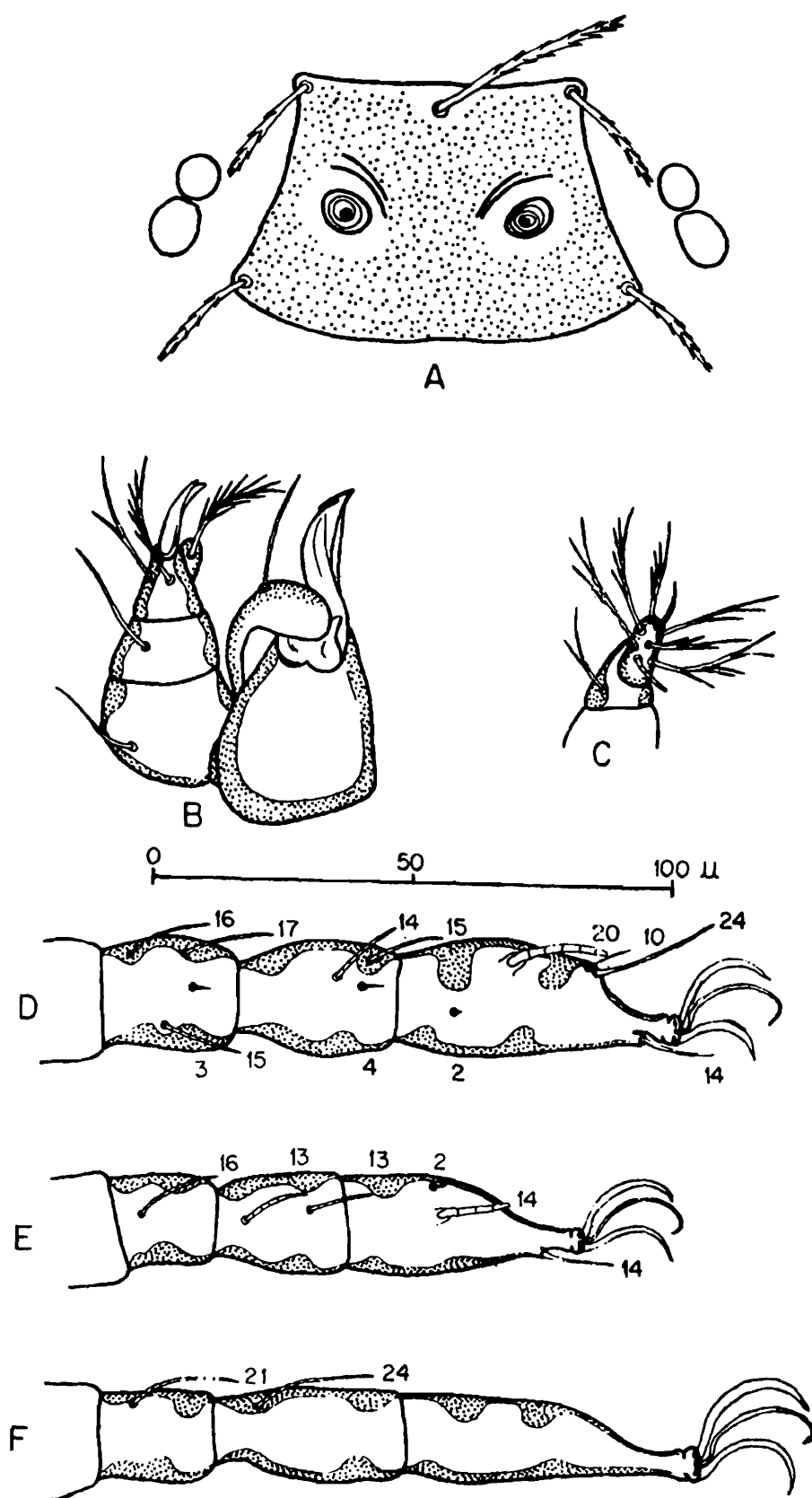


Fig. 128. *Walchiella lewthwaitei*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Schoengastia (*Ascoschoengastia*) *lacunosa* (in part) Womersley, 1952, 198, **misidentification**.

Schongastia lewthwaitei, **sic!** Audy *et al.*, 1953, 27.

Euschongastia (*Walchiella*) *lewthwaitei*, **sic!** Audy and Domrow, 1957, 137; Womersley and Audy, 1957, 275.

Walchiella lewthwaitei, Domrow, 1962f, 106; Vercammen-Grandjean, 1968b, 89.

Euschongastia lewthwaitei, **sic!** Prasad, 1974, 76.

Walchiella sp. A Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 420x324 in engorged specimen. Eyes 2/2, anterior distinct, free on cuticle. One pair of humeral setae, measuring 35-37; 36 dorsal idiosomal setae, measuring 27-40, arranged : 6-6-6-8-6-4 (Original description : approximately 40, measuring 45, arranged : 6-6-6-6-6-4-4-2; Domrow, 1962f : more than 38 dorsal body setae); 2 pairs of sternal setae, anterior 26-27; posterior 20-25; 34-42 preanal setae, 16; 6-12 postanal setae, 20-30 (Original description : approximately 46 ventral setae); total idiosomal setae 82-96 (Original description : approximately 92).

Gnathosoma : Palpal setal formula N(b)/N(b)/Bbb (Womersley and Audy, 1957 : B/N/BbB; Domrow (1962) in illustrations (figs. 49, 53) : N/b/Bbb) / 7B.S; palpal claw 3-pronged (appearing 2-pronged in GOA NIV specimen); galeala N(b); cheliceral blade (36) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subtrapezoidal with anterior margin shallowly biconcave; posterior margin shallowly biconvex; AM base posterior to level of AL bases; SB anterior to level of PL bases; AM>AL>PL (Original description : scutal setae subequal); sensillary bases with anteromedial cuticular ridge; sensillae not described earlier, missing in NIV specimens; PW/SD = 1.38-1.52. Scutal measurements giving ranges of holotype and 3 paratypes after original description, followed by measurements of 2 paratypes in parentheses after Domrow (1962f) : AW 68-70 (70, 67); PW 80-93 (81, 79); SB 38 (39, 37); ASB 32-38 (32, 33); PSB 22 (23-24); AP 42-48 (43-47); AM 32-35 (43, 46); AL 35 (35, 38); PL 35-38 (38, 36); sens. -. Scutal measurements of 2 NIV specimens : AW 52, 59; PW 73, 74; SB 36, 32; ASB 25, 29; PSB 22, 18; AP 40, 38; AM 45, 39; AL 23, 24; PL 17, 24; sens. -.

Legs : 7-6-6-segmented, similar to *W. oudemansi* (Walch, 1922) in the number of ordinary and sensory setae. Measurements recorded as follows : Ip = 630-693 (Original description : 817). Leg I : 217-231 (268); tarsus (54x23) with supplementary sclerotized bar 22B, tarsala (17-20). Leg II : 192-215 (241); tarsus (46x20), tarsala (14-15). Leg III : 221-247 (308); tarsus (58x16).

Type data : Holotype and 2 paratypes, MANIPUR, Palei, Tamu Road, 48km South of Imphal, ex *Tupaia glis belangeri*, 24.XI.1945, STRU, coll.; 2 paratypes, same data, but ex *Hadromys humei*.

Type depository : Holotype in LSTHM; 2 paratypes in SAM.

New records : WEST BENGAL, Jalpaiguri District, Chunabhatti, 150-200m, 1 ex *Rattus rattus brunneusculus*, 27.III.1969, NIV, coll. GOA, Mollem, 1 ex *Rattus blanfordi*, 27.VIII.1983, S. Fernandes, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. *W. lewthwaitei* runs to couplet 7 of the key to *Walchiella* species given by Domrow (1962f) with cheliceral blade simple, and > 38 dorsal body setae inserted directly on the cuticle. The NIV specimens, however, have 36 dorsal body setae and the standard measurements are proportionately lower than those reported for the type specimens. Womersley (1952) considers *W. lewthwaitei* closely similar to *W. lacunosa* (Gater, 1932) in scutal shape, and to *W. oudemansi* (Walch, 1922) in having legs 7-6-6-segmented and cheliceral blade serrate. In the NIV specimens, however, the cheliceral blade is simple, with only tricuspid cap, as reported by Domrow (1962f). Womersley distinguishes *W. lewthwaitei* from *W. oudemansi* by the standard data, especially by the difference in length of PL setae (measuring 13-16 in *W. oudemansi*). Audy and Womersley (1957) draw attention to a description of this species mistakenly ascribed to *W. lacunosa* by Womersley (1952). They reiterate the caution of Audy and Domrow (1957) that confusion must be avoided between this species and *Gahrlepieia* (*Walchia*) *lewthwaitei* (Gater, 1932). The species has been named to honour Dr. R. Lewthwaite, a former Director of the Institute for Medical Research, Kuala Lumpur, who pioneered the study of the Malaysian trombiculid fauna.

Tribe **Gahrlepieini** Nadchatram and Dohany, 1974

Genus **Gahrlepieia** Oudemans

Gahrlepieia Oudemans, 1912, 273 (**Nomen novum** for *Typhlothrombium* Oudemans, 1910b); Ewing, 1945, 348; Womersley and Heaslip, 1943, 72, **in part**; Womersley, 1952, 19, **in part**; Radford, 1946b, 247; Wharton and Fuller, 1952, 93; Traub and Morrow, 1955, 1; 1957, 169, **in part**; Vercammen-Grandjean, 1968b, 115; Vercammen-Grandjean *et al.*, 1973, 58; Vercammen-Grandjean and Langston, 1976, 54; Nadchatram and Dohany, 1974, 47, **in part**; Kolebinova and Vercammen-Grandjean, 1978, 119; Fernandes *et al.*, 1988, 108; Nadchatram, 1989, 3; Nadchatram and Fernandes, 1989, 17.

Gateria Ewing, 1938, 291; Radford, 1946b, 247; Traub and Morrow, 1955, 2, **synonymy**.

Type species : *Typhlothrombium nanus* Oudemans, 1910, by monotypy and original designation.

Diagnosis : *Gahrlepieini* larvae parasitic on ground mammals. Shape oval, with a tendency to constriction just posterior to coxa III. Palpal tarsus 4B, 4B.S, 5B or 6B; palpal claw 3-pronged; cheliceral blade with tricuspid cap; galeala N, rarely f. Scutum lacking AM seta; small, shield-shaped to large tongue-shaped, almost covering idiosoma in unengorged larva; posterior margin extending beyond level of PL setae proper to include 2 or more pairs of dorsal idiosomal setae on scutum; scutal punctae simple to scrobiculate; sensillae expanded, fusiform to globose. Eyes 2/2, 1/1, or rarely absent. Legs 7-6-6 segmented; onychotriches absent; 2 genualae I, genuala II and III; tibiala III and mastisetae absent.

Remarks : There is much confusion in the literature regarding the taxonomic status of *Schoengastiella* Hirst, 1915, and *Walchia* Ewing, 1931. Following Fernandes *et al.* (1988), Nadchatram (1989), and Nadchatram and Fernandes (1989), these taxa are treated here as independent genera. Kolebinova and Vercammen-Grandjean (1978) have redefined the earlier proposals of Vercammen-Grandjean (1968b) and Vercammen-Grandjean *et al.* (1973), dividing the genus *Gahrliopia* into 6 subgenera : 1. *Gahrliopia* with 10 known species, having palpotarsal setation 5B - recorded only from the Ethiopian region. 2. *Gateria* Ewing, 1938, with 25 known species, having palpotarsal setation 4B, and legs I and III subequal - recorded primarily from the Oriental region. 3. *Scrobiculata* Vercammen-Grandjean, 1968b, with palpotarsal setation 4B or 4B.S, scrobiculate scutum, and leg III>I (over 10% longer) - recorded from the Oriental region. 4. *Lecythaspida* Vercammen-Grandjean, 1968, with 1 known species, having palpotarsal setation 6B, ampulliform scutum, and leg III>I (over 10% longer) - recorded from the Oriental region. 5. *Giroudia* Jadin and Vercammen-Grandjean, 1952, with palpotarsal setation 5B and festooned prolongation of the tricuspid cap of cheliceral blade - recorded only from the Ethiopian region. 6. *Ozosetialla* Kolebinova and Vercammen-Grandjean, 1978, with 1 known species, having palpotarsal setation 6B and porous scutum - recorded from the Ethiopian region. 18 Indian species are reported here in the genus *Gahrliopia*, including 9 new species. This study reveals the inadequacy of the artificial definition of the proposed subgenera *Gateria* and *Scrobiculata*. Hence, the above subgeneric classification is not followed here. The abundance of the *Gahrliopia*, *Schoengastiella* and *Walchia* species recorded from India confirm the hypothesis of Audy (1954b), Traub and Morrow (1955), and Nadchatram (1989) that the Gahrliopiini have attained their maximum development in the Oriental region.

153. *Gahrliopia armata* new species
(Fig. 129)

Description of species : Larva.

Idiosoma : Measuring 390 x 285 in partially engorged holotype. Eyes 2/2, anterior larger, on ocular plate. Two pairs of stout, spicate humeral setae, measuring 44-50; 50-64 dorsal idiosomal setae, similar to humeral setae, measuring 40-49, anterior median setae longer, arrangement variable, in holotype : 6-10-2-4-2-12-7-7-6-4-2-2; 2 pairs of sternal setae, ciliated, anterior 27-36; posterior 25-27; 22-32 preanal setae, ciliated, 17-22; 22-28 postanal setae, similar to humeral setae, 31-42; total idiosomal setae 102-132 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (34) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with shallowly concave anterior margin; posterior margin broadly rounded; SB anterior to level of PL bases; 2 pairs of usurped setae

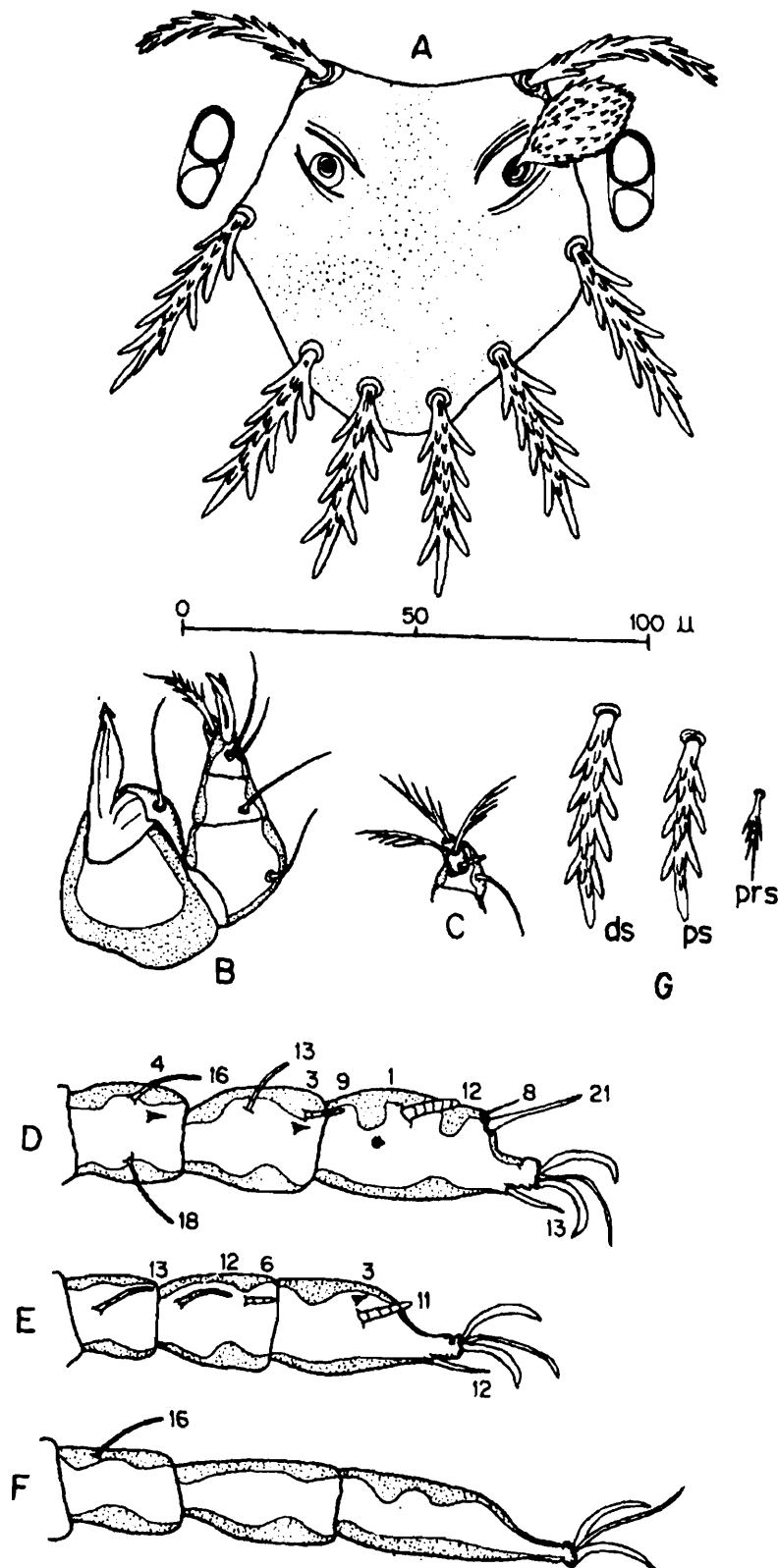


Fig. 129. *Gahrlipeia armata* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

posterior to PL setae, anterior pair at posterolateral margins of scutum, posterior pair at posterior angle of scutum; AL setae with heavy barbules, PL and usurped setae similar to humeral setae; $PL > AL$; sensillae clavate, head with setules; $PW/SD = 0.89-0.95$. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 45 (46, 43-50); PW 78 (78, 72-84); PPW1 46 (48, 37-60); PPW2 18 (19, 15-24); SB 44 (44, 42-48); ASB 22 (22, 21-22); PSB 61 (62, 58-68); AP 37 (38, 36-42); AL 43 (44, 41-46); PL 45 (49, 45-54); sens. 33×15 (32×15 , $32-36 \times 14-16$).

Legs : Legs 7-6-6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. $Ip = 642-674$. Leg I : 220-231; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus (47×22) 20B, tarsala (12-14), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 190-202; coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (40×21) 15B, tarsala (11-14), microtarsala, pretarsala. Leg III : 228-247; coxa 1B; trochanter 1B; femur 5B; genu 3B, genuala; tibia 6B; tarsus (52×15) 15B.

Type data : Holotype (NIV A99338) and 2 paratypes, MAHARASHTRA, Pune District, Bhor, Shirgaon, 850m, ex 2 *Suncus murinus*, 24.IX.1971, S.M. Kulkarni, coll.; 1 paratype, same data, but taken 24.XI.1971; 2 paratypes, same data, but Hirdoshi, 680m, taken 21.VIII.1971; 2 paratypes, same data, but Nighudgarh, 620m, ex 2 *S. murinus*, taken 18.XII.1970 and 19.II.1971; 3 paratypes, same data, but Sinhgarh, Atkarwadi, 650m, taken 12.XI.1970.

Additional records : MAHARASHTRA, Pune District, 8 ex 7 *S. murinus*, 7.II.1970 to 26.II.1971, S.M. Kulkarni, coll.; 1, same data, but ex *Mus booduga*, taken 12.XI.1970.

Remarks : *G. armata* may easily be separated from the remaining species in the subgenus by the stout, spicate scutal and idiosomal setae, and the subpentagonal scutum. *G. armata* is similar to *G. cetrata* Gater, 1932, *G. elbeli* Traub and Morrow, 1955, and *G. yangchenensis* Chen and Hsu, 1957, in having micropunctate scutum with 4 usurped setae. *G. armata* may be separated from these 3 species in having $PSB < 70$ (measuring 166 in *G. cetrata*, 114 in *G. elbeli*, and 109 in *G. yangchenensis*), 50-64 dorsal idiosomal setae (numbering 30 in *G. cetrata*, 20-28 in *G. elbeli*, and 30-32 in *G. yangchenensis*), and palpal femoral seta N (B in other 3 species). The species name is based on the form of the modified scutal and idiosomal setae.

154. *Gahrlepiea armigera* new species (Fig. 130)

Description of species : Larva.

Idiosoma : Measuring 345×260 in partially engorged holotype. Eyes 2/2, anterior larger, free on cuticle. Two pairs of humeral setae with heavy barbules, measuring 31-38; 60-66 dorsal idiosomal setae, similar to humeral setae, measuring 30-39, anterior median setae

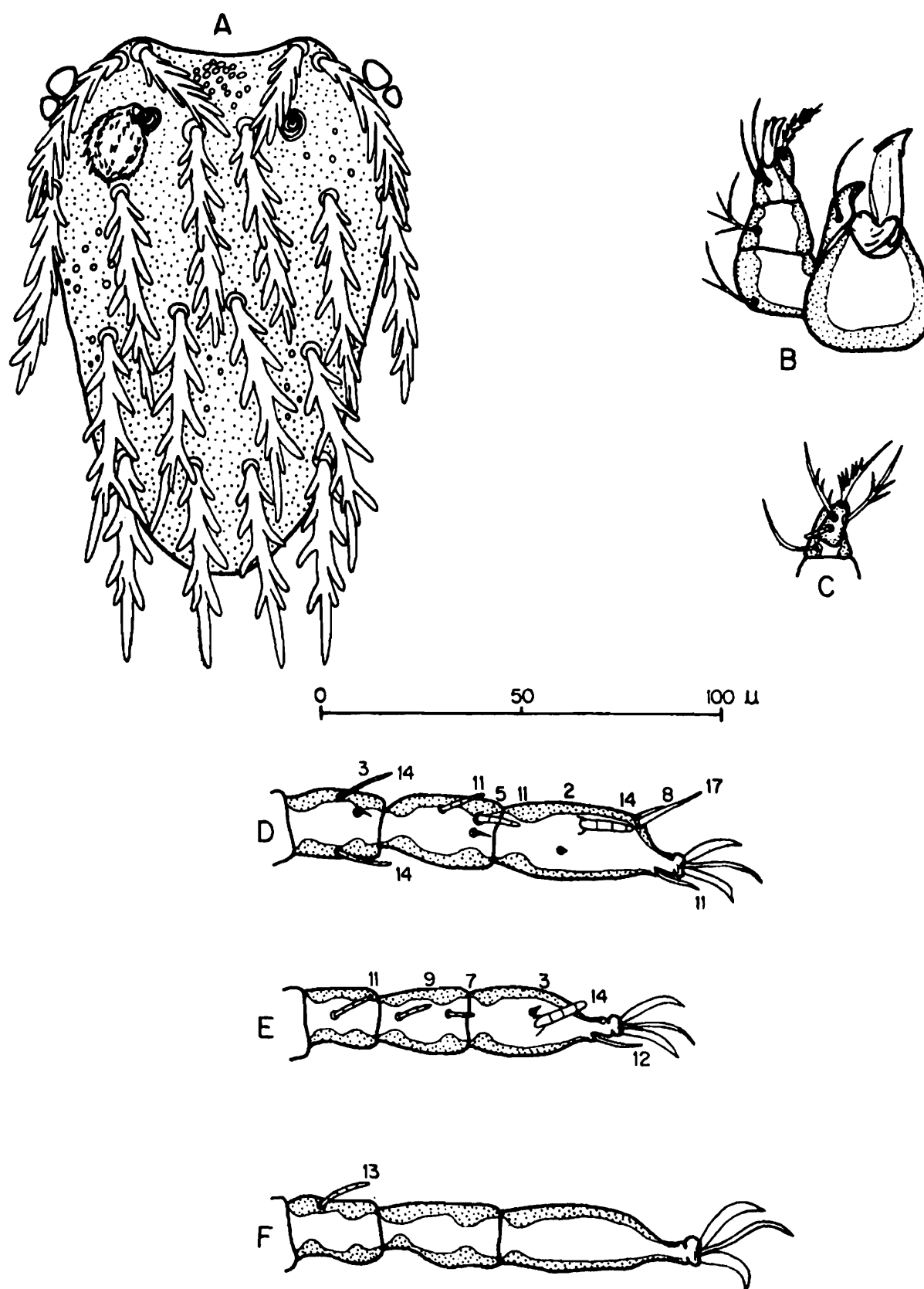


Fig. 130. *Gahrliepia armigera* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

longer, arrangement variable, in holotype : 6-6-6-4-10-8-6-6-6-2; 2 pairs of sternal setae, ciliated, anterior 25-30, posterior 23-25; 34-42 preanal setae, ciliated, 18-20; 26-34 postanal setae, with heavy barbules, 26-33; total idiosomal setae (excluding usurped scutal setae) 130-148.

Gnathosoma : Palpal setal formula b(N)/b/NNN(f)/4B; palpal claw 3-pronged; galeala N (rarely f); cheliceral blade (32) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, tongue-shaped, with oval scrobiculae concentrated below mid-anterior margin, sparsely scattered posterior to bases of 2nd row of usurped setae; anterior margin shallowly concave, posterior margin deeply produced; AL setae displaced from anterolateral angles by the adjacent PL setae; SB posterior to level of PL bases; 8 pairs of usurped setae on scutum (17 in paratype NIV A99034.4), measuring 53-58, arranged 2-4-4-4, the 1st pair inserted medially at level of SB; scutum broadest at level of 2nd row of usurped setae; AL setae with heavy barbules; PL setae with heavy barbules near base, distally spicate; usurped setae stout, spicate; sensillae subglobose, head with setules; PW/SD = 0.40-0.45. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 38 (39, 38-43); PW 52 (54, 52-58); PPW1 85 (87, 83-89); SB 37 (37, 35-38); ASB 21 (20, 20-21); PSB 110 (109, 106-113); AP 7 (8, 7-9); AL 33 (33, 29-36); PL 49 (50, 48-55); sens. 26x15 (28x15, 26-29 x 14-15).

Legs : Similar to *G. armata* n.sp. in the number of ordinary and sensory setae. Measurements as follows : lp = 630-662. Leg I : 215-225; tarsus (47x20), tarsala (14-15). Leg II : 184-197; tarsus (37x17), tarsala (13-15). Leg III : 223-241; tarsus (50x15).

Type data : Holotype (NIV A99034.2) and 5 paratypes, MAHARASHTRA, Pune District, Sinhgarh, Atkarwadi, 650m, ex *Suncus murinus*, 5.VI.1970, S.M. Kulkarni, coll.; 1 paratype, same data, but taken 18.IX.1970; 1 paratype, same data, but Sinhgarh, 1270m, taken 9.VII.1970.

Remarks : *G. armigera* is similar to *G. armata* n.sp. in having stout, spicate usurped setae on scutum. It may easily be distinguished from *G. armata* in having PL setae anteriorly displaced (posterior to SB in *G. armata*), scutum with oval scrobiculae and minute punctae (only minute punctae in *G. armata*), posterior margin deeply produced, PSB 106-113 (measuring 58-68 in *G. armata*), and 8 pairs of usurped setae on scutum (2 pairs in *G. armata*). *G. armigera* will run to couplet 14 of the key to species of the subgenus *Gahrlepiea* given by Traub and Morrow (1957) along with *G. picta* Traub and Morrow, 1955, and *G. evansi* Traub and Morrow, 1955. *G. armigera* may easily be separated from these 2 species by the stout, spicate usurped setae on scutum (slender, ciliated in other 2 species), anterior displacement of PL setae (posterior to SB in other 2 species), and the number of usurped setae on scutum (8 in *G. picta*, 17-20 in *G. evansi*).

The modification of the usurped scutal setae, independently of the dorsal idiosomal setae,

is extremely interesting (Audy, 1954d). It suggests that the 'usurped' setae may not be genetically linked to the dorsal idiosomal setae, and form an independent embryological organizer field.

The species name is derived from the spicate appearance of the usurped setae on the scutum.

155. *Gahrliepia barbiger*a Traub and Morrow
(Fig. 131)

*Gahrliepia (Gahrliepia) barbiger*a Traub and Morrow, 1957, 170; Traub *et al.*, 1967, 40.

*Gahrliepia (Gateria) barbiger*a, Vercammen-Grandjean, 1968b, 116.

*Gahrliepia barbiger*a, Prasad, 1974, 77.

Redescription of species : Larva.

Idiosoma : Measuring 322x220 in partially engorged holotype. Eyes 1/1, subovate. Two pairs of humeral setae, measuring 38; 43 dorsal idiosomal setae, measuring 27-39, arranged : 2-4-8-2-8-6-4-3-4-2 (Original description : about 46, arrangement commencing : 2-6-8, the rest irregular); 2 pairs of sternal setae, anterior 38, posterior 24; 30 preanal setae, 18-19; 18 postanal setae, 24-26; total idiosomal setae approximately 100 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B (Original description : Dorsal palpotibial seta N(b), and palpotarsal setation 1B - *lapsus*! Dorsal tibial seta is always nude; ventral may be weakly barbed, as in original illustration, fig. 6. Palpotarsal setation correctly illustrated in figs. 5 and 6 as 4B); palpal claw 3-pronged; galeala N; cheliceral blade (33) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with concave anterior margin; posterior margin deeply produced, caudally broadly rounded; SB anterior to level of PL bases; number of usurped setae on scutum variable (13, 16 and 23 in type series, 15 in specimen examined); AL and PL setae stout, subequal, with heavy setules; usurped setae slender, finely ciliated, measuring 27-32; sensillae ovate-laceolate, head with setules; PW/SD = 0.75-0.77. Scutal measurements of holotype followed by means and ranges of 2 paratypes after original description : AW 52 (52, 51-53); PW 95 (94, 91-97); SB 51 (51, 50-52); ASB 24 (23, 22-24); PSB 100 (103, 100-106); AP 48 (46, 44-48); AL 39 (37, 35-39); PL 37 (38, 37-39); sens. - (46x10, -).

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae (microtarsala I proximal to tarsala I, not distal as in original illustration - fig. 2). Leg III coxa 2B.

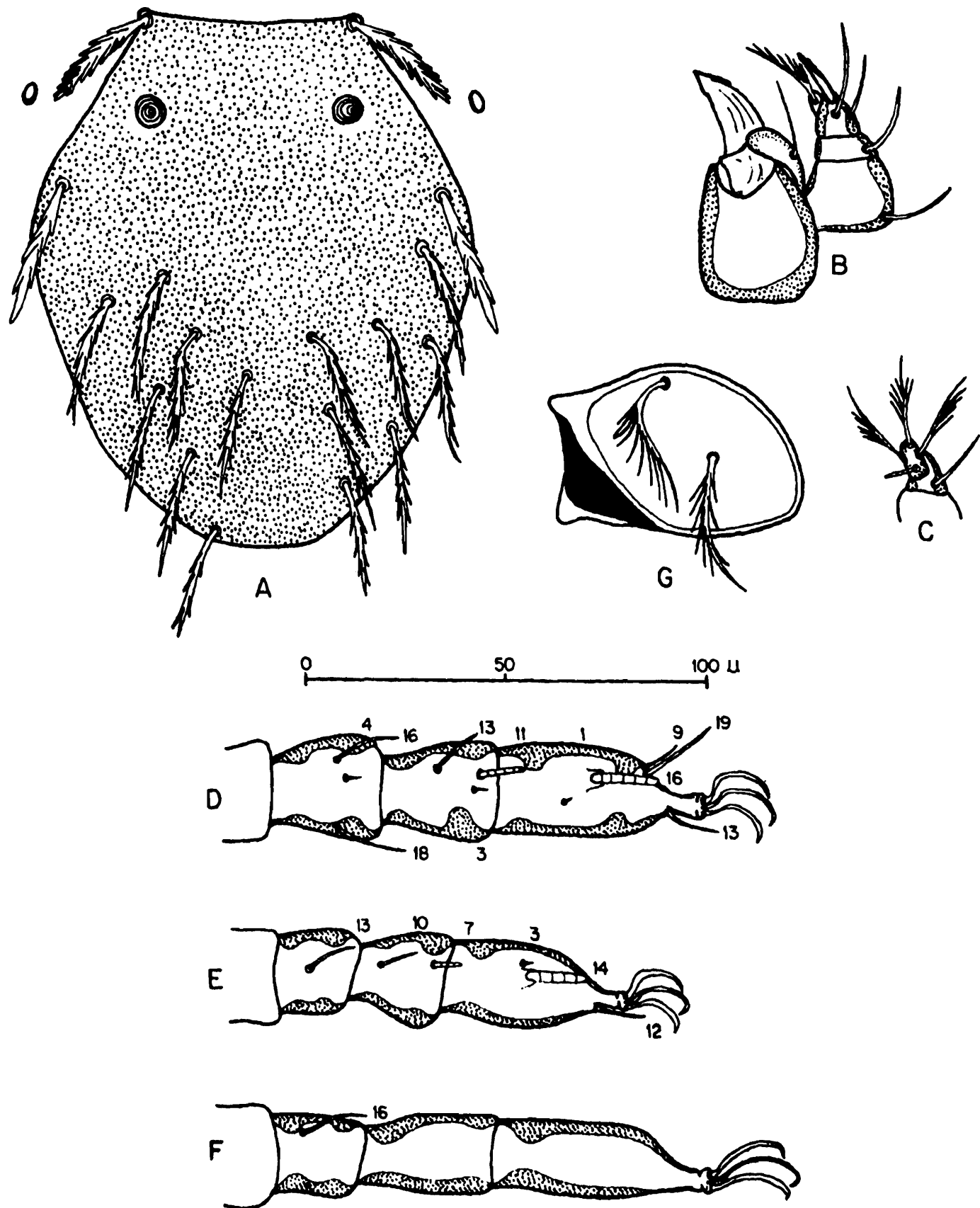


Fig. 131. *Gahrlepiea barbiger*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Measurements as follows : Ip = 663. Leg I : 225; tarsus (49x22), tarsala (16). Leg II : 198; tarsus (2x20), tarsala (14). Leg III : 240; tarsus (53x17).

Type data : Holotype (USNM 2439) and 2 paratypes, WEST BENGAL, Sunderbani, 29.IX.1950, ex 'shrew', S.L. Kalra, coll. (There are no collection records of S.L. Kalra in September 1950 in Bengal. Audy (1954b) makes reference to R. Varma's collection records in Bengal between May 1950-May 1952. Thus, the collection should more likely be attributed to R. Varma!)

Type depository : Holotype in USNM; 2 paratypes in IMR and Traub's collection.

Specimen examined : 1 specimen (B67727.1) on loan from M. Nadchatram : WEST PAKISTAN, Saidu, ex *Suncus* sp., date of collection and collector's name not recorded.

Remarks : The above redescription is based on the original description and study of the West Pakistan specimen. Traub and Morrow (1957) compare *G. barbiger*a with *G. hirsuta* (Radford, 1946), distinguishing it as having PL setae in normal position (displaced anteriorly adjacent to AL setae in *G. hirsuta*), 13-23 usurped setae on scutum (8-10 in *G. hirsuta*), femoral and genual palpal setae nude (B in *G. hirsuta*), and 2 setae on coxa III (1 in *G. hirsuta*). They further consider *G. barbiger*a very different from the other non-ornate species with 2 setae on coxa III, the African *G. lawrencei* Jadin and Vercammen-Grandjean, 1952, and *G. philipi* (Jadin and Vercammen-Grandjean, 1952).

156. *Gahrlepiea crassiscuti* new species

(Fig. 132)

Description of species : Larva.

Idiosoma : Measuring 315x250 in partially engorged holotype. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, heavy, measuring 37-40; 22-32 dorsal idiosomal setae, anterior lateral heavy, anterior median and posterior finely ciliated, measuring 23-33, anterior longest, arrangement variable, in holotype : 2-6-4-6-2-2; 2 pairs of sternal setae, finely ciliated, anterior 22-28, posterior 21-23; 24-34 preanal setae, finely ciliated, 15-18; 14-24 postanal setae, heavy, 26-32; total idiosomal setae 74-88 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (30) with dorsal subapical tooth and tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, suboval, with pronounced cuticular thickening of anterolateral margins; anterior margin shallowly concave; posterior margin deeply produced, caudally broadly rounded; SB anterior to level of PL bases; 4 pairs of usurped setae posterior to PL setae, slender, finely ciliated, arranged : (2-2)-2-2, measuring 11-16, anterior longest; AL and

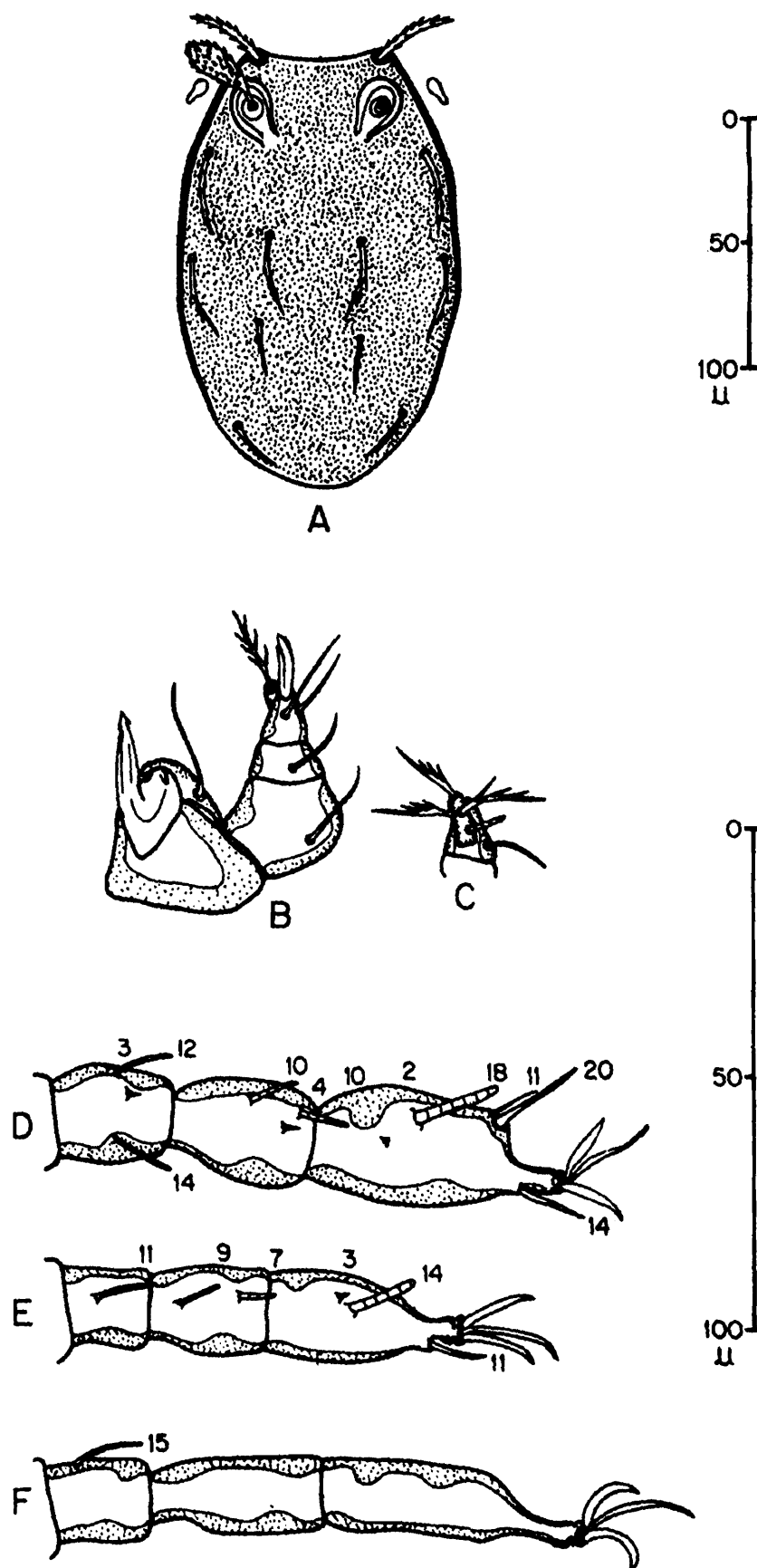


Fig. 132. *Gahrlipeia crassiscuti* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

PL setae stout, subequal; sensillary bases with conspicuous anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.4-0.49. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 49 (49, 46-50); PW 86 (82, 76-87); PPW1 42 (38, 35-42); PPW2 96 (96, 93-101); SB 50 (49, 46-52); ASB 22 (22, 20-23); PSB 152 (155, 154-157); AP 42 (43, 42-45); AL 36 (34, 33-36); PL 33 (38, 33-42); sens. 37x12 (36x11, 34-37 x 10-12).

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae. Measurements as follows : Ip = 645-686. Leg I : 219-233; tarsus (49x23), tarsala (16-18). Leg II : 190-215; tarsus (39x19), tarsala (14). Leg III : 230-242; tarsus (52x13).

Type data : Holotype (NIV A95480), MAHARASHTRA, Pune District, Bhore, Nighudgarh, 620m, ex *Suncus murinus*, 19.II.1971, S.M. Kulkarni, coll. 1 paratype, same data, but Hirdoshi, 680m, taken 17.VI.1971; 1 paratype, same data, but Mulshi, Mulshi-khurd, 680m, taken 29.VI.1970; 5 paratypes, same data, but Khandala, 680m, ex 3 *S. murinus*, taken 8.VI.1970 and 3.VII.1970.

Remarks : *G. crassiscuti* will run to couplet 33 of the key to species of the subgenus *Gahrlepiea* given by Traub and Morrow (1957), along with *G. neterella* Traub and Morrow, 1955, with scutum more than twice as long as broad. *G. crassiscuti* may easily be separated from *G. neterella* in having 4 pairs of usurped setae on scutum (3 pairs in *G. neterella*), uniformly micropunctate scutum (micropunctae interspersed with coarser punctae in *G. neterella*), and palpal femoral seta N (B in *G. neterella*). The species name is based on the characteristic cuticular thickening of the anterolateral scutal margins.

157. *Gahrlepiea crocidura* (Radford)

Gateria crocidura Radford, 1946b, 252; Wharton and Fuller, 1952, 93; Audy *et al.*, 1953, 36.

Gateria lancearia Radford, 1946b, 256; Wharton and Fuller, 1952, 94; Audy *et al.*, 1953, 36; Traub and Morrow, 1955, 71, **synonymy**.

Gahrlepiea (Gateria) crocidura, Womersley, 1952, 307; Vercammen-Grandjean, 1968b, 116.

Gahrlepiea (Gateria) lancearia, Womersley, 1952, 306.

Gahrlepiea (Gahrlepiea) crocidura, Traub and Morrow, 1955, 71; 1957, 181; Womersley and Audy, 1957, 285.

Gahrlepiea crocidura, Prasad, 1974, 78.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Presence and nature of eyes not reported. One pair of humeral setae; 36 dorsal idiosomal setae, measuring 42-58, arranged : 4-6-6-8-8-4 (Womersley, 1952 : 46, arranged : 8-8-8-8-6-4-4); 2 pairs of sternal setae; approximately 62

preanal and postanal setae, preanal setae measuring 30-32, postanal 60; total idiosomal setae approximately 104 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/BNb/4B; palpal claw 3-pronged; galeala N; cheliceral blade not described; gnathobase bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal with anterior margin shallowly concave; posterior margin deeply produced, caudal angle rounded; SB anterior to level of PL bases; 3 pairs of usurped setae posterior to PL setae; anterior pair inserted submarginally on scutum, 2nd and 3rd pair medially; PL>AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate (appearing lanceolate in former *G. lancearia* holotype), head with setules; PW/SD = 0.58-0.61. Scutal measurements of holotype after original description and redescription by Traub and Morrow (1955), followed by measurements of former *G. lancearia* holotype after original description : AW 51,51,51; PW 85,92,85; SB 51,49,51; ASB 27,30,27; PSB 119,120,119; AP 36,38,35; AL 44,45,44; PL 57,60,68; sens. -, -, 40x-.

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Coxa III 1B. Leg measurements not reported.

Type data : Holotype (BMNH No.1948-2-3-16), MANIPUR, Imphal, ex *Suncus murinus* (= *S. caeruleus fulvocinereus*), 8.III.1945 (cited as 8.V.1945 in original description, corrected by Traub and Morrow, 1955), STRU, coll.

Type depository : Holotype in BM(NH).

Additional records : MANIPUR, Imphal, Kanglatongbi, 1 (former *G. lancearia* holotype) ex *Talpa micrura*, 22.VI.1945, STRU, coll. Lawrence (in Audy *et al.*, 1947) indicates that more specimens may be extant.

Remarks : The above redescription is based only on the literature. *G. crocidura* runs to couplet 31 of the key to species of the subgenus *Gahrleipia* given by Traub and Morrow (1957) along with *G. longipili* (Radford, 1946). *G. crocidura* may easily be separated in having 6 usurped setae on scutum (9 in *G. longipili*).

158. *Gahrleipia darita* Traub and Morrow

Gahrleipia (*Gahrleipia*) *darita* Traub and Morrow, 1957, 181; Nadchatram, 1970b, 136.

Gahrleipia (*Gateria*) *darita*, Vercammen-Grandjean, 1968b, 116.

Redescription of species : Larva. Colour in life white.

Idiosoma : Measuring 366x260 in partially engorged specimen. Eyes 2/2, anterior larger,

on ocular plate. One pair of humeral setae; approximately 30 dorsal idiosomal setae, stout, well barbed, measuring 31-37, arrangement commencing : 2-4-4, the rest irregular; 2 pairs of sternal setae; approximately 26 preanal setae, slender, sparsely barbed, measuring 21; approximately 22 postanal setae; total idiosomal setae approximately 84 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/NNb/4B; palpal claw 3-pronged; galeala N; cheliceral blade with dorsal subapical tooth and tricuspid cap; gnathobase well punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subovate with anterior margin shallowly concave; posterior margin deeply produced, tongue-like, caudally broadly rounded; SB anterior to level of PL bases; 17-22 usurped setae, shorter, thinner than scutal setae, sparsely barbed; anterior pair inserted medially at level of PL bases, most others inserted nonmarginally on scutum; AL and PL setae stout, well barbed, subequal; sensillary bases with weakly developed anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.47-0.48. Scutal measurements of holotype followed by means and ranges of 8 paratypes in parentheses after original description : AW 42 (44, 38-50); PW 72 (78, 68-88); SB 43 (48, 43-53); ASB 20 (21, 19-23); PSB 132 (144, 97-161); AP 35 (37, 33-41); AL 38 (38, 35-41); PL 38 (38, 35-41).

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Coxa III with 1 branched seta (1B). Leg measurements not reported.

Type data : Holotype (USNM #2156), North BURMA, Myitkyina, ex *Rattus rattus sladeni*, 12.X.1945, USATC, coll. 37 paratypes, Myitkyina and Shingbuiyang, ex *Tupaia glis*, *Rattus fulvescens fulvescens*, *R. r. sladeni*, *Rattus* sp., *Suncus murinus*, *Suncus* sp., and *Crocidura* sp., taken between 10.I.1945 to 28.X.1945, USATC, coll. 1 paratype, INDIA, Assam, 21 miles North of Ledo, Stilwell Road, ex *Suncus* sp., 25.X.1945, USATC, coll.

Type depository : Holotype in USNM; paratypes in USNM, BM(NH), RML, SAM, IMR and Traub collection.

Remarks : The above redescription is based only on the literature. *G. darita* runs to couplet 29 of the key to species of the subgenus *Gahrlepiea* given by Traub and Morrow (1957), along with *G. fletcheri* Gater, 1932. *G. darita* may easily be separated by the uniformly micropunctate scutum (micropunctate with scattered scrobiculae in *G. fletcheri*), 17-22 usurped setae on scutum (10-17, usually 11-12, rarely more than 14 in *G. fletcheri*), 1-3 (usually 2) usurped setae inserted at level of PL bases (1st row of usurped setae posterior to level of PL bases in *G. fletcheri*), and weak or inapparent antesensillary cuticular ridges (conspicuous in *G. fletcheri*).

159. *Gahrliepia dhandai* new species
(Fig. 133)

Description of species : Larva.

Idiosoma : Measuring 365x305 in partially engorged holotype. Eyes 2/2, on ocular plate. 2 pairs of humeral setae, measuring 37-42; 26-28 dorsal idiosomal setae, measuring 20-26, arranged : 2(4)-4(6)-6-6-4-2; 2 pairs of sternal setae, anterior 21-27, posterior 18-20; 20-26 preanal setae, 12-16; 12-18 postanal setae, 21-28; total idiosomal setae 64-76 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (26) with distinct tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subhexagonal with shallowly concave anterior margin; posterior margin deeply produced, caudally truncate; SB anterior to level of PL bases; 3 pairs of usurped setae inserted posterior to level of PL bases, measuring 32-40, arranged : 4-2; anterior 2 pairs at about level of midscutum, medial and marginal; posterior pair, admarginal, close to posterolateral scutal corners; PL>AL; sensillae clavate, head with setules; PW/SD = 0.43-0.50. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 37 (36, 34-37); PW 64 (62, 55-64); PPW1 47 (45, 34-50); PPW2 95 (91, 83-98); SB 40 (38, 35-40); ASB 18 (18, 18-20); PSB 115 (114, 111-117); AP 39 (37, 34-39); AL 34 (33, 25-38); PL 47 (46, 43-49); sens. 31x13 (31x13, 30-32 x 12-13).

Legs : Similar to *G. armata* n.sp. in the number of ordinary and sensory setae. Measurements as follows : Ip = 574-631. Leg I : 193-214; tarsus (47x21), tarsala (13-15). Leg II : 177-190; tarsus (40x18), tarsala (13-15). Leg III : 204-227; tarsus (51x14).

Type data : Holotype (NIV A96896.1) and 3 paratypes, MAHARASHTRA, Pune District, Sinhgarh, Atkarwadi, 650m, ex 2 *Suncus murinus*, 12.XI.1970, S.M. Kulkarni, coll.; 2 paratypes, same data, but taken 7.II.1970 and 5.II.1971; 2 paratypes, same data, but Mulshi, 680m, ex 2 *S. murinus*, taken 24.XII.1970 and 29.I.1971.

Remarks : *G. dhandai* may easily be separated from the remaining species of the subgenus in having the posterior pair of usurped setae inserted admarginally near the posterolateral corners of the scutum. *G. dhandai* will run to couplet 34 of the key to species of the subgenus *Gahrliepia* given by Traub and Morrow (1957) along with *G. romeri* Womersley, 1952, with PSB more than 3 times AW and palpal femoral seta N. *G. dhandai* differs from *G. romeri* in having the posterior pair of usurped setae inserted admarginally (submarginally in *G. romeri*), 2 pairs of humeral setae (1 pair in *G. romeri*), and ventral palpal tibial seta N (b in *G. romeri*).

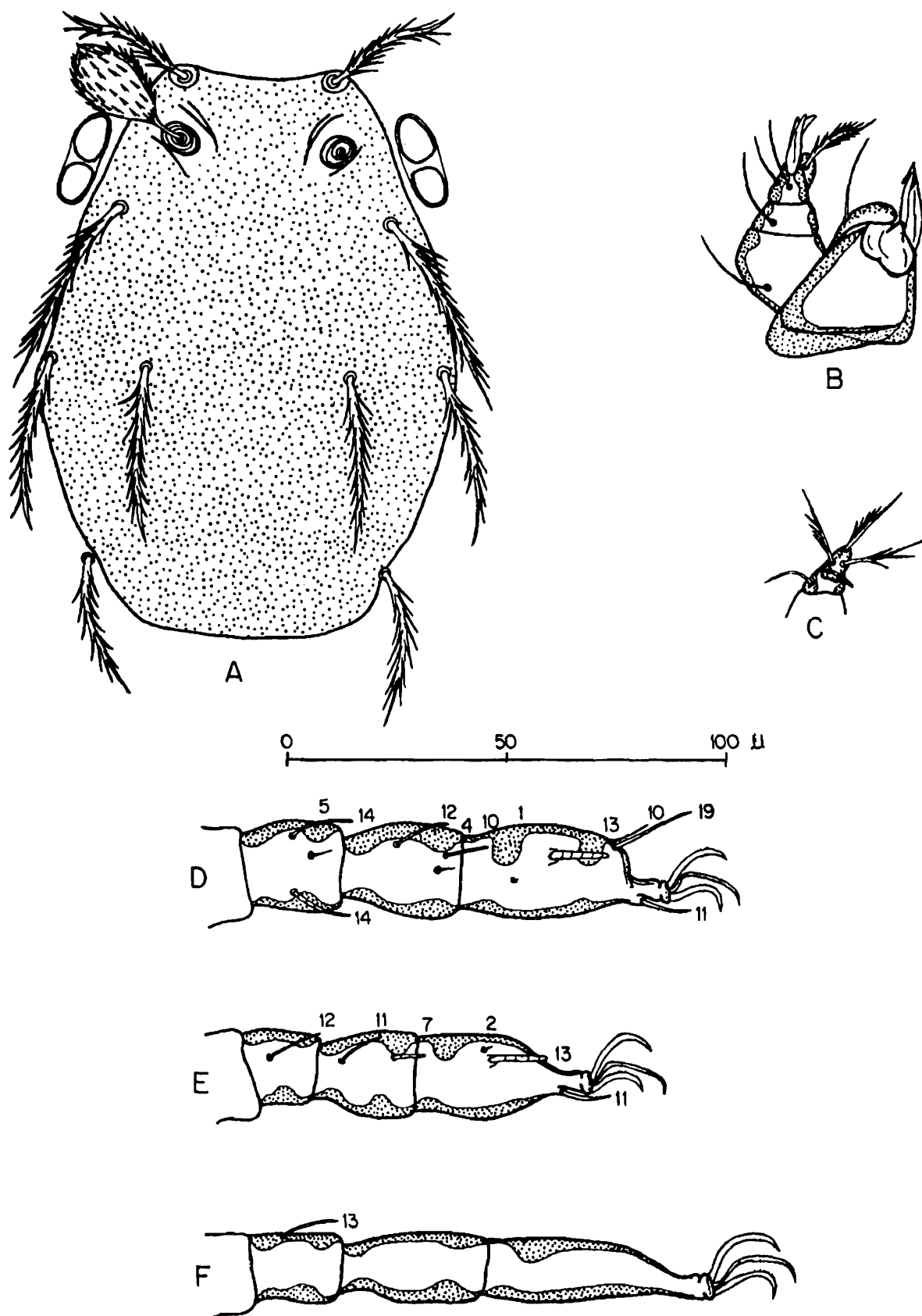


Fig. 133. *Gahrlepiea dhandai* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

This species is named in honour of the late Dr. Vijay Dhanda, former Head of Department of Entomology and Medical Zoology at NIV, in recognition of his many contributions to acarology.

160. *Gahrliepia dupliseta* Traub and Morrow

Gahrliepia (*Gahrliepia*) *dupliseta* Traub and Morrow, 1955, 26; 1957, 180; Lakshana and Dohany, 1972, 13.

Gahrliepia (*Scrobiculata*) *dupliseta*, Vercammen-Grandjean, 1968b, 117.

Redescription of species : Larva.

Idiosoma : Measuring 236x134 in partially engorged holotype. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae; approximately 28 dorsal idiosomal setae, slender, sparsely barbed, measuring 35, irregularly arranged; 2 pairs of sternal setae; approximately 18 preanal setae, slender, finely ciliated, measuring 26; approximately 26 postanal setae; total idiosomal setae approximately 78 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/BNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, suboval with minute punctae and scattered scrobiculae; anterior margin shallowly concave; posterior margin deeply produced, caudally rounded; PL setae anteriorly displaced, contiguous to AL setae; SB at level of anterior eighth of scutum; 2 pairs of usurped setae inserted submedially on scutum; anterior pair near midscutal level, measuring 40; posterior pair at posterior seven-eighths of scutum, measuring 36; AL and PL setae similar to dorsal idiosomal setae; PL>>AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.40. Scutal measurements of holotype after original description : AW 42; PW 56; PPW1 43; PPW2 39; SB 40; ASB 21; PSB 122; AP 8; AL 36; PL 35.

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Microtarsala I is apparently misrepresented in the original illustration (fig. 73), shown distal to tarsala I; it is usually inserted proximal to tarsala I in the genus *Gahrliepia*.

Type data : Holotype (USNM 2162), ASSAM, Stilwell Road, 21 miles North of Ledo, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 28.VIII.1945, USATC, coll. 1 paratype, same data, but date not recorded.

Type depository : Holotype in USNM; paratype in Traub collection.

Remarks : The above redescription is based only on the literature. *G. dupliseta* runs to couplet 18 of the key to species of the subgenus *Gahrliepia* given by Traub and Morrow (1957) along with *G. gemina* Traub and Morrow, 1955. They distinguish *G. dupliseta* as having usurped setae inserted submedially on scutum (marginally in *G. gemina*), PL/AL setal

ratio 2 : 1 (10 : 7 in *G. gemina*), and PSB/SB ratio 3 : 1 (approximately 2 : 1 in *G. gemina*) so that scutum is merely 3/5 as broad as long in *G. dupliseta*, not 3/4 as in *G. gemina*.

161. *Gahrliepia fletcheri* Gater
(Fig. 134)

Gahrliepia fletcheri Gater, 1932, 161.

Gateria spinulosa Radford, 1946b, 252; Audy *et al.*, 1953, 36; Traub and Morrow, 1955, 55, **synonymy**.

Gahrliepia (Gateria) fletcheri, Womersley, 1952, 311.

Gahrliepia (Gahrliepia) fletcheri, Traub and Morrow, 1955, 55; Womersley and Audy, 1957, 285; Nadchatram, 1970b, 136.

Gahrliepia (Gateria) fletcheri, Vercammen-Grandjean, 1968b, 116.

Gahrliepia spinulosa, Prasad, 1974, 81.

Redescription of species : Larva. Colour in life yellow.

Idiosoma : Measuring 320-460 x 240-330 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 36; 38 dorsal idiosomal setae, measuring 27-31, arranged : 4-6-8-6-6-6-2 (Traub and Morrow, 1955 : 24-30, measuring 28-38, arrangement commencing : 4-4-6-6-4, the rest irregular; Womersley, 1952 : approximately 38, arranged : 4-10-4-6-8-4-2); 2 pairs of sternal setae, anterior 32, posterior 24; 38 preanal setae, 17; 28 postanal setae, 25-27 (Traub and Morrow (1955) : 50-60 ventral setae, of which 20-26 are postanals); total idiosomal setae 110 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/NNb(N)/4B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap (tip broken off in specimen examined); gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, suboval with minute punctae and sparsely scattered scrobiculae beyond level of PL bases to midscutal (Traub and Morrow, 1955 : evenly distributed beyond level of PL setae); anterior margin almost straight, lateral margins sinuate; posterior margin deeply produced, caudally rounded; SB anterior to level of PL bases; 10-17 usurped setae posterior to PL bases (usually 12-13, rarely more than 14; 12 in specimen examined), slender, sparsely barbed, most inserted non-marginally, in 3-4 rows, measuring 25-27; AL and PL setae stout, with heavy setules; PL > AL; sensillary bases with conspicuous anteromedial cuticular ridge; sensillae clavate, head with setules (missing in specimen examined); PW/SD = 0.43-0.45. Scutal measurements of holotype after Fuller (1952), followed by means and ranges of 50 specimens in parentheses from Malaysia (including 5 paratypes), Assam and Burma after Traub and Morrow (1955) : AW 53 (48, 42-54); PW 78 (73, 63-83); SB 48 (44, 37-51); ASB 22 (21, 17-25); PSB 160 (144, 122-166); AP 42 (37, 31-43); AL 35 (32, 26-38); PL 38 (34, 28-40).

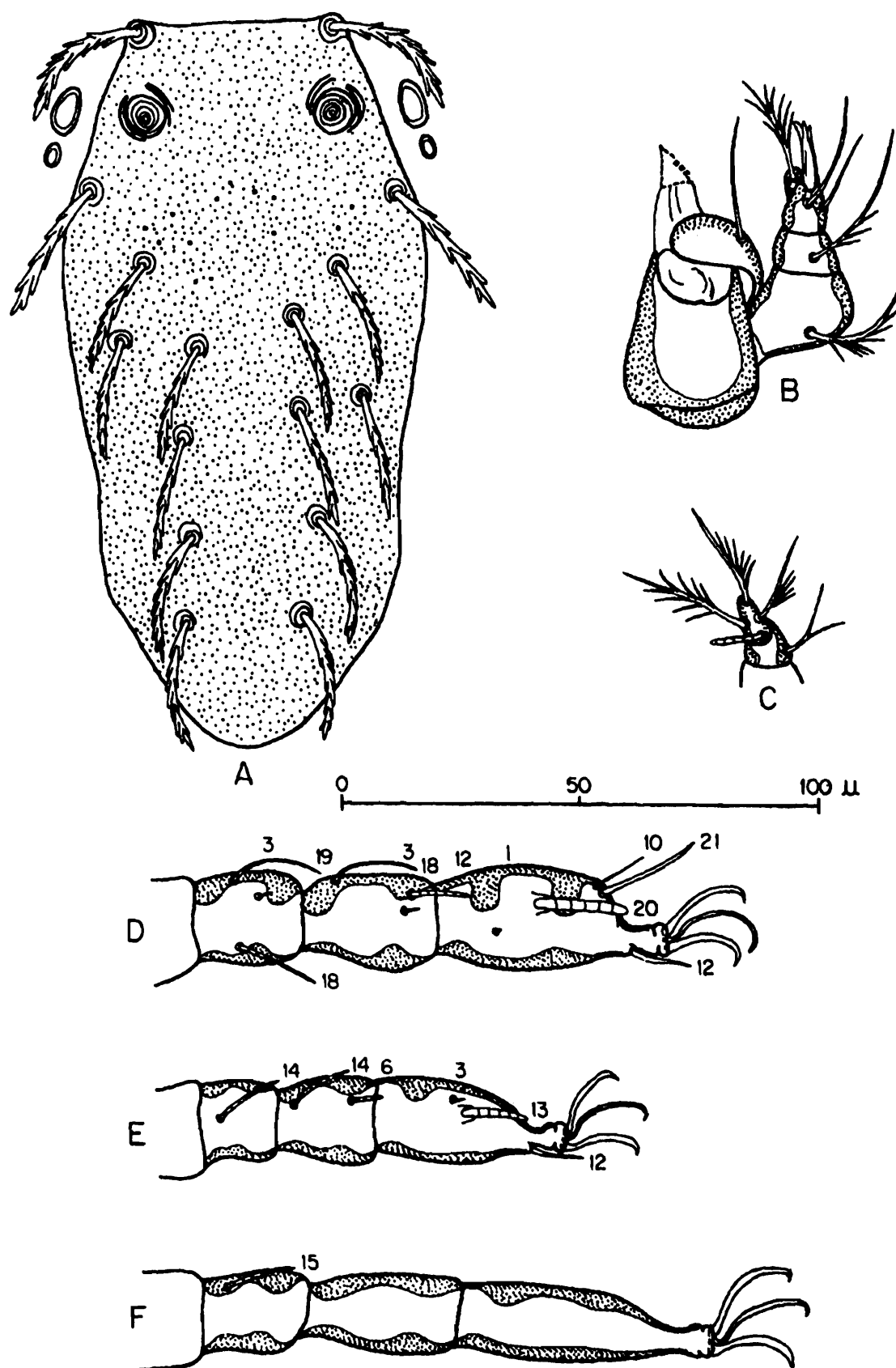


Fig. 134. *Gahrliepia fletcheri*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae. Measurements as follows : Ip = 636. Leg I : 217; tarsus (48x21), tarsala (20). Leg II : 198; tarsus (40x18), tarsala (13). Leg III : 221; tarsus (52x15).

Type data : Holotype (#1932-7-18-22) and several paratypes, MALAYA (now Malaysia), Selangor, Kuala Lumpur, ex *Rattus rattus diardi*, (III-XI ?).1929, W.J. Vickers and E.P.G. Ritchie, coll.

Type depository : Holotype and 2 paratypes in BM(NH); paratypes in USNM, IMR, SAM and other museums.

Additional records : 17 records, ASSAM, Ledo, ex 'shrew', *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), *Tupaia glis* (= *Tupaia belangeri versurae*), and *Rattus rattus* (= *Rattus flavipectus yunnanensis*), taken between X.1944 and X.1945, USATC, coll. Recorded as *G. spinulosa* (Radford 1946b) : MANIPUR, Imphal, ex *S. murinus* (= *S. caeruleus fulvocinereus*), 8.V.1945, Sergeant J. Hake, coll.

Material examined : 2 specimens of *G. fletcheri* on a single slide together with a specimen of *Walchia turmalis* (Gater 1932) on loan from M. Nadchatram : SINGAPORE, Bukit Timah, ex *Tupaia glis*, 8.VIII.1985, Dept. of Zoology, University of Singapore, coll.

Remarks : The above redescription is based on the literature and study of the Singapore specimens. Gater (1932) draws attention to the extreme variation encountered among specimens, evident in the range of scutal measurements. Fuller (1952) considered *G. spinulosa* a valid species on the basis of difference in scutal punctation (only micropunctae in *G. spinulosa*). Traub and Morrow (1955) synonymized *G. spinulosa* with *G. fletcheri*, pointing out that the scrobiculae of *G. fletcheri* are not always evident, and at times show up only in freshly mounted specimens.

G. fletcheri runs to couplet 29 of the key to species of the subgenus *Gahrliopia* given by Traub and Morrow (1957) along with *G. darita*, Traub and Morrow 1955. The points of distinction have been noted above in the redescription of *G. darita*. *G. fletcheri* has been named in honour of Dr. W. Fletcher.

162. *Gahrliopia hirsuta* (Radford)

Gateria hirsuta Radford, 1946b, 249; Fuller, 1952, 217; Wharton and Fuller, 1952, 94; Audy *et al.*, 1953, 27.

Gahrliopia (Gateria) hirsute, Womersley, 1952, 305.

Gahrliopia (Gahrliopia) hirsute, Traub and Morrow, 1955, 61; 1957, 171; Womersley and Audy, 1957, 285; Lakshana and Dohany, 1972, 13.

Gahrliopia (Scrobiculata) hirsute, Vercammen-Grandjean, 1968b, 117, new subgenus.

Gahrliopia hirsute, Audy, 1954b, 162; Prasad, 1974, 79.

Redescription of species : Larva.

Idiosoma : Measuring 270×180 in partially engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae; approximately 32 dorsal idiosomal setae, measuring 35-46, arranged : 4-4-6-6-4-4-2-2; 2 pairs of sternal setae; approximately 46 ventral setae; preanal setae measuring 23, postanal 38; total idiosomal setae approximately 84 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula b/b/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly concave; posterior margin deeply produced, caudally angled; about 1.5 times as long as broad, broadest at about level of 1st row of usurped setae; PL setae anteriorly displaced, adjacent to AL setae; SB at about level of anterior sixth of scutum; 8-10 usurped setae on scutum, arranged : 4-2-2-(2); AL and PL setae stout, PL>>AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.39-0.42. Scutal measurements of holotype after original description, followed by measurements of holotype and specimen 'No.61' (from South Burma) after Womersley (1952) and after Traub and Morrow (1955) : AW 57, 42, 38, 41, 38; PW 68, 57, 54, 60, 56; SB 50, 42, 42, 46, 44; ASB 23, 21, 22, 22, 23; PSB 119, 112, 108, 122, 111; AP 45, 12, 10, 11, 9; AL 72, 45, 42, 45, 39; PL 48, 58, 64, 72, 60; sens. 34x-, 32x9, -, -, -.

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Measurements after Womersley (1952) as follows : Ip = 730. Leg I : 240. Leg II : 220. Leg III : 270.

Type data : Holotype, MANIPUR, Imphal, Kanglatongbi, ex *Suncus murinus*, (= *Suncus caeruleus fulvocinereus*), 29.IV.1945, Sergeant J. Hake, coll. 1 'paratype', same data, but taken 21.VI.1945; 13 'paratypes', same data, but ex *Talpa micrura*, taken 22.VI.1945.

Type depository : Holotype in BM(NH).

Remarks : The above redescription is based only on the literature. Radford (1946b) considers *G. hirsuta* as having 2 pairs of AL setae, reflected in his recorded AP measurement. Womersley (1952), however, rightly regards the additional pair as anteriorly displaced PL setae. He further disagrees with the proposal to group species with anteriorly displaced PL setae under a separate genus. He considers the raising of a new genus unwarranted as the nymphs of *G. hirsuta* cannot be separated, except specifically, from other members of the genus.

G. hirsuta runs to couplet 16 of the key to species of the subgenus *Gahrlipeia* given by Traub and Morrow (1957). It is similar to *G. gemina*, *G. dupliseta* and *G. plurisetata* described by Traub and Morrow (1955) in having anteriorly displaced PL setae. *G. hirsuta* may be distinguished from these 3 species in having 8-19 usurped setae on scutum (4-6

listed for the other 3 species), and all palpal tibial setae nude (at least one seta barbed in other 3 species).

163. *Gahrлиеpia inconstans* new species
(Fig. 135)

Description of species : Larva.

Idiosoma : Measuring 330x240 in partially engorged holotype. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, internal measuring 37-43, external measuring 43-50; 58-69 dorsal idiosomal setae, measuring 36-52, irregularly arranged, arrangement in holotype : 2-4-6-10-2-4-10-10-6-4; 1 pair of sternal setae, 36-41; 42-52 preanal setae, 18-27; 22-28 postanal setae, 31-38; total idiosomal setae 134-153 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B(b)/N(b)/NNb/4B; palpal claw 3-pronged; galeala N; cheliceral blade (35) with distinct tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, broadest at level of PL bases; anterior margin shallowly concave; posterior margin deeply produced, tapering gently, caudally rounded; SB anterior to level of PL bases; 6-11 usurped setae on scutum, posterior to level of PL bases, measuring 41-55, usually arranged in 2 irregular rows; AL>PL (PL>AL in NIV AA249.7); sensillae clavate, head with setules; PW/SD = 0.69-0.76. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 36 (38, 36-42); PW 79 (79, 76-84); SB 45 (45, 42-46); ASB 24 (22, 20-24); PSB 88 (89, 84-94); AP 29 (29, 26-32); AL 62 (56, 47-61); PL 53 (53, 49-55); sens. 46x10 (43x10, 40-46 x 10).

Legs : Similar to *G. armata* n.sp. in the number of ordinary and sensory setae. 2 genualae I (NIV AA249.1,4 with 2 genualae on one leg, 3 on the other); coxa III 2B (NIV AA249.7,8,10,11 with 2 coxalae on one leg, 3 on the other). Measurements as follows : Ip = 746-800. Leg I : 243-265; tarsus (55x24), tarsala (17-19). Leg II : 222-241; tarsus (49x21), tarsala (14-16). Leg III : 276-304; tarsus (62x17).

Type data : Holotype (NIV AA249.1) and 9 paratypes, ORISSA, Belangir District, Belangir, ex *Rattus blanfordi*, 2.XII.1972, H.N. Kaul, coll.

Additional records : 6 specimens, same data as type series, but Ganjam District, Singpur, taken 23.XI.1972.

Remarks : *G. inconstans* will run to couplet 20 of the key to species of the subgenus *Gahrлиеpia* given by Traub and Morrow (1957) along with *G. barbiger*a Traub and Morrow, 1957, in having 2 setae on coxa III. *G. inconstans* may easily be separated in having 1 pair of sternal setae (2 pairs in *G. barbiger*a), fewer usurped setae on scutum (13-23 in *G. barbiger*a), and palpal femoral seta barbed (nude in *G. barbiger*a). The species name is based

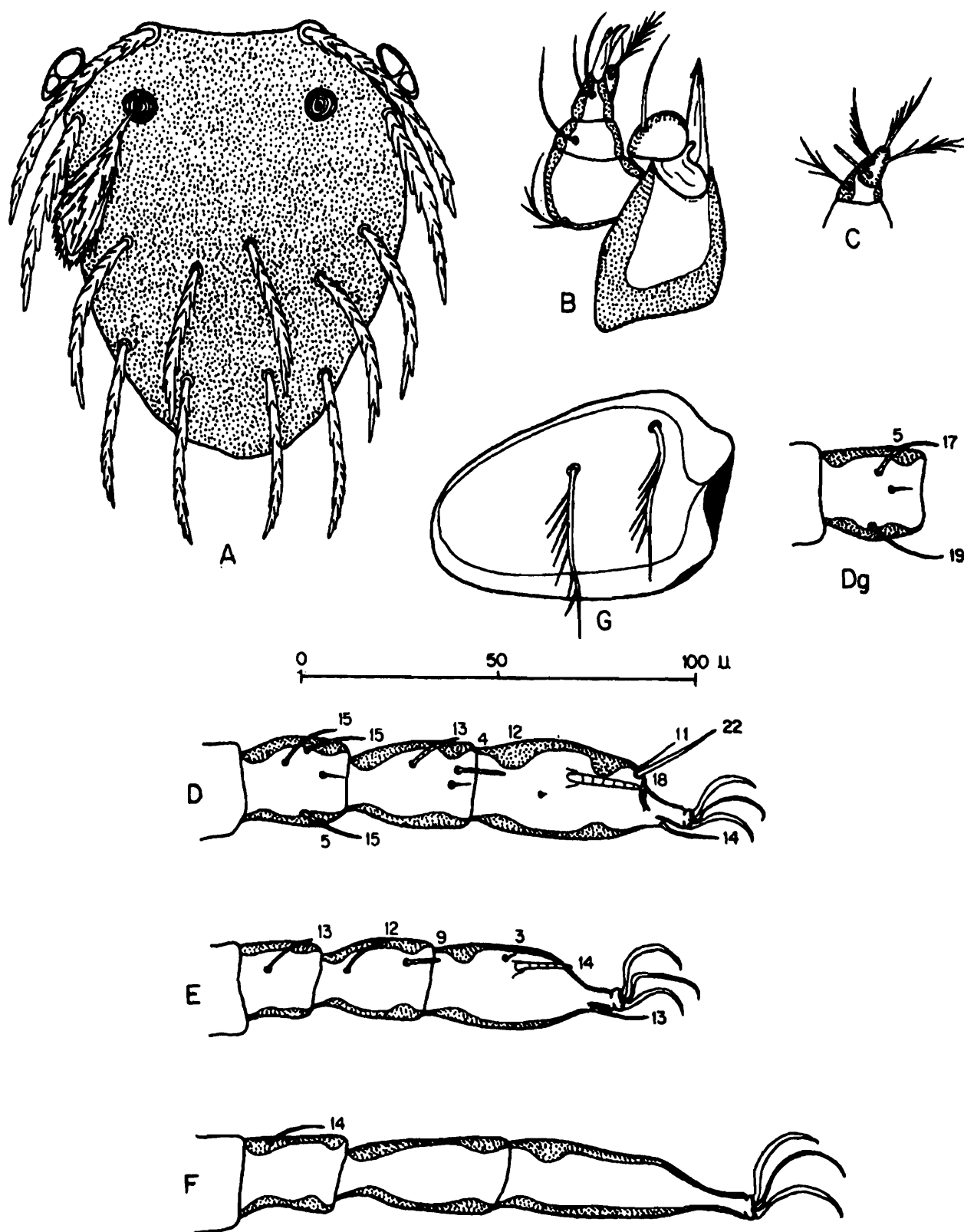


Fig. 135. *Gahrlepiea inconstans* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; Dg. leg I genu with 2 genualae; E. leg II as above; F. leg III as above; G. coxa III.

on the high degree of variability encountered in this taxon. This variation is observed in the numbers of usurped setae on scutum, of idiosomal setae, of leg genualae I, and of setae on coxa III. The scutal setae may also show a range of variation in length in different specimens, from the usual $AL \gg PL$ to $AL > PL$ or even $PL > AL$!

164. *Gahrliepia khandalaensis* Kulkarni
(Fig. 136)

Gahrliepia (Gahrliepia) khandalaensis Kulkarni, 1974, 451; 1979, 19; Kulkarni *et al.*, 1979, 10.

Redescription of species : Larva. Colour in life pale yellow.

Idiosoma : Measuring 308-400 x 216-285 in partially engorged to engorged specimens. Eyes 2/2, on ocular plate. 2 pairs of humeral setae, internal measuring 41-46, external measuring 45-49; 22-28 dorsal idiosomal setae, measuring 29-42, arranged : 6-4-6(4)-4(6)-2(4)-(2); 2 pairs of sternal setae, anterior 24-29; posterior 21-25; 32-37 preanal setae, 16-18; 17-21 postanal setae, 26-35; total idiosomal setae 83-94 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula $b(N)/N/NNN/4B$ (Original description : palpal tarsal setation 5B); palpal claw 3-pronged; galeala N; cheliceral blade (28-32) with distinct tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Suboval, measuring 180 x 120 in holotype, broadest at the level of 2nd pair of usurped setae, with minute punctae at anterolateral corners, except around sensillary bases; large oval scrobiculae, measuring 4-5 in diameter, evenly distributed over scutum, posterior to level of SB; smaller scrobiculae concentrated medially from anterior margin to level of SB; anterior margin shallowly concave; posterior margin deeply produced, caudally rounded; SB anterior to level of PL bases; 4 pairs of usurped setae on scutum, posterior to PL bases; slender, measuring 31-49, anterior pairs longer; 1st and 3rd pair inserted submedially, 2nd and 4th pair submarginally; AL and PL setae stout; $AL > PL$; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; $PW/SD = 0.37-0.42$. Scutal measurements of holotype followed by means and ranges of 10 paratypes in parentheses after original description : AW 42 (42, 40-44); PW 68 (68, 63-73); PPW1 22 (27, 22-31); PPW2 84 (87, 84-91); PPW3 36 (38, 36-42); PPW4 66 (61, 54-68); SB 42 (43, 42-45); ASB 19 (19, 19-21); PSB 163 (164, 152-178); AP 38 (39, 38-42); AL 42 (42, 37-45); PL 49 (50, 40-58); sens. 35x12 (35x12, 33-37 x 12).

Legs : Similar to *G. armata* n.sp. in the number of ordinary and sensory setae. Measurements as follows : $Ip = 612-685$. Leg I : 210-239; tarsus (49-55 x 19-25), tarsala (17-19). Leg II : 175-202; tarsus (38-43 x 19-21), tarsala (16-17). Leg III : 227-244; tarsus (51-52 x 17-18).

Type data : Holotype (NIV A94961) and 25 paratypes, MAHARASHTRA, Pune District, ex 8 *Suncus murinus*, S.M. Kulkarni, coll. : Holotype and 13 paratypes, Khandala, 8.VI.1970;

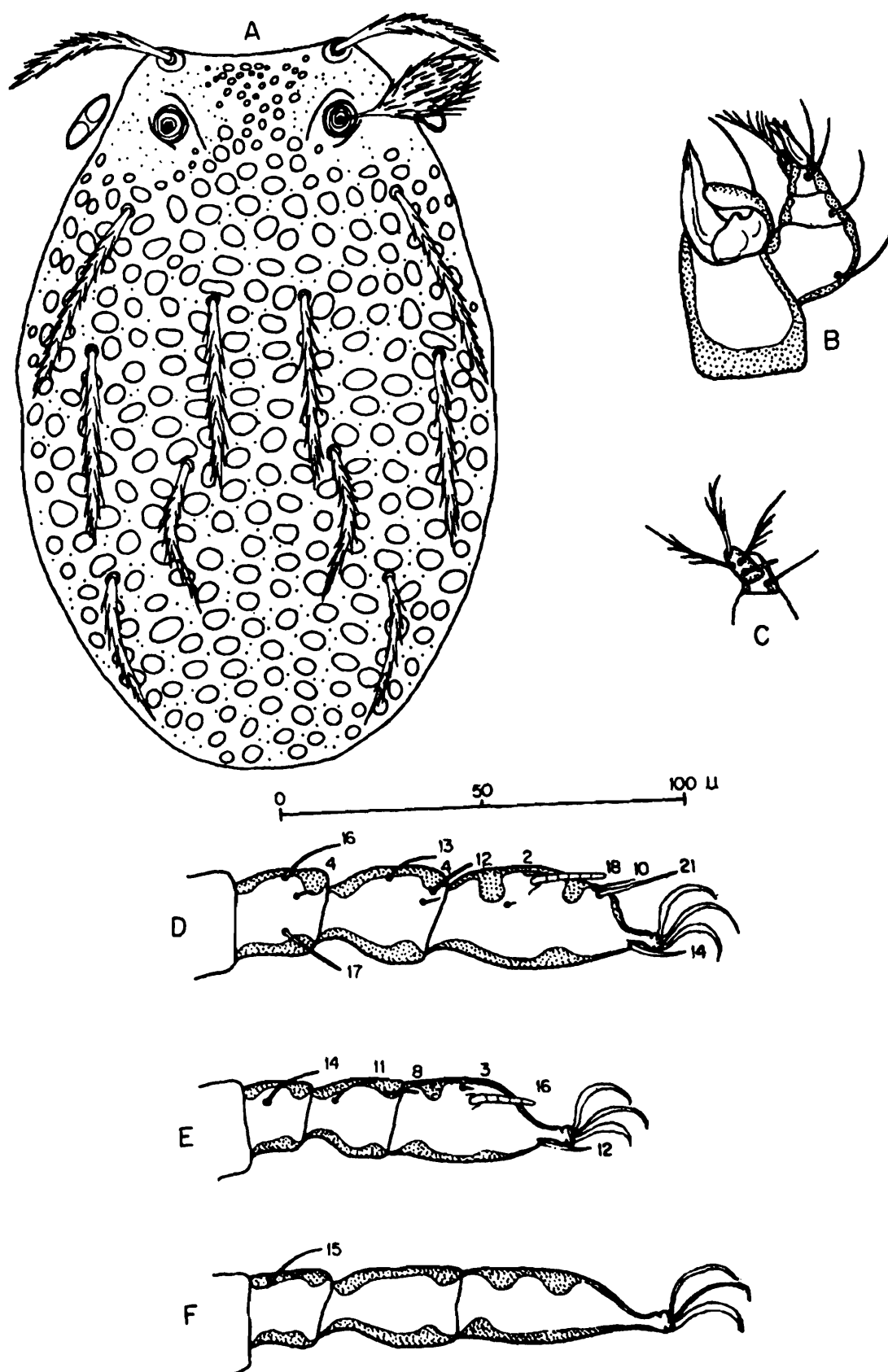


Fig. 136. *Gahrlepiea khandalaensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

2 paratypes, same data; 1 paratype, same data, but taken 12.VI.1970; 3 paratypes, same data; 3 paratypes, same data, but Lonavala, taken 10.I.1970; 2 paratypes, same data, but Sinhgarrh, taken 8.VI.1970; 1 paratype, same data, but taken 6.VII.1970.

Type depository : Holotype and paratypes at NIV; paratypes at IM, BM(NH), RML and IMR.

Additional records : MAHARASHTRA, Pune District, several specimens ex *S. murinus*, *Rattus rattus satarae* and *Bandicota bengalensis*, 1.1970-IX.1971, S.M. Kulkarni, coll.

New records : GOA, Brittona, 5 ex *S. murinus*, 16.XII.1983, S. Fernandes, coll.

Specimens examined : Type series and specimens in NIV collection.

Remarks : The above redescription is based on the literature and study of the NIV collection. *G. khandalaensis* will run to couplet 14 of the key to species of the subgenus *Gahrliopia* given by Traub and Morrow (1957) along with *G. picta* Traub and Morrow, 1955, and *G. evansi* Traub and Morrow, 1955. *G. khandalaensis* may be separated from *G. picta* by the palpal setal formula (b/b/bNb/4B in *G. picta*), broader scutum (measuring 179x92 in *G. picta*), and position of usurped scutal setae (all submedian in *G. picta*). *G. khandalaensis* differs from *G. evansi* in having fewer usurped scutal setae (17-20 in *G. evansi*), 2 pairs of humeral setae (1 pair in *G. evansi*), and palpal genual seta nude (barbed in *G. evansi*). This species has been named after the type locality, Khandala, Pune District, in the Western Ghats.

165. *Gahrliopia longipili* (Radford)

Gateria longipili Radford, 1946b, 252; Wharton and Fuller, 1952, 94; Audy *et al.*, 1953, 36.

Gahrliopia (Gateria) longipilis, sic! Womersley, 1952, 307.

Gahrliopia (Gahrliopia) longipili, Traub and Morrow, 1955, 72; 1957, 181; Womersley and Audy, 1957, 285.

Gahrliopia (Gateria) longipili, Vercammen-Grandjean, 1968b, 116, revival of subgenus *Gateria*.

Gahrliopia longipilis, sic! Prasad, 1974, 81.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Presence and nature of eyes not reported in the literature. 1 pair of humeral setae; 36 dorsal idiosomal setae, measuring 48-54, arranged : 6-6-8-6-2-6-2; 2 pairs of sternal setae; approximately 66 ventral setae, preanal measuring 29, postanal 60; total idiosomal setae approximately 108 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/BNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Strongly punctate, subpentagonal with anterior margin shallowly concave; posterior

margin deeply produced, tapering, caudally angled; SB anterior to level of PL bases; 9 usurped setae posterior to level of PL bases, 3 forming row anteriorly, remainder randomly scattered over posterior half of scutum; $PL > AL$; $PW/SD = 0.60$; sensillary bases with distinct anteromedial cuticular ridge; sensillae missing in holotype. Scutal measurements of holotype after original description : AW 51; PW 85; SB 51; ASB 26; PSB 116 (Fuller, 1952 : 85.5); AP 34; AL 46; PL 57.

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Coxa III 1B. Measurements not reported in the literature.

Type data : Holotype, MANIPUR, Imphal, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 8.V.1945, Sergeant J. Hake, coll.

Type depository : Holotype in BM(NH).

Remarks : The above redescription is based only on the literature. *G. longipili* runs to couplet 31 of the key to species of the subgenus *Gahrlipeia* given by Traub and Morrow (1957) along with *G. crocidura* (Radford, 1946). *G. longipili* may be distinguished by the greater number of usurped setae on scutum (6 in *G. crocidura*), and by the deeply angled caudal margin (more rounded in *G. crocidura*).

166. *Gahrlipeia murini* new species (Fig. 137)

Description of species : Larva.

Idiosoma : Measuring 348x256 in partially engorged holotype. Eyes 2/2, often only faintly visible, anterior larger, free on cuticle. 1 pair of humeral setae, measuring 28-37; 28-32 dorsal idiosomal setae, measuring 25-35, irregularly arranged, arrangement in holotype : 4-6-6-6-4-2; 2 pairs of sternal setae, anterior 31-34; posterior, 20-25; 26-40 preanal setae, 16-21; 14-22 postanal setae, 23-32; total idiosomal setae 80-92 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (30) with distinct tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudally rounded; SB anterior to level of PL bases; 4 (sometimes 5) usurped setae inserted on posterior third of scutum, measuring 28-36; $PL > AL$; sensillary bases with prominent antero- and postero-medial cuticular ridges; sensillae clavate, head with setules; $PW/SD = 0.65-0.72$. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 49 (49, 45-54); PW 69 (71, 66-78); PPW1 49 (46, 39-49); PPW2 22 (21, 18-24); SB

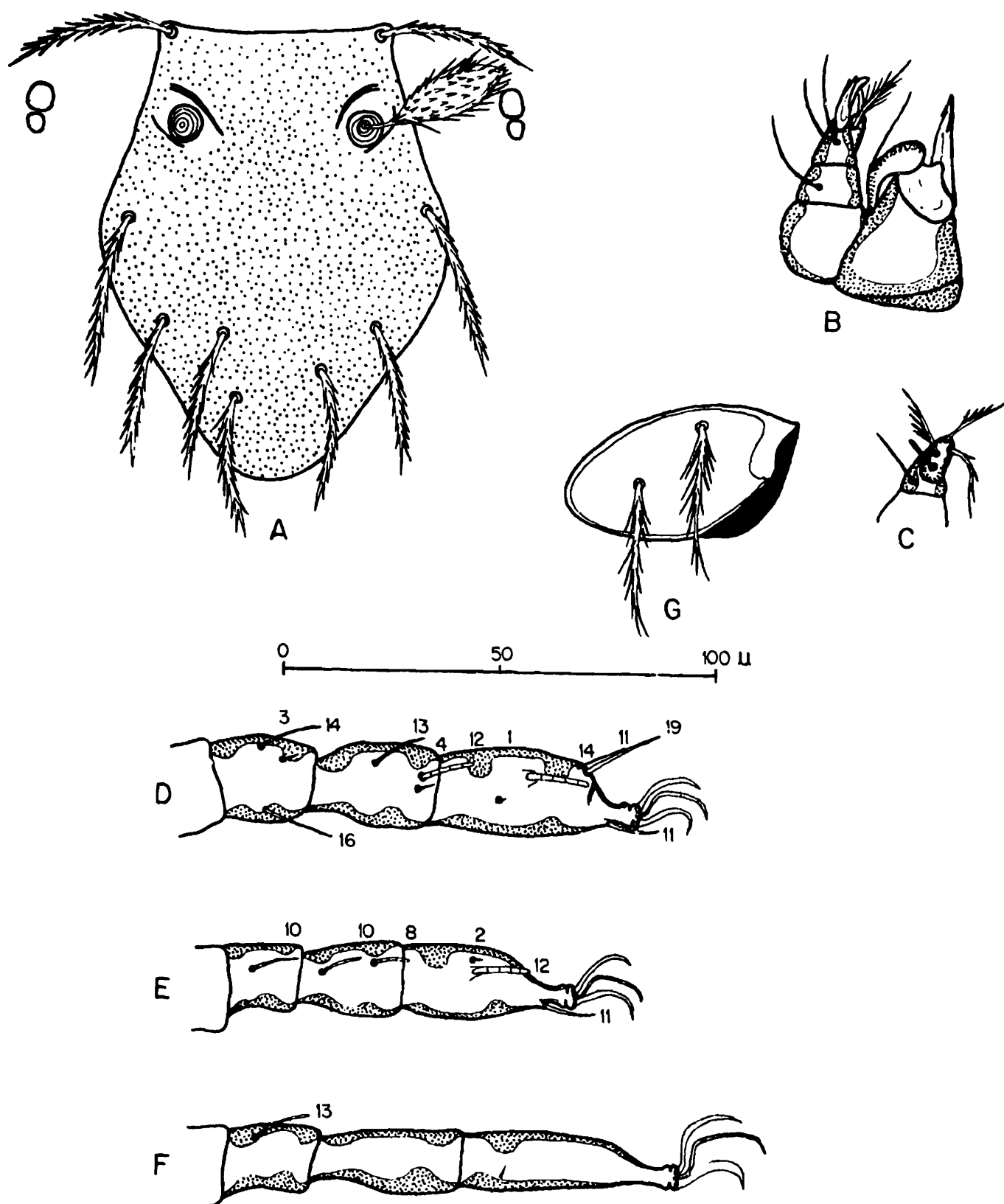


Fig. 137. *Gahrliepia murini* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

42 (44, 38-51); ASB 23 (22, 21-24); PSB 80 (82, 77-85); AP 44 (44, 40-48); AL 38 (36, 34-38); PL 38 (39, 36-43); sens. 36x11 (34x11, 32-36 x 9-12).

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae. Coxa III 2B. Measurements as follows : Ip = 589-671. Leg I : 202-236; tarsus (47x20), tarsala (14-16). Leg II : 172-200; tarsus (40x18), tarsala (12-15). Leg III : 200-237; tarsus (50x12).

Type data : Holotype (NIV A95480.2) and 2 paratypes, MAHARASHTRA, Pune District, Bhor, Nighudgarh, 620m, ex *Suncus murinus*, 19.II.1971, S.M. Kulkarni, coll. 8 paratypes, same data, but ex 4 *S. murinus*, taken 14.II.1970.

Additional records : MAHARASHTRA, Pune District, 17 ex 17 *S. murinus*, 14.II.1970 to 30.VI.1971, S.M. Kulkarni, coll.

Remarks : *G. murini* will run to couplet 20 of the key to species of the subgenus *Gahrliopia* given by Traub and Morrow (1957) along with *G. barbiger* Traub and Morrow, 1957, with coxa III 2B. *G. murini* may easily be separated by the smaller number of usurped scutal setae (13-23 in *G. barbiger*), fewer dorsal idiosomal setae (43-46 in *G. barbiger*), and single pair of humeral setae (2 pairs in *G. barbiger*). The species name is based on the type host, *Suncus murinus*.

167. *Gahrliopia plurisetae* Traub and Morrow

Gahrliopia (Gahrliopia) plurisetae Traub and Morrow, 1955, 28; 1957, 180; Lakshana and Dohany, 1972, 13.

Gahrliopia (Scrobiculata) plurisetae, Vercammen-Grandjean, 1968b, 117.

Redescription of species : Larva.

Idiosoma : Measuring approximately 247x165 in partially engorged holotype. Eyes 2/2, anterior larger, on ocular plate. 1 pair of humeral setae; approximately 28 dorsal idiosomal setae, measuring 32-40, slightly thicker than PL setae, arrangement commencing : 2-4-4, the rest irregular; 2 pairs of sternal setae; approximately 18 preanal setae, slender, finely ciliated, measuring 15-18; approximately 22 postanal setae, thinner than dorsal idiosomal setae; total idiosomal setae approximately 72 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/B/BNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, suboval, measuring 88x117 in holotype, with minute punctae and scattered scrobiculae; anterior margin fairly straight; posterior margin deeply produced; posterolateral margins gently angled at midscutal level, caudally rounded; AL setae displaced from anterolateral angles by nearly contiguous PL setae; SB at level of anterior sixth of scutum; 3 pairs of usurped setae on scutum; anterior pair submarginal, at lateral angles of scutum; 2nd pair, submedial, at 3/4th level; posterior pair caudomarginal; AL setae, thick,

bushy; AL << PL; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.41-0.49. Scutal measurements of holotype followed by means and ranges of paratypes after original description : AW 37 (40, 38-42); PW 52 (54, 52-56); PPW1 - (64, 57-71); PPW2 - (37, 33-41) (with reference to distance between caudomarginal pair, as clarified in original description); SB 39 (42, 38-46); ASB 20 (19, 18-20); PSB 97 (103, 97-109); AP 9 (8, 7-9); AL 32 (34, 30-38); PL 51 (53, 49-57); (measurements of sensillae not recorded).

Legs : Similar to *G. armata* n. sp. in the number of sensory setae. Coxa III 1B. Measurements not recorded in the literature.

Type data : Holotype (USNM No.2163), ASSAM, 21 miles North of Ledo, Stilwell Road (in scrub terrain), ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 28.VIII.1945, USATC, coll. 1 paratype, same data, but taken 17.VI.1945; 1 paratype, same data, but taken 29.VI.1945.

Type depository : Holotype and 1 paratype in USNM; 1 paratype in Traub collection.

Remarks : The above redescription is based only on the literature. *G. plurisetae* runs to couplet 17 of the key to species of the subgenus *Gahrlepiea* given by Traub and Morrow (1957). It is similar to *G. gemina* Traub and Morrow, 1955, and *G. dupliseta* Traub and Morrow, 1955, in having PL setae anteriorly displaced and scutum caudally rounded, not angled. *G. plurisetae* may be distinguished from these 2 species in having 3 pairs of usurped scutal setae (2 pairs in *G. gemina* and *G. dupliseta*). *G. plurisetae* may further be separated from *G. gemina* in having lateral angles at midscutal level (at anterior fifth in *G. gemina*), anterior pair of usurped scutal setae submarginal, at level of lateral angles (marginal, far posterior in *G. gemina*), and 2 pairs of sternal setae (3 pairs in *G. gemina*). *G. plurisetae* may further be separated from *G. dupliseta* in having scutum broader, 3/4 as broad as long (3/5 in *G. dupliseta*), and posterior pair of usurped scutal setae submarginal (submedial in *G. dupliseta*).

168. *Gahrlepiea punensis* new species
(Fig. 138)

Description of species : Larva.

Idiosoma : Measuring 335x302 in engorged holotype. Eyes 2/2, on ocular plate. 1 pair of humeral setae, measuring 42-51; 32-42 dorsal idiosomal setae, measuring 34-55, irregularly arranged, arrangement in holotype : 4-6-2-8-2-6-6-4-4; 1 pair of sternal setae, measuring 31-39; 32-36 preanal setae, 20-26; 14-18 postanal setae, 26-44; total idiosomal setae 90-98 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula b/b/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (31) with dorsal subapical tooth and tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

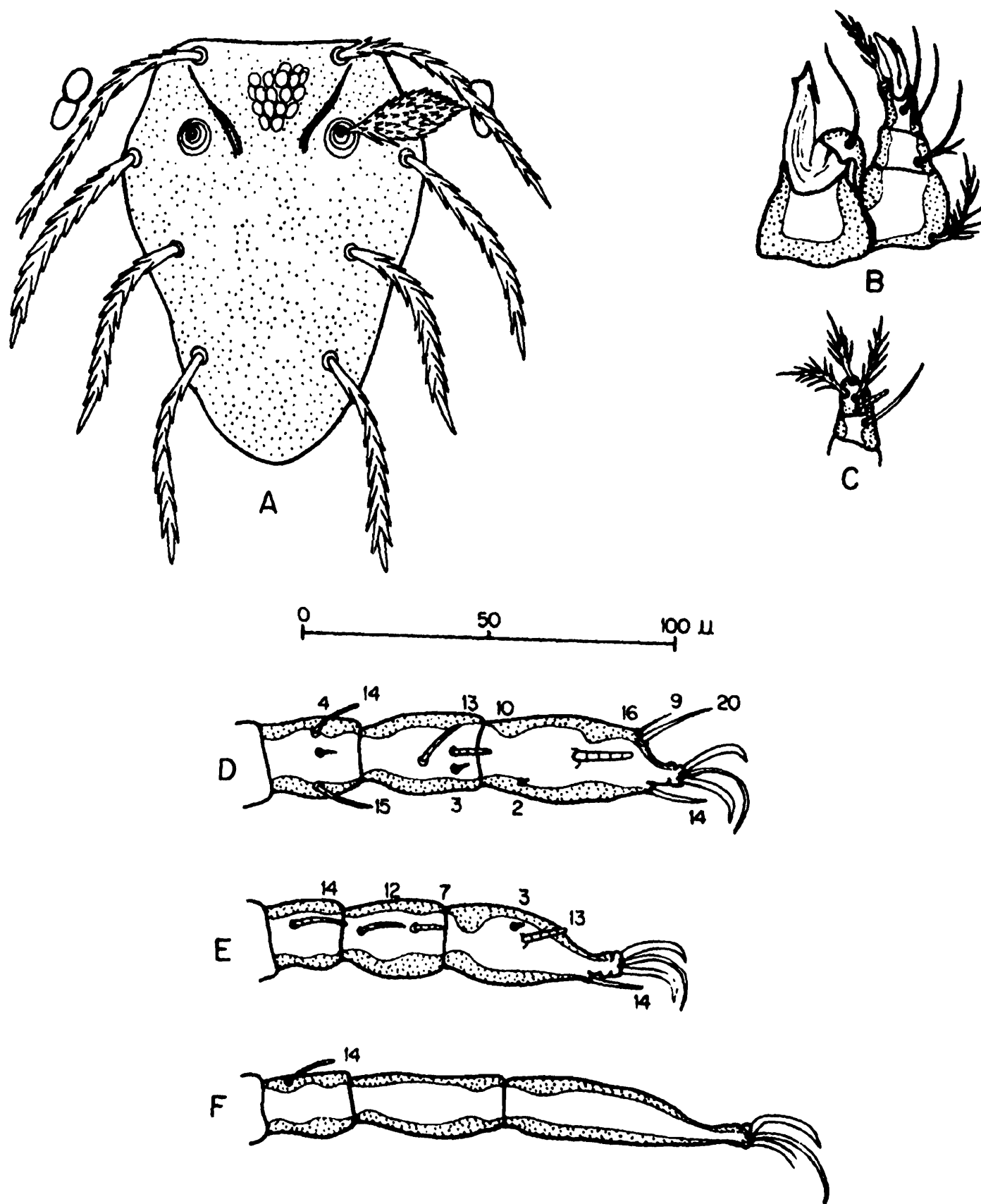


Fig. 138. *Gahrlepiea punensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Scutum : Moderately punctate, subpentagonal with oval scrobiculae clustered below mid-anterior margin; anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudally rounded; SB anterior to level of PL bases; 2 pairs of usurped setae inserted submarginally on posterior 1/2 of scutum; anterior pair near midscutal level, measuring 53-62; posterior pair near posterior 3/4 of scutum, measuring 51-61; AL and PL setae subequal (varying from AL>PL to PL>AL); sensillary bases with conspicuous anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.57-0.83. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 39 (41, 36-47); PW 77 (75, 66-93); PPW1 - (52, 46-55); PPW2 - (28, 27-29); SB 42 (43, 39-52); ASB 24 (25, 24-28); PSB 84 (90, 82-112); AP 37 (39, 36-42); AL 55 (56, 40-68); PW 61 (58, 47-65); sens. 35x15 (36x14, 33-39 x 13-15).

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 686-751; Leg I : 223-252; tarsus (55x22), tarsala (16-17). Leg II : 202-224; tarsus (47x21), tarsala (13-14). Leg III : 252-275; tarsus (67x16).

Type data : Holotype (NIV A99053.1) and 2 paratypes, MAHARASHTRA, Pune District, Khandala, 680m, ex *Rattus blanfordi*, 12.VI.1971, S.M., Kulkarni, coll.; 8 paratypes, same data, but ex 3 *R. blanfordi*, taken 21.IX.1969, 16.IX.1970 and 12.VI.1971.

Additional records : MAHARASHTRA, Pune District, 56 ex *R. blanfordi*, *Mus platythrix*, *Bandicota bengalensis*, *Millardia kondana*, and *S. murinus*, 21.IX.1969 to 9.VIII.1971, S.M., Kulkarni, coll. GOA, Bicholim, Brittona, and Keri, 3 ex 3 *S. murinus*, 16.XII.1983 and 11,12.II.1984, S. Fernandes, coll.

Remarks : *G. punensis* will run to couplet 20 of the key to species of the subgenus *Gahrliopia* given by Traub and Morrow (1957) along with *G. barbiger* Traub and Morrow, 1957, with coxa III 2B. *G. punensis* may easily be separated by the smaller number of usurped scutal setae (13-23 in *G. barbiger*), 2 pairs of eyes (1 pair in *G. barbiger*), and 1 pair of humeral setae (2 pairs in *G. barbiger*). *G. punensis* is similar to *G. murini* n. sp. from which it may be distinguished by the single pair of sternal setae (2 pairs in *G. murini*), palpal femoral and genual setae barbed (nude in *G. murini*), and usurped scutal setae inserted on posterior 1/2 of scutum (on posterior 1/3 of scutum in *G. murini*). This species has been named after the primary collection locality, Pune District.

169. *Gahrliopia uttaranchalensis* new species

(Fig. 139)

Gahrliopia sp. A Fernandes *et al.*, 1988, 108.

Description of species : Larva.

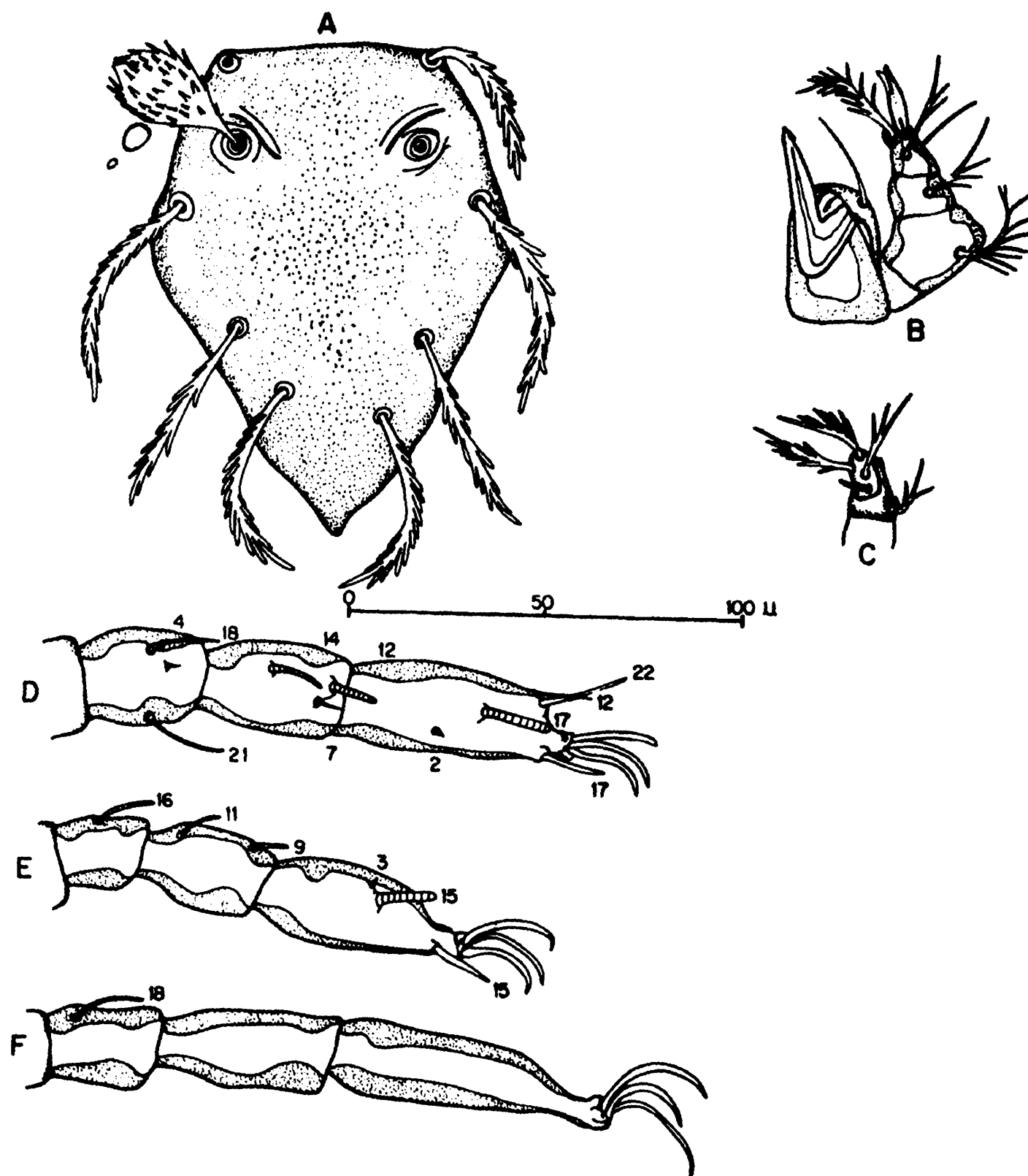


Fig. 139. *Gahrlepiea uttaranchalensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Idiosoma : Measuring 390x272 in partially engorged holotype. Eyes 2/2, anterior larger, free on cuticle. 2 pairs of humeral setae, internal measuring 48-52, external 49-54; 58-86 dorsal idiosomal setae, irregularly arranged, arrangement in holotype : 6-4-8-4-6-4+52, measuring 40-53, anterior median setae longest; 1 pair of sternal setae, inserted at level between coxa II-III, 39-48; 58-68 preanal setae, 26-36; 22-42 postanal setae, 30-41; total idiosomal setae 148-188 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/b(N)/N(b)NB/4B; palpal claw 3-pronged; galeala N; cheliceral blade (39) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin almost straight; posterolateral margins tapering, caudally subacuminate; SB anterior to level of PL bases; 4 (5 in paratype NIV A83225.20) usurped scutal setae, inserted submarginally, posterior to PL bases; PL>AL; PW/SD = 0.55-0.70; sensillae clavate, head with setules. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 48 (48, 44-52); PW 65 (69, 63-80); PPW1 - (56, 45-71); PPW2 - (29, 23-42); SB 43 (44, 41-47); ASB 25 (26, 23-28); PSB 84 (89, 79-101); AP 38 (40, 34-44); AL 47 (45, 43-47); PL 52 (58, 52-64); sens. 38x17 (38x17, 36-39 x 16-17).

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 782-828. Leg I : 258-273; tarsus (59x24), tarsala (16-18). Leg II : 232-249; tarsus (52x22), tarsala (15-16). Leg III : 286-306; tarsus (71x18).

Type data : Type series from the Himalayan collection by NIV field teams : Holotype (NIV A81884.13) and 1 paratype, UTTARANCHAL, Dehra Dun District, Kanasar, 1800-2300m, ex *Rattus rattoides*, 31.III.1968; 4 paratypes, Chamoli District, Lambagarh, 2150-2450m, ex *Mus musculus*, 26.VI.1968; 1 paratype, Tehri District, Chirbatia, 1800-3200m, ex *Rattus rattus gangutrianus*, 23.VI.1970; 1 paratype, Chamoli District, Dogalbita, 2300-2650m, ex *R. rattoides*, 8.VII.1970; 1 paratype, same data, but ex *Rattus rattus rufescens*, 9.VII.1970; 1 paratype, Chamoli District, Gwaldam, 1700-2000m, ex *R. rattoides*, 22.VII.1970.

Additional records : 9 records of collections from the Himalayan region by NIV field teams : UTTARANCHAL, 3 same data as holotype; 49 same data, but Chamoli District, Dogalbita, ex 2 *R. rattoides*, taken 8.VII.1970; 14 same data, but ex *R. r. rufescens*, taken 9.VII.1970; 1 same data, but Gwaldam, ex *R. rattoides*, taken 22.VII.1970; 33 same data, but Lambagarh, ex *Mus musculus*, taken 26.VI.1968; 1 same data, but Tehri District, Chirbatia, 1 ex *R. r. gangutrianus*, taken 26.V.1969; 1 same data, but ex *R. r. rattoides*, taken 27.V.1969; 13 same data, but taken 23.VI.1970; 29 same data, but Uttarkashi District, Sakhi, 2700m, ex *R. rattoides*, taken 4.VI.1969.

Remarks : *G. uttaranchalensis* will run to couplet 20 of the key to species of the subgenus *Gahrlipeia* given by Traub and Morrow (1957) along with *G. barbiger* Traub and Morrow, 1957, in having coxa III 2B. *G. uttaranchalensis* may easily be separated in having 4-5 usurped setae on scutum (13-23 in *G. barbiger*), 1 pair of sternal setae (2 pairs in *G.*

barbigera), and scutum caudally subacuminate (broadly rounded in *G. barbigera*). *G. uttaranchalensis* is close to *G. crocidura* (Radford, 1946) and *G. longipili* (Radford, 1946), from which it may be distinguished in having 1 pair of sternal setae (2 pairs in other two species), coxa III 2B (1B in other two species), and 2 pairs of humeral setae (1 pair in other two species). The species name is derived from the collection locality, UTTARANCHAL.

170. *Gahrлиеpia usitata* new species
(Fig. 140)

Description of species : Larva.

Idiosoma : Measuring 440x260 in partially engorged holotype. Eyes 2/2, on ocular plate. 2 pairs of humeral setae, measuring 38-39; 35-36 dorsal idiosomal setae, measuring 38-44, irregularly arranged, arrangement in holotype : 2(+1)-6-6-6-4-4-4-2; 2 pairs of sternal setae, anterior 36-38; posterior, 44-46; 34-36 preanal setae, 22-26; 14-16 postanal setae, 26-32; total idiosomal setae 92-96 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (32) with distinct tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal with anterior margin shallowly concave; posterior margin deeply produced, caudal angle gently rounded; SB anterior to level of PL bases; 5-6 usurped setae with short barbs, similar to idiosomal setae, measuring 45-47, inserted on posterior 1/2 of scutum, anterior pair near midscutal level; AL and PL setae with fine barbs; PL>AL; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = .054-.61. Scutal measurements of holotype followed by paratypes: AW 48, 50, 44; PW 70, 75, 64; PPW1 53, 69, -; SB 47, 50, 46; ASB 19, 22, 22; PSB 111, 115, 105; AP 41, 42, 38; AL 37, 37, -; PL 55, 49, -; sens. 41x14, -, -.

Legs : Similar to *G. armata* n. sp. in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 667-679. Leg I : 223-235; tarsus (52x20), tarsala (15-16). Leg II : 193-200; tarsus (42x20), tarsala (15). Leg III : 244-251; tarsus (59x15).

Type data : Holotype (NIV A95843.22) and 2 paratypes, UTTARANCHAL, Tehri District, Chirbatia, 1800-3200m, ex *Rattus rattoides*, 23.VI.1970, NIV, coll.

Remarks : *G. usitata* will run to couplet 20 of the key to species of the subgenus *Gahrлиеpia* given by Traub and Morrow (1957) along with *G. barbigera* Traub and Morrow, 1957, having coxa III 2B. *G. usitata* may easily be separated by the smaller number of usurped scutal setae (13-23 in *G. barbigera*), 2 pairs of eyes (1 pair in *G. barbigera*), and longer PL setae (measuring 37-39 in *G. barbigera*). *G. usitata* is close to *G. uttaranchalensis* n.sp. from which it may be distinguished by having palpal femoral seta nude (barbed in *G. uttaranchalensis*), 2 pairs of sternal setae (1 pair in *G. uttaranchalensis*), and a lower Ip range (782-828 in *G. uttaranchalensis*). The species name is derived from the Latin for 'ordinary'

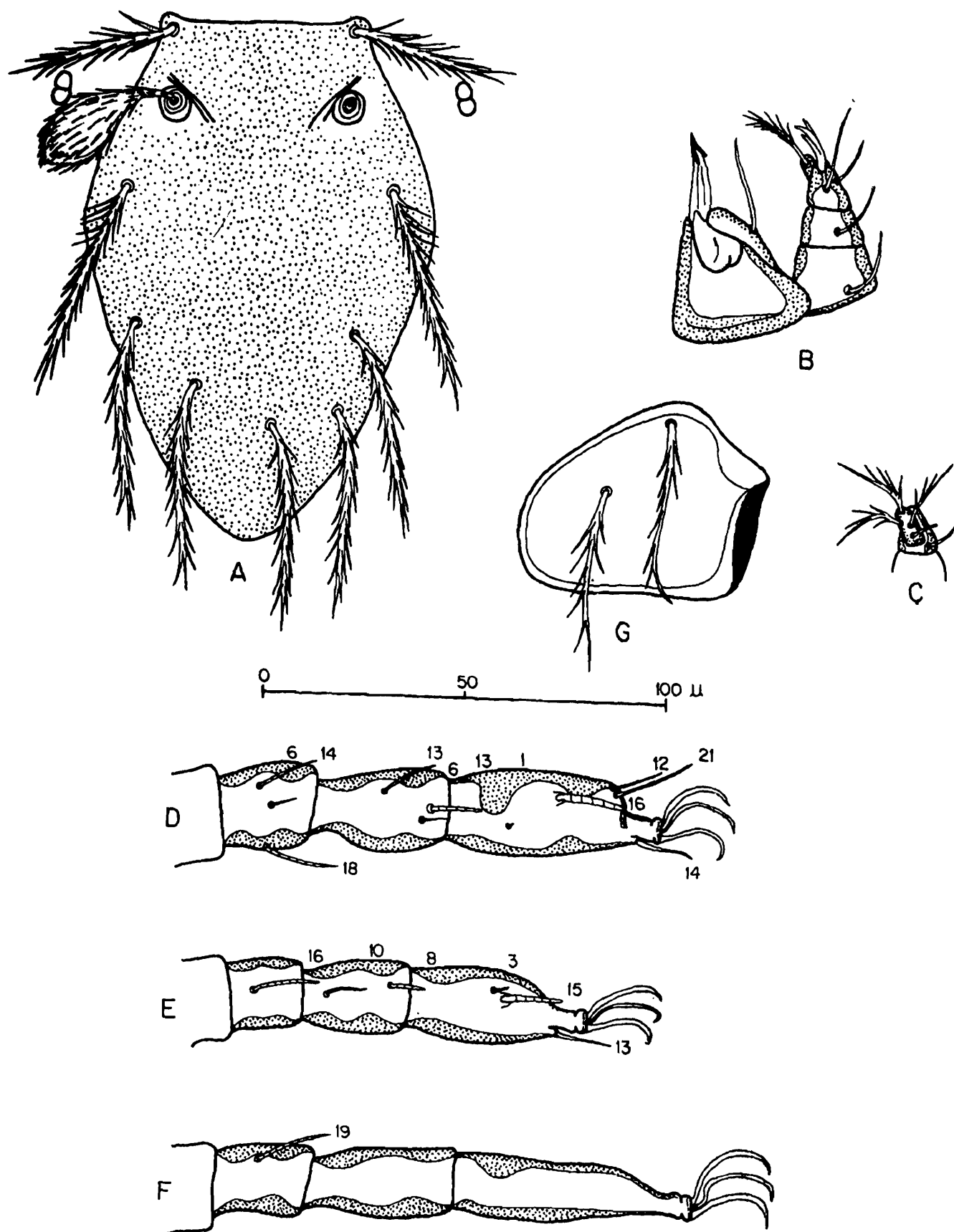


Fig. 140. *Gahrliepia usitata* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Genus *Schoengastiella* Hirst

Schoengastiella Hirst, 1915, 188; Wharton and Fuller, 1952, 94; Vercammen-Grandjean, 1968b, 113; Vercammen-Grandjean and Langston, 1976, 58; Kolebinova and Vercammen-Grandjean, 1978, 111; Wang and Ku, 1983, 381; Brown and Goff, 1988, 217; Fernandes et al., 1988, 109; Nadchatram and Fernandes, 1989, 17.

Gahrlepiea (*Schoengastiella*), Womersley, 1952, 22; Audy, 1954b, 161; Traub and Evans, 1954, 89; 1957, 297; Traub and Morrow, 1955, 2; 1957, 183; Nadchatram and Dohany, 1974, 48.

Type species : *Schoengastiella bengalensis* Hirst, 1915, by original designation.

Diagnosis : *Gahrlepieiini* larvae parasitic on ground mammals. Idiosoma oval in shape with a tendency to constriction just posterior to coxa III. Palpal tarsus 4B, 4B.S or 5B; palpal claw 3-pronged; cheliceral blade with tricuspid cap; galeala N. Scutum lacking AM seta; posterior margin produced beyond PL setae proper with the inclusion of 1 pair of dorsal body setae on the scutum; scutal punctae simple (scattered scrobiculae sometimes present); sensillae expanded, fusiform to globose. Eyes 2/2, or 1/1. 2 genualae I, genualae II and III (rarely with single genuala I, genuala II and III absent); tibiala III and mastisetae absent.

Remarks : Following Nadchatram and Fernandes (1989), *Schoengastiella* is here accorded full generic status. Kolebinova and Vercammen-Grandjean (1978) have reported 7 subgenera in the genus, including 3 new subgenera : *Radfordiella*, *Elasmoproctiella* and *Dureniella*. Earlier, Vercammen-Grandjean (1968b) had proposed the subgenus *Colocynthiella*, distinguishing it from the nominate subgenus in having palpal tarsal setation 5B (4B in the nominate subgenus), single genuala I with genuala II and III absent (2 genualae I with genualae II and III present in the nominate subgenus), and scutum with rounded posterior margin (scutum markedly elongate in the nominate subgenus). A new species described here, *S. singularis* n. sp., shares this unusual number of pedigenualae with the subgenus *Colocynthiella*, but has palpal tarsal setation 4B and the scutum markedly elongate. Hence, the subgeneric classification proposed by Vercammen-Grandjean (1968b) and Kolebinova and Vercammen-Grandjean (1978) is not followed here. 26 *Schoengastiella* species are reported here from India, including 12 new species.

171. *Schoengastiella bengalensis* Hirst (Fig. 141)

Schoengastiella bengalensis Hirst, 1915, 188; Wharton and Fuller, 1952, 94; Schluger and Myschenko, 1957, 455; Nadchatram and Fernandes, 1989, 16.

Gahrlepiea (*Schoengastiella*) *bengalensis*, Womersley, 1952, 298; Womersley and Audy, 1957, 286.

Gahrlepiea (*Schoengastiella*) *bengalensis*, sic! Joshee, 1964, 46; Wattal et al., 1967a, 352; Varma and Mahadevan, 1971, 821; Kochhar, 1972, 138.

Schoengastiella (*Schoengastiella*) *bengalensis*, Vercammen-Grandjean, 1968b, 113.

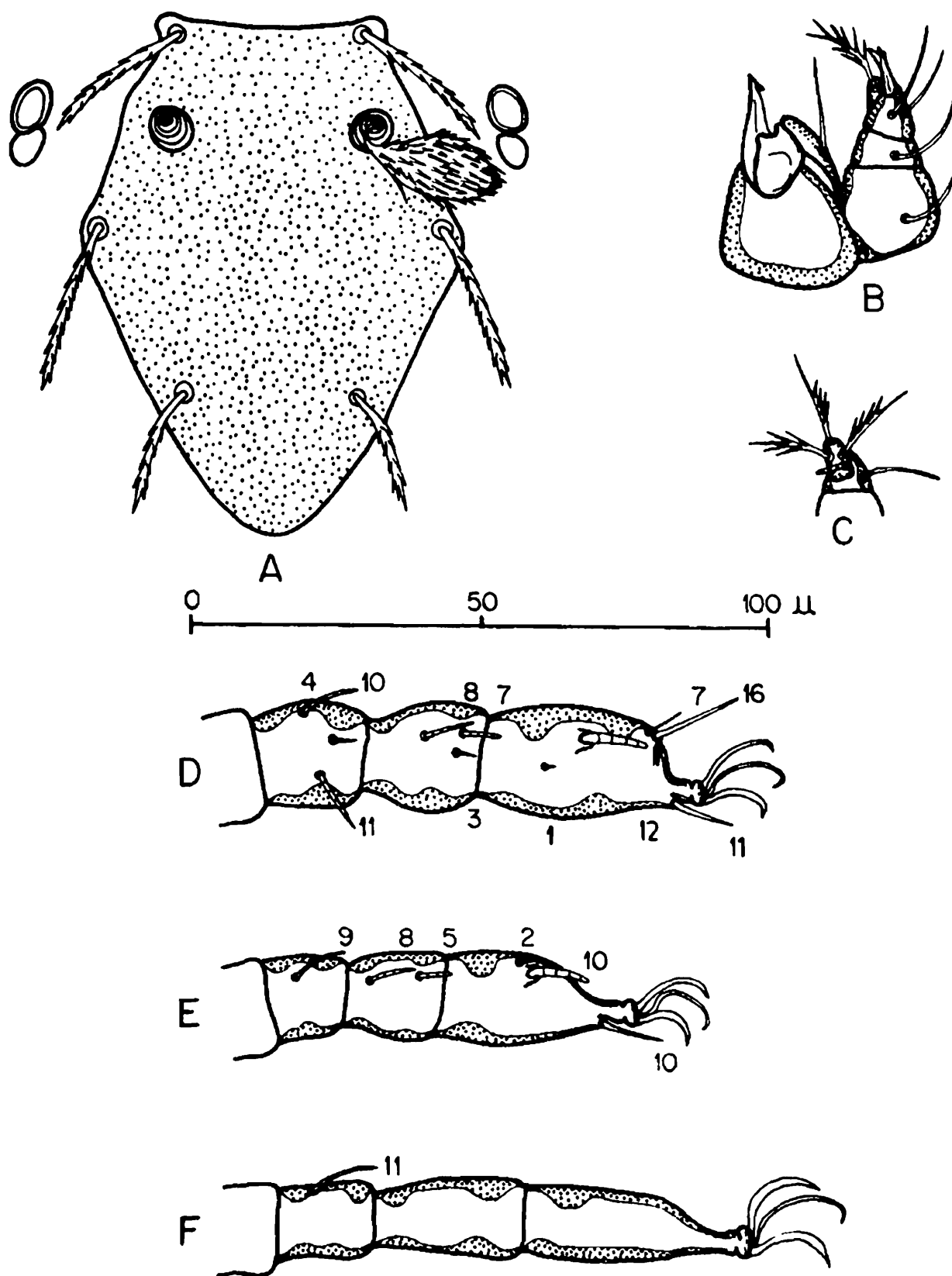


Fig. 141. *Schoengastiella bengalensis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Gahrliepia bengalensis, Prasad, 1974, 77.

As Trombicula oudemansi, Mehta, 1937, 358.

Redescription of species : Larva.

Idiosoma : Measuring 317x196 in partially engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 26; 30-32 dorsal idiosomal setae, measuring 20-22, arranged : 4-6-6-2-6-4-2-(2) (Womersley, 1952: 36, arranged : 6-8-8-6-4-2-2); 2 pairs of sternal setae, anterior 20-25, posterior 16-18; 32 preanal setae, 12-14; 16-18 postanal setae, 18-20 (Womersley, 1952 : 36 ventral setae); total idiosomal setae 84-88 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged (2-pronged in original illustration); galeala N; cheliceral blade (21) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL setae; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae subequal, with short barbs; PPL setae similar to scutal setae, measuring 20-22; sensillae clavate, head with setules; PW/SD = 0.61-0.64. Scutal measurements giving means and ranges of 11 specimens from JAMMU and KASHMIR after Womersley (1952) : AW 37, 34-39; PW 51, 46-54; SB 32, 28-35; ASB 21, 16-24; PSB 58, 54-70; AP 38, 35-39; AL 31, 30-38; PL 36, 35-36; sens. 33x15. Scutal measurements giving means of 5 specimens from MAHARASHTRA, Bombay, Bhandup after Joshee (1964) : AW 33; PW 41; SB 26; ASB 16; PSB 48; AP 36; AL 25; PL 28; sens. 28x-.

Legs : 7-6-6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Ip = 478-483. Leg I : 164-171; coxa with 1 branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala, tarsus (39x19), tarsala (12-13), microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 136-141; coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus (32x16) 15B, tarsala (10-12), microtarsala, pretarsala. Leg III : 173-176; coxa 1B; trochanter 1B; femur 5B; genu 3B, genuala; tibia 6B; tarsus (38x12) 15B.

Type data : Holotype, WEST BENGAL, Calcutta, ex *Rattus rattus*, 20.III.1915, ? Paiva, coll.

Type depository : Holotype in BM(NH).

Additional records : HIMACHAL PRADESH, Simla Hills, Kasauli and Sabathu, ex *R. rattus*, VI.1935 - V.1936, D.R. Mehta, coll. MADHYA PRADESH, Chindwara forest, near Thunia, 2 ex 'rat', 17.XII.1946, S.L. Kalra, coll. JAMMU AND KASHMIR, Kanzalwan, 5 ex 'rats?', 10-11.X.1948, S.L. Kalra, coll.; Raniket, 1 ex 'rat', 20.X.1948; Tithwal, 4 ex

'rats?', 17.XII.1948. MAHARASHTRA, Bombay, ex *R. rattus*, V-VIII.1958 and VIII-XII.1959, A.K. Joshee, coll. SIKKIM and WEST BENGAL, East Himalayan foot-hills, ex 'rodents and insectivores?', 1966-1967, R.N. Varma, coll. UTTARANCHAL, Nainital District, 10 ex *R. rattus* and *Bandicota bengalensis*, VIII.1967, NICD, coll. ARUNACHAL PRADESH and ASSAM, ex *B. bengalensis*, rodents and *S. murinus* (specific hosts not reported), 1968-1969, R.K. Kochhar, coll.

New records : GOA, about 1100 ex *S. murinus* and *Rattus blanfordi*, 14.XII.1983 to 20.II.1984, S. Fernandes, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens from Goa. Hirst (1915) raised the genus *Schoengastiella* to accommodate this species. The original description is very sketchy and the redescription by Womersley (1952) is based on Kalra's collection from Jammu and Kashmir. *S. bengalensis* is very close to *S. argalea*. It is distinguished primarily by the presence of 2 pairs of eyes (1 pair in *S. argalea*). The latter may subsequently prove to be a synonym of *S. bengalensis*. The species name is based on the type locality.

172. *Schoengastiella argalea* Traub and Morrow
(Fig. 142)

Gahrlepiea (Schoengastiella) argalea Traub and Morrow, 1957, 183; Kundin *et al.*, 1966, 213; Nadchatram, 1970b, 136; Kulkarni *et al.*, 1979, 20.

Schoengastiella (Schoengastiella) argalea Vercammen-Grandjean, 1968b, 114; Kaul *et al.*, 1978, 22.

Redescription of species : Larva. Colour in life white.

Idiosoma : Measuring about 312x276 in engorged specimen. Eyes 1/1, free on cuticle. One pair of humeral setae, measuring 21-28; 28-32 dorsal idiosomal setae, measuring 18-23, arranged : 4-6-6-8(6)-4-4(2) (Original description : about 32, measuring 22-28, arranged : 4-8-8-6-4-2); 2 pairs of sternal setae, anterior 22-25, posterior 15-19; 26-36 preanal setae, 12-15; 12-16 postanal setae, 18-21 (Original description : about 40 preanal and 24 postanal setae); total idiosomal setae 72-88 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (21) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae slender, subequal, finely ciliated; usurped or pseudoposterolateral (PPL) setae similar to scutal setae, measuring 21-26; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.57-0.68 (Original description : 0.44-0.52). Scutal measurements of holotype followed by

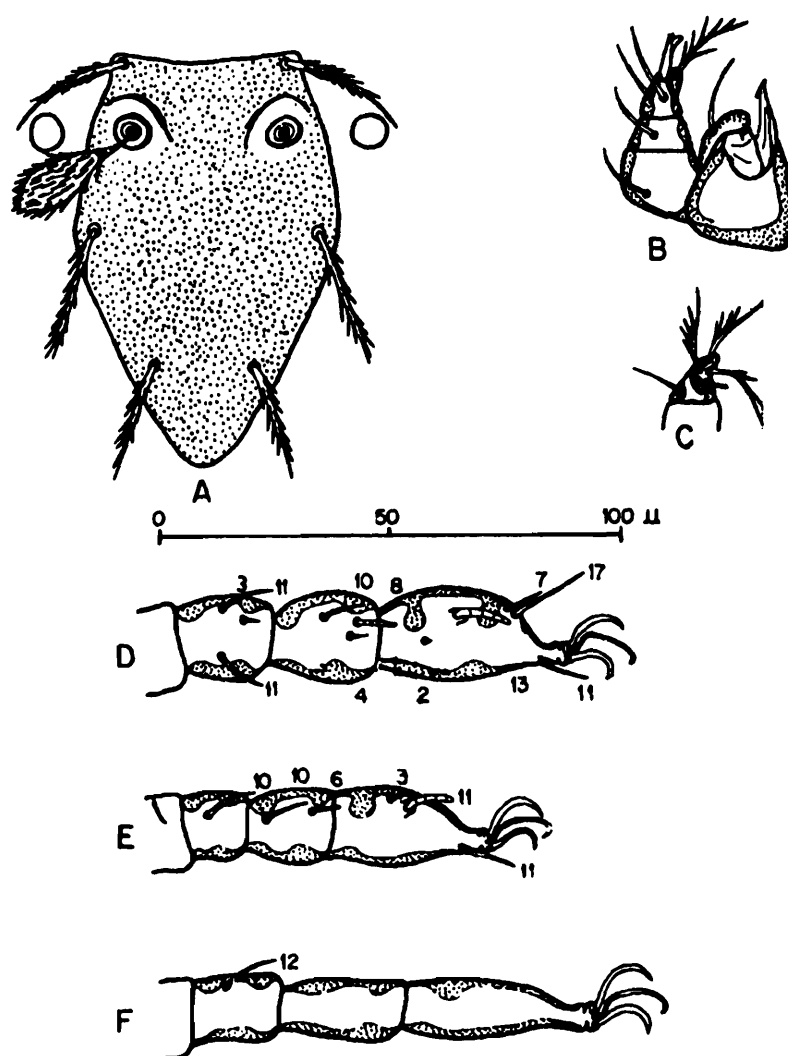


Fig. 142. *Schoengastiella argalea*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

means and ranges of 3 paratypes in parentheses after original description : AW 34 (33, 31-35); PW 48 (45, 42-48); SB 35 (31, 27-35); ASB 20 (19, 18-20); PSB 79 (74, 69-79); AP 40 (38, 36-40); AL 27 (28, 26-30); PL 26 (24, 22-26). Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 35, 32-39; PW 56, 51-64; PPW 25, 22-27; SB 34, 31-37; ASB 20, 18-21; PSB 71, 61-79; AP 37, 34-41; APP 67, 64-72; PP 22, 18-24; AL 26, 22-32; PL 28, 24-32; sens. 30x9, 29-31 x 9-11.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 498-560. Leg I : 170-194; tarsus (39x20), tarsala (11-14). Leg II : 147-169; tarsus (32x17), tarsala (11-12). Leg III : 180-199; tarsus (39x13).

Type data : Holotype (USNM 2443), MALAYSIA (formerly MALAYA), Selangor, ex *Rattus sabanus*, 31.VIII.1951, USAMRU, coll.; 2 paratypes, same locality, ex *Tupaia glis*, 24.XI.1951, CORU, coll. (Traub and Morrow, 1957, report 3 paratypes, but give records for only 2!).

Type depository : Holotype in USNM; paratypes in IMR and Traub collection.

Additional records : MAHARASHTRA, Pune District, about 1250 ex *Suncus murinus*, *Funambulus tristriatus*, *Millardia kondana*, and *Rattus rattus rufescens*, 25.IV.1970 to 21.VIII.1971, S.M. Kulkarni, coll. RAJASTHAN, Kota District, 5 ex *S. murinus*, 28.X.1971, H.N. Kaul, coll.

New records : GOA, about 600 ex 10 *S. murinus*, 12.XII.1983 to 20.II.1984, S. Fernandes, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Traub and Evans (1957) distinguish *S. argalea* from *S. helata* (Traub and Evans, 1954) and *S. liota* (Traub and Evans, 1954) by the unisetose coxa III (bisetose in the other 2 species), and single pair of eyes, inserted relatively far from scutum (eyes 2/2, close to scutum in the other 2 species). They distinguish *S. argalea* from *S. ligula* Radford, 1946, with unisetose coxa III, in having scutum nonligulate. The Indian specimens have a larger PW and fewer ventral setae compared to the Malaysian type series.

173. *Schoengastiella brevis* Radford

Schoengastiella brevis Radford, 1946b, 256; Wharton and Fuller, 1952, 94; Audy *et al.*, 1953, 27.

Gahrlepiea (Schoengastiella) brevis, Womersley, 1952, 298; Womersley and Audy, 1957, 286.

Schoengastiella brevipes, **sic!** Schluger and Myschenko, 1957, 455.

Schoengastiella (Colocynthiella) brevis, Vercammen-Grandjean, 1968b, 115.

Gahrlepiea brevis, Audy, 1954b, 162; Prasad, 1974, 77.

Redescription of species : Larva.

Idiosoma : Measurements not recorded. Eyes apparently absent. One pair of humeral setae; 24 dorsal idiosomal setae, arranged : 2-4-6-6-6 (Womersley, 1952 : 4-6-6-2-4-2); 2 pairs of sternal setae; approximately 42 ventral setae (Original illustration : 24 preanal and 18 postanal setae); total idiosomal setae approximately 70 (excluding usurped scutal setae).

Scutum : Broad, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle broadly rounded; SB anterior to level of PL bases; PL > AL; PPL setae inserted submarginally; sensillary bases with anteromedial cuticular ridge; sensillae missing in holotype. Scutal measurements of holotype after original description : AW 44; PW 86; SB 51; ASB 26; PSB 78; AP 43; AL 38; PL 41.

Legs : Coxa III with 2 branched setae (2B). Measurements not recorded.

Type data : Holotype, MANIPUR, Imphal, ex *Rattus rattus bullocki* (= *Rattus rattus rufescens*), 7.V.1945, Sergeant J. Hake, coll.

Type depository : Holotype in BM(NH).

Remarks : The above redescription is based only on the literature. This species has not been recorded subsequent to its discovery. Vercammen-Grandjean (1968b) erected a new subgenus *Colocynthiella* for *S. brevis* and *S. cucurbitula* (Traub and Morrow, 1957). He characterized this subgenus by the rounded posterior projection of the scutum, the absence of eyes, palpal tarsal setation 5B and an unusual number of genualae (single genuala I, genualae II and III absent). Vercammen-Grandjean has included *S. brevis* in *Colocynthiella* on the basis of the sketchy original description alone. This placement is doubtful, and is not followed here.

174. *Schoengastiella ceylonica* (Womersley)
(Fig. 143)

Gahrlepiea (Schoengastiella) ceylonica, Womersley, 1952, 297; Womersley and Audy, 1957, 286; Mitchell *et al.*, 1966, 120; Varma and Mahadevan, 1971, 821; S.M. Kulkarni, 1979, 20.

Schoengastiella (Schoengastiella) ceylonica, Vercammen-Grandjean, 1968b, 114.

Gahrlepiea ceylonica, Prasad, 1974, 78.

Schoengastiella ceylonica, Fernandes *et al.*, 1988, 109; Nadchatram and Fernandes, 1989, 18.

Redescription of species : Larva.

Idiosoma : Measuring 267-545 x 171-350 in partially engorged to engorged specimens. Eyes apparently absent. One pair of humeral setae, measuring 25-32; 32-42 dorsal idiosomal setae, measuring 22-30, arrangement in holotype after original description : 4-8-8-6-4-2; 2 pairs of sternal setae, anterior 21-24, posterior 18-23; 24-30 preanal setae, 12-17; 16-26 postanal setae, 20-28 (Original description : 52 ventral setae); total idiosomal setae 88-102 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B (Vercammen-Grandjean, 1968b: palpal tarsal setation 4B.S); palpal claw 3-pronged (Original description : 2-pronged); galeala N; cheliceral blade (23) with distinct tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of sensillary bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae subequal, stout, bushy; PPL setae more slender, measuring 26-33; sensillary bases with pronounced anteromedial cuticular ridge; sensillae globose, head with fine setules; PW/SD = 0.34-0.43 (Original description : 0.40). Scutal measurements of holotype after original description, followed by means and ranges of 10 NIV specimens in parentheses : AW 31 (34, 26-40); PW 28 (28, 21-34); PPW - (12, 9-15); SB 23 (26, 21-30); ASB 14 (18, 15-22); PSB 55 (60, 57-63); AP 28 (31, 27-36); APP - (58, 46-67); AL 20 (20, 18-25); PL 20 (21, 18-25); sens. 20x14 (20x14, 18-23 x 13-16).

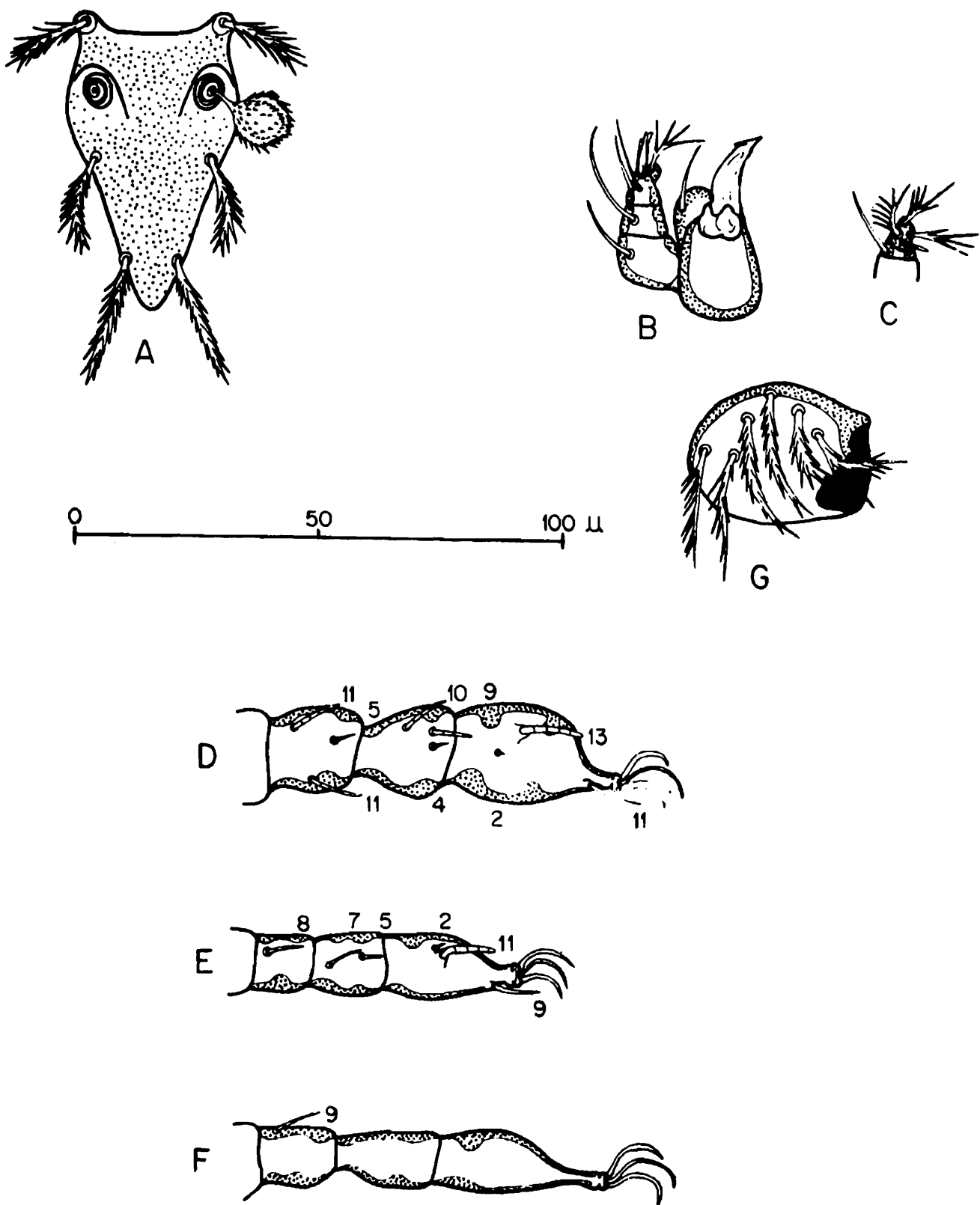


Fig. 143. *Schoengastiella ceylonica*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III with 4 (sometimes 5, rarely 6) branched setae. Measurements as follows : Ip = 409-522. Leg I : 150-192; tarsus (34x20), tarsala (12-13). Leg II : 119-153; tarsus (26x14), tarsala (11-12). Leg III : 140-177; tarsus (33x14).

Type data : Holotype, SRI LANKA (formerly Ceylon), Nalanda, ex *Rattus rattus kandiyanus*, V.1944, S.H. Jayewickreme, coll.; paratype, same data, but ex *Mus cervicolor fulviventris* (= *Leggada booduga fulvidiventris*).

Type depository : Not reported.

Additional records : JAMMU and KASHMIR, Naoshera, ex 'mouse', 14.V.1949, S.L. Kalra, coll. MADHYA PRADESH, Kanha National Park, 540-840m, 14 ex *Mus musculus humourus* and *Mus booduga*, 20-24.XII.1964, C.J. Mitchell, J. Spillelt and G.B. Schaller, coll. SIKKIM and WEST BENGAL, Eastern Himalayan foot-hills, ex rodents and insectivores (specific hosts not reported), 1966-1967, R.N. Varma, coll. MAHARASHTRA, Pune District, approximately 3500 ex *Suncus murinus*, *Millardia kondana*, *Golunda ellioti*, *Rattus rattus rufescens*, *Mus musculus*, *Mus platythrix*, and *M. booduga*, I.1970 - VIII.1971, S.M. Kulkarni, coll.

New records : ORISSA, Nandan Kanan Park, 20 ex *M. booduga*, 15.XI.1972, H.N. Kaul, coll. GOA, Dudhsagar, Pirla and Porvorim, 8 ex *Rattus blanfordi*, *M. platythrix*, and *Mus saxicola*, 17,19.X.1983 and 4.V.1984, S. Fernandes, coll. 12 records of collections from the Himalayan region by NIV field teams : CHHATTISGARH, Bilaspur District, Ghumarwim, 740-750m, 9 ex *M. musculus*, 25.III.1969. HIMACHAL PRADESH, Simla District, Nalagarh, 500-600m, 13 ex *M. platythrix*, 8.IV.1969; Sirmur District, Nahan, 500-520m, 13 ex 2 *M. platythrix*, 25,27.IV.1969. JAMMU and KASHMIR, Doda District, Khilani, 1200-1400m, 1 ex *Rattus rattoides*, 19.XI.1969; 1, same data, but ex *M. musculus*, taken 20.XI.1969; Udampur District, Phalata, 750m, 9 ex 2 *M. musculus*, 24,27.XI.1969; 3, same data, but ex *M. platythrix*, taken 23.XI.1969. UTTARANCHAL, Almora District, Dwarahat, 1400-2000m, 16 ex *Rattus nitidus*, 5.V.1967; Tehri District, Munikireti, 450m, 43 ex 2 *M. platythrix*, 26.X.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Womersley (1952) considers *S. ceylonica* close to *S. ligula* Radford, 1946, in the peculiar ligulate form of the scutum. He distinguishes it, however, by the differences in scutal dimensions, arrangement of dorsal body setae, and in having coxa III 4B (1B in *S. ligula*). *S. ceylonica* is close to *S. angusta* Nadchitaram and Fernandes, 1989. It may easily be separated in having palpal femoral seta N (B in *S. angusta*), AW>PW (PW>AW in *S. angusta*), and coxa III 4B (1B in *S. angusta*). The species name is based on the type locality.

175. *Schoengastiella chirbatiensis* new species

(Fig. 144)

Description of species : Larva.

Idiosoma : Measuring 246-465 x 174-318 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 52-60; 42 dorsal idiosomal setae, measuring 44-53, arranged : 4-6-4-8-8-6-4-2; 2 pairs of sternal setae, anterior 42-48, posterior 34-39; 38-40 preanal setae, 22-26; 24-28 postanal setae, 29-34; total idiosomal setae 112-114 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N(b)/N/NNN(b)/4B; palpal claw 3-pronged; galeala N; cheliceral blade (35) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin very shallowly concave; broadest at level of PL bases, posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL similar to scutal setae, measuring 45-54; sensillary bases with pronounced antero- and posteromedial cuticular ridges; sensillae clavate, head with setules; PW/SD = 0.54-0.59. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 48 (48, 46-51); PW 71 (74, 71-78); PPW 52 (45, 40-52); SB 49 (49, 46-50); ASB 23 (22, 20-24); PSB 106 (109, 105-116); AP 45 (46, 42-49); APP 88 (89, 85-94); PP 41 (43, 39-51); AL 44 (44, 41-48); PL 55 (56, 55-60); sens. - (41-42 x 13-15).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III with 3 (rarely 4) branched setae. Measurements as follows : Ip = 738-778. Leg I : 252-272; tarsus (67x23), tarsala (19-21). Leg II : 210-233; tarsus (54x20), tarsala (17-19). Leg III : 266-288; tarsus (77x16).

Type data : Holotype (NIV A95843.17) and 9 paratypes, UTTARANCHAL, Tehri District, Chirbatia, 1800-3200m, ex *Rattus rattoides*, 23.VI.1970, NIV, coll.

Additional records : 5, same data as type series; 20, same data, but Chamoli District, Gwaldam, 1700-2000m, taken 22.VII.1970.

Remarks : *S. chirbatiensis* is close to *S. kumaonensis* (Womersley, 1952) and *S. shrivastavi* (Srivastva and Wattal, 1975). *S. chirbatiensis* may easily be separated from these 2 species by the greater number of dorsal body setae (30 in *S. kumaonensis*, 30-32 in *S. shrivastavi*), longer PL setae (measuring 42 in *S. kumaonensis*, 42-50 in *S. shrivastavi*). *S. chirbatiensis* may be further distinguished from *S. kumaonensis* in having a higher Ip (636 in *S. kumaonensis*). *S. chirbatiensis* further differs from *S. shrivastavi* in having a uniformly micropunctate scutum (micropunctate with a few scattered scrobiculae in *S. shrivastavi*). The species name is based on the type locality.

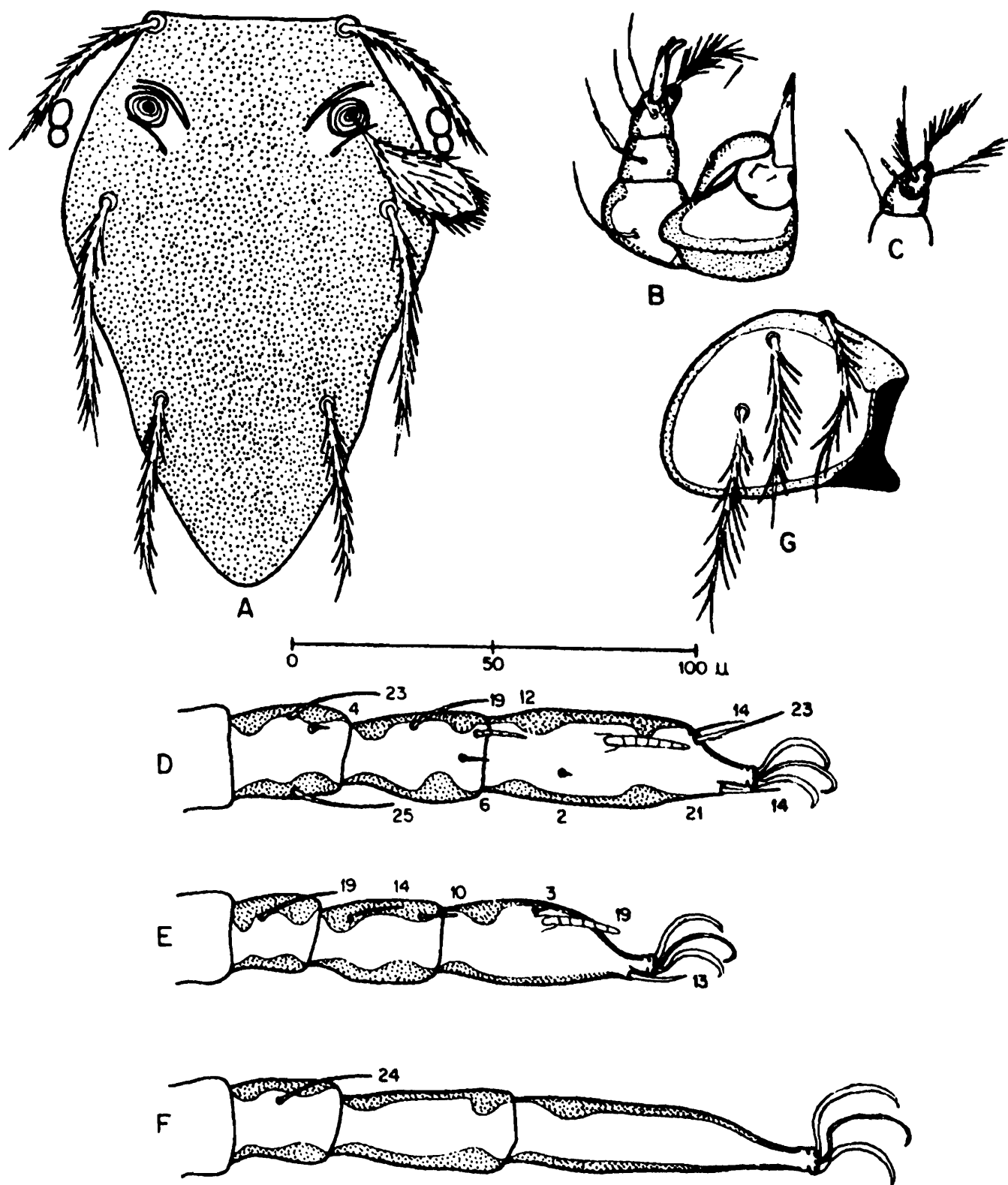


Fig. 144. *Schoengastiella chirbhathiensis* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

176. *Schoengastiella dalhousiensis* new species
(Fig. 145)

Schoengastiella sp. B Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 344-465 x 246-325 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, internal measuring 35-38, external measuring 37-44; 38-44 dorsal idiosomal setae, measuring 33-37, irregularly arranged, arrangement in holotype : 4-6-2-2-6-6-6-4-2; 2 pairs of sternal setae, anterior 39-45, posterior 26-31; 38-40 preanal setae, 20-23; 18 postanal setae, 27-36; total idiosomal setae 104-108 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/N(b)Nb(N)/4B; palpal claw 3-pronged; galeala N; cheliceral blade (35) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subhexagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudally truncate; SB anterior to level of PL bases; AL and PL setae with short barbs; PL>AL; PPL setae similar to scutal setae, measuring 35-38; sensillary bases with pronounced anteromedial cuticular ridge; sensillae missing in all specimens extant; PW/SD = 0.70-0.78. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 48 (54, 48-56); PW 95 (96, 92-101); PPW 67 (68, 62-70); SB 53 (55, 52-57); ASB 23 (24, 21-26); PSB 109 (106, 99-109); AP 52 (53, 50-57); APP 90 (91, 84-94); PP 40 (39, 37-41); AL 39 (37, 31-39); PL 45 (42, 40-45).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 706-769. Leg I : 245-262; tarsus (58x22), tarsala (18-20). Leg II : 208-230; tarsus (50x19), tarsala (16-18). Leg III : 245-278; tarsus (69x16).

Type data : Holotype (NIV A77737.22) and 4 paratypes, HIMACHAL PRADESH, Chamba District, Surkhigali, 1600-1620m, ex *Rattus rattoides*, 8.IX.1967, NIV, coll.; 1 paratype, same data, but JAMMU and KASHMIR, Udhampur District, Phalata, 750m, ex *Rattus* sp., taken 27.XI.1969.

Remarks : *S. dalhousiensis* is most similar to *S. erula* (Traub and Evans, 1954) and *S. unisternala* Nadchatram and Fernandes, 1989. *S. dalhousiensis* may easily be separated from these 2 species by the caudally truncate scutum (rounded in *S. erula* and *S. unisternala*), and bisetose coxa III (unisetose in *S. erula* and *S. unisternala*). *S. dalhousiensis* may further be separated from *S. erula* in having 2 pairs of humeral setae (1 pair in *S. erula*). *S. dalhousiensis* may further be distinguished from *S. unisternala* in having nude palpal femoral and genual setae (barbed in *S. unisternala*), and 2 pairs of sternal setae (1 pair in *S. unisternala*). The species is named after the better known mountain resort, Dalhousie, called the "Health farm of India", neighbouring Surkhigali, the type locality.

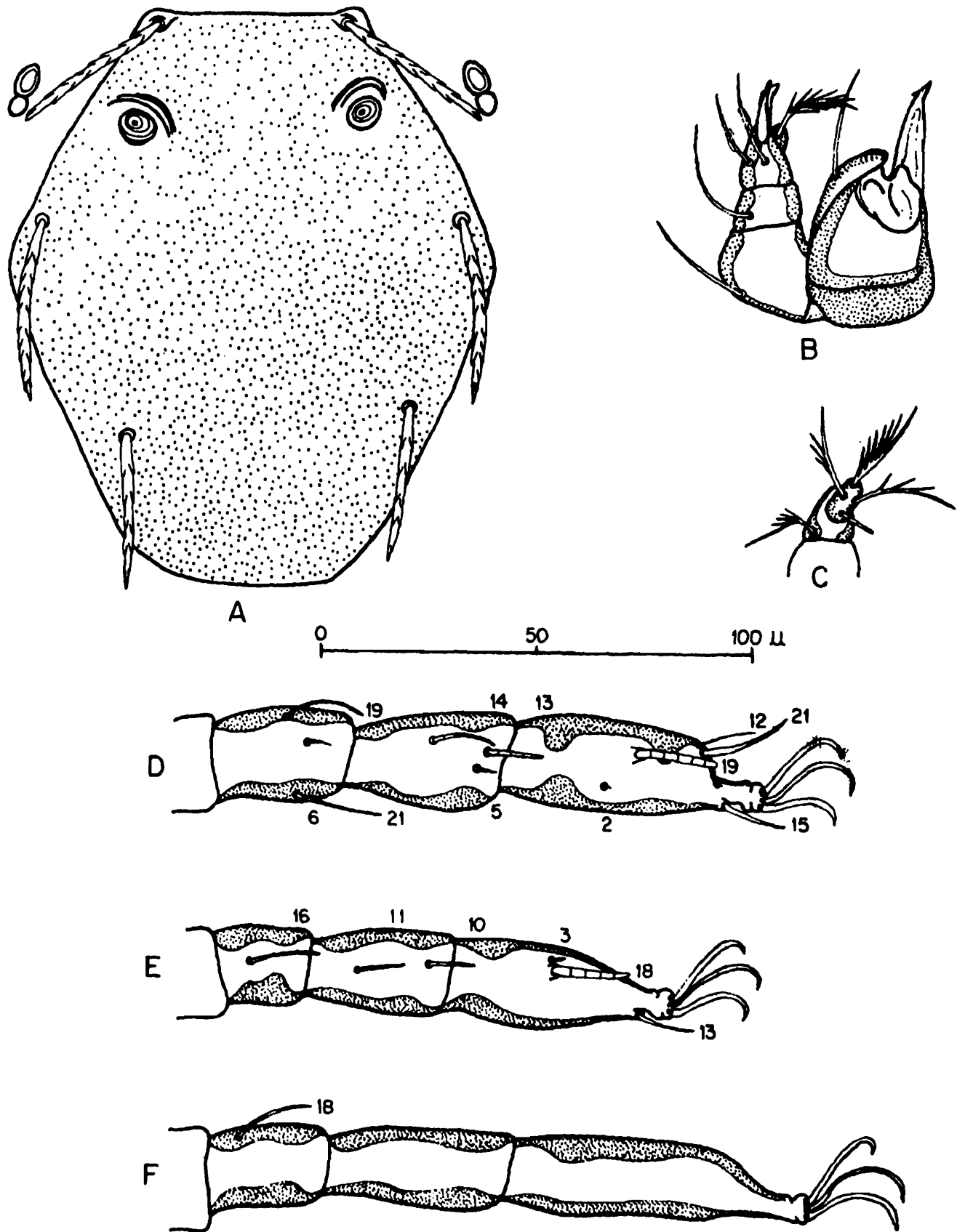


Fig. 145. *Schoengastiella dalhousiensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

177. *Schoengastiella darjeelingensis* new species
(Fig. 146)

Schoengastiella sp. A Fernandes *et al.*, 1988, 109.

Description of species : Larva.

Idiosoma : Measuring 321-580 x 224-324 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 28-31; 42-50 dorsal idiosomal setae, measuring 28-33, irregularly arranged, arrangement in holotype : 4-8-4-6-6-4-4-6-4-4; 2 pairs of sternal setae, anterior 30-35, posterior 24-26; 32-42 postanal setae, 23-27; total idiosomal setae 120-130 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (31) with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, narrowly elongate, with anterior margin shallowly concave; AW and PW subequal; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL setae similar to scutal setae, measuring 31-35; sensillary bases with conspicuous anteromedial cuticular ridge; sensillae globose, head with setules; PW/SD = 0.35-0.44. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 34 (35, 32-41); PW 33 (35, 31-42); PPW 15 (15, 12-18); SB 26 (27, 22-30); ASB 19 (18, 17-20); PSB 73 (74, 71-76); AP 33 (32, 30-36); APP 64 (65, 58-70); PP 28 (27, 23-28); AL 29 (27, 24-30); PL 37 (36, 33-42); sens. 26x15 (23x16, 20-26 x 15-17).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 500-582. Leg I : 180-213; tarsus (46x20), tarsala (14-16). Leg II : 152-173; tarsus (38x16), tarsala (13-14). Leg III : 168-196; tarsus (49x14).

Type data : Holotype (NIV AA26779.10) and 9 paratypes, WEST BENGAL, Darjeeling District, Darjeeling, 2100m, ex *Mus* sp., 22.III.1986, NIV, coll.

Additional records : 8, same data as type series; 7, same data, but Jorepokhri, 1200-2300m, ex *Rattus fulvescens*, 11.III.1969. 36, same data, but SIKKIM, Lachung, 2450-2750m, ex *Rattus eha*, 22.IV.1969; 19, same data, but ex *Ochotona thibetana*, taken 25.IV.1969.

Remarks : *S. darjeelingensis* is very close to *S. absonata* Nadchatram and Fernandes, 1989, and *S. angusta* Nadchatram and Fernandes, 1989. It may be separated from these 2 species in having coxa III 2B (3B in *S. absonata*, 1B in *S. angusta*), and a different Ip range (583-600 in *S. absonata*, 458-475 in *S. angusta*). *S. darjeelingensis* may further be distinguished from *S. absonata* in having a smaller PSB (measuring 90-104 in *S. absonata*). *S. darjeelingensis* further differs from *S. angusta* in having longer AL setae (measuring 17-20 in *S. angusta*). The species name is based on the type locality, Darjeeling.

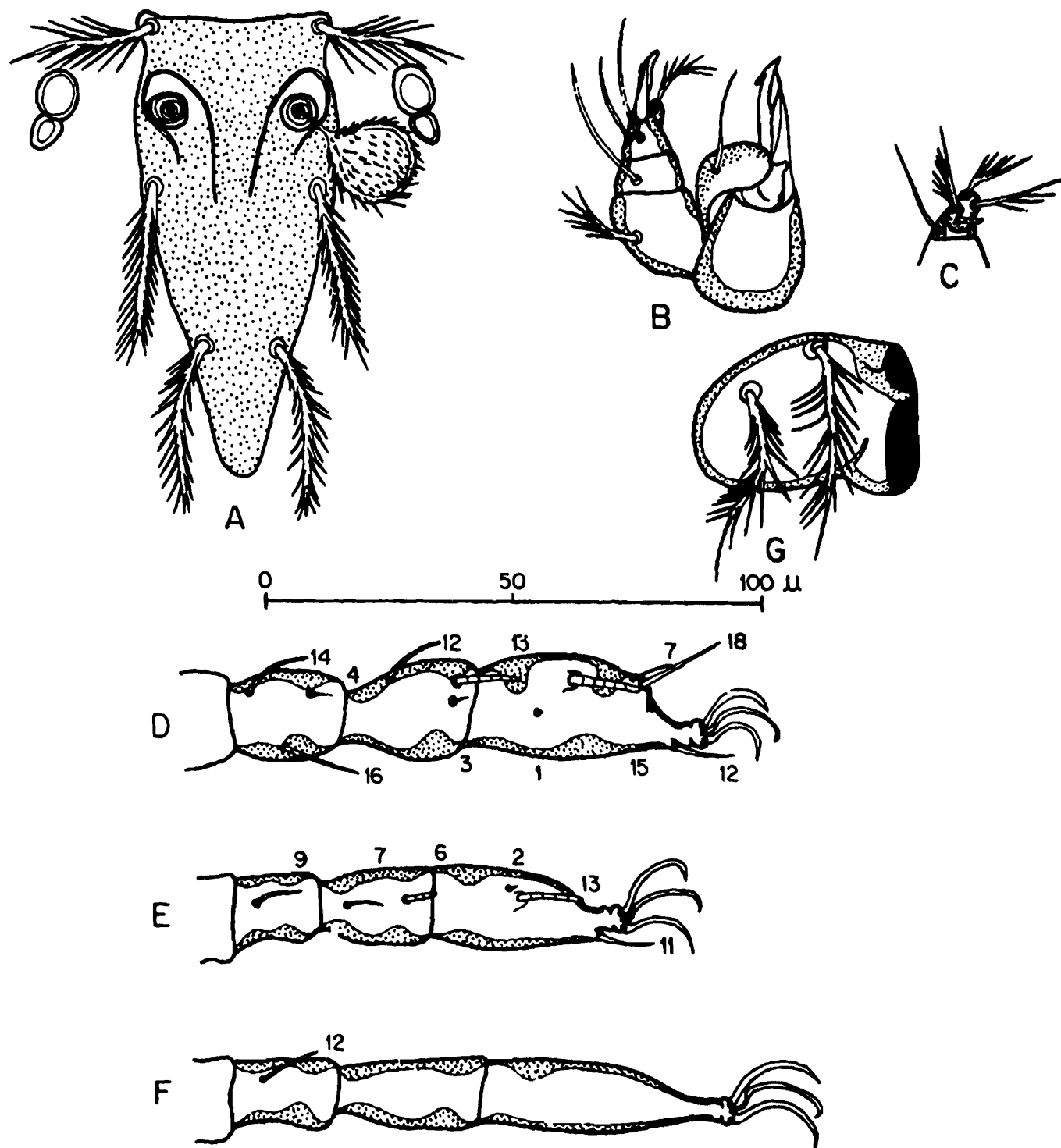


Fig. 146. *Schoengastiella darjeelingensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

178. *Schoengastiella galarea* new species
(Fig. 147)

Description of species : Larva.

Idiosoma : Measuring 266-327 x 196-224 in partially engorged to engorged specimens. Eyes 1/1, free on cuticle. Two pairs of humeral setae, internal measuring 24-32, external measuring 30-37; 55-66 dorsal idiosomal setae, measuring 25-35, irregularly arranged, arrangement in holotype : 6-3-8-8-4-8-6-6-4-2; 2 pairs of sternal setae, anterior 30-34, posterior 21-26; 46-56 preanal setae, 17-18; 30-34 postanal setae, 22-25; total idiosomal setae 146-160 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (28) with dorsal subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering sharply immediately beyond PL bases, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL setae similar to scutal setae, measuring 35-41; sensillary bases with pronounced antero- and postero-medial cuticular ridges; sensillae clavate, head with setules; PW/SD = 0.46-0.53. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 42 (44, 40-48); PW 50 (49, 46-52); PPW 22 (22, 19-25); SB 35 (36, 34-38); ASB 19 (20, 19-22); PSB 78 (78, 74-84); AP 35 (37, 35-40); APP 70 (71, 69-77); PP 25 (27, 25-30); AL 32 (31, 29-34); PL 41 (40, 36-45); sens. 31x12 (31x12, 29-32 x 11-12).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 583-631. Leg I : 204-223; tarsus (49x19), tarsala (15-17). Leg II : 175-192; tarsus (41x17), tarsala (14-15). Leg III : 200-218; tarsus (50x14).

Type data : Holotype (NIV A96334.1) and 9 paratypes, MAHARASHTRA, Pune District, Sinharh, Atkarwadi, 650m, ex 2 *Suncus murinus*, 12.IV.1970, S.M Kulkarni, coll.

Additional records : 22, same data as type series, but ex 14 *S. murinus*, taken 14.III.1970 to 5.VI.1971.

Remarks : *S. galarea* is close to *S. argalea* and *S. goffi* Nadchatram and Fernandes, 1989. *S. galarea* may easily be distinguished from *S. argalea* in having bisetose coxa III (unisetose in *S. argalea*), 2 pairs of humeral setae (1 pair in *S. argalea*), and a greater number of dorsal body setae (28-32 in *S. argalea*). *S. galarea* may be separated from *S. goffi* by the nude palpal femoral and genual setae (barbed in *S. goffi*), single pair of eyes (2/2 in *S. goffi*), and lower Ip range (910-948 in *S. goffi*). The species name is an anagram of *S. argalea*, which it closely resembles.

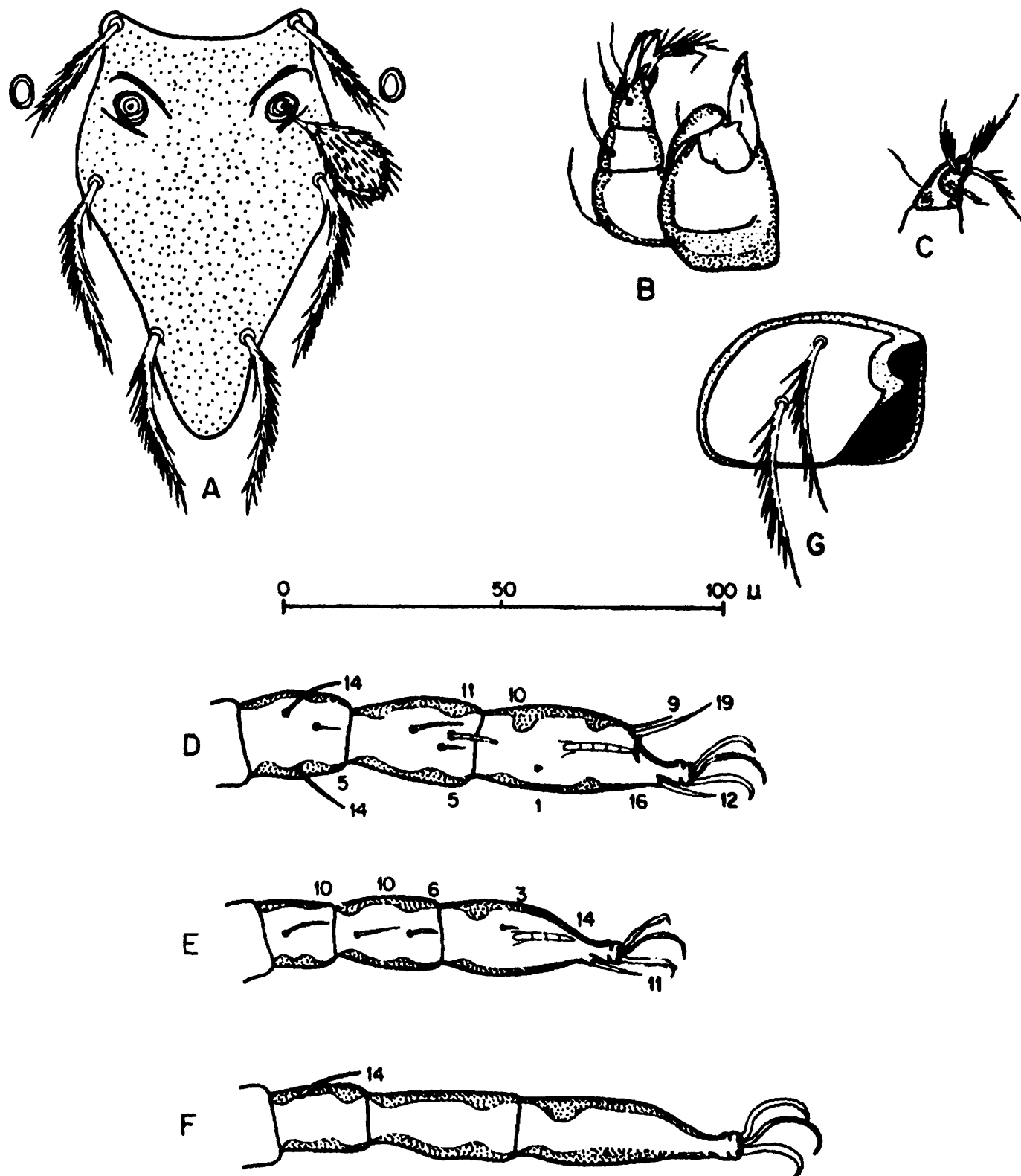


Fig. 147. *Schoengastiella galarea* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

179. *Schoengastiella gammonsi* (Traub and Evans)

Gahrlepiea (*Schoengastiella*) *gammonsi* Traub and Evans, 1954, 100; Traub *et al.*, 1967, 40; Sandhu and Kapoor, 1977, 151.

Schoengastella (*Schoengastiella*) *gammonsi*, Vercammen-Grandjean, 1968b, 114.

Gahrlepiea gammonsi, Audy, 1954b, 162; Prasad, 1974, 79.

Redescription of species : Larva.

Idiosoma : Measuring approximately 358x245 in engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae; approximately 26 dorsal idiosomal setae, arrangement commencing : 6-6-6 (Original illustration : 4-6-6), the rest irregular; 2 pairs of sternal setae; about 32 preanal setae, measuring approximately 14; about 20 postanal setae, 17-23; total idiosomal setae approximately 84 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B.S; palpal claw 3-pronged; galeala N; cheliceral blade with dorsal subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL>AL; PPL setae similar to scutal setae, inserted submarginally; sensillary bases with pronounced antero- and postero-medial cuticular ridges; sensillae missing in holotype; PW/SD = 0.50. Scutal measurements of holotype after original description : AW 33; PW 51; PPW 22; SB 35; ASB 21; PSB 82; AP 39; APP 77; PP 23; AL 25; PL 29.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of sensory setae. Number of ordinary setae not reported, but coxa III 2B.

Type data : Holotype (USNM 2072), ASSAM, 21 miles North of Ledo, ex short-tailed shrew *Anourosorex squamipes assamensis*, 25.X.1945, R. Traub and D.P. Millsaugh, coll.

Type depository : Holotype in USNM.

Additional records : PUNJAB, Ludhiana, 2 ex 2 *Mus booduga*, 3,16.V.1975, P.S. Sandhu and V.C. Kapoor, coll.

Remarks : The above redescription is based only on the literature. Traub and Evans (1954) consider *S. gammonsi* close to *S. helata* (Traub and Evans, 1954), from which it may be distinguished by the narrower scutum (PW/SD = 0.64-0.66 in *S. helata*), larger PSB (measuring 63-69 in *S. helata*), and difference in the arrangement of dorsal body setae (arrangement commencing : 4-8-8 in *S. helata*). The Indian *Schoengastiella* species usually have palpal tarsal setation 4B. Hence, the 4B.S setation reported for *S. gammonsi* needs confirmation. This species was named in honour of John G. Gammons of the Army Medical Service Graduate School, Washington.

180. *Schoengastiella helata* (Traub and Evans)
(Fig. 148)

Gahrlepiea (*Schoengastiella*) *helata* Traub and Evans, 1954, 93.

Gahrlepiea helata, Audy, 1954b, 162.

Schoengastiella (*Schoengastiella*) *helata*, Vercammen-Grandjean, 1968b, 114.

Schoengastiella helata, Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring approximately 263-290 x 180-216 in partially engorged to engorged specimens (Original description: approximately 200x128 in engorged specimens). Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 26-31; 28-32 dorsal idiosomal setae, measuring 20-30, arranged : 4-6-6-6-4-4-(2) (Original description : arrangement commencing : 4-8-8-6, the rest irregular); 2 pairs of sternal setae, anterior 22-26, posterior 19-21; 28 preanal setae, 10-15; 14 postanal setae, 17-22 (Original description : 40 ventral setae); total idiosomal setae 78-80 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B (Original description : palpal tarsal setation 4B.S); palpal claw 3-pronged; galeala N; cheliceral blade (23) with dorsal subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle broadly rounded; SB anterior to level of PL bases; AL and PL setae subequal, with short barbs; PPL setae similar to scutal setae, measuring 21-28; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.64-0.67. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 34 (32, 30-34); PW 52 (54, 50-58); PPW 29 (29, 27-31); SB 35 (34, 32-36); ASB 17 (17, 15-19); PSB 64 (66, 63-69); AP 36 (36, 34-38); APP 64 (67, 64-70); PP 17 (18, 16-20); AL 28 (28, 26-32); PL 27 (29, 26-32); sens. - (34x11, -). Scutal measurements giving means and ranges of 4 NIV specimens : AW 35, 33-37; PW 54, 52-55; PPW 30, 22-37; SB 32, 30-34; ASB 18, 17-19; PSB 69, 63-74; AP 36, 33-38; APP 64, 58-67; PP 21, 19-26; AL 27, 24-30; PL 30, 26-34; sens. -, broken off in all specimens.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 460-516. Leg I : 166-180; tarsus (40x19), tarsala (14-15). Leg II : 132-150; tarsus (33x16), tarsala (12-13). Leg III : 162-186; tarsus (40x13).

Type data : Holotype (USNM 2068) and 6 paratypes, BURMA, Shingbuiyang, ex *Crocidura* sp., 10.I.1945, USATC, coll.

Additional records : ASSAM, Ledo, 22 mile mark on Stilwell Road, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 29.VIII.1945, USATC, coll.

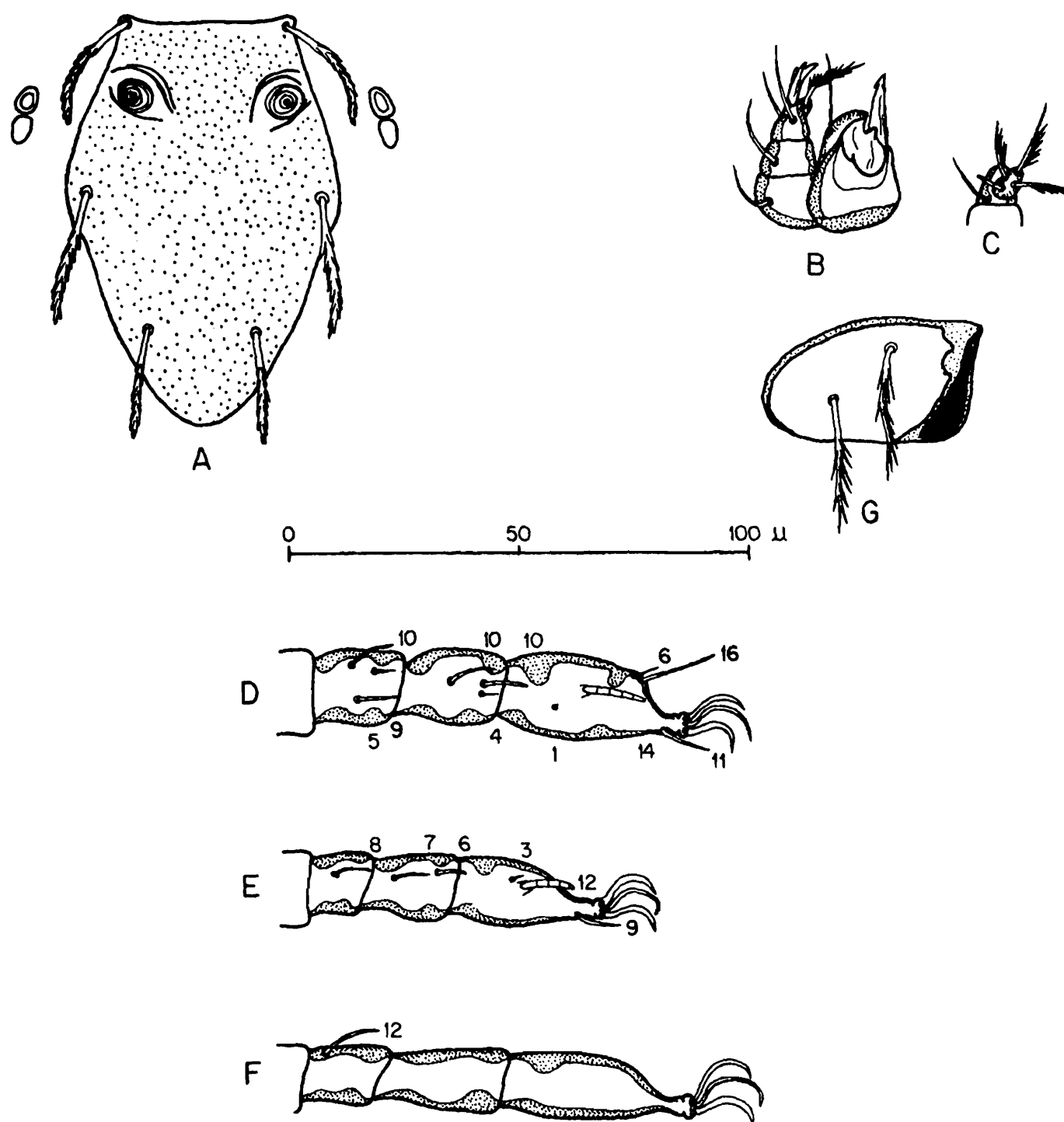


Fig. 148. *Schoengastiella helata*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

New records : 4 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Kulu District, Palchan, 2000-2290m, 1 ex *Rattus rattus gangutrianus*, 27.VIII.1970. JAMMU and KASHMIR, Rajouri District, Naoshera, 750m, 1 ex *Rattus rattoides*, 7.XII.1969; 1, same data, but ex *S. murinus*, taken 9.XII.1969. UTTARANCHAL, Pithoragarh District, Tejam, 1100-1200m, 1 ex *S. murinus*, 14.IX.1967.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Traub and Evans (1954) consider *S. helata* close to *S. liota* (Traub and Evans, 1954), in having bisetose coxa III and small scutum. They distinguish *S. helata* by the shape, measurements and proportions of the scutum: PPW broader (measuring 21 in *S. liota*), APP larger (measuring 56 in *S. liota*), and posterolateral margins evenly curved beyond PL bases (constricted at a point beyond PL bases and then slightly sinuate in *S. liota*).

181. *Schoengastiella herulata* new species (Fig. 149)

Description of species : Larva.

Idiosoma : Measuring 450-522 x 332-437 in engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 32-37; 30-32 dorsal idiosomal setae, measuring 27-34, arranged : 4-6-6-6-4-4-(2); 2 pairs of sternal setae, anterior 34-39, posterior 23-24; 26-28 preanal setae, 16-19; 14-18 postanal setae, 25-30; total idiosomal setae 100-102 (excluding usurped scutal setae).

Gnathosoma : Palpal seetal formula N(b)/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (38) with tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering gently, caudally rounded broadly; SB anterior to level of PL bases; AL and PL setae with short barbs; PL>AL; PPL setae similar to scutal setae, measuring 30-33; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.61-0.66. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 49 (49, 47-53); PW 94 (87, 80-96); PPW 62 (59, 56-64); SB 51 (50, 46-56); ASB 26 (24, 22-26); PSB 128 (112, 101-128); AP 56 (52, 49-59); APP 106 (94, 85-107); PP 51 (41, 35-51); AL 37 (32, 29-37); PL 42 (41, 38-42); sens. - (40x10, 39-42 x 10-11).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 681-757. Leg I : 230-266; tarsus (58x20), tarsala (15-17). Leg II : 201-229; tarsus (47x19), tarsala (14). Leg III : 244-269; tarsus (66x14).

Type data : Holotype (NIV A99191.1) and 3 paratypes, MAHARASHTRA, Pune District,

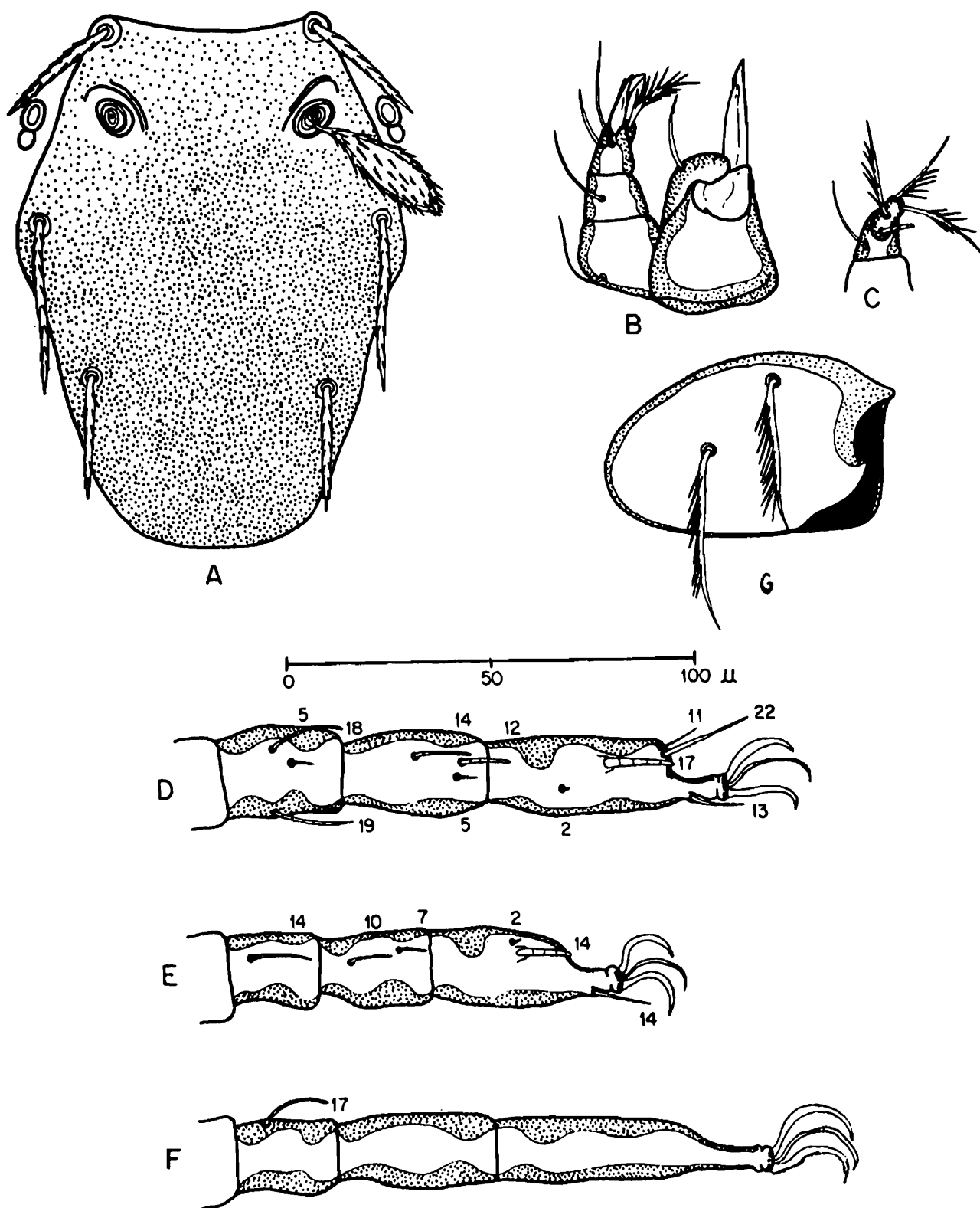


Fig. 149. *Schoengastiella herulata* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Sinhgarh, 1270m, ex *Bandicota bengalensis*, 9.VII.1971, S.M. Kulkarni, coll.; 2 paratypes, same data, but Bhor, Shirgaon, 850m, ex *Suncus murinus*, taken 20.V.1971; 2 paratypes, same data, but ex *Rattus blanfordi*, taken 17.VI.1971.

Additional records : 25, same data as holotype, but Bhor, Shirgaon, ex *R. blanfordi*, taken 25.IX.1970. GOA, 8 ex 6 *S. murinus* and 4 ex 3 *R. blanfordi*, 17.X.1983 to 20.II.1984, S. Fernandes, coll.

Remarks : *S. herulata* is close to *S. erula* (Traub and Evans, 1954) and *S. helata* (Traub and Evans, 1954). It may be separated from *S. erula* by the bisetose coxa III (unisetose in *S. erula*), broader PW (measuring 65-75 in *S. erula*), and larger AP (measuring 36-42 in *S. erula*). *S. herulata* may be distinguished from *S. helata* in having a higher Ip range (460-516 in *S. helata*), broader PW (measuring 50-58 in *S. helata*), and smaller AP (measuring 34-38 in *S. helata*). The species name is a combination of *helata* and *erula*, to which species it is closely related.

182. *Schoengastiella homunguis* (Abdussalam) (Fig. 150)

Gahrlepiea homunguis Abdussalam, 1939, 83; Audy, 1954b, 162.

Schoengastiella homunguis, Wharton and Fuller, 1952, 94; Prasad, 1974, 90.

Redescription of species - Larva. Colour in life yellowish white.

Idiosoma : Measuring 141-380 x 99-250 in unengorged to partially engorged specimens. Eyes 2/2 (Original description: not discernable), on ocular plate. One pair of humeral setae, measuring 30-34; 38-40 dorsal idiosomal setae, measuring 26-31, arrangement commencing: 4-8-8, the rest irregular; 2 pairs of sternal setae, anterior 27-30, posterior 21-25; 26-30 preanal setae, 15-16; 14-20 postanal setae, 25-29; total idiosomal setae 88-92 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged (Original description: 2-pronged); galeala N; cheliceral blade (30) with dorsal subapical tooth and tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL setae similar to scutal setae, measuring 31-34; sensillary bases with pronounced anteromedial cuticular ridge; sensillae subglobose, head with fine setules; PW/SD = 0.74-0.85. Scutal measurements giving means followed by ranges of 10 NIV specimens : AW 38, 36-42; PW 56, 53-58; PPW 20, 18-24; SB 32, 27-35; ASB 20, 19-20; PSB 49, 46-53; AP 35, 32-38; APP 59, 55-66; PP 10, 8-11; AL 32, 28-34; PL 36, 34-40; sens. 28x14, 27-29 x 13-15.

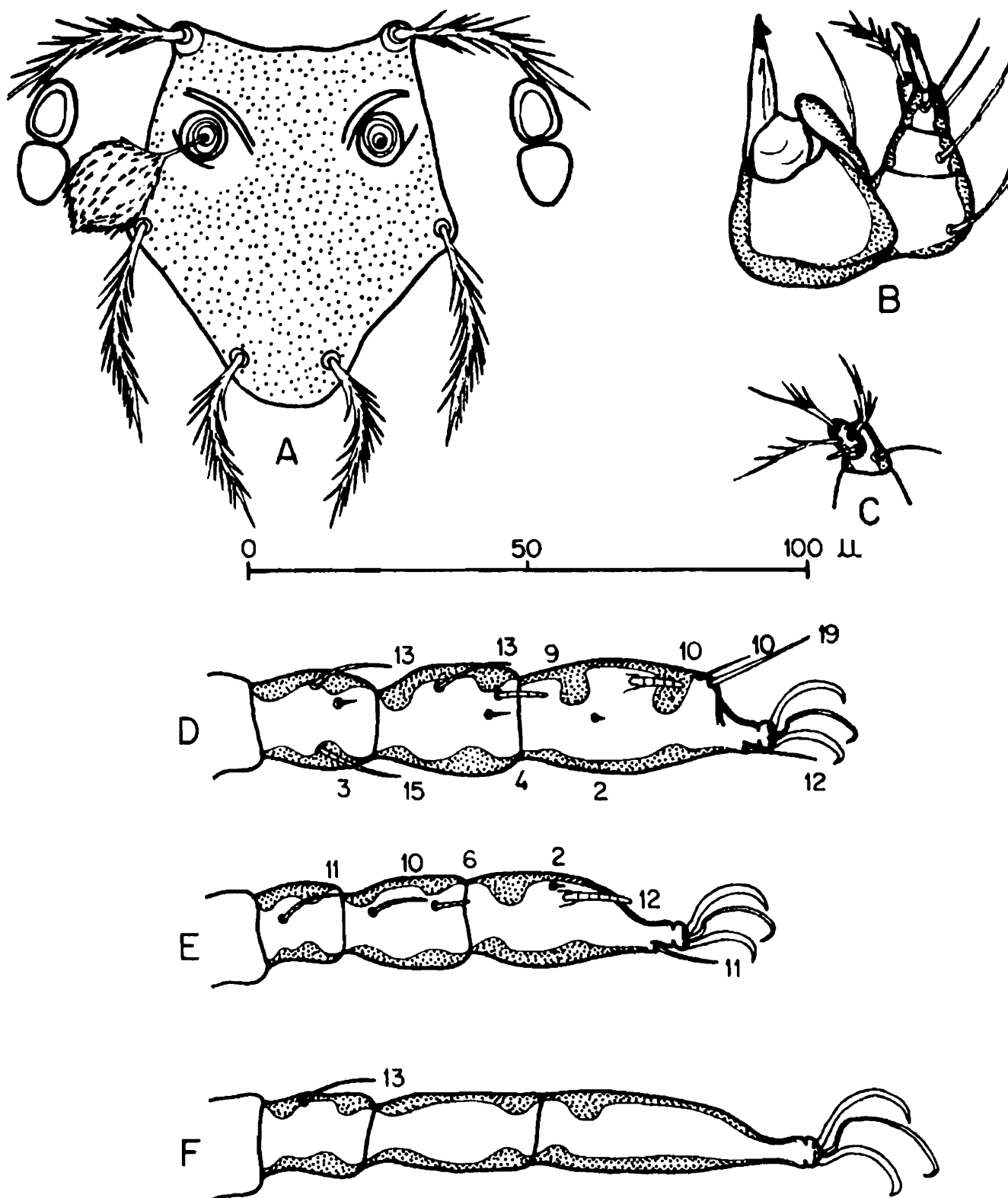


Fig. 150. *Schoengastiella homunguis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 540-606. Leg I : 183-214; tarsus (45x20), tarsala (10-11). Leg II : 163-176; tarsus (39x16), tarsala (11-13). Leg III : 194-211; tarsus (50x13).

Type data : A few specimens (types not specified!), UTTARANCHAL, Kumaon Hills, Mukteshwar, 2286m, ex *Rattus rattus*, date of collection not reported, M. Abdussalam, coll. Specimens were recovered from external auditory canal.

Type depository : Not reported.

New records : GUJARAT, Ahmedabad, Dediapada and Jhankvav, 52 ex 16 *Suncus murinus*, 25-27.X.1984, S. Fernandes, coll. MAHARASHTRA, Bombay, Goregaon, 25 ex *S. murinus*, 31.I.1985, S. Fernandes, coll.; Akola District, Mhaispur, 4 ex *S. murinus*, 25.IX.1986, P.V. Mahadev, coll.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Abdussalam (1939) has placed *homunguis* in the genus *Gahrleipia*, following the redefinition of *Schoengastiella* by Oudemans (1929) to include only those species with unequal tarsal claws. The original description is very sketchy with an illustration of the scutum (inverted!). Abdussalam considers this species close to *S. bengalensis* Hirst, 1915. The NIV specimens, though from a different ecogeographical region of India, agree with the given description. *S. homunguis* is close to *S. ramachandrai* (Kulkarni, 1973), but may easily be distinguished in having PL>AL (AL>>PL in *S. ramachandrai*), scutal margin caudally rounded (truncate in *S. ramachandrai*), and dorsal idiosomal setae inserted directly on the cuticle (inserted on sclerotized platelets in *S. ramachandrai*).

183. *Schoengastiella kalrata* (Traub and Evans) (Fig. 151)

Gahrleipia (Schoengastiella) kalrata Traub and Evans, 1954, 98; Traub *et al.*, 1967, 36.

Schoengastiella (Schoengastiella) kalrata, Vercammen-Grandjean, 1968b, 114.

Gahrleipia kalrata, Prasad, 1974, 79.

Schoengastiella kalrata, Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring approximately 196-680 x 131-480 in unengorged to engorged specimens. Eyes 2/2 (Original description : 1/1), anterior larger, on ocular plate. Two pairs of humeral setae, internal measuring 35-38, external measuring 37-40; 70-76 dorsal idiosomal setae, measuring 30-41, arrangement commencing : 8(10)-10(12), the rest irregular; 2 pairs of sternal setae, anterior 32-37, posterior 27-33; 46-64 preanal setae, 19-28; 26-32 postanal setae, 31-36; total idiosomal setae 154-180 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/N/NNN/4B (Original illustration : palpal tarsal setation

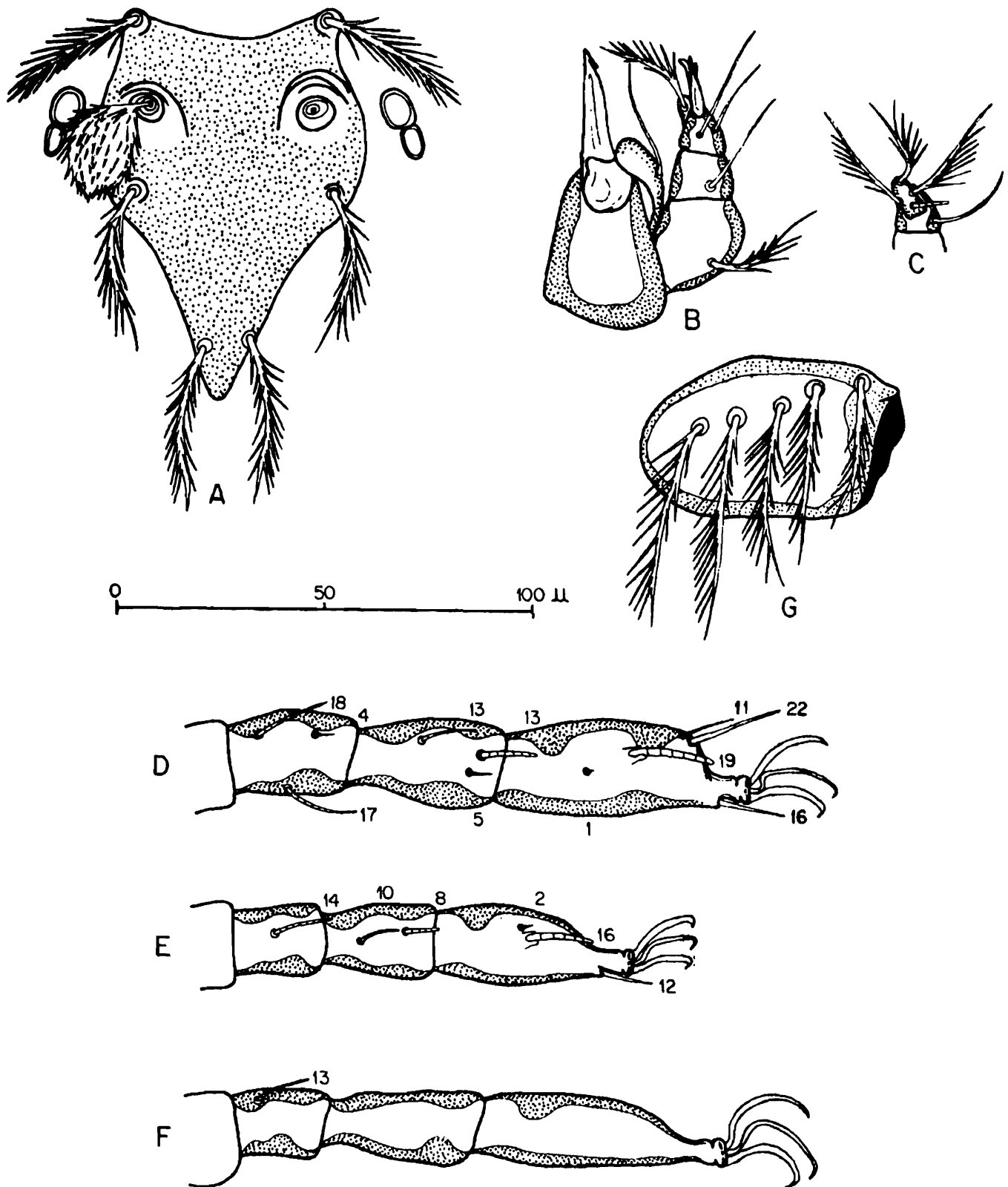


Fig. 151. *Schoengastiella kalrata*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

4B.S); palpal claw 3-pronged; galeala N; cheliceral blade (39) with tricuspid tip; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, flask-shaped, with anterior margin shallowly concave; posterolateral margins tapering, caudally subacuminate; SB anterior to level of PL bases; AL and PL setae finely ciliated; $PL > AL$; PPL setae similar to scutal setae, measuring 36-43; sensillary bases with pronounced anteromedial cuticular ridge; sensillae subglobose, head with fine setules; $PW/SD = 0.41-0.49$ (Original description: 0.45-0.49). Scutal measurements of holotype followed by means and ranges of paratypes in parentheses after original description : AW 56 (50, 46-54); PW 58 (53, 47-59); PPW 19 (17, 14-20); SB 47 (43, 39-47); ASB 28 (26, 23-29); PSB 98 (89, 77-101); AP 47 (46, 41-51); APP 101 (94, 83-105); PP 25 (25, 17-33); AL 29 (29, 26-32); PL 36 (36, 34-38). Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 44, 41-49; PW 47, 43-51; PPW 13, 11-15; SB 40, 38-42; ASB 23, 23-24; PSB 79, 76-84; AP 43, 40-44; APP 83, 78-88; PP 18, 16-22; AL 35, 33-38; PL 39, 38-41; sens. 31×16 , $28-34 \times 15-16$.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III with 4 or 5 branched setae. Measurements as follows : Ip = 650-706. Leg I : 230-255; tarsus (59×23), tarsala (17-19). Leg II : 193-206; tarsus (48×19), tarsala (14-16). Leg III : 226-253; tarsus (59×17).

Type data : Holotype (USNM 2071), JAMMU and KASHMIR, Sonmarg, ex *Rattus rattus* sp. (*turkestanicus*?), VIII.1949, S.L. Kalra, coll.; 6 paratypes (or 8, as recorded in original table of standard measurements!), Baltal, same data, but ex same host or 'mouse'

Type depository : Holotype at USNM; paratypes at USNM, BM(NH), and Traub collection.

New records : 41 records of collections from the Himalayan region by NIV field teams: HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 1 ex *Rattus rattus gangutrianus*, 8.IV.1968; Kalatop, 2440-2620m, 8 ex *R. r. gangutrianus*, 10.IX.1967; 34, same data, but ex *Rattus rattoides*, taken 9.IX.1967; Tindi, 2440-2590m, 25 ex 4 *Apodemus flavicollis*, 17,18.IX.1968; 4, same data, but ex *R. r. gangutrianus*, taken 17.IX.1968; Kinnaur District, Rakcham, 3120m, 7 ex 4 *A. flavicollis*, 19,20.VI.1970; Kulu District, Kothi, 2440m, 8 ex *R. rattoides*; 2.X.1967; Manali, 1820-1860m, 1 ex *R. rattoides*, 9.VIII.1970; Lahul District, Chhetru, 3450m, 4 ex *Alticola roylei*, 8.IX.1968; Kelong, 3110-3170m, 25 ex 2 *A. flavicollis*, 28.IX.1967; Kiriting, 2680-3250m, 7 ex *A. roylei*, 23.IX.1968; 28, same data, but ex *A. flavicollis*; 1, same data, but ex *Rattus rufescens*; Thiro, 2850m, 9 ex 2 *A. flavicollis*, 11.IX.1968; Mahasu District, Baghi, 2700-2760m, 1 ex *R. rattoides*, 11.VII.1970; Sungri, 2650-2750m, 51 ex 2 *R.r. gangutrianus*, 16,18.VII.1970; 2, same data, but ex *R. rattoides*, taken 17.VII.1970. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 3 ex *A. flavicollis*, 31.X.1969. UTTARANCHAL, Pithoragarh District, Milam, 1800-4400m, 3 ex *A. roylei*, 1.VI.1968; 5, same data, but ex 2 *A. flavicollis*, taken 1,2.VI.1968; Uttarkashi District, Sakhi, 2700m, 16 ex 4 *R. rattoides*, 4-7.VI.1969; Harsil, 2600m, 71 ex 6 *A. flavicollis*, 10,11.VI.1969; 5, same data, but ex *R. rattoides*, taken 11.VI.1969.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Traub and Evans (1954) consider *S. kalrata* close to *S. ceylonica* (Womersley, 1952) in having the scutum markedly ligulate posterior to PL bases and in having coxa III multisetose. They distinguish *S. kalrata* by the larger scutum: AW measuring 47-56, PW 47-58, and PW/Coxa II >0.84 (AW 31, PW 28, and PW/Coxa II >0.72 in *S. ceylonica*), larger number of ventral setae (approximately 60 in *S. ceylonica*), and in having coxa III typically 5B (typically 4B in *S. ceylonica*). This species has been named in honour of the collector, Lt. Col. S.L. Kalra, in recognition of his contribution to the knowledge of scrub typhus.

184. *Schoengastiella kumaonensis* (Womersley)

Gahrliepia (*Schoengastiella*) *kumaonensis* Womersley, 1952, 300.

Gahrliepia kumaonensis, Audy, 1954b, 162.

Gahrliepia (*Schoengastiella*) *kumaoensis*, sic! Womersley and Audy, 1957, 286.

Gahrliepia kumaoensis, sic! Prasad, 1974, 80.

Schoengastiella (*Schoengastiella*) *kumaonensis*, Vercammen-Grandjean, 1968b, 114.

Redescription of species : Larva.

Idiosoma : Measuring 420x350 in engorged specimen. Eyes apparently absent. One pair of humeral setae; approximately 28 dorsal idiosomal setae, measuring 36, arranged : 4-6-6-6-4-2; 2 pairs of sternal setae; approximately 40 ventral setae; total idiosomal setae approximately 70 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B? (Palpal tarsal setation not reported in original description; Vercammen-Grandjean, 1968b : 4B.S); palpal claw 2-pronged (Vercammen-Grandjean, 1968b : 3-pronged); galeala N; celiceral blade with tricuspid cap; gnathobase bearing a pair of branched setae.

Scutum : Fairly large, moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle rounded; SB nearer AL than PL bases; AL setae and sensillae missing in only specimen extant; PW/SD = 0.56. Scutal measurements of holotype after original description : AW 51; PW 77; SB 50; ASB 28; PSB 110; AP 51; AL -; PL 42; sens. -.

Legs : Number of ordinary and sensory setae not reported; but, coxa III with 4B. Measurements as follows : Ip = 636. Leg I : 216. Leg II : 182. Leg III : 238.

Type data : Holotype, UTTARANCHAL, Kumaon Hills, Bhimtal, ex 'shrew', 10.X.1949, S.L. Kalra, coll.

Type depository : Holotype in SAM.

Remarks : The above redescription is based only on the literature. This species has not been recorded since its original discovery. Womersley (1952) considers *S. kumaonensis* close to *S. bengalensis* Hirst, 1915, and *S. punctata* Radford, 1946. It differs from these 2 species in the standard data, scutal shape, number of dorsal body setae, and in having coxa III 4B. *S. saduski* (Womersley, 1952) also shares the 4B setation of coxa III, but differs in the above mentioned characters. The species name is based on the type locality.

185. *Schoengastiella ligula* Radford
(Fig. 152)

Schoengastiella ligula Radford, 1946b, 256; Wharton and Fuller, 1952, 94; Fernandes *et al.*, 1988, 109.

Gahrlepiea (Schoengastiella) ligula, Womersley, 1952, 296; Traub and Evans, 1954, 100; Womersley and Audy, 1957, 286; Mitchell *et al.*, 1966, 120; Traub and Wisseman, 1974, 253; Kulkarni, 1979, 17; Kulkarni *et al.*, 1979, 1.

Schoengastiella (Schoengastiella) ligula, Vercammen-Grandjean, 1968b, 14; Kaul *et al.*, 1978, 1.

Schongastiella ligula, sic! Audy *et al.*, 1953, 27.

Gahrlepiea (Schongastiella) ligula, sic! Kalra, 1959, 477; Wattal *et al.*, 1967a, 352; 1967b, 364; Muljarskaya, 1968, 139; Srivastva and Wattal, 1971, 154; Varma and Mahadevan, 1971, 821; Srivastva and Wattal, 1975b, 318; Kochhar, 1972, 138.

Galrlepiea (Schongastiella) logula, sic! Joshee, 1964, 49.

Gohrlepiea (Schongastiella) ligula, sic! Saxena, 1985, 345.

Redescription of species : Larva.

Idiosoma : Measuring 560x320 in engorged specimen. Eyes 2/2 (Womersley, 1952 : apparently absent), anterior larger, on ocular plate. One pair of humeral setae, measuring 31-39; 30-44 dorsal idiosomal setae, measuring 27-34 (Womersley, 1952 : 44, measuring 35; Traub and Evans, 1954 : 36-42, measuring 28-42), usually arranged : 4-8-2-8-6, the rest irregular; 2 pairs of sternal setae, anterior 25-33, posterior 22-28; 24-34 preanal setae, 15-19; 18-30 postanal setae, 24-38 (Womersley, 1952 : approximately 56 ventral setae; Traub and Evans, 1954 : generally about 50, with approximately 80 in 5 specimens from bat cave, BURMA, Myitkyina); total idiosomal setae 84-104 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B (Traub and Evans, 1954 : 3B.S?); palpal claw 3-pronged; galeala N; cheliceral blade (32) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; posterolateral margins tapering immediately beyond PL bases, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL>AL; PPL setae similar to scutal setae, measuring 29-35; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.47-0.80 (Womersley, 1952 : 0.52-0.55; Traub and Evans, 1954 : 0.55-0.75). Scutal measurements giving ranges of 48 specimens

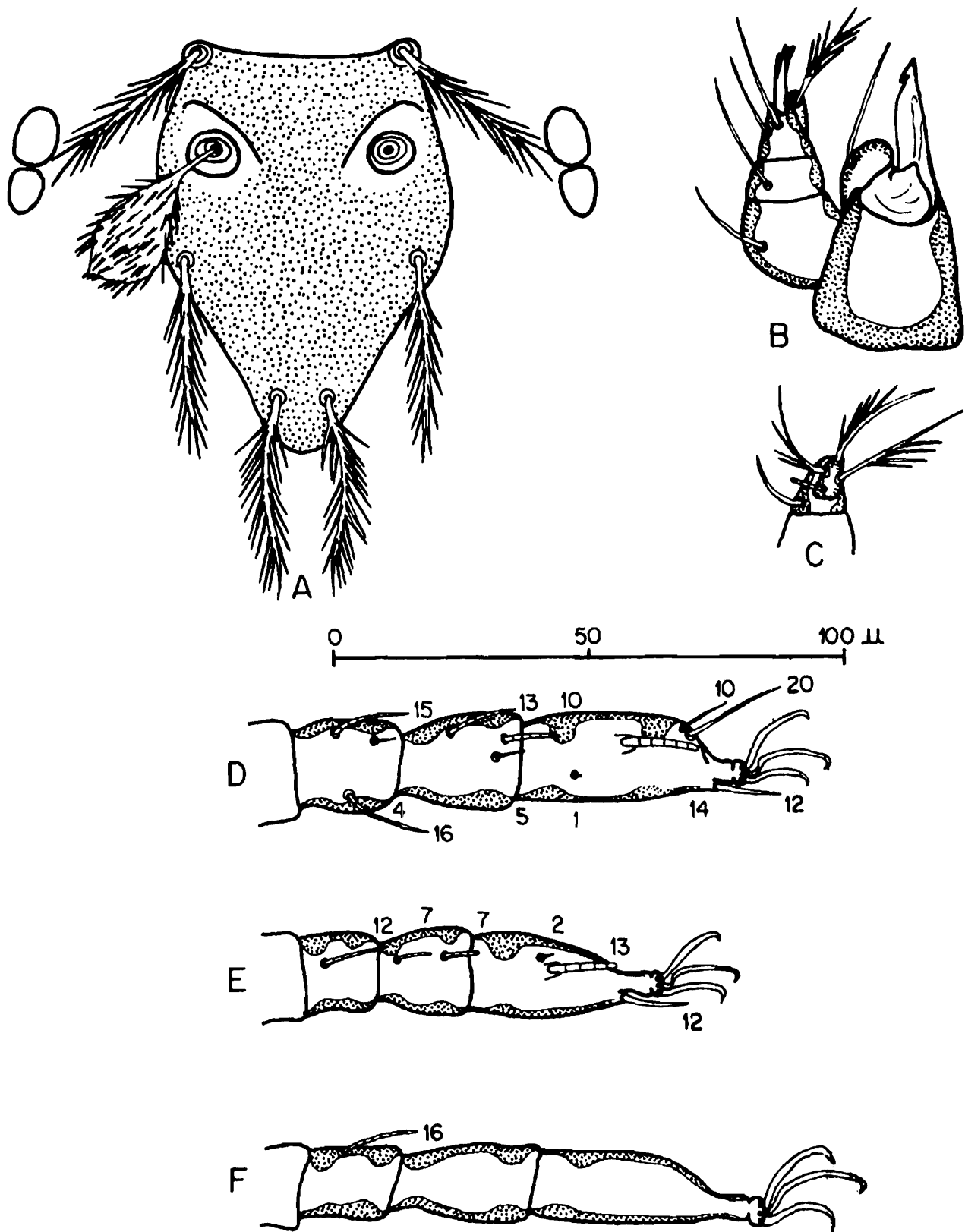


Fig. 152. *Schoengastiella ligula*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

from BURMA after Womersley (1952) : AW 34-39; PW 45-56; SB 34-39; ASB 25-28; PSB 62-73; AP 42-48; AL 39-45; PL 42; sens. 34x14. Means followed by ranges of 25 ASSAM and BURMA specimens after Traub and Evans (1954) : AW 39, 31-47; PW 52, 42-62; PPW 14, 9-19; SB 34, 30-38; ASB 22, 18-26; PSB 58, 52-64; AP 39, 35-43; APP 71, 66-76; PP 9, 5-13; AL 35, 27-43; PL 38, 30-46. Means followed by ranges of 19 NIV specimens : AW 37, 27-44; PW 48, 38-61; PPW 15, 10-20; SB 32, 29-40; ASB 20, 18-22; PSB 56, 48-68; AP 37, 33-42; APP 65, 56-78; PP 10, 8-12; AL 31, 27-35; PL 33, 28-38; sens. 30x12, 24-35 x 9-14.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 509-646 (Womersley, 1952 : 640). Leg I : 186-226; tarsus (44x18); tarsala (12-16). Leg II : 148-196; tarsus (36x16), tarsala (12-16). Leg III : 175-229; tarsus (45x14).

Type data : Holotype, MANIPUR, Imphal, ex *Rattus rattus bullocki* (= *Rattus rattus rufescens*), 6.V.1945, Sergeant J. Hake, coll.

Type depository : Holotype in BM(NH).

Additional records : ASSAM, Ledo and BURMA, Myitkyina, ex *Rattus rattus* (= *Rattus flavipectus yunnanensis*), *Rattus rattus sladeni*, *Mus musculus* (*Mus. bactianus*), *Rattus manipulus*, *Tupaia glis* (*Tupaia belangeri*), *Suncus* (= *Crocidura*), *Herpestes*, *Anourosorex*, *Bandicota* and 'bird' (unidentified), X.1944-XII.1945, USATC, coll. MANIPUR and BURMA, ex squirrels, *Hadromys humei*, *R. r. bullocki*, *R. manipulus*, *Diomys crumpi*, *Bandicota bengalensis*, *Suncus murinus*, *Anourosorex squamipes*, IV.1945-III.1946, STRU, coll. JAMMU and KASHMIR, Gurais, Khandhar, Naoshera, Kanzalwan, Srinagar, ex 'rats and shrews', VII.1948-VIII.1949, S.L. Kalra, coll. UTTARANCHAL, Kumaon Hills, Nainital, ex 'rats and shrews', VIII-X.1946, S.L. Kalra, coll.; Nainital District, Ranibagh and Kathgodam areas, 102 ex *R. rattus*, *B. bengalensis*, *Millardia meltada*, and *S. murinus*, VIII.1967, NICD, coll. MADHYA PRADESH, Kanha National Park, 533-791m, 42 ex *Rattus rattus narbadae*, *R. r. rufescens*, *Suncus stoliczkanus*, *Mus musculus humourus*, *Mus booduga booduga*, 20-27.XII.1964, C.J. Mitchell, J. Schaller, and G.B. Spillett, coll. DELHI, Badli village, 1017 ex *B. bengalensis*, *M. meltada*, *Mus platythrix*, *Nesokia indica*, *S. murinus*, and *Tatera indica*, XII.1964-XII.1966, NICD, coll. SIKKIM and WEST BENGAL, Eastern Himalayas, ex 'rodents and insectivores' (specific hosts not reported), 1966-1967, R.N. Varma, coll. MAHARASHTRA, Nagpur, 218 ex *M. platythrix*, *M. musculus*, *M. meltada*, *R. rattus*, *S. murinus*, and *T. indica*, VII.1967-IV.1968, NICD, coll. Pune District, approximately 47,000 ex *S. murinus*, *Funambulus tristriatus*, *M. meltada*, *Millardia kondana*, *Golunda ellioti*, *R. r. rufescens*, *Rattus rattus satarae*, *Rattus blanfordi*, *B. bengalensis*, *Bandicota indica*, *M. booduga*, *M. platythrix*, and *Mus cervicolor*, I.1970-IX.1971, S.M. Kulkarni, coll. HIMACHAL PRADESH, Kangra District, Dharamsala, 500-2500m, 54 ex *R. rattus*, IX.1968, NICD, coll.; 140km NE Simla, Tangoo, 3000m, 12 ex *Bandicota* sp., IX.1983, NICD, coll. ARUNACHAL PRADESH and ASSAM, ex *B. bengalensis*, other rodents and *S. murinus*, 1968-1969, AFMC, coll. RAJASTHAN, Kota, Bundi and Sirohi Districts, 811 ex *S. murinus*, *Rattus cutchicus rajput*, *R. r. rufescens*, and *M. meltada*, 28-30.X.1971, H.N. Kaul, coll.

New records : KARNATAKA, Shimoga District, Hennagere, 14 ex *Rattus rattus wroughtoni*, 4-19.X.1966, NIV, coll. ORISSA, Ganjam District, Singpur, and Nandan Kanan Park, 12 ex *M. booduga*, *Rattus rattus arboreus*, and *S. murinus*, 15,23.XI.1972, H.N. Kaul, coll. GOA, approximately 6300 ex *S. murinus*, *R. r. rufescens*, *B. bengalensis*, *Mus saxicola*, and *T. indica*, 14.X.1983 to 17.II.1984, S. Fernandes, coll. GUJARAT, Dediapada and Jhankvav, 397 ex *S. murinus*, 26-27.X.1984, S. Fernandes, coll. MAHARASHTRA, Satara District, Mahableshwar, 28 ex *R. r. wroughtoni*, and *S. murinus*, 12.XII.1984, P.K. Deshmukh, coll.; Bombay, 8 ex *Rattus norvegicus*, 31.I.1985, S. Fernandes, coll. 260 records of collections from the Himalayan region by NIV field teams : CHHATTISGARH, Bilaspur District, Deoli, 510m, 7 ex *Rattus rattus gangutrianus*, 25.III.1968; Ghumarwin, 740-750m, 2 ex *M. musculus*, 25.III.1969; 9, same data, but ex *S. murinus*. HIMACHAL PRADESH, Chamba District, Chamba, 1070-1220m, 8 ex *R. r. gangutrianus*, 8.V.1968; Kalatop, 2440-2620m, 3 ex *R. r. gangutrianus*, 10.IX.1967; Surkhigali, 1600-1620m, 35 ex 2 *Rattus rattoides*, 7,8.IX.1967; Tindi, 2440-2590m, 19 ex 7 *Apodemus flavicollis*, 17,18.IX.1968; 11, same data, but ex *Crocidura* sp., 17.IX.1968; Kangra District, Dadh, 1080-1110m, 17 ex 2 *R. r. gangutrianus*, 14.IX.1967; 12, same data, but ex *R. rattoides*, taken 3.VI.1967; Hamirpur, 900m, 2 ex *R. r. gangutrianus*, 21.III.1969; 21, same data, but ex *S. murinus*, 20.III.1969; Kinnaur District, Karcham, 1700m, 22 ex 2 *R. rattoides*, 19.X.1967; Rakcham, 3120m, 7 ex 2 *A. flavicollis*, 19,20.VI.1970; Sangla, 2700m, 1 ex *A. flavicollis*, 7.VI.1970; 9, same data, but ex 2 *R. r. gangutrianus*; 11, same data, but ex 2 *R. rattoides*, taken 8,9.VI.1970; 2, same data, but ex *M. musculus*, 7.VI.1970; Kulu District, Bhuin, 1100-1922m, 6 ex *R. rattoides*, 11.X.1967; 7, same data, but ex *M. musculus*; Jibi, 1000-1922m, 7 ex 2 *R. rattoides*, 15,20.IV.1969; Manali, 1820-1860m, 84 ex *R. rattoides*, 8.VIII.1970; Palchan, 1800-2290m, 15 ex 5 *R. r. rufescens*, 1,2.X.1968; 15, same data, but ex 6 *R. r. gangutrianus*, taken 27.VIII.1970; 67, same data, but ex 6 *R. rattoides*, taken 3,4.X.1967 and 27.VIII.1970; 2, same data, but ex *M. musculus*, taken 1.X.1968; 3, same data, but ex *Crocidura* sp., taken 2.X.1968; Lahul District, Kirting, 2680-3250m, 2 ex *Alticola roylei*, 24.IX.1968; 15, same data, but ex *R. r. rufescens*, taken 23, 24.IX.1968; Thiro, 2850m, 1 ex *A. flavicollis*, 11.IX.1968; Mahasu District, Baghi, 2700-2760m, 17 ex 7 *R. rattoides*, 11,12.VII.1970; Kotkhai, 1800-1900m, 1 ex *R. rattoides*, 11.V.1969; Rampur, 1000-1200m, 7 ex 3 *S. murinus*, 16.X.1967; Sarhan, 1300-2140m, 1 ex *R. rattoides*, 5.V.1968; Sungri, 39 ex 2 *R. r. gangutrianus*, 16,18.VII.1970; 69, same data, but ex 4 *R. rattoides*; Mandi District, Mandi, 920-1070m, 2 ex *R. r. gangutrianus*, 19.IX.1967; 67, same data, but ex 2 *S. murinus*, taken 19.IX.1967 and 31.VIII.1970; Simla District, Nalagarh, 500-600m, 1 ex *M. platythrix*, 6.IV.1969; 32, same data, but ex 4 *S. murinus*, taken 6,8.IV.1969; Simla, 1700-2000m, 17 ex 3 *R. rattoides*, 29.X,4.XI.1967. JAMMU and KASHMIR, Baramulla District, Bandipore, 550m, 4 ex 2 *R. rattoides*, 2,3.XI.1969; 27, same data, but ex 2 *M. musculus*; 4, same data, but ex *B. bengalensis*, taken 2.XI.1969; 5, same data, but *S. murinus*, taken 3.XI.1969; 2, same data, but ex *Capra* sp., taken 1.XI.1969; Rampore, 1400m, 27 ex 6 *R. rattoides*, 5-7.XI.1969; 19, same data, but ex 4 *Rattus* sp., taken 8.XI.1969; Sopore, 500m, 17 ex 2 *M. musculus*, 25.X.1969; 1, same data, but ex *S. murinus*, taken 22.X.1969; Tangmarg, 600m, 4 ex *A. roylei*, 20.X.1969; Bhadarwah, 1700m, 16 ex 2 *R. rattoides*, 15,17.XI.1969; 6, same data, but ex 2 *M. musculus*, taken 16,17.XI.1969; 3, same data, but ex *S. murinus*, taken 17.XI.1969.

JAMMU and KASHMIR, Rajouri, Naoshera, 750m, 61 ex 2 *R. rattoides*, 7,8.XII.1969; 1, same data, but ex *M. musculus*, taken 7.XII.1969; 38, same data, but ex 4 *M. mclutad*; 7-10.XII.1969; 2, same data, but ex *G. ellioti*, taken 9.XII.1969; 82, same data, but ex 2 *S. murinus*, taken 7,9.XII.1969; Udhampur District, Dehari, 750-900m, 42 ex 2 *Rattus* sp., taken 1.XII.1969; 11, same data, but ex *S. murinus*; Kulwanda, 1700-1800m, 19 ex 2 *R. rattoides*, 3,4.XII.1969; Phalata, 750m, 11 ex 3 *Rattus* sp., 22,27 and 30.XI.1969; 2, same data, but ex *G. ellioti*, taken 30.XI.1969; SIKKIM, Kyangnosla, 3200-3800m, 1 ex *Pitymys sikimensis*, 15.IV.1969. UTTARANCHAL, Almora District, Phurkia, 1100-2450m, 24 ex 5 *R. rattoides*, 3,4 and 8.X.1967; Chamoli District, Badrinath, 3650m, 11 ex 4 *A. roylei*, 16,19.VI.1968; 19, same data, but ex 3 *A. flavicollis*; Chamoli, 1100-1500m, 2 ex *R. r. gangutrianus*, 26.V.1967; 38, same data, but ex *S. murinus*; Dogalbita, 2300-3800m, 1 ex *Oreocincl* sp., 12.V.1969; 4, same data, but ex *R. r. rufescens*, taken 9.VII.1970; 20, same data, but ex 4 *R. rattoides*, taken 11.V.1969 and 8.VII.1970; 1, same data, but ex *Ochotona roylei*, taken 12.V.1969; Gwaldam, 1500-2100m, 1 ex *R. rattoides*, 12.IV.1967; Joshimath, 1700-2300m, 12 ex *Rattus fulvescens*, 5.VI.1967; Lambagarh, 2150-2450m, 35 ex *M. musculus*, 26.VI.1968; Nandprayag, 900-1200m, 1 ex *R.r. gangutrianus*, 24.IV.1968; Dehra Dun District, Asarodi, 600-750m, 11 ex *Rattus* sp., 26.III.1970; Dehra Dun, 600-800m, 18 ex 4 *R.r. gangutrianus*, 29.X.1967 and 26.III.1968; 10, same data, but ex 2 *B. bengalensis*, taken 28.X.1967; 9, same data, but ex 2 *S. murinus*, taken 31.X.1967; Kanasar, 1800-2300m, 5 ex 2 *R. rattoides*, 31.III.1968; Sahaspur, 600m, 7 ex 2 *S. murinus*, 2.IV.1968; Pauri Garhwal District, Dogadda, 700-900m, 4 ex 2 *R. r. gangutrianus*, 11,12.XI.1967; 5, same data, but ex 2 *S. murinus*, taken 12.XI.1967; Rudraprayag, 600-900m, 4 ex *R. r. gangutrianus*, 23.V.1967; Shrinagar, 550m, 3 ex *S. murinus*, 24.X.1967; Nainital District, Bhimtal, 1200-1700m, 2 ex 2 *Mus* sp., 27.XI.1966; 27, same data, but ex 5 *S. murinus*, 27,28.XI.1966; Bhowali, 1200-1700m, 8 ex *R. r. gangutrianus*, 23.XI.1967; Garjia, 400-500m, 69 ex 5 *R. r. gangutrianus*, 15-18.XI.1967; 24, same data, but ex 2 *S. murinus*, 18,19.XI.1967; Haldwani, 400-1100m, 10 ex 4 *R. r. gangutrianus*, 3-7.XII.1967; 48, same data, but ex 4 *S. murinus*, taken 1,3.XII.1966 and 8.IX.1967; Mukteshwar, 1400-2300m, 7 ex 2 *R. rattoides*, 1.V, 26.XI.1967; 4, same data but ex *Rattus niviventer*, taken 26.XI.1967; 2, same data, but ex *R. fulvescens*, taken 30.IV.1967; Ramnagar, 350m, 7 ex *S. murinus*, 29.VIII.1970; Ranibag, 650m, 4 ex 3 *R. r. gangutrianus*, 25.VIII.1970; Tanakpur, 250m, 12 ex 2 *R. r. gangutrianus*, 6.IX.1967; Pithoragarh District, Dharchula, 750-1100m, 1 ex *R. rattoides*, 15.V.1968; 10, same data, but ex *S. murinus*, taken 18.III.1967; Goucher (Thal), 750-1200m, 60 ex 4 *S. murinus*, 30.III,1.IV.1967 and 6.VIII.1970; Milam, 1800-4400m, 6 ex *A. roylei*, 1.VI.1968; 3, same data, but ex 2 *A. flavicollis*, taken 1,2.VI.1968; Tejam, 1100-1200m, 7 ex *A. roylei*, 19.IX.1967; 24, same data, but ex *S. murinus*, taken 13.IX.1967; Tehri District, Chirbatia, 1800-3200m, 2 ex *R. r. gangutrianus*, 26.V.1969; 6, same data, but ex 2 *R. rattoides*, taken 27.V.1969 and 23.VI.1970; Ghansali, 900-1100m, 12 ex *R. r. gangutrianus*, 21.V.1969; 4, same data, but ex *S. murinus*, taken 19.V.1969; Munikreti, 450m, 1 ex *Funambulus pennanti*, 25.X.1967; Uttarkashi District, Sakhi, 2700m, 128 ex 9 *R. rattoides*, 4-7.VI.1969; 2, same data, but ex *M. musculus*, taken 3.VI.1969; Harsil, 2600m, 21 ex 5 *A. flavicollis*, 11.VI.1969; 10, same data, but ex 2 *R. r. gangutrianus*, taken 14.VI.1967; 3, same data, but ex *R. rattoides*, taken 11.VI.1969; Kuthanur, 1700-3200m, 2 ex *Rattus nitidus*, 16.VI.1969; 14,

same data, but ex *Rattus* sp., taken 20.VI.1969; 34, same data, but ex *S. murinus*, taken 19.VI.1969; Uttarkashi, 900-1800m, 1 ex *R. r. gangutrianus*, 13.IV.1968; 49, same data, but ex *S. murinus*, taken 12.VI.1967. WEST BENGAL, Darjeeling District, Siliguri, 119m, 83 ex 3 *S. murinus*, 20,21.III.1986; Jalpaiguri District, Chunabhatti, 150-200m, 502 ex 6 *Rattus rattus brunneusculus*, 23-27.III.1969.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Womersley (1952) redescribed *S. ligula* based on the study of South Burma specimens. Traub and Evans (1954) redescribed this species from material taken in the Ledo area, Assam and in the vicinity of Myitkyina, North Burma. As the records and literature indicate, *S. ligula* is a very common species in India, being collected during all seasons of the year from a wide range of rodent and insectivore hosts. It has been recorded in a variety of habitats, including the submontane, temperate and alpine zones of the Himalayas. The study of the NIV specimens confirm the observations of Traub and Evans (1954) regarding the great variation in setal pattern and standard data of this species. Several studies indicate that *S. ligula* may serve as an intramurine vector of *Rickettsia tsutsugamushi*. Its involvement in the transmission of chiggerborne rickettsiosis to man, however, is regarded as doubtful (Traub and Wisseman, 1974; Goff, 1984).

186. *Schoengastiella liota* (Traub and Evans)
(Fig. 153)

Gahrlepiea (Schoengastiella) liota Traub and Evans, 1954, 89; Traub and Morrow, 1957, 183.

Schoengastiella (Schoengastiella) liota, Vercammen-Grandjean, 1968b, 114.

Gahrlepiea liota, Prasad, 1974, 80.

Schoengastiella liota, Nadchatram and Fernandes, 1989, 23.

Redescription of species : Larva.

Idiosoma : Measuring approximately 325x214 in engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae; approximately 28 dorsal idiosomal setae, measuring 24-25, arranged : 4-6-6-6, the rest irregular; 2 pairs of sternal setae; approximately 40 ventral setae, measuring about 13; total idiosomal setae approximately 74 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B.S; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; ganthobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering sharply immediately beyond PL bases, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae with short barbs (Original description : scutal setae well developed, heavily plumose); PL>>AL; PPL

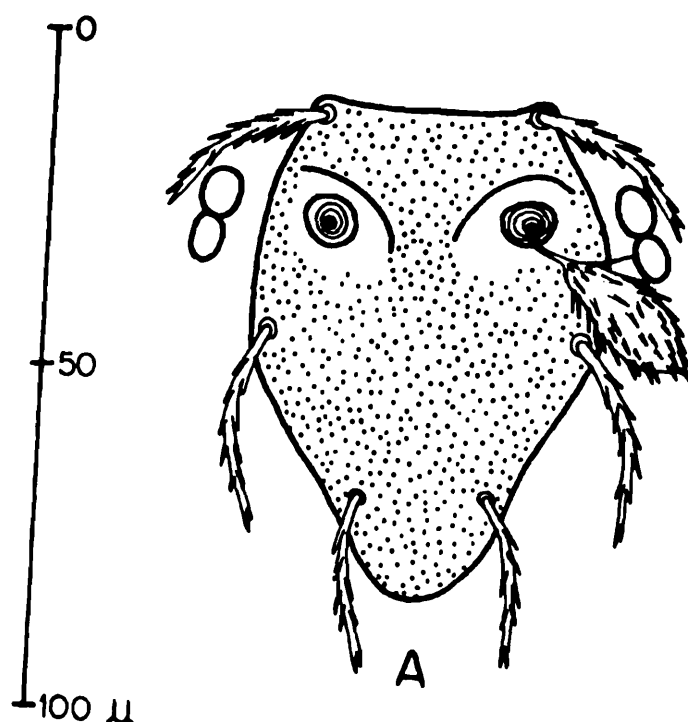


Fig. 153. *Schoengastiella liota*
A. scutum.

setae similar to scutal setae, measuring 22-24; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.58-0.64. Scutal measurements of holotype followed by means and ranges of type series in parentheses after original description : AW 30, (29, 28-31); PW 46 (46, 43-49); PPW 19 (21, 19-22); SB 29 (28, 27-31); ASB 16 (16, 15-16); PSB 60 (60, 58-62); AP 35 (35, 35-36); APP 58 (56, 54-58); PP 18 (19, 18-20); AL 27 (27, 26-27); PL 28 (28, 27-28); sens. - (40x9, -).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of sensory setae. Number of ordinary setae not recorded; but, coxa III 2B. Measurements not reported.

Type data : Holotype and 4 paratypes, ASSAM, Ledo area, USATC, coll. : Holotype (USNM 2066), 22 miles North of Ledo on Stilwell Road, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 29.VIII.1945; 1 paratype, same data, but taken 28.VIII.1945; 1 paratype, 4.6 mile mark, ex *Suncus* sp., 7.IX.1945; 1 paratype, 15 mile mark, ex *Anourosorex squamipes squamipes* (= *Anourosorex squamipes assamensis*), 27.VII.1945; 1 paratype, 21 mile mark, ex *Suncus* sp. (= *Crocidura* sp.), 29.VII.1945.

Type depository : Holotype and 2 paratypes in USNM; 2 paratypes in Traub collection.

Specimen examined : Holotype, on loan from USNM.

Remarks : The above redescription is based on the original description and study of the holotype. The illustration of only the scutum has been possible, since the specimen is in poor condition. The palpal tarsal setation 4B.S, as reported in the original description, needs confirmation as the Indian *Schoengastiella* species generally have palpal tarsal setation 4B.

Traub and Evans (1954) consider *S. liota* close to *S. ligula* Radford, 1946, from which it may be distinguished in having coxa III bisetose (unisetose in *S. ligula*), posterior portion of scutum broader (ligulate in *S. ligula*), and smaller scutal dimensions (mean AW measuring 39, PW 52, AP 39, and APP 71 in *S. ligula*). *S. liota* is also close to *S. goffi* Nadchatram and Fernandes, 1989 and *S. tiola* Nadchatram and Fernandes, 1989. It differs from both these species in having smaller scutal dimensions (mean measurements of *S. goffi* and *S. tiola*: AW 60, 44; PW 86, 68; AP 58, 44; and APP 111, 87), and fewer body setae (numbering 108-124 in *S. goffi*, and 96-104 in *S. tiola*). *S. liota* may further be separated from *S. goffi* in having palpopfemoral and genual setae nude (barbed in *S. goffi*). *S. liota* may be further distinguished from *S. tiola* in having coxa III bisetose (unisetose in *S. tiola*). Prasad (1974) inadvertently reports MANIPUR in place of ASSAM as the type locality! Srivastva and Wattal (1975b) in their summary report *S. liota* from Nagpur. This evidently is a *lapsus*, as they have recorded only *S. punctata* in their collection!

187. *Schoengastietta minuta* new species
(Fig. 154)

Description of species : Larva.

Idiosoma : Measuring 357-387 x 261-328 in engorged specimens. Eyes not discernable. One pair of humeral setae, measuring 30; 32-34 dorsal idiosomal setae, measuring 27-28, arranged : 4-8-2-6, the rest irregular; 2 pairs of sternal setae, anterior 21-26, posterior 19-20; 30-34 preanal setae, 13-15; 16 postanal setae, 19-24; total idiosomal setae 86-88 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade missing in holotype and paratype; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Lightly punctate, narrowly elongate, with anterior margin shallowly concave; AW and PW subequal; posterolateral margins tapering, caudally subacuminate; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL similar to scutal setae, measuring 25-26; sensillary bases with conspicuous anteromedial cuticular ridge; sensillae missing in holotype and paratype; PW/SD = 0.28-0.30. Scutal measurements of holotype followed by paratype : AW 24, 25; PW 23, 24; PPW 14, 14; SB 22, 23; ASB 17, 18; PSB 60, 66; AP 31, 32; APP 54, 57; PP 22, 27; AL 23, 21; PL 27, 28.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 477-480. Leg I : 165-170; tarsus (39x18), tarsala (14-15). Leg II : 141-146; tarsus (34x18), tarsala (11). Leg III : 166-169; tarsus (40x14).

Type data : Holotype (NIV AA26274.2), GOA, Pirla, ex *Mus platythrix*, 19.X.1983, S. Fernandes, coll.; 1 paratype, same data, but Quepem, ex *Suncus murinus*, taken 15.X.1983.

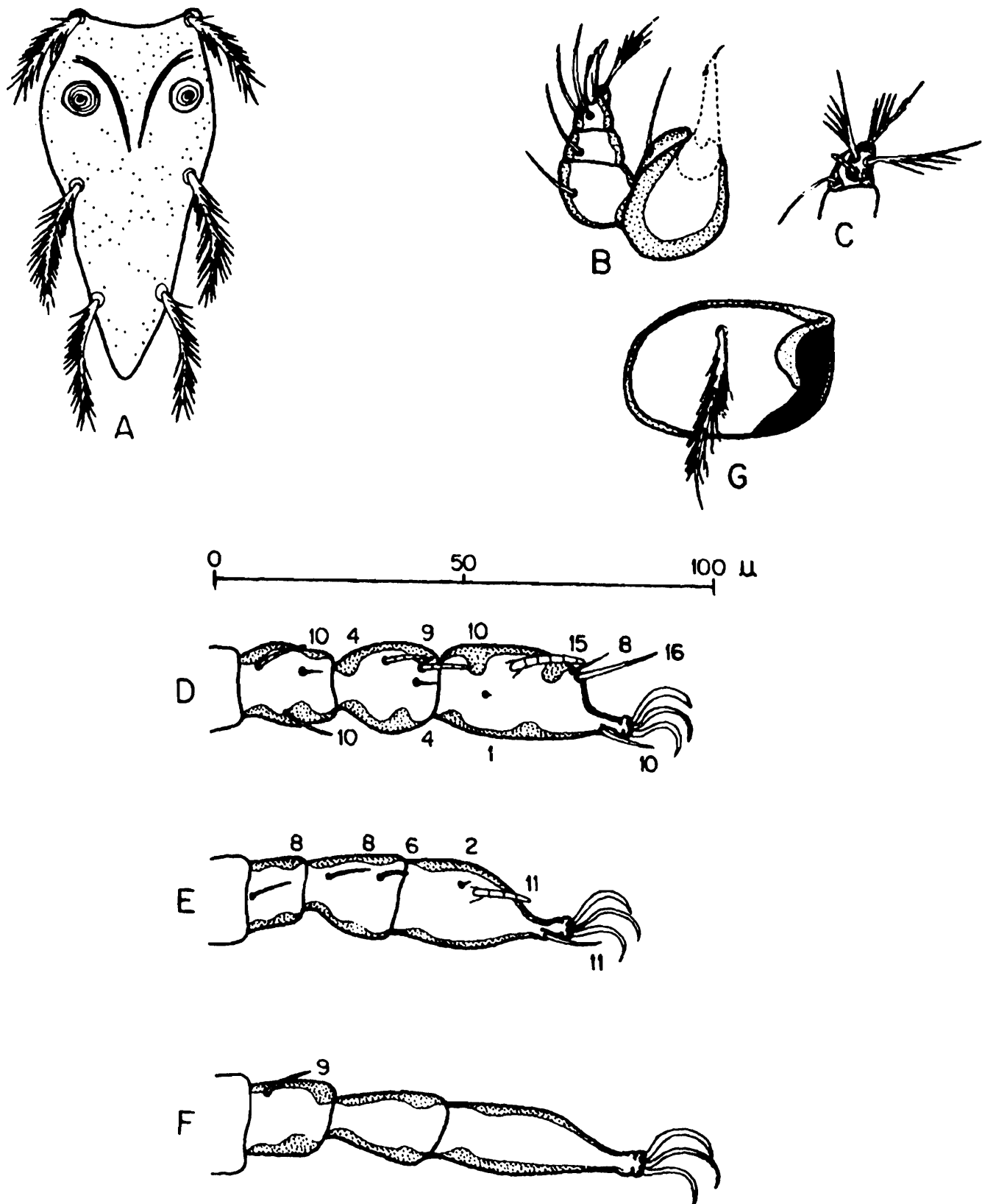


Fig. 154. *Schoengastiella minuta* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Remarks : *S. minuta* is close to *S. angusta* Nadchatram and Fernandes, 1989, from which it may be separated in having palpal femoral seta nude (barbed in *S. angusta*), fewer dorsal body setae (44-50 in *S. angusta*), and scutum narrower (AW measuring 29-33, PW 32-36, and PPW 16-22 in *S. angusta*). The species name draws attention to the remarkably small scutum of this species.

188. *Schoengastiella praecipua* new species
(Fig. 155)

Description of species : Larva.

Idiosoma : Measuring 420-446 x 273-324 in engorged specimens. Eyes 2/2, anterior larger, free on cuticle. Two pairs of humeral setae, internal measuring 45-46, external 48-49; 58 dorsal idiosomal setae, measuring 43-44, arranged : 2-4-4-8-6-8-2-8-6-4-4-2; 1 pair of sternal setae, inserted at level between coxae I-II, measuring 38-43; 50 preanal setae, 24-34; 22 postanal setae, 32-36; total idiosomal setae 136 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/b/bNB/4B; palpal claw 3-pronged; galeala N; cheliceral blade (34) with dorsal subapical tooth and tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at level immediately beyond PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae stout with heavy setules; PL > AL; PPL setae similar to scutal setae, measuring 49-50; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD 0.57. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 48 (46, 42-49); PW 70 (65, 60-70); PPW 36 (36, 33-37); SB 42 (40, 35-44); ASB 22 (23, 22-24); PSB 100 (92, 82-101); AP 39 (38, 35-45); APP 88 (80, 73-88); PP 35 (32, 28-35); AL 39 (40, 39-42); PL 57 (59, 57-60); sens. 40x15, broken off in paratypes.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 716-763. Leg I : 245-258; tarsus (54x23), tarsala (18). Leg II : 205-217; tarsus (45x21), tarsala (16). Leg III : 266-288; tarsus (64x17).

Type data : Holotype (NIV A95965.8) and 6 paratypes, UTTARANCHAL, Chamoli District, Gwaldam, 1700-2000m, ex *Rattus rattoides*, 22.VII.1970, NIV, coll.

Remarks : *S. praecipua* is close to *S. unisternala* Nadchatram and Fernandes, 1989, in having only 1 pair of sternal setae. *S. praecipua* differs in having coxa III bisetose (unisetose in *S. unisternala*), galeala nude (barbed in *S. unisternala*, and PPW narrower (measuring 60-86 in *S. unisternala*). The species name, derived from the Latin for 'special', draws attention to the single pair of sternal setae characteristic of this species.

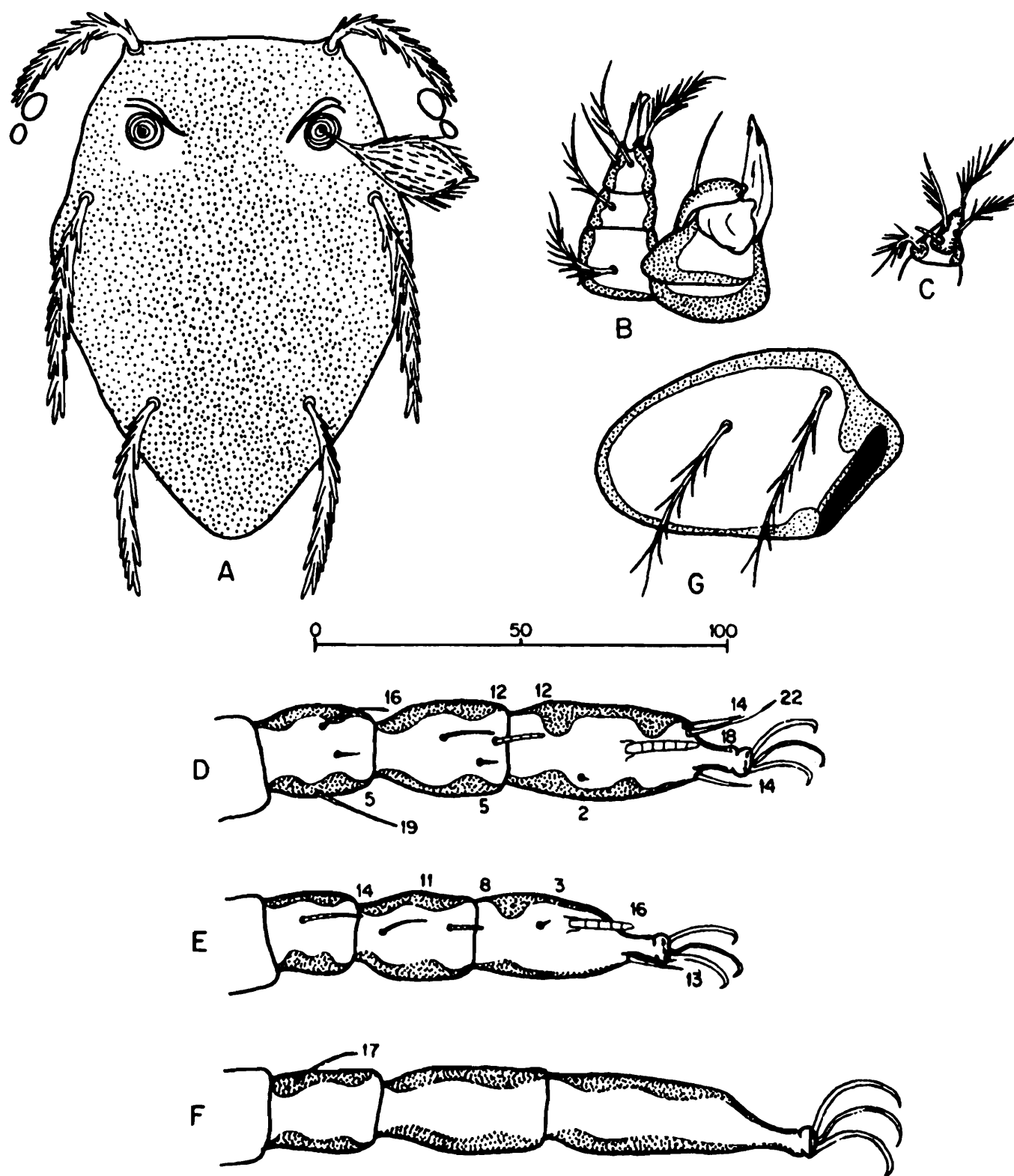


Fig. 155. *Schoengastiella praecipua* new species
 A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

189. *Schoengastiella punctata* Radford
(Fig. 156)

Schoengastiella punctata Radford, 1946b, 256; Wharton and Fuller, 1952, 94; Audy *et al.*, 1953, 27; Nadchatram and Fernandes, 1989, 16.

Gahrliopia (Schoengastiella) punctata, Womersley, 1952, 299; Traub and Evans, 1954, 103; Womersley and Audy, 1957, 286; Traub and Evans, 1957, 354; Srivastva and Wattal, 1975b, 318; Kulkarni, 1979, 20.

Schoengastiella (Schoengastiella) punctata, Vercammen-Grandjean, 1968b, 114.

Gahrliopia punctata, Prasad, 1974, 81.

Redescription of species : Larva.

Idiosoma : Measuring 407-480 x 288-370 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 31-41; 30-32 dorsal idiosomal setae, measuring 30-35, arranged : 4-6-(2)-6-6-4 (Womersley, 1952 : 24, arranged: 4-6-6-4-2-2; Traub and Evans, 1954: approximately 31, measuring 30-36, arranged : 4-6-2-6, the rest irregular); 2 pairs of sternal setae, anterior 32-37, posterior 21-28; 34-44 preanal setae, 16-20; 14-20 postanal setae, 28-31 (Womersley, 1952 : approximately 40 ventral setae; Traub and Evans, 1954, *in text* : approximately 35 ventral setae, measuring about 20 - *in illustration*, however: 36 preanal and 12 postanal setae!); total idiosomal setae 86-100 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N(b)/N/NNN/4B (Womersley, 1952 : b/N/NNN/-; Traub and Evans, 1954 : N/N/NNN/4B.S); palpal claw 3-pronged; galeala N (Womersley, 1952 : b); cheliceral blade (31) with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae stout, finely ciliated; PL > AL; PPL setae similar to scutal setae, measuring 30-39; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.59-0.63 (Traub and Evans, 1954 : 0.55-0.65). Scutal measurements of holotype after original description, followed by ranges of 12 Burma specimens after Womersley (1952) in parentheses : AW 44 (42-51); PW 73 (61-74); SB 48 (38-45); ASB 23 (22-26); PSB 111 (80-102); AP 43 (42-48); AL 34 (39, no variation recorded); PL 36 (39, no variation recorded). Scutal measurements of 15 Assam and Burma specimens giving means and ranges after Traub and Evans (1954) : AW 42, 39-4; PW 71, 65-77; PPW 41, 36-46; SB 46, 42-50; ASB 21, 18-24; PSB 98, 90-106; AP 46, 41-51; APP 83, 77-89; PP 36, 35-41; AL 38, 35-41; PL 41, 38-44. Scutal measurements of 10 NIV specimens giving means and ranges : AW 46, 43-48; PW 70, 61-77; PPW 42, 34-45; SB 43, 38-47; ASB 24, 23-25; PSB 96, 86-103; AP 47, 43-51; APP 86, 82-89; PP 35, 30-39; AL 36, 30-43; PL 41, 37-47; sens. 32x14, 29-34 x 12-15.

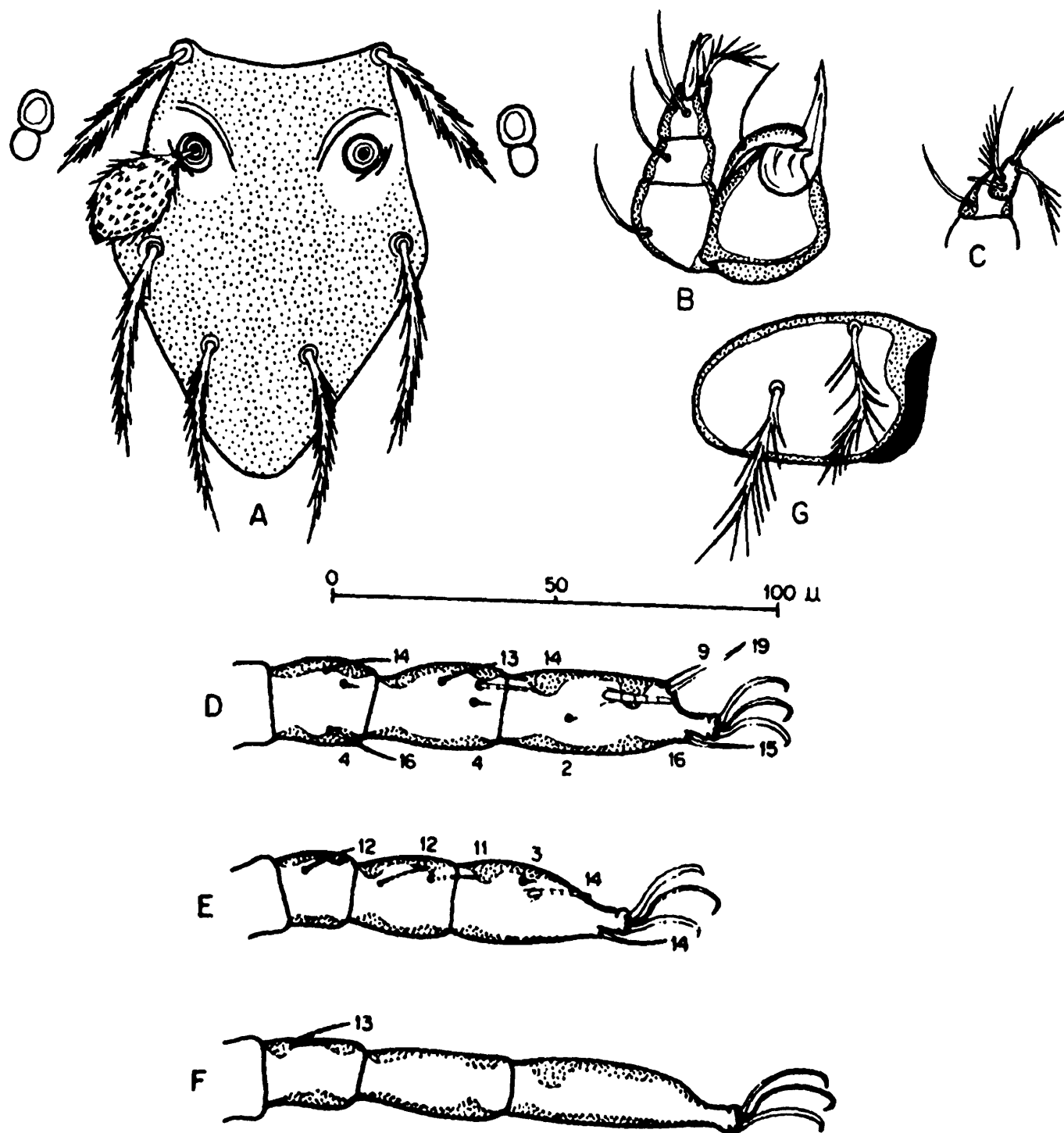


Fig. 156. *Schoengastiella punctata*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B/ rarely 3B. Measurements as follows : Ip = 615-686. Leg I : 221-237; tarsus (49x18), tarsala (16-17). Leg II : 180-206; tarsus (39x18), tarsala (14-15). Leg III : 214-243; tarsus (51x14).

Type data : Holotype, MANIPUR, Imphal, Kanglatongbi, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 20.IV.1945, Sergeant J. Hake, coll.

Type depository : Not recorded in original description, but Prasad (1974) reports BM(NH).

Additional records : ASSAM, Ledo area and BURMA, Myitkyina and Shingbuiyang, ex *Crocidura* sp., *Suncus* sp., *Anourosorex* sp., *Rattus rattus sladeni*, *Rattus rattus* subsp. (= *Rattus flavipectus yunnanensis*), and *Mus musculus* (= *Mus bactrianus kakhyensis*), X.1944-XII.1945, USATC, coll. MANIPUR, Imphal, ex *Suncus murinus*, *Rattus rattus bullocki*, and *Mus* sp., IV-VI.1945, STRU, coll. MADHYA PRADESH, Thunia, Chindwara forest, host not specified, 16.XII.1946, S.L. Kalra, coll. MAHARASHTRA, Nagpur District, Nagpur, 26 ex *Millardia meltada* (= *Rattus meltada meltada*), and *Rattus rattus* subsp., 1967-1968, NICD, coll.; Pune District, approximately 5400 ex *M. meltada*, *S. murinus*, *Mus booduga*, *Mus cervicolor*, *Mus platythrix*, *Golunda ellioti*, *Rattus rattus rufescens*, and *Rattus rattus satarae*, I.1970-IX.1971, S.M. Kulkarni, coll.

New records : ORISSA, Nandan Kanan Park, 19 ex *M. booduga*, 15.XI.1971, H.N. Kaul, coll. GOA, 482 ex *S. murinus*, *Rattus blanfordi*, *M. musculus*, and *Mus saxicola*, 27.VIII.1983 to 21.XII.1983, S. Fernandes, coll. GUJARAT, Jhankvav, 1 ex *S. murinus*, 27.X.1984, S. Fernandes, coll. MAHARASHTRA, Satara District, Mahableshwar, 29 ex *S. murinus*, 12.XII.1984, P.K. Deshmukh, coll. 2 records of collections from the Himalayan region by NIV field teams: UTTARANCHAL, Almora District, Sukhidang, 250m, 1 ex *S. murinus*, 4.III.1967; Dehra Dun District, Asarodi, 600-750m, 62 ex *Rattus rattus gangutianus*, 5.VI.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Womersley (1952) based his redescription on the study of specimens from South Burma. Traub and Evans (1954) recorded their observations based on material from Assam and North Burma. The study of the NIV specimens reveals that the palpal tarsal setation is 4B (without a subterminala), palpal femoral seta is usually nude (lightly branched in Orissa material), palpal claw is 3-pronged (at times appearing bifurcate), and the number of preanal and postanal setae varies considerably.

190. *Schoengastiella ralagea* new species (Fig. 157)

Description of species : Larva.

Idiosoma : Measuring 232-319 x 174-253 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, internal measuring 27-37,

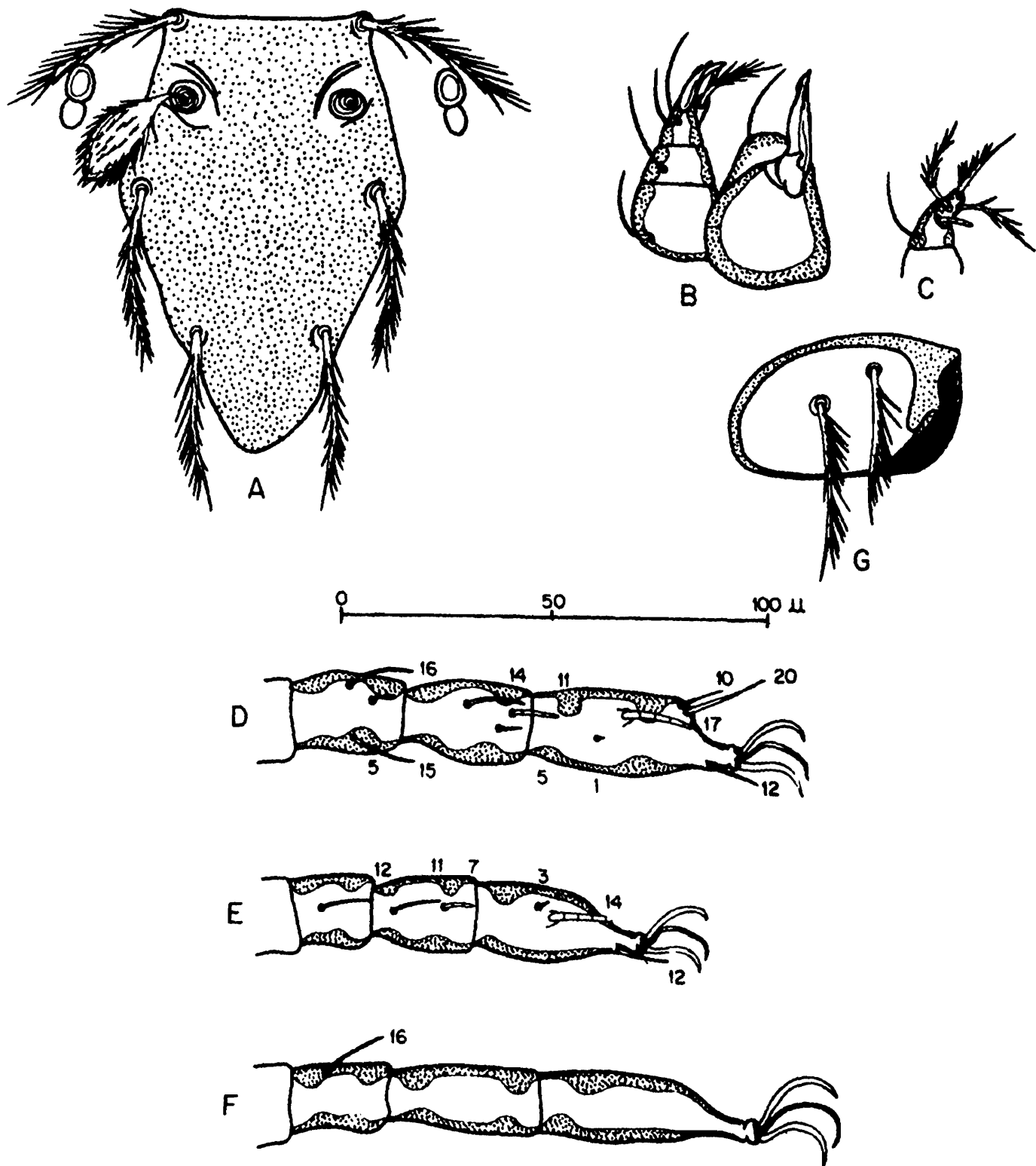


Fig. 157. *Schoengastiella ralagea* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

external measuring 30-38; 36-42 dorsal idiosomal setae, measuring 30-38, arranged : 4-8-4-(2)-8, the rest irregular; 2 pairs of sternal setae, anterior 30-33, posterior 19-24; 30-46 preanal setae, 18-20; 18-24 postanal setae, 24-30; total idiosomal setae 102-120 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N(b)/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (30) with dorsal subapical tooth and tricuspid cap; gnathosoma sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to PL bases; AL and PL setae finely ciliated; PL>AL; PPL setae similar to scutal setae, measuring 33-43; sensillary bases with antero- and postero-medial cuticular ridges; sensillae clavate, head with setules; PW/SD = 0.51-0.61. Scutal measurements of holotype followed by means and ranges of type series in parentheses : AW 37 (43, 37-45); PW 54 (56, 54-62); PPW 24 (29, 22-37); SB 37 (38, 37-41); ASB 22 (22, 20-24); PSB 75 (83, 75-87); AP 41 (42, 41-46); APP 71 (77, 71-83); PP 24 (29, 24-36); AL 34 (34, 31-40); PL 42 (42, 39-45); sens. 31x10 (33x10, 31-35 x 10-11).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; coxa III 1B (but, occasionally 2B). Measurements as follows : Ip = 586-653. Leg I : 206-233; tarsus (50x20), tarsala (15-17). Leg II : 180-191; tarsus (40x17), tarsala (13-14). Leg III : 200-229; tarsus (52x16).

Type data : Holotype (NIV A95014.1), MAHARASHTRA, Pune District, Khandala, 680m, ex *Suncus murinus*, 3.VII.1970, S.M. Kulkarni, coll.; 6 paratypes, same data, but Sinhgarh, Panshet, 650m, taken 14.III.1970; 3 paratypes, same data, but Bhore, Hirdoshi, 680m, 17.VI.1971.

Additional records : MAHARASHTRA, Pune District, 47 ex 27 *S. murinus*, 14.II.1970 to 30.VI.1971, S.M. Kulkarni, coll. GOA, 21 ex 10 *S. murinus*, 19.VIII.1983 to 15.II.1984, S. Fernandes, coll. GUJARAT, Dediapada and Jhankvav, 6 ex 3 *S. murinus*, 26,27.X.1984, S. Fernandes, coll.

Remarks : *S. ralagea* is close to *S. argalea* (Traub and Morrow, 1957), from which it may easily be distinguished in having 2 pairs of humeral setae (1 pair in *S. argalea*), greater number of dorsal body setae (28-32 in *S. argalea*), and a higher Ip range (498-560 in *S. argalea*). *S. ralagea* is also close to *S. galarea* n. sp. from which it may be separated by the smaller number of body setae (146-160 in *S. galarea*), difference in scutal shape (posterolateral margins tapering sharply immediately beyond PL bases in *S. galarea*), and in having coxa III unisetose (bisetose in *S. galarea*). The species name is an anagram of *argalea*, which species it closely resembles.

**191. *Schoengastiella ramachandrai* (Kulkarni)
(Fig. 158)**

Gahrlepiea (*Schoengastiella*) *ramachandrai* Kulkarni, 1973, 521; 1979, 18; Kulkarni *et al.*, 1979, 10.

Redescription of species : Larva. Colour in life creamy white.

Idiosoma : Measuring 254-415 x 154-290 in unengorged to engorged specimens. Eyes 2/2, on ocular plate. One pair of humeral setae, measuring 38-46; 36-38 dorsal idiosomal setae, measuring 35-39, arranged : 4-6-2-8-6-2-6(4)-4; 2 pairs of sternal setae, anterior 30-37, posterior 20-27; 32-40 preanal setae, measuring 28-33; 14-22 postanal setae, measuring 28-33 (Original description in text : 18-19 preanal and 8-9 postanal setae; in illustration (fig. 9), however: 32 preanal and 22 postanal setae); total idiosomal setae 90-104 (excluding usurped scutal setae). Humeral, dorsal idiosomal, preanal and postanal setae inserted on sclerotized platelets.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (28-31) with conspicuous subapical dorsal tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subhexagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudally truncate; SB anterior to level of PL bases; AL and PL setae finely ciliated; AL>>PL; PPL setae similar to scutal setae, measuring 31-35; sensillary bases with pronounced anteromedial cuticular ridge; sensillae globose, head with setules; PW/SD = 0.79-0.86. Scutal measurements of holotype followed by means and ranges of 11 paratypes in parentheses after original description : AW 40 (40, 38-42); PW 61 (59, 56-63); PPW 14 (16, 14-17); SB 35 (33, 31-35); ASB 24 (24, 23-26); PSB 49 (44, 42-49); AP 38 (38, 35-40); APP 66 (63, 60-66); PP 7 (7, -); AL 59 (61, 58-64); PL 47 (45, 43-48); sens. 28x17 (25x17, 23-28 x 14-19).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 592-643. Leg I : 200-230; tarsus (49-52 x 17-19), tarsala (10-13). Leg II : 177-191; tarsus (40-42 x 17-19), tarsala (8-12). Leg III : 215-231; tarsus (56-58 x 14).

Type data : Holotype (NIV A89950) and 11 paratypes, MAHARASHTRA, Pune District, Sinhgarh, Atkarwadi, ex 3 *Rattus rattus rufescens*, 15.VIII.1969, S.M. Kulkarni, coll.; 1 paratype, same data, but ex *Mus booduga*; 5 paratypes, same data, but ex *Suncus murinus*; 4 paratypes, same data, but ex *S. murinus*, taken 12.XI.1970; 2 paratypes, same data, but Lonavala, ex *S. murinus*, 21.IX.1969.

Type depository : Holotype and paratypes at NIV; paratypes at IM, BM(NH), RML, and IMR.

Additional records : MAHARASHTRA, Pune District, approximately 2100 ex *Millardia*

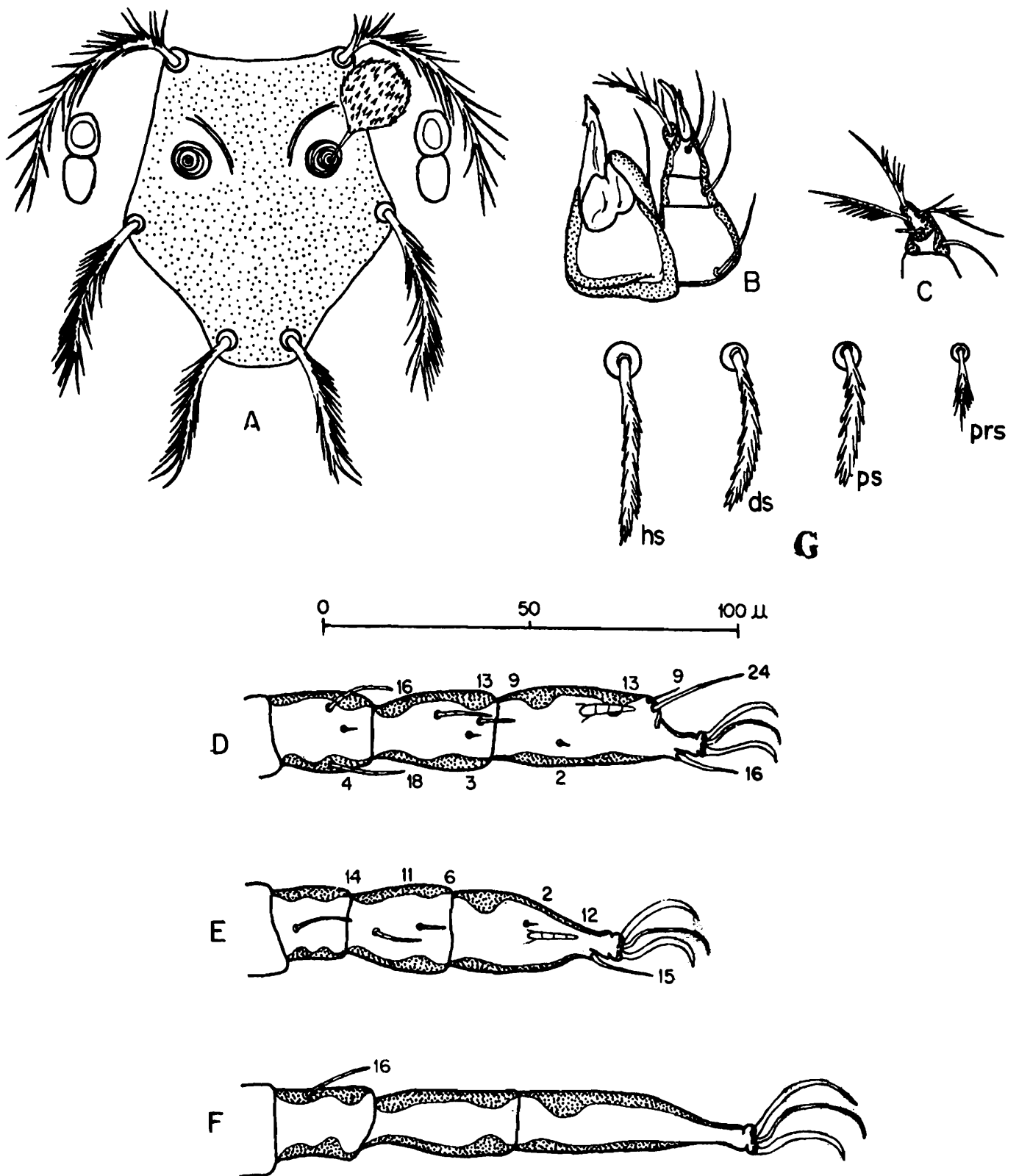


Fig. 158. *Schoengastiella ramachandrai*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. selected idiosomal setae.

kondana, *Rattus blanfordi*, *Bandicota indica*, *Mus platythrix*, and *Mus cervicolor*, 1.1970 - IX.1971, S.M. Kulkarni, coll.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Kulkarni (1973) distinguishes *S. ramachandrai* from *S. ligula* Radford, 1946, in having posterior scutal margin reduced (extended in *S. ligula*), humeral, dorsal, preanal and postanal setae inserted on sclerotized platelets (inserted directly on cuticle in *S. ligula*), and AL>>PL setae (PL>AL in *S. ligula*). This species has been named in honour of Dr. T. Ramachandra Rao, former NIV Director, in recognition of his valuable contributions to medical entomology.

**192. *Schoegastiella shrivastavi* (Srivastva and Wattal)
(Fig. 159)**

Gahrlepiea (Schoengastiella) shrivastavi Srivastva and Wattal, 1975a, 150; 1975b, 318.

Redescription of species : Larva.

Idiosoma : Measuring 332-490 x 221-361 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 42-44; 30-32 dorsal idiosomal setae, measuring 35-46, arranged : 4-6-6(8)-6-4-4; 2 pairs of sternal setae, anterior 37-40, posterior 26-31; 26-28 preanal setae, 19-24; 12 postanal setae, 27-36; total idiosomal setae 74-78 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula b/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (34) with dorsal subapical tooth and tricuspid cap; gnathosoma moderately punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with minute punctae evenly distributed and oval scrobiculae sparsely scattered beyond level of PL bases; anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL>AL; PPL setae similar to scutal setae, measuring 39-46; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules (sensillae missing in type series, not described earlier); PW/SD = 0.56-0.66. Scutal measurements of holotype followed by means and ranges of 18 paratypes in parentheses after original description : AW 42 (41, 38-46); PW 68 (71, 68-76); PPW 32 (36, 32-42); SB 46 (46, 45-49); ASB 23 (23, 21-25); PSB 93 (93, 90-98); AP 45 (43, 40-45); APP 78 (76, 73-81); PP 38 (38, 36-42); AL 45 (40, 37-47); PL 49 (42-50). Scutal measurements giving means and ranges of 10 NIV specimens : AW 43, 39-48; PW 71, 66-75; PPW 38, 34-45; SB 47, 44-51; ASB 24, 20-26; PSB 102, 95-113; AP 45, 41-48; APP 80, 74-86; PP 45, 43-47; AL 43, 41-44; PL 46, 44-49; sens. 38x14, 38 x 14-15.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 3B (occasionally 4B). Measurements as follows : Ip = 702-743 (Original

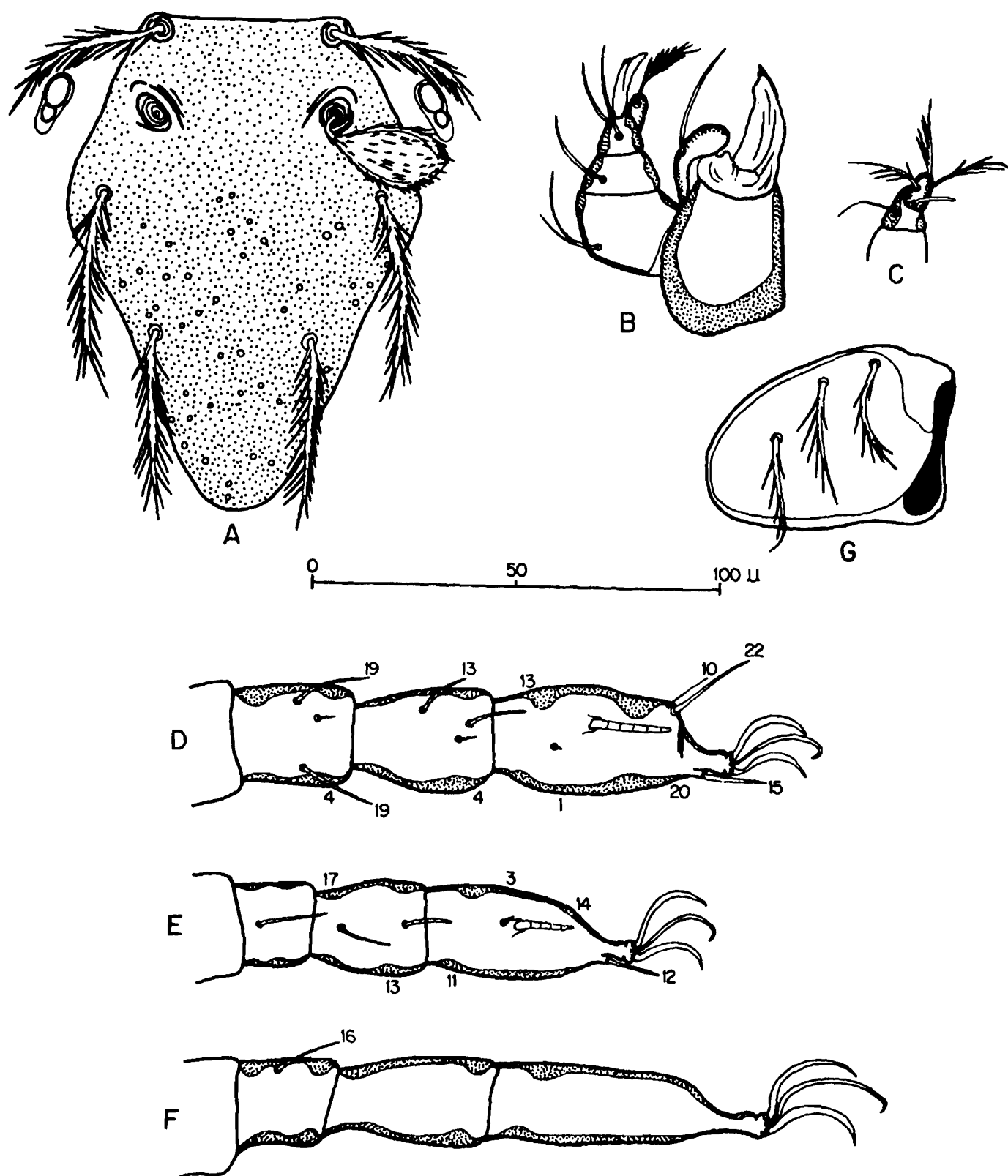


Fig. 159. *Schoengastiella shrivastavi*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

description : 696). Leg I : 249-261; tarsus (50-59 x 17-26), tarsala (19-20). Leg II : 210-220; tarsus (47-50 x 20-22), tarsala (14-16). Leg III : 243-269; tarsus (56-68 x 15-18).

Type data : Holotype (NICD-116/8) and 9 paratypes, MAHARASHTRA, Nagpur District; Nagpur, Ward 24, ex *Millardia meltada* (= *Rattus meltada meltada*), 13.IV.1968, S.P. Srivastva, coll.; 10 paratypes, same data, but ex *Mus platythrix*.

Type depository : Holotype at NICD; paratypes at NICD and IM.

New records : ORISSA, Ganjam District, Singpur, 11 ex *Rattus blanfordi*, 23.XI.1972, H.N. Kaul, coll.; 1 same data, but ex *Suncus murinus*.

Remarks : The above redescription is based on the original description and study of the NIV specimens. Srivastva and Wattal (1975a) consider *S. shrivastavi* close to *S. punctata* Radford, 1946b, *S. helata* (Traub and Evans, 1954) and *S. liota* (Traub and Evans, 1954). *S. shrivastavi* may be separated from these 3 species in having coxa III 3B (2B in other 3 species), scutum with micropunctae and scattered scrobiculae (only micropunctae in other 3 species), and palpal femoral seta barbed (nude in *S. helata* and *S. liota*, occasionally lightly barbed in *S. punctata*). This species has been named in honour of Dr.J.B. Shrivastav, former NICD Director, in recognition of his valuable contributions to medical entomology.

193. *Schoengastiella sicata* new species (Fig. 160)

Description of species : Larva.

Idiosoma : Measuring 222-343 x 174-254 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two pairs of humeral setae, slightly expanded, with inconspicuous barbs, measuring 35-41; 30 dorsal idiosomal setae, similar to humeral setae, measuring 21-44, anterolateral setae longer, arranged : 4-6-6-2-6-4-2; 2 pairs of sternal setae, finely ciliated, anterior 28-36, posterior 20-26; 22 preanal setae, finely ciliated, 16-19; 12-14 postanal setae, similar to humeral setae, 24-33; total idiosomal setae 70-72 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula b(B)/N(b)/b(N)b(N)b/4B; palpal claw 3-pronged; galeala N; cheliceral blade (29) with dorsal subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subhexagonal, with anterior margin shallowly concave; broadest at level immediately beyond PL bases; posterolateral margins tapering, caudal margin broadly rounded; SB anterior to level of PL bases; AL, PL and PPL setae similar to humeral setae; PL > AL; PPL setae measuring 22-28; sensillae clavate, head with setules; PW/SD = 0.71-0.79. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 46 (46, 41-52); PW 88 (88, 79-105); PPW 64 (58, 50-64); SB 52 (51, 47-58); ASB 23 (21, 19-24); PSB 98 (97, 90-111); AP 46 (45, 39-51); APP 90 (82, 76-90);

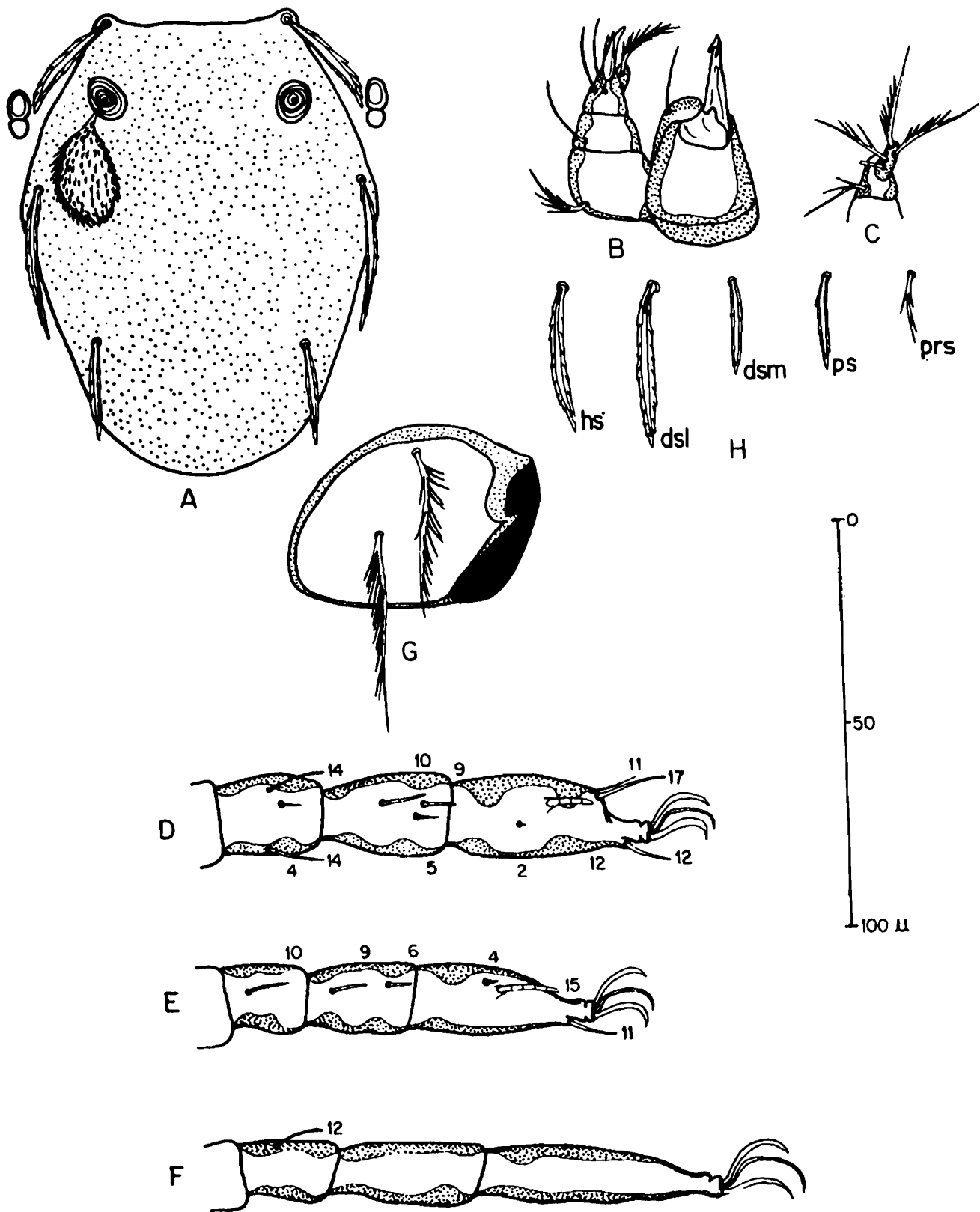


Fig. 160. *Schoengastiella sicata* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus;
 D. leg I distal 3 segments showing specialized setae; E. leg II as above;
 F. leg III as above; G. coxa III; H. selected idiosomal setae.

PP 34 (36, 34-43); AL 31 (30, 26-33); PL 38 (36, 33-40); sens. 32x14 (31x14, 30-32 x 14).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 691-746. Leg I : 235-253; tarsus (51x20), tarsala (12-13). Leg II : 204-223; tarsus (44x17), tarsala (14-16). Leg III : 247-270; tarsus (59x12).

Type data : Holotype (NIV A95354.1), MAHARASHTRA, Pune District, Sinhgarh, Atkarwadi, 650m, ex *Suncus murinus*, 20.I.1971, S.M. Kulkarni, coll.; 1 paratype, same data, but taken 12.XI.1970; 7 paratypes, same data, but Bhor, Nighudgarh, 620m, ex 6 *S. murinus*, taken 14.II, 18.XII.1970 and 19.II.1971; 2 paratypes, same data, but Mulshi, Gonaudi, 680m, taken 28.II.1970.

Additional records : MAHARASHTRA, Pune District, 20 ex 15 *S. murinus*, 10.I.1970 to 5.II.1971, S.M. Kulkarni, coll.; 1, same data, but ex *Funambulus tristriatus*, taken 18.XII.1970; 1, same data, but ex *Golunda ellioti*, taken 17.I.1970. GOA, Mollem, 1 ex *Rattus blanfordi*, 27.VIII.1983, S. Fernandes, coll.

Remarks : *S. sicata* is close to *S. erula* (Traub and Evans, 1954), from which it may be distinguished in having coxa III bisetose (unisetae in *S. erula*), palpal femoral seta barbed (nude in *S. erula*), and dorsal body setae modified (finely ciliated in *S. erula*). The species name, derived from the Latin for 'dagger-like', draws attention to the form of the modified idiosomal setae.

194. *Schoengastiella singularis* new species (Fig. 161)

Description of species : Larva.

Idiosoma : Measuring 261-280 x 185-199 in partially engorged specimens. Eyes 2/2, anterior large, on ocular plate. Two pairs of humeral setae, measuring 22-26; 28 dorsal idiosomal setae, measuring 20-23, arranged : 4-6-6-6-4-2; 2 pairs of sternal setae, anterior 23-26, posterior 20; 24-28 preanal setae, 14-15; 12-14 postanal setae, 18-20; total idiosomal setae 70-74 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/N(b)NN(b)/4B; palpal claw 3-pronged; galeala N; cheliceral blade (28) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae with short barbs; PL > AL; PPL similar to scutal setae, measuring 20-25; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.50-0.58. Scutal measurements of holotype followed

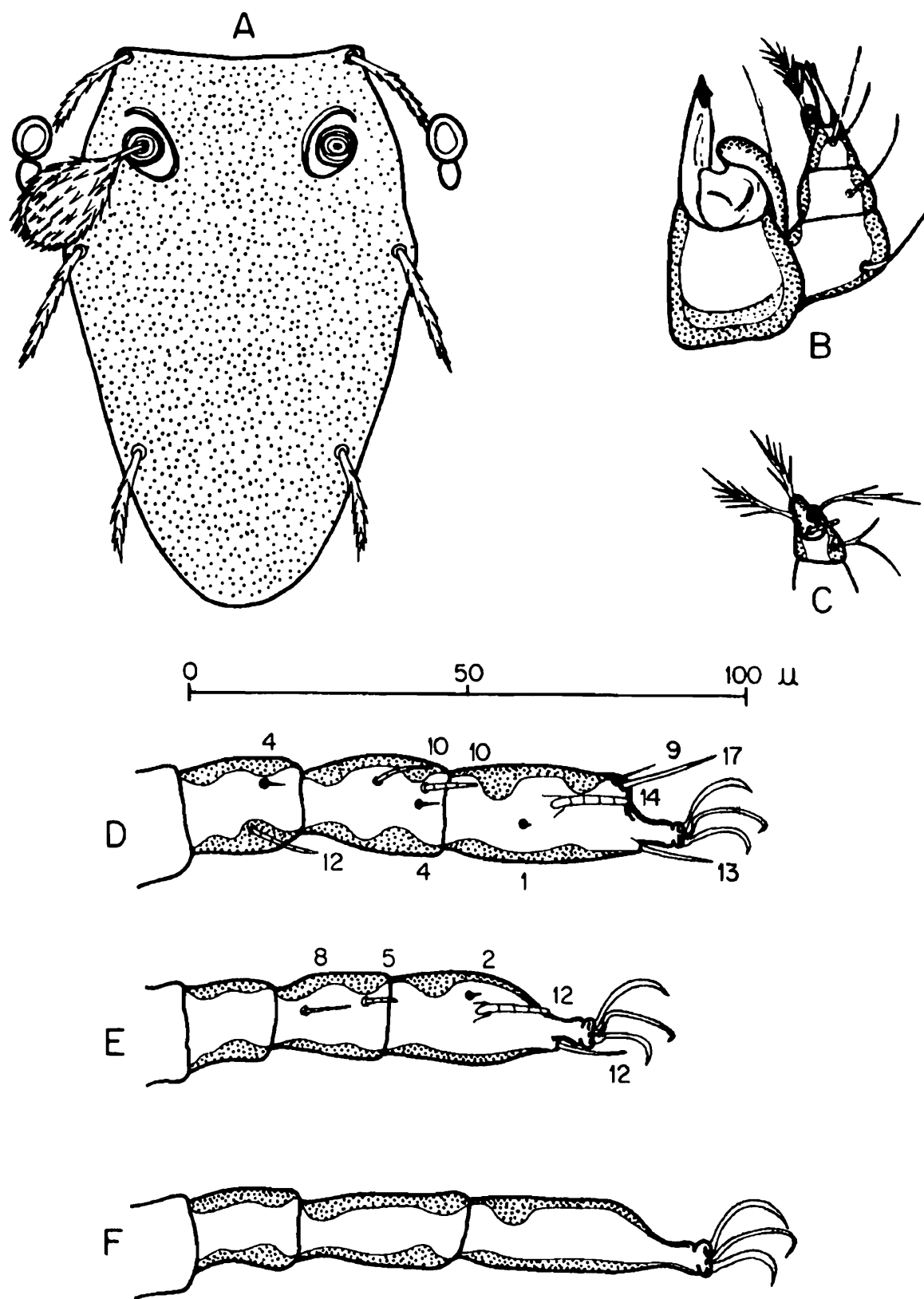


Fig. 161. *Schoengastiella singularis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

by means and ranges of 10 specimens in parentheses : AW 39 (40, 38-42); PW 57 (58, 55-59); PPW 38 (35, 32-38); SB 36 (36, 35-38); ASB 20 (19, 18-20); PSB 87 (86, 83-91); AP 38 (38, 36-41); APP 75 (74, 70-80); PP 30 (29-32); AL 21 (21, 19-24); PL 27 (24, 23-27); sens. - (27x13, 27-28 x 12-13).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary, but exceptional in number of sensory setae: single genuala I; genualae II and III absent. Measurements as follows : Ip = 551-571. Leg I : 193-208; tarsus (42x18), tarsala (13-14). Leg II : 165-170; tarsus (37x16), tarsala (11-12). Leg III : 192-201; tarsus (44x13).

Type data : Holotype (NIV A95440.1) and 9 paratypes, MAHARASHTRA, Pune District, Mulshi-khurd, 680m, ex *Bandicota bengalensis*, 29.I.1971, S.M. Kulkarni, coll.

Additional records : 10, same data as type series; 4, same data, but Bhor, Hirdoshi, 680m, ex *Suncus murinus*, taken 17.VI.1971. GUJARAT, Dediapada, 1 ex *S. murinus*, 26.X.1984, S. Fernandes, coll.

Remarks : *S. singularis* shares the unusual number of leg genualae with *S. cucurbitula* (Traub and Morrow, 1957). *S. singularis* may, however, easily be distinguished in having coxa III unisetose (trisetose in *S. cucurbitula*), palpal tarsal setation 4B (5B in *S. cucurbitula*), and palpal femoral and genual setae nude (barbed in *S. cucurbitula*). The species name, derived from the Latin meaning 'extraordinary', draws attention to the exceptional number of leg genualae.

195. *Schoengastiella tarsala* new species (Fig. 162)

Description of species : Larva.

Idiosoma : Measuring 324-468 x 232-327 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate. Two or three pairs of humeral setae, measuring 37-42; 54-56 dorsal idiosomal setae, measuring 35-37, arranged : 2-4-10-2-8-8-6-6-2(4)-4-2; 2 pairs of sternal setae, anterior 37, posterior 30; 46 preanal setae, 19-20; 12-16 postanal setae, 34-36; total idiosomal setae 122-128 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula B/b/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (42) with distinct tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at about level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL similar to scutal setae, measuring 34-36; sensillary bases with conspicuous anteromedial cuticular ridge; sensillae missing in specimens extant; PW/SD = 0.57-0.66. Scutal measurements of holotype followed

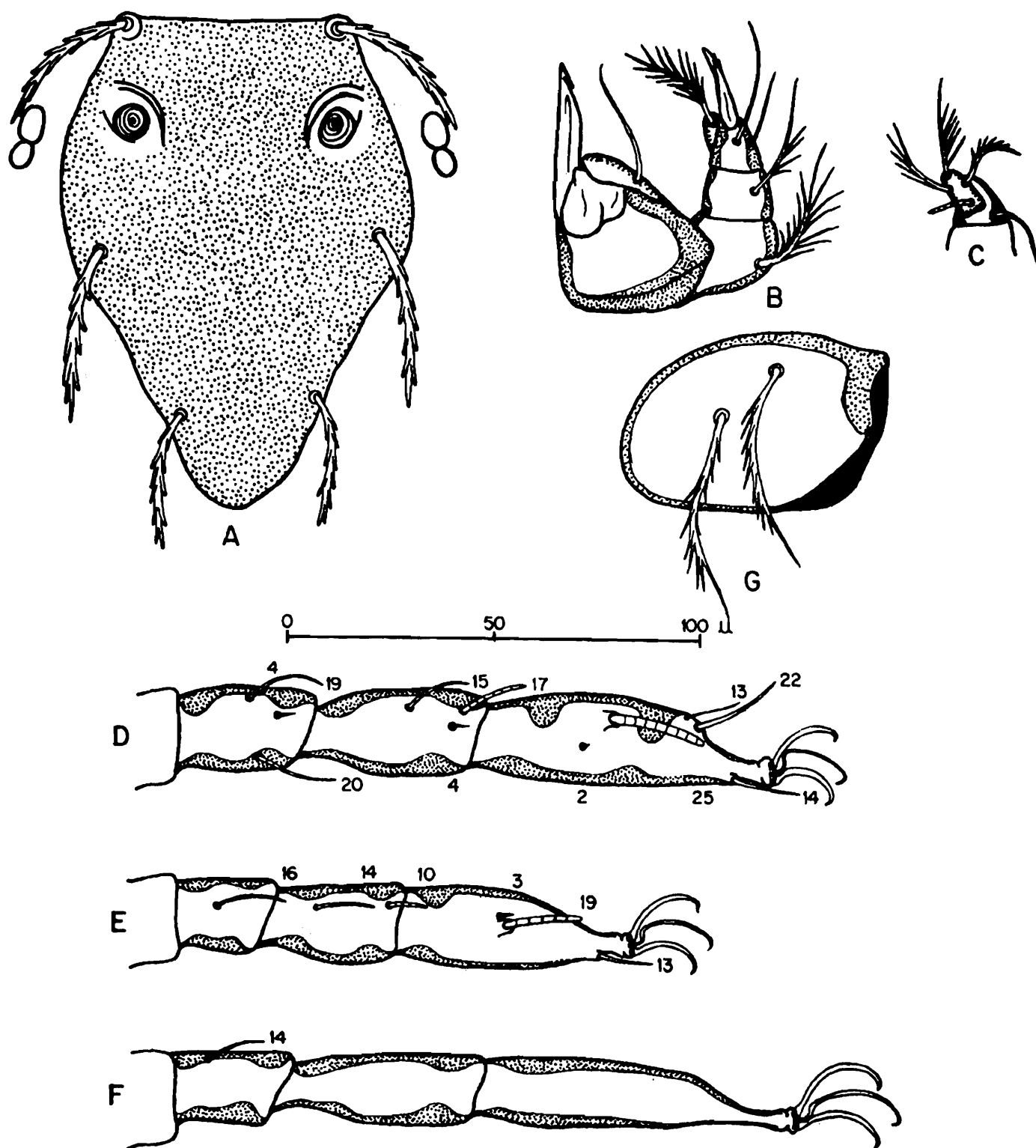


Fig. 162. *Schoengastiella tarsala* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

by means and ranges of type series in parentheses : AW 59 (54, 49-59); PW 84 (76, 68-84); PPW 33 (32, 29-37); SB 56 (52, 48-56); ASB 26 (26, no variation recorded); PSB 102 (100, 94-110); AP 62 (56, 53-62); APP 108 (101, 94-108); PP 23 (28, 23-35); AL 36 (36, 36-37); PL 43 (42, 42-43).

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 763-891. Leg I : 267-310; tarsus (72x22); tarsala (24-27). Leg II : 218-261; tarsus (57x19), tarsala (19-22). Leg III : 278-320; tarsus (76x16).

Type data : Holotype (NIV A86190.1) and 5 paratypes, UTTARANCHAL, Uttarkashi, Kuthanur, 1700-3200m, ex *Rattus* sp., 20.VI.1969.

Remarks : *S. tarsala* is close to *S. liota* (Traub and Evans, 1954), from which it may easily be separated in having palpal femoral seta barbed (nude in *S. liota*), greater number of dorsal body setae (approximately 28 in *S. liota*), and broader scutum (AW measuring 28-31, and PW 43-49 in *S. liota*). The species name draws attention to the elongate peditarsalae characteristic of this species.

196. *Schoengastiella uttarkashiensis* new species
(Fig. 163)

Description of species : Larva.

Idiosoma : Measuring 375-486 x 232-313 in partially engorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 41-44; 42-44 dorsal idiosomal setae, measuring 31-42, anterolateral setae longer, arranged : 4-8-2-8-8(6)-4-4-2; 2 pairs of sternal setae, anterior 30-38, posterior 29-30; 38-40 preanal setae, 17-20; 20-26 postanal setae, 31-37; total idiosomal setae 108-116 (excluding usurped scutal setae).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (38) with dorsal subapical tooth and tricuspid cap; gnathobase moderately punctate, bearing a pair of branched setae.

Scutum : Densely punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; posterolateral margins tapering, caudal angle rounded; SB anterior to level of PL bases; AL and PL setae finely ciliated; PL > AL; PPL setae similar to scutal setae, measuring 33-40; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.66-0.75. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 48 (47, 42-50); PW 66 (70, 66-75); PPW 25 (27, 21-34); SB 43 (42, 38-45); ASB 21 (22, 20-23); PSB 79 (79, 71-86); AP 43 (44, 4-47); APP 87 (87, 79-94); PP 16 (14, 12-16); AL 44 (40, 34-44); PL 43 (43, 41-45); sens. 35x15 (35x15, no variation recorded).

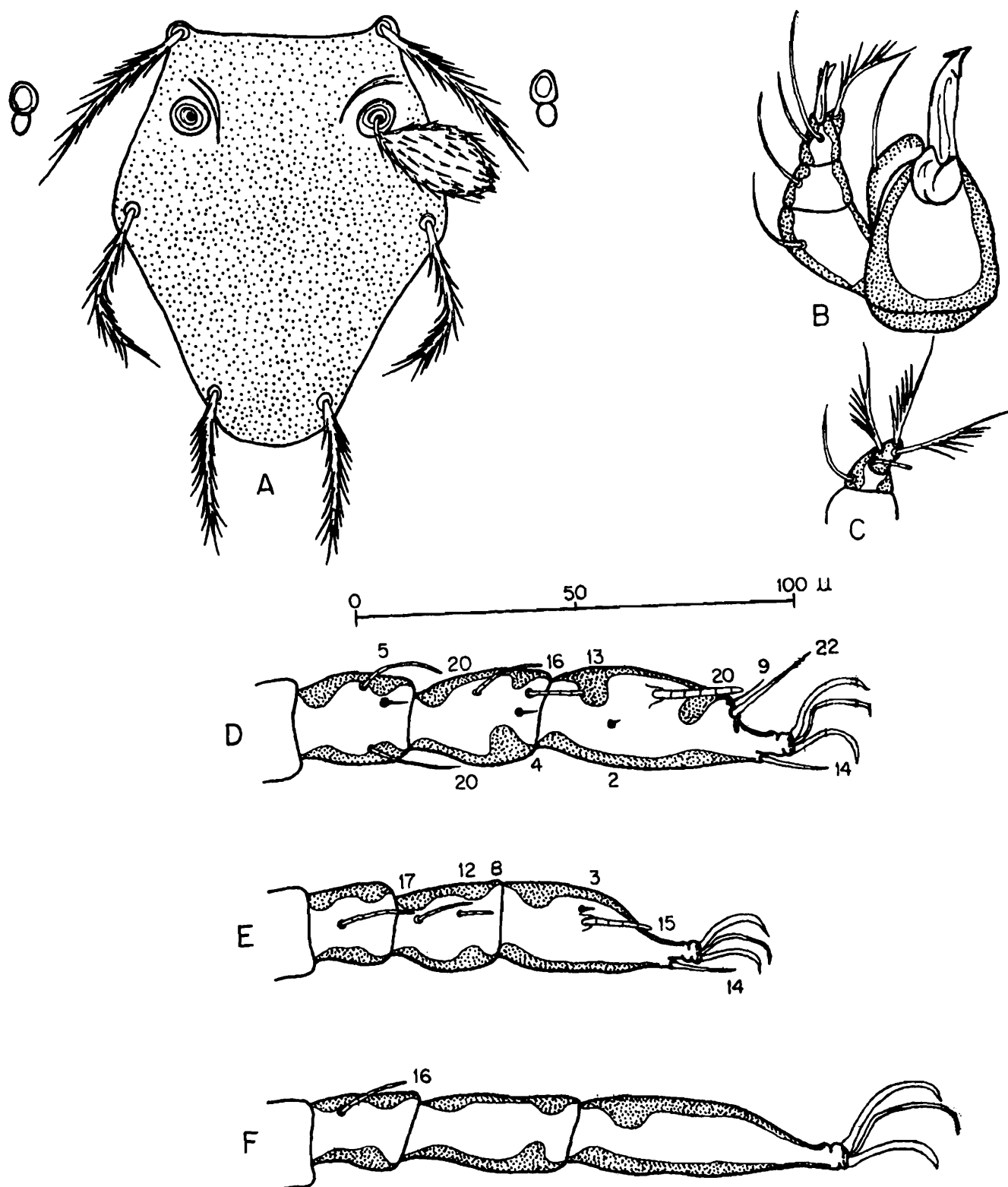


Fig. 163. *Schoengastiella uttarkashiensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Legs : Similar to *S. bengalensis* Hirst, 1915, in the number of ordinary and sensory setae. Measurements as follows : Ip = 658-709. Leg I : 241-255; tarsus (59x23), tarsala (19-20). Leg II : 195-209; tarsus (47x20), tarsala (15-17). Leg III : 222-250; tarsus (63x16).

Type data : Holotype (NIV A86190E.21) and 9 paratypes, UTTARANCHAL, Uttarkashi District, Kuthanur, 1700-3200m, ex *Rattus* sp., 20.VI.1969, NIV, coll.

Additional records : 3 records of collections from the Himalayan region by NIV field teams: 22, same data as type series; 1, same data, but Tehri District, Chirbatia, 1800-3200m, ex *Rattus rattoides*, taken 23.VI.1970. HIMACHAL PRADESH, Kinnaur District, Karcham, 1700m, 4 ex *R. rattoides*, 19.X.1967.

Remarks : *S. uttarkashiensis* is close to *S. bengalensis* Hirst, 1915, from which it may easily be distinguished by the greater number of body setae (84-88 in *S. bengalensis*), broader scutum (AW measuring 34-37, and PW 46-51 in *S. bengalensis*), and higher Ip range (478-483 in *S. bengalensis*). The species name is based on the type locality, Uttarkashi District.

Genus *Walchia* Ewing

Walchia Ewing, 1931, 11; Gater, 1932, 169; Wharton and Fuller, 1952, 91; Vercammen-Grandjean, 1968b, 110; 1971, 1; Vercammen-Grandjean et al., 1980, 783; Schluger and Amanguliev, 1975, 463; Kudryashova, 1976a, 1100; Kolebinova and Vercammen-Grandjean, 1978, 111; Suzuki, 1979, 371; Fernandes et al., 1988, 109; Nadchatram and Fernandes, 1989, 17.

Gahrlepiea (*Walchia*), Womersley, 1952, 279; Audy, 1954b, 161; Traub and Morrow, 1955, 2; Traub and Evans, 1957, 297; Liang and Hwang, 1959, 149; Schluger, 1960, 1258; Nadchatram and Dohany, 1974, 48; Goff, 1984a, 524; Goff and Durden, 1987, 209.

As *Gahrlepiea* Oudemans, 1912: Domrow and Lester, 1985, 61.

Gahrlepiea (*Ripiaspichia*), Brown and Goff, 1988, 117.

Type species : *Walchia ewingi* Fuller, 1949 (**nomen novum** for *Thrombidium glabrum* Walch, 1927).

Diagnosis : *Gahrlepieiini* larvae parasitic on ground mammals. Shape oval, with a tendency to constriction just posterior to coxa III. Palpal tarsus 4B or 5B; palpal claw 3-pronged; cheliceral blade with tricuspid cap; galeala N. Scutum lacking AM seta; usually small, without inclusion of dorsal idiosomal setae; subpentagonal, with pointed posterior projection, sometimes rounded; scutal punctae simple; sensillae clavate to globose. Eyes 2/2, 1/1, or rarely absent. Legs 7-6-6-segmented; onychotriches absent; 2 genualae I, genuala II and III (sometimes 1 or 2 genualae I, genuala II present or absent, and genuala III absent); tibiala III and mastisetae absent.

Remarks : Following Nadchatram and Fernandes (1989), *Walchia* is here accorded full generic status. Kolebinova and Vercammen-Grandjean (1978) have reported 5 subgenera in the genus, including a new subgenus *Kepkaia*. The following 3 subgenera are represented in the Oriental Region :

1. The nominate subgenus with palpal tarsus 4B, scutum usually subpentagonal with angled posterior projection, and leg genual setation : 2-1-1.
2. Subgenus *Ripiaspichia* Vercammen-Grandjean, 1968, with palpal tarsus 5B, scutum with rounded posterior projection, and leg genual setation : 2-1-1.
3. Subgenus *Evansichia* Vercammen-Grandjean, 1968, with palpal tarsus 4B, scutum with rounded posterior projection, and leg genual setation : 1-1-0.

Eight *Walchia* species, including a new species, are reported here, all in the nominate subgenus. Fernandes *et al.* (1988) recorded a new species, designated *Walchia* sp. A, from the NIV Himalayan collection. This concerns a single specimen from SIKKIM, Lachung, 2450-2750m, ex *Ochotona thibetana*, taken 25.IV.1969. This specimen is here regarded as sp. *indet.* close to *W. sunweiensis* (Liang and Hwang, 1959), pending further study.

197. *Walchia (Walchia) ewingi* Fuller

Walchia ewingi Fuller, 1949, 1 (new name proposed for *Trombidium glabrum* Walch, 1927, a homonym of *Trombidium glabrum* Duges, 1834).

Gahrliepia (Walchia) ewingi Fuller (1951) sic! : Womersley, 1952, 292.

Gahrliepia (Walchia) pingue, Womersley, 1952, 293 (not *pingue* Gater, 1932; erroneously reiterates synonym with *ewingi*).

Gahrliepia (Walchia) ewingi, Womersley and Audy, 1957, 27.

Gahrliepia (Walchia) ewingi ewingi, Traub and Evans, 1957, 330.

Walchia (Walchia) ewingi, Vercammen-Grandjean, 1968b, 110; 1971, 5.

Redescription of species : Larva.

Idiosoma : Measurements not reported in the literature. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 28; Traub and Evans (1957): 26-35 dorsal idiosomal setae, measuring 25-33, arranged : 6-6-6-6-4-2; Vercammen-Grandjean (1971) : 40, measuring 24-28, arranged : 6-6-6-6-6-4-4-2; 2 pairs of sternal setae; 30-32 preanal setae, 15-16; 16-20 postanal setae, 22-27; total idiosomal setae 78-98.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (26) with dorsal subapical tooth and ticuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; caudal angle rounded; SB about midway between AL and PL bases, close to lateral scutal margins; AL and PL setae finely ciliated; PL > AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.79-0.88. Scutal measurements giving means and ranges of 37 specimens from Malaysia, Batavia and

New Guinea after Womersley (1952) : AW 28, 26-30; PW 49, 43-54; SB 25, 22-26; ASB 22, no variation recorded; PSB 34, 32-35; AP 37, 32-38; AL 22, no variation recorded; PL 29, no variation recorded; sens. 29x11, no variation recorded. Scutal measurements giving means and ranges of 20 specimens from Manipur and North Burma after Traub and Evans (1957) : AW 29, 26-32; PW 44, 38-50; SB 23, 20-26; ASB 19, 17-21; PSB 34, 31-37; AP 32, 30-34; AL 21, 18-24; PL 25, 22-28. Scutal measurements of the original *glabrum* of Walch, followed by means of North Burma specimens after Vercammen-Grandjean (1971) : AW 27, 28; PW 42, 42; SB 23, 20; ASB 17, 18; PSB 33, 32; AP 29, 29; AL 24, 23; PL 25, 24; sens. 25x10, 26x9.

Legs : 7-6-6-segmented, terminating in a pair of claws and a clawlike empodium; onychotriches absent. Measurements of the original *glabrum* of Walch followed by means of North Burma specimens after Vercammen-Grandjean (1971) : Ip = 501, 484. Leg I : 173,171; coxa with 1 branched setae (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus 20B, tarsala, microtarsala, subterminala, parasubterminala, pretarsala. Leg II : 145,142; coxa 1B; trochanter 1B; femur 6B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 15B, tarsala, microtarsala, pretarsala. Leg III : 183,171; coxa III 3B (occasionally 2/4B); trochanter 1B; femur 5B; genu 3B, genuala; tibia 6B; tarsus 15B.

Type data : Originally described from SUMATRA, Lampong District, ex 'rats', 1927(?).

Type depository : Vercammen-Grandjean (1971): Holotype and paratype in Medical School, University of Jakarta, Indonesia.

Additional records : ASSAM, Ledo, ex *Rattus rattus* subsp. (= *Rattus flavipectus yunnanesis*), *Rattus* sp., and *Tupaia glis* (= *Tupaia belangeri versurae*), 1.XII.1944-1.XII.1945, USATC, coll. MANIPUR, Imphal, ex *Rattus rattus bullocki*, *Rattus bowersi*, *Rattus manipulus*, *Diomys crumpi*, *Mus* sp., *Suncus murinus*, and *Anourosorex squamipes*, IV.1945-III.1946, STRU, coll.

Remarks : The above redescription is based only on the literature. Traub and Evans (1957) describe the inner tarsal claw in *W. ewingi* as slightly thinner than the outer claw and empodium, but not nearly as thin as in *W. disparunguis* (Oudemans, 1929), and almost equal in length to the outer claw. Vercammen-Grandjean (1971), however, describes the external tarsal claw as thinner and smaller than the internal claw! This species has been named in honour of H.E. Ewing for his pioneering contributions to Acarology.

198. *Walchia* (*Walchia*) *enode* Gater (Fig. 164)

Walchia enode Gater, 1932, 169; Wharton and Fuller, 1952, 92; Audy *et al.*, 1953, 27.

Walchia enodis, **sic!** Radford, 1946b, 247.

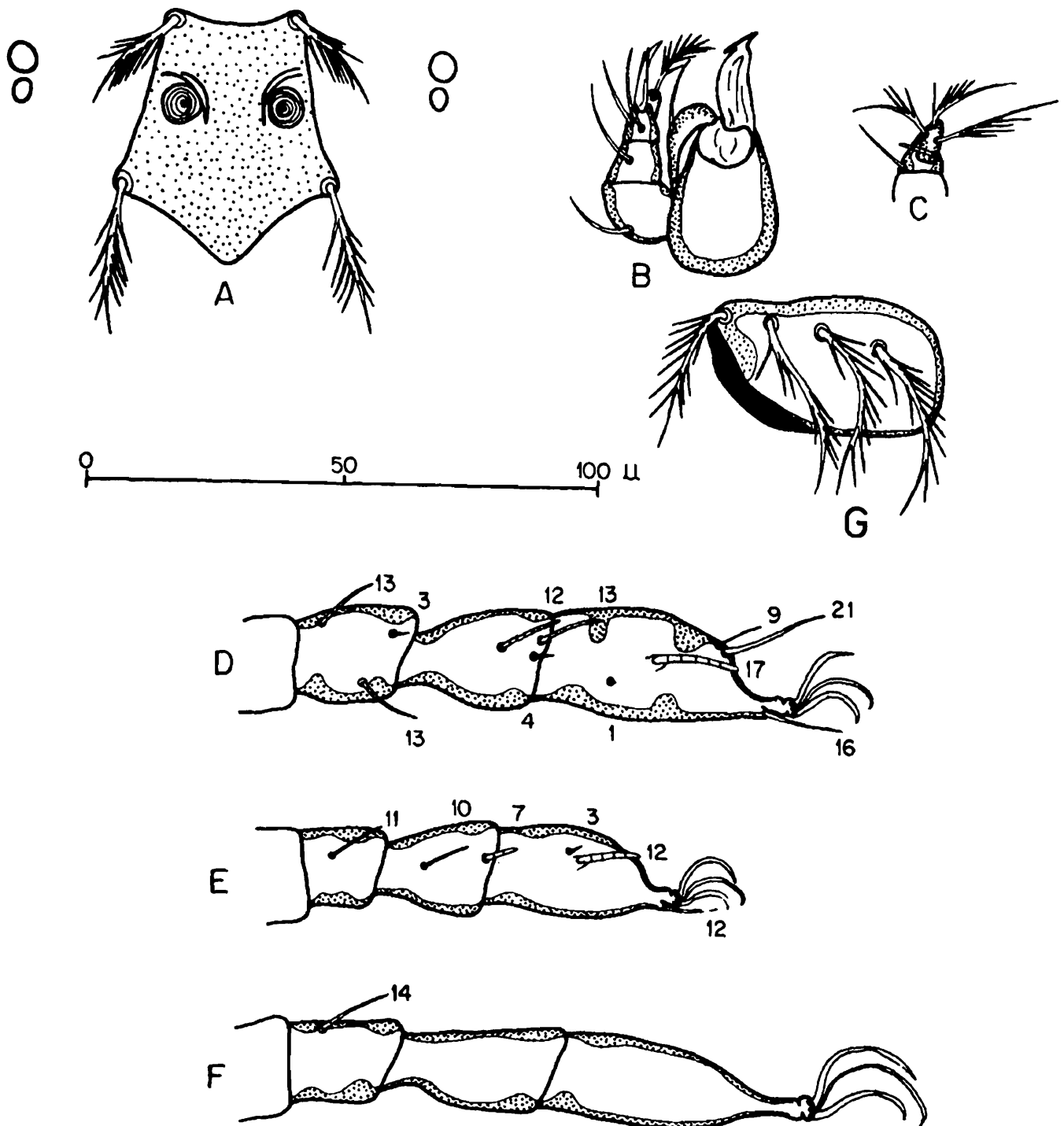


Fig. 164. *Walchia enode*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

Gahrlepiea (Walchia) enode, Womersley, 1952, 293; Traub and Evans, 1957, 345; Nadchatram, 1970b, 136.

Walchia (Walchia) enode, Vercammen-Grandjean, 1968b, 112.

Gahrlepiea enode, Prasad, 1974, 78.

Redescription of species : Larva.

Idiosoma : Measuring 350-510 x 250-380 in partially engorged to engorged specimens. Eyes 2/2 (Original description, Womersley, 1952, Fuller, 1952, and Traub and Evans, 1957 : absent!), anterior larger, free on cuticle. One pair of humeral setae, measuring 25-27; 30-36 dorsal idiosomal setae, measuring 21-34, arrangement variable (Original description : 8-6-6-6-4-4-2; Traub and Evans, 1957 : 6-6-2-6-6-2-4-2); 2 pairs of sternal setae, anterior 27-29, posterior 21; approximately 32 preanal setae, 17-21; approximately 16 postanal setae, 25-29; total idiosomal setae approximately 84-96.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galaela N; cheliceral blade (28) with dorsal subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; posterolateral margins tapering sharply beyond PL bases, caudally angled; SB anterior to level of PL bases; AL and PL setae finely ciliated, subequal; sensillay bases with anteromedial cuticular ridge; sensillae capitate, head with setules; PW/SD = 0.73-1.0. Scutal measurements of holotype and paratype after Fuller (1952) : AW 30, 28; PW 54, 53; SB 27, 22; ASB 21, 22; PSB -, 36; AP 39, 36; AL 28, 24; PL 28, 28. Scutal measurements giving means and ranges of 191 specimens from Manipur, Imphal and South Burma after Womersley (1952) : AW 26, 22-32; PW 38, 35-51; SB 21, 18-25; ASB 19, 18-22; PSB 33, 29-35; AP 31, 29-35; AL 19, 16-26; PL 21, 19-22; sens. 22x16. Scutal measurements of USNM paratype, followed by means and ranges of 2 Malaysian specimens after Traub and Evans (1957) : AW 29 (27, 26-28); PW 51 (42, 41-43); SB 25 (23, 22-24); ASB 21 (20, 18-22); PSB 31 (28, 27-29); AP 36 (33, 32-34); AL 26 (22, 21-23); PL 28 (25, 23-27).

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae; but, coxa III 4B (occasionally 3/5B). Measurements as follows : Ip = 523-551. Leg I : 186-187; tarsus (49x22), tarsala (17). Leg II : 149-162; tarsus (37x18), tarsala (12). Leg III : 188-202; tarsus (52x16).

Type data : Holotype and 8 paratypes, MALAYSIA, Selangor, Sungei Buloh, ex *Rattus mulleri validus*, 24.IV.1930 and 8.VIII.1930, M.L. Webber, coll.

Type depository : Holotype and 1 paratype in BM(NH); paratypes in USNM, MI, and KECM.

Additional records : MANIPUR, Imphal and South Burma, ex *Rattus rattus bullocki*, *Bandicota bengalensis*, and *Rattus* sp., IV.1945-III.1946, STRU, coll.

Material examined : 1 specimen (#22664) on loan from M. Nadchatram: MALAYSIA, Kepong - R 16650 5/12. 1 specimen from Womersley collection, labelled : S. Aust. Mus. I. #469 - *Gahrliopia (Walchia) enode* (Gater) - Imphal - Det. H. Womersley.

Remarks : The above redescription is based on the literature and study of the Kepong and Imphal specimens. Gater (1932) considers this species close to *W. ewingi* Fuller, 1949, from which it differs in having coxa III 4B (3B in *W. ewingi*), and in having tarsal claws subequal (unequal in *W. ewingi*). Womersley (1952) further distinguishes this species from *W. ewingi* in having a smaller scutum and fewer dorsal body setae. He considers the size of the scutum and its standard data to be determinative in cases where the number of setae on coxae III is 3/4. Traub and Evans (1957) separate this species from *W. ewingi* and the related *W. disparunguis* (Oudemans, 1929) by the scutum having smaller caudal triangle (scutum produced into much broader and deeper triangle in *W. ewingi* and *W. disparunguis*), and in having coxa III 4/5B (2/3B in *W. ewingi* and *W. disparunguis*). They point out that though the standard measurements of their Malaysian specimens are much smaller than those recorded by Fuller (1952) for the holotype and 2 paratypes as well those of the USNM paratype, these agree closely with the Imphal specimens. In their opinion, the critical diagnostic feature for recognition of this species is the shape of the scutum; and, proportionate differences in scutal measurements represent individual variations rather than a taxonomic entity.

199. *Walchia (Walchia) gujaratensis* new species
(Fig. 165)

Description of species : Larva.

Idiosoma : Measuring 158-393 x 128-306 in unengorged to engorged specimens. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae, measuring 28-30; 34-36 dorsal idiosomal setae, measuring 25-28, arranged : 6-6-2-8(6)-6-4-(4)-2; 2 pairs of sternal setae, anterior 25-30, posterior 20-22; 26 preanal setae, 15-16; 16-26 postanal setae, 21-26; total idiosomal setae 82-94.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (29) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subpentagonal, with anterior margin shallowly concave; broadest at level of PL bases; AL and PL setae finely ciliated, subequal; sensillae clavate, head with setules; PW/SD = 0.76-0.90. Scutal measurements of holotype followed by means and ranges of 10 specimens in parentheses : AW 32 (32, 30-33); PW 50 (49, 46-52); SB 33 (30, 28-32); ASB 19 (19, 18-20); PSB 36 (39, 35-44); AP 36 (36, 34-39); AL 29 (29, 27-31); PL 32 (30, 28-32); sens. - (28x12, 27-29 x 11-12).

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 531-554. Leg I : 185-195; tarsus (45x22);

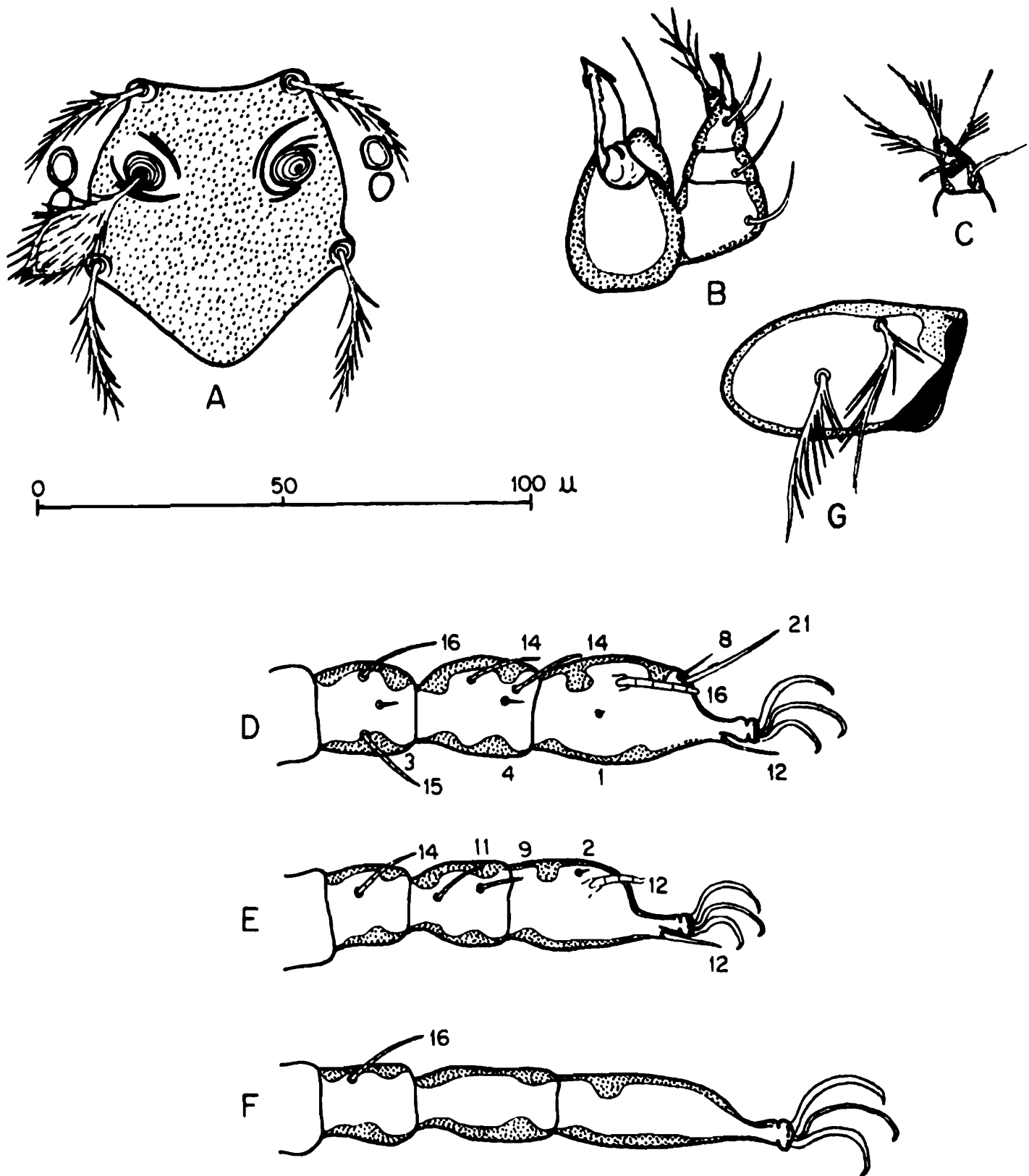


Fig. 165. *Walchia gujaratensis* new species

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

tarsala (15-17). Leg II : 159-168; tarsus (37x18), tarsala (11-13). Leg III : 182-194; tarsus (47x15).

Type data : Holotype (NIV AA26766.13) and 4 paratypes, GUJARAT, Jhankvav, ex *Suncus murinus*, 27.X.1984, S. Fernandes, coll.; 5 paratypes, same data, but Dediapada, taken 26.X.1984.

Additional records : GUJARAT, Jhankvav and Dediapada, approximately 360 ex 7 *S. murinus*, 26,27.X.1984, S. Fernandes, coll. RAJASTHAN, Kota District, Darah and Ganesh Pal and Bundi District, Bundi, 369 ex 13 *S. murinus* and 1 *Millardia meltada*, 27-30.X.1971, H.N. Kaul, coll.

Remarks : *W. gujaratensis* is close to *W. morrowae* (Traub and Evans, 1957), from which it differs in having palpal femoral and genual setae nude (barbed in *W. morrowae*), smaller AW (measuring 37-41 in *W. morrowae*), and scutum caudally prolonged into triangle (caudally broad, tongue-shaped in *W. morrowae*). The number of postanal setae is approximately 16 in the Gujarat specimens, and 26 in the Rajasthan specimens. Kaul et al. (1978) have earlier reported the Rajasthan material as *W. ewingi* Fuller, 1949. The species name is based on the type locality.

200. *Walchia (Walchia) lupella* Traub and Evans
(Fig. 166)

Gahrlepiea (Walchia) ewingi lupella Traub and Evans, 1957, 332; Womersley and Audy, 1957, 287; Mitchell et al., 1966, 120.

Walchia (Walchia) lupella, Vercammen-Grandjean, 1968b, 111, full species; 1971, 8.

Gahrlepiea ewingi lupella, Prasad, 1974, 79.

Walchia lupella, Fernandes et al., 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 317-335 x 208-232 in partially engorged specimens. Eyes 2/2 (Original description: 1/1), on ocular plate. One pair of humeral setae, measuring 27-37; 30-36 dorsal idiosomal setae, arranged : 6-6(8)-2, the rest irregular (Original description : 26-35, arranged : 6-6-6-6-4-2; Vercammen-Grandjean, 1971 : 40, arranged : 6-6-8-6-6-4-4), measuring 22-37; 2 pairs of sternal setae, anterior 24-25, posterior 18-19; 24-30 preanal setae, 14-16 (Vercammen-Grandjean, 1971: measuring 19-33); 14-24 postanal setae, 22-25; total idiosomal setae 74-88 (Vercammen-Grandjean, 1971 : 100).

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (21-26) with dorsal subapical tooth and tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subpentagonal, with anterior margin shallowly concave;

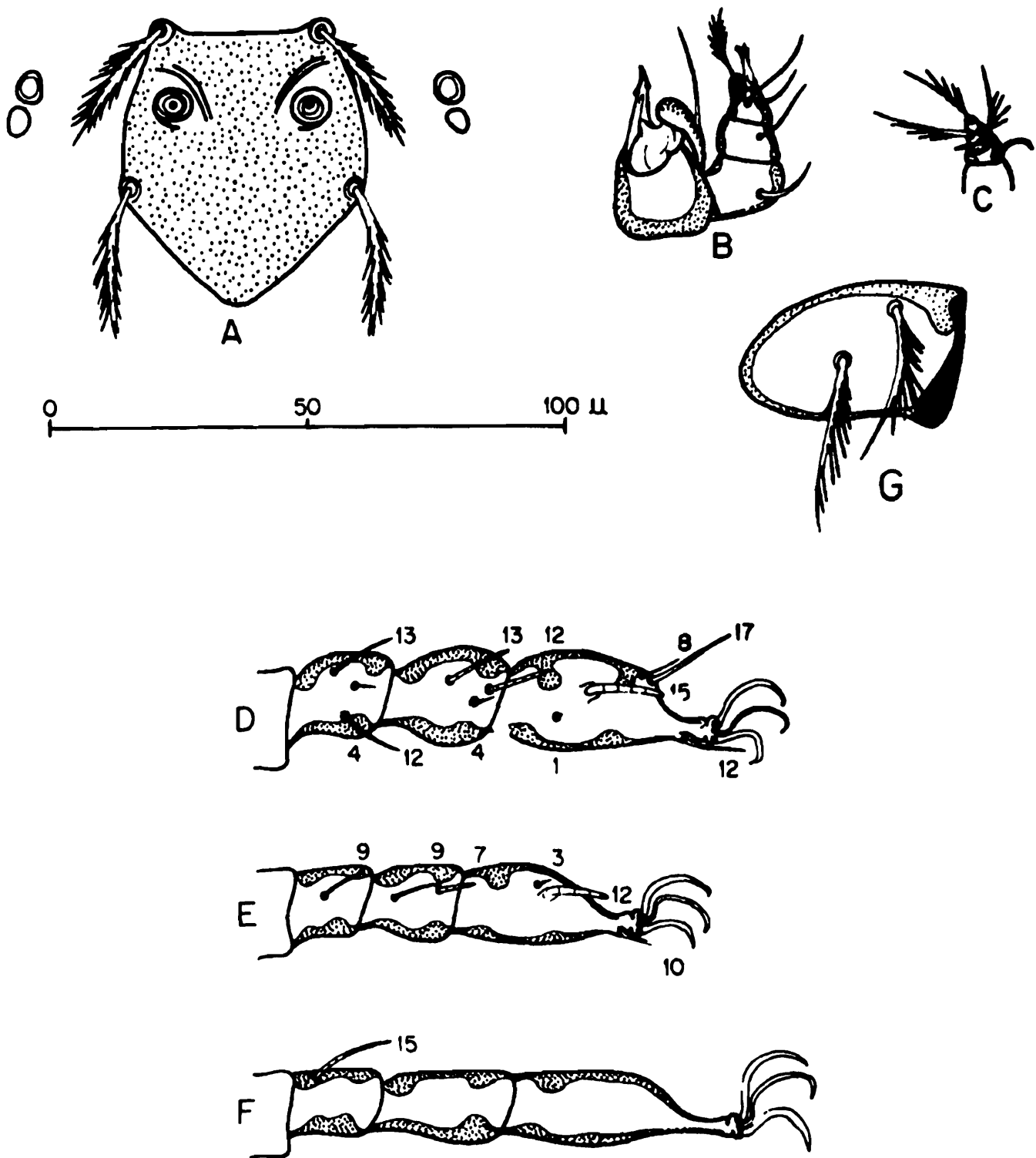


Fig. 166. *Walchia lupella*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above; G. coxa III.

broadest at level of PL bases; caudal angle gently rounded; SB anterior to PL bases; AL and PL setae finely ciliated; $PL > AL$ (subequal in Indian specimens examined); sensillary bases with conspicuous anteromedial cuticular ridge; sensillae clavate, head with setules; $PW/SD = 0.69-0.80$ (Original description : 0.76-0.97; Vercammen-Grandjean, 1971 : 0.76-0.83). Scutal measurements of holotype followed by means and ranges of 30 paratypes and other specimens in parentheses after original description : AW 32 (32, 29-35); PW 48 (47, 42-52); SB 28 (28, 25-31); ASB 21 (20, 17-23); PSB 40 (36, 31-41); AP 36 (35, 32-38); AL 21 (22, 19-25); PL 28 (25, 21-29). Scutal measurements giving means followed by ranges after Vercammen-Grandjean (1971) (number of specimens and locality not reported) : AW 33, 30-34; PW 44, 43-45; SB 23, 20-25; ASB 20, 18-21; PSB 36, 34-38; AP 35, 33-36; AL 25, 24-25; PL 32, 31-34. sens. 29×10 . Scutal measurements of 10 NIV specimens giving means followed by ranges : AW 32, 29-33; PW 45, 41-51; SB 28, 26-30; ASB 18, 16-21; PSB 42, 38-45; AP 34, 32-39; AL 29, 28-31; PL 28, 27-30; sens. 32×11 .

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae; but, coxa III 2B. Measurements as follows : Ip = 480-546. Leg I : 171-194; tarsus (43×19), tarsala (15-16). Leg II : 143-164; tarsus (38×16), tarsala (12). Leg III : 166-190; tarsus (45×14). Vercammen-Grandjean (1971) : Ip = 556-581. Leg I : 200-208. Leg II : 164-171. Leg III : 194-206.

Type data : Holotype (USNM 2438) and 18 paratypes, THAILAND, Chaiyaphum, ex *Bandicota* sp., 11.XII.1952, R.E. Elbel and associates, coll.; 1 paratype, same data, but ex *Rattus rattus*, 23.I.1952; 70 paratypes, same data, but Ratchasima, ex *Bandicota indica*, *Rattus rattus* subsp., and *Herpestes* sp., 11.VIII.1952-30.VIII.1953.

Type depository : Holotype and paratypes in USNM; paratypes in BM(NH), SAM, CNHM, CORU, and Traub collection.

Additional records : MADHYA PRADESH, Kanha National Park, 540-840m, 37 ex *Suncus stoliczkanus*, 23,27.XII.1964, C.J. Mitchell, J. Schaller, and G.B. Spillett, coll.

New records : ORISSA, Ganjam District, Singpur, 2 ex *Suncus murinus*, 23.XI.1972, H.N. Kaul, coll. 8 records of collections from the Himalayan region by NIV field teams : HIMACHAL PRADESH, Lahul District, Keylong, 3110-3170m, 1 ex *Apodemus flavicollis*, 28.IX.1967; 7, same data, but Mandi District, Mandi, 920m, ex *S. murinus*, taken 31.VIII.1970. UTTARANCHAL, Dehra Dun District, Satyanarayan, 300m, 3 ex *S. murinus*, 4.VII.1970; 16, same data, but Nainital District, Ramnagar, 350m, ex *Rattus rattus rufescens*, taken 29.VIII.1970; 19, same data, but ex 4 *S. murinus*, taken 28,29.VIII.1970.

Remarks : The above redescription is based on the literature and study of the NIV specimens. Traub and Morrow (1957) described *lupella* as a subspecies of *W. ewingi* Fuller, 1949, distinguishing it in having coxa III 2B (3B in *W. ewingi* s.str.), eyes 1/1 (2/2 in *W. ewingi* s.str.), and SB measuring 28 (24 in *W. ewingi* s.str.). Vercammen-Grandjean (1968b) raised *lupella* to full species, and confirmed this status in his redescription (Vercammen-Grandjean, 1971). He describes the external and smaller claw as slightly thinner than the

internal one and inconspicuously thinner than the empodium. In the Indian specimens examined, the external claw is smaller than the internal one, but not thinner than the empodium. The standard data of the Indian specimens is in general agreement with the measurements reported in the literature, except for differences recorded above for the scutal setae and leg measurements.

201. *Walchia (Walchia) manipurensis* Sinha

Walchia manipurensis Sinha, 1954, 335.

Gahrliepia (Walchia) manipurensis, Traub and Evans, 1957, 351; Sinha, 1957, 296; Liang and Hwang, 1959, 151.

Walchia (Walchia) manipurensis, Vercammen-Grandjean, 1968b, 111.

Redescription of species: Larva.

Idiosoma : Measurements of idiosoma not reported. Eyes not discernable, but may be present. One pair of humeral setae, measuring 22; 34 dorsal idiosomal setae, measuring 29, arranged: 6-10-6-6-4-2; 2 pairs of sternal setae; 46 ventral setae; total idiosomal setae 86 (Traub and Evans, 1957: approximately 32 dorsal idiosomal setae, measuring 34, arrangement commencing: 6-6-2-6; approximately 44 preanal and 20 postanal setae; total idiosomal setae approximately 102).

Gnathosoma : Palpal seal formula N/N/NNN/4B; palpal claw 3-pronged; cheliceral blade with tricuspid cap; gnathobase lightly punctate, bearing a pair of branched setae.

Scutum : Sparsely punctate, subpentagonal, with anterior margin shallowly concave; lateral margins convex between AL and PL bases, rapidly tapering beyond PL bases, caudal apex acute; SB anterior to PL bases; AL and PL setae sparsely ciliated; PL > AL; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.48-0.52. Scutal measurements of holotype after original description, followed by measurements of holotype and paratype after Traub and Evans (1957) in parentheses: AW 22 (27, 29); PW 29 (33, 34); SB 22 (28, 30); ASB 18 (19, 18); PSB 43 (45, 50); AP 36 (36, 37); AL - (29, 31); PL 40 (33, 34); sens. 25x- (-, -).

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae; but, coxa III 1B. Measurements not reported.

Type data : Holotype and 1 paratype, MANIPUR, Kanglatongbi, ex *Bandicota bengalensis*, 9.X.1945, M.L. Roonwal, coll.

Type depository : Holotype and paratype at ZSI.

Remarks : The above redescription is based only on the literature. The types at the ZSI are apparently misplaced. Traub and Evans (1957) distinguish this species by the very small scutum (PW measuring 34), coxa III 1B, tarsal claws subequal (shorter than empodium),

and AL setae subequal to AW. Liang and Hwang (1959) have described *W. sunweiensis*, which they consider close to *W. manipurensis*. They distinguish *W. sunweiensis* by the scutal measurements (AW measuring 31, and PW 41), in having lateral scutal margins slightly concave, sensillae capitate, and eyes 2/2. The species name is based on the type locality.

202. *Walchia (Walchia) rustica* (Gater)
(Fig. 167)

Gahrlepiea rustica Gater, 1932, 167.

Gahrlepiea (Walchia) rustica, Womersley, 1952, 286; Traub and Evans, 1957, 339.

Walchia rustica, Wharton and Fuller, 1952, 93.

Walchia (Walchia) rustica, Vercammen-Grandjean, 1968b, 112.

Walchia turmalis (Gater, 1932) : Fernandes *et al.*, 1988, 109.

Redescription of species : Larva.

Idiosoma : Measuring 320-360 x 190-240 in partially engorged specimens. Eyes 2/2, anterior larger, on ocular plate (Original description and Womersley, 1952 : eyes absent). One pair of humeral setae, measuring 28-32; 34-42 dorsal idiosomal setae, measuring 21-40, arrangement commencing : 6-8-8 or 4-6-6-2-6, the rest irregular; 2 pairs of sternal setae, anterior 25-29, posterior 23-25; 36 preanal setae, 18-20; 20 postanal setae, 21-33 (Traub and Evans, 1957 : 46-50 ventral setae); total idiosomal setae 86-104.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (28-31) with distinct subapical tooth and tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; posterolateral margins tapering and sinuate beyond level of PL bases; AL and PL setae finely ciliated, subequal; sensillary bases with anteromedial cuticular ridge; sensillae clavate, head with setules; PW/SD = 0.58-0.86. Scutal measurements giving means and ranges of 15 Malaysian specimens, followed by means and ranges 20 Assam and North Burma specimens, and 25 Thai specimens after Traub and Evans (1957) : AW 42, 39-45; 39, 34-44; 48, 45-51; PW 54, 48-60; 50, 46-54; 60, 56-64; SB 35, 31-39; 35, 29-41; 40, 36-44; ASB 23, 21-25; 20, 17-23; 23, 20-26; PSB 61, 53-69; 53, 49-57; 56, 52-60; AP 42, 40-44; 39, 37-41; 41, 38-44; AL 33, 29-37; 29, 25-33; 30, 25-35; PL 36, 33-39; 29, 26-31; 30, 25-35; sens. - (measurements not reported in the literature). Scutal measurements giving means and ranges of 10 NIV specimens : AW 42, 40-44; PW 49, 46-53; SB 34, 31-37; ASB 20, 19-22; PSB 51, 49-53; AP 37, 34-39; AL 31, 29-33; PL 30, 28-32; sens. 32x12, 29-34 x 11-12.

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae;

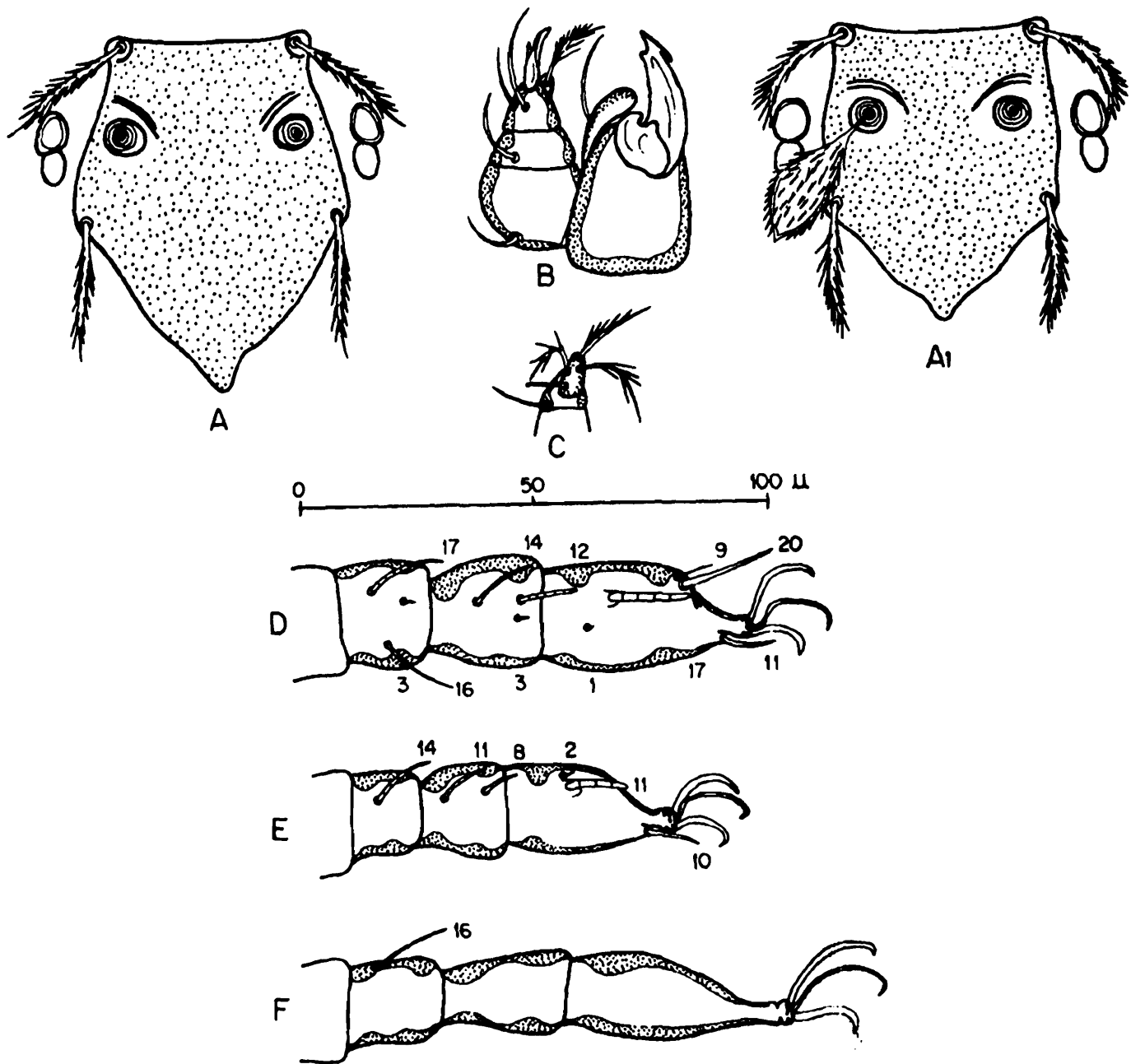


Fig. 167. *Walchia rustica*

A. scutum (Malaysian specimen); A1. scutum (NIV specimen); B. dorsal aspect of gnathosoma;
 C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae;
 E. leg II as above; F. leg III as above.

but, coxa III 1B. Measurements as follows : Ip = 536-569. Leg I : 188-202; tarsus (44x22), tarsala (17). Leg II : 158-168; tarsus (36x18), tarsala (13). Leg III : 190-199; tarsus (48x16).

Type data : Holotype and 6 paratypes, MALAYSIA, Selangor, Sungei Buloh, ex *Rattus rajah surifer* (= *Rattus surifer surifer*), 23.VII.1930, M.L. Webber, coll.

Type depository : Holotype and 1 paratype in BM(NH); paratypes in USNM, SAM, and IMR.

Additional records : ASSAM, Ledo area and North Burma, ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), *Suncus* (= *Crocidura*) sp., *Rattus rattus sladeni*, *Rattus rattus* subsp. (= *Rattus flavipectus yunnanensis*), *Rattus nitidus nitidus*, *Tupaia glis* (= *Tupaia belangeri versurae*), a leopard, and an Assamese lineated barbet *Cyanops lineatus hodgsoni*, X.1944-XII.1945, USATC, coll.

New records : WEST BENGAL, Darjeeling District, Siliguri, 119m, 1 ex *S. murinus*, 21.III.1986, S. Fernandes, coll.; 13, same data, but Jalpaiguri District, Chunabhatti, 150-200m, ex *Rattus rattus brunneusculus*, taken 27.III.1969, NIV, coll.

Material examined : 2 slides on loan from M. Nadchatram: 4 specimens on a single slide (BP-121) together with a specimen of *Leptotrombidum* (L.) *gentryi* Nadchatram and Upham, 1966, MALAYSIA, Machang District, Kelantan, on black plate from rat hole, 16.V.1965, M. Nadchatram, coll. 2 specimens on a single slide together with 2 specimens of *Walchiella impar* (Gunther, 1939), SINGAPORE, MacRitchie, ex *Tupaia glis*, 4.VIII.1985, M. Nadchatram for Dept. of Zoology, University of Singapore, coll.

Remarks : The above redescription is based on the literature and study of the Malaysian, Singapore and NIV specimens. Traub and Evans (1957) cite the key diagnostic characters of this species in relation to *W. turmalis* (Gater, 1932) and *W. cuspidata* (Traub and Evans, 1957), as: presence of a distinct dorsal subapical tooth on the cheliceral blade, relatively shorter scutum (i.e. PSB and PW subequal, but often PSB>PW in Malaysian specimens), caudal apex of scutum papillate, and posterolateral scutal margins sinuate beyond PL bases. They have pointed out that the scutal dimensions of the Assam and North Burma specimens are smaller than the Malaysian and Thai specimens. They do not, however, consider these differences significant or constant enough to warrant an independent taxonomic status. A critical re-examination of the NIV specimens from Jalpaiguri District, WEST BENGAL revealed that their earlier determination by Fernandes et al. (1988) as *W. turmalis* was a misidentification, hence the correction.

203. *Walchia* (*Walchia*) *soricicola* (Traub and Evans)

Gahrlepiea (*Walchia*) *soricicola* Traub and Evans, 1957, 303.

Walchia (*Walchia*) *soricicola*, Vercammen-Grandjean, 1968b, 112.

Gahrlepiea soricicola, Prasad, 1974, 81.

Redescription of species : Larva.

Idiosoma : Measuring approximately 207x126 in partially engorged specimen. Eyes 2/2, anterior larger, on ocular plate. One pair of humeral setae; approximately 28 dorsal idiosomal setae, sparsely ciliated, measuring 35-48, usually arranged : 6-6-6-6-2-2; 2 pairs of sternal setae; approximately 20 preanal setae, measuring about 30; about 20 postanal setae; total idiosomal setae approximately 74.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade with tricuspid cap; gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; lateral margins excised between AL bases and level of SB, then broadly and evenly convex, caudal apex acute; SB anterior to level of PL bases; AL and PL setae proximally sparsely ciliated, distally nude; AL>>PL; sensillary bases with pronounced anteromedial cuticular ridge; sensillae clavate (Original description : fusiform portion about 2.5-3x as long as broad, apex acuminate), head with setules; PW/SD = 0.41-0.49. Scutal measurements of holotype, followed by means and ranges of 13 paratypes in parentheses : AW 21 (24, 20-28); PW 32 (37, 31-43); SB 32 (34, 28-40); ASB 22 (23, 22-24); PSB 52 (56, 49-63); AP 40 (41, 38-44); AL 60 (59, 50-68); PL 50 (47, 42-52).

Legs : Similar to *W. ewingi* Fuller, 1949, in the number of ordinary and sensory setae; but, coxa III 1B. Tarsal claws unusually long and stout. Measurements not reported.

Type data : Holotype (USNM 2427) and 1 paratype, ASSAM, Stilwell Road, 19 miles North of Ledo, ex *Suncus* (= ?*Crocidura*) sp., 19.V.1945, USATC, coll.; 25 paratypes, same data, but 23 miles North of Ledo, taken 20.V.1945; 1 paratype, same data, but ex *Rattus rattus* subsp. (= *Rattus flavipectus yunnanensis*); 10 paratypes, same data, but 12-21 miles North of Ledo, ex 4 *Anourosorex squamipes squamipes* (= *Anourosorex squamipes assamensis*), taken 22.V-26.X.1945; 1 paratype, same data, but North BURMA, Myitkyina, ex *Rattus rattus sladeni*, taken 24.VII.1945.

Type depository : Holotype and 2 paratypes in USNM; paratypes in BM(NH), IMR, and Traub collection.

Remarks : The above redescription is based only on the original description. Traub and Evans (1957) consider *W. soricicola* unique among known members of the genus *Walchia* in having AL setae very long, 2.5x>AW (usually AL<AW in genus *Walchia*), AW smaller than typical for the genus, SB as large as in the largest species, and PSB also nearly maximal. They differentiate *W. soricicola* from *W. manipurensis* Sinha, 1954, by the type of setation and shape of the scutum. Prasad (1974) has inadvertently recorded this species from MANIPUR, instead of ASSAM, Ledo area.

204. *Walchia (Walchia) turmalis* (Gater)
(Fig. 168)

Gahrlepiea turmalis Gater, 1932, 168; Prasad, 1974, 82.

Walchia turmalis, Womersley and Heaslip, 1943, 136; Radford, 1946a, 48; 1954, 270; *Wharton and Fuller*, 1952, 93; **not** Fernandes *et al.*, 1988, 109.

Gahrlepiea (Walchia) turmalis, Womersley, 1952, 288; Traub and Evans, 1957, 337.

Walchia (Walchia) turmalis, Vercammen-Grandjean, 1968b, 112.

Redescription of species : Larva.

Idiosoma : Measuring 350-410 x 220-260 in partially engorged specimens. Eyes 2/2, small, free on cuticle. One pair of humeral setae, measuring 30; approximately 38 dorsal idiosomal setae, measuring 27-35, arranged : 6-2-6-2-6, the rest irregular; 2 pairs of sternal setae, anterior 28, posterior 24; approximately 32 preanal setae, 16-17; 22-24 postanal setae, 21-25; total idiosomal setae approximately 100.

Gnathosoma : Palpal setal formula N/N/NNN/4B; palpal claw 3-pronged; galeala N; cheliceral blade (34) with dorsal subapical tooth and tricuspid cap (Original description: dorsal apical tooth blunt; Womersley, 1952, and Traub and Evans, 1957: chelicerae lacking deep subapical notch or conspicuous pointed tubercle as in *W. rustica* (Gater, 1932), but with subapical nubbin!); gnathobase sparsely punctate, bearing a pair of branched setae.

Scutum : Moderately punctate, subpentagonal, with anterior margin shallowly concave; lateral margins flared to level of PL bases, then tapering, caudal apex rounded; SB anterior to level of PL bases; AL and PL setae sparsely barbed, subequal; sensillary bases with anteromedial cuticular ridge; sensillae (missing in type series) clavate, head with setules; PW/SD = 0.56-0.66. Scutal measurements of Malaysian specimens giving means followed by ranges after Traub and Evans (1957): AW 41, 38-44; PW 51, 46-56; SB 37, 35-39; ASB 22, 20-24; PSB 61, 57-65; AP 42, 39-45; AL 31, 26-36; PL 32, 28-36.

Legs : Similar to *W. enode* Gater, 1932, in the number of ordinary and sensory setae; but, coxa III 1B. Measurements as follows : Ip = 587. Leg I : 203 (Original description: 167); tarsus (53x18), tarsala (14). Leg II : 177; tarsus (41x18), tarsala (13). Leg III : 208; tarsus (49x14).

Type data : Holotype and 5 paratypes, MALAYSIA, Selangor, Sungei Buloh, ex *Rattus sabanus vociferans*, 23.VII.1930, M.L. Webber, coll.

Type depository : Holotype and 1 paratype in BM(NH); paratypes in USNM, MI, and KECM.

Additional records : ASSAM, Stilwell Road, 12 miles North of Ledo, 5 ex *Suncus murinus* (= *Suncus caeruleus fulvocinereus*), 26.X.1945, STRU, coll.

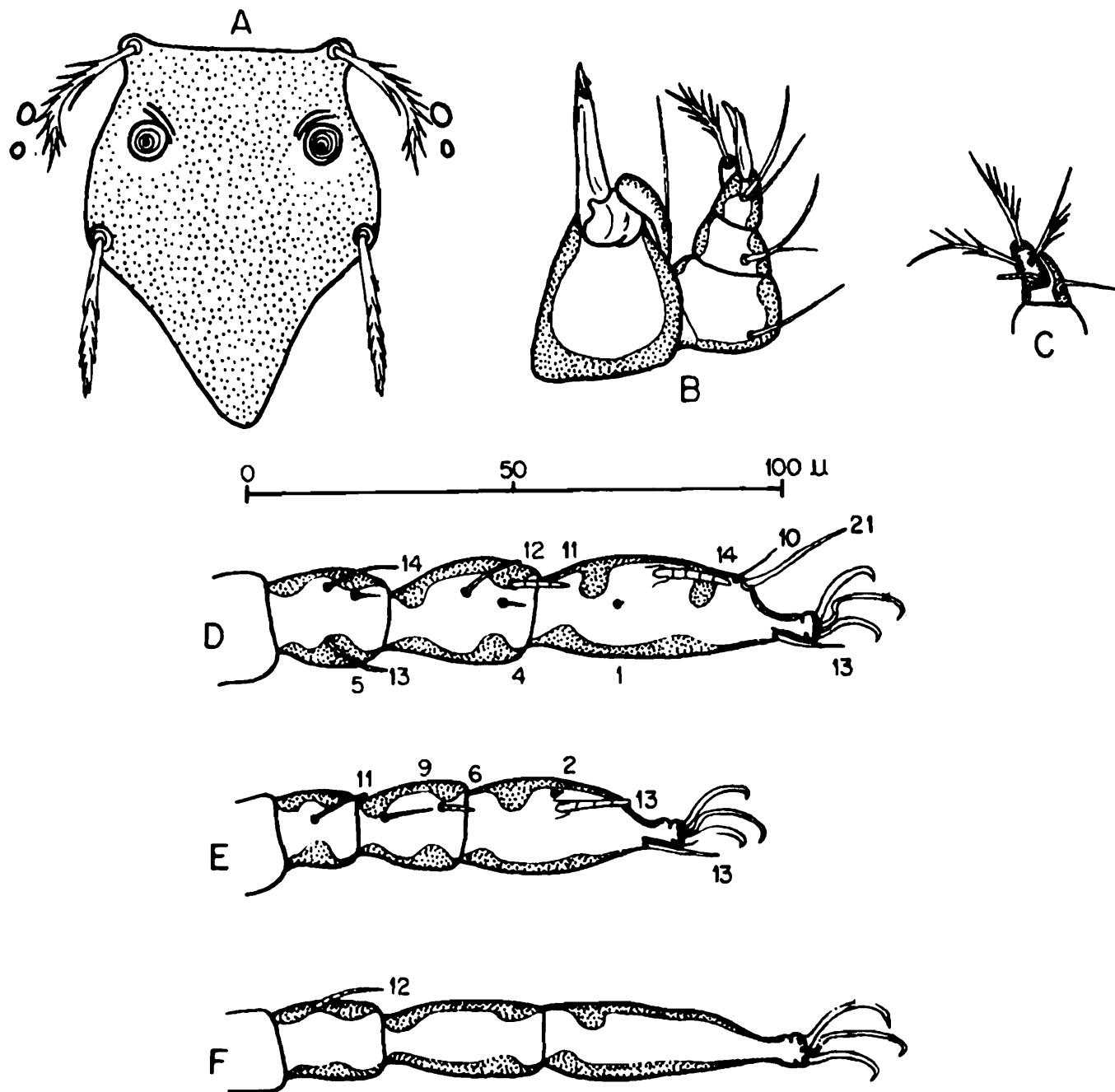


Fig. 168. *Walchia turmalis*

A. scutum; B. dorsal aspect of gnathosoma; C. ventral aspect of palpotibia and tarsus; D. leg I distal 3 segments showing specialized setae; E. leg II as above; F. leg III as above.

Specimen examined : 1 specimen on a slide with 2 specimens of *Gahrliepia fletcheri* Gater, 1932: SINGAPORE, Bukit Timah, ex *Tupaia glis*, 8.VIII.1985, Dept. of Zoology, University of Singapore, coll.

Remarks : The above redescription is based on the literature and study of the Singapore specimen. The literature highlights the close similarity between *W. turmalis* and *W. rustica*, from which it may be distinguished in having posterolateral margins of scutum fairly straight (sinuate in *W. rustica*), scutum caudally subacute (caudal apex papillate in *W. rustica*), PSB>>PW (PSB not definitely greater than PW, except in Malaysian specimens, in *W. rustica*), and chelicera with dorsal subapical nubbin (with distinct subapical subacuminate tooth in *W. rustica*). Traub and Evans (1957) describe *W. cuspidata*, which they consider close to *W. turmalis*. *W. turmalis* is distinguished in having the chelicera with a simple tricuspid cap (sagittate cheliceral apex in *W. cuspidata*), and AP/PP = 1 (0.85 in *W. cuspidata*). Comparison with the Singapore specimen indicates that the determination of the NIV Chunabhatti specimens by Fernandes *et al.* (1988) as *W. turmalis* was incorrect. This NIV material is here regarded as *W. rustica* (Gater, 1932).

CONCLUSION

This study provides a consolidated reference manual for the recognition and identification of Indian chiggers. It presents :

1. basic information on the morphology and bionomics of these mites;
2. keys for the rapid identification of the genera and species known from India;
3. relevant references, diagnostic characters, standard data, distribution and host records for the 204 Indian chigger species, with illustrations of some 160 species.

This taxonomic information is of immense value for the accurate determination of vector species of chigger-borne rickettsiosis, and for the planning of control measures.

Hoogstraal (1970) has remarked that the Himalayas harbour the world's richest tick fauna. This study reveals the wealth of its trombiculid fauna as well. In recording 43 Indian species in the medically important subgenus *Leptotrombidium*, this study bears out the claim of Audy (1954a), Traub and Wisseman (1974) and Nadchatram (1984) that the height of development of this subgenus has been on the Indian subcontinent and South East Asia. Traub, in Vercammen-Grandjean and Langston (1976), points out that the distribution of the classical vector species *L. akamushi* is restricted to Japan, and several other taxa masquerade under that name. The results of this study confirm this view. Species like *L. kulkarnii* and *L. singharhense* have been earlier misidentified as *L. akamushi*, which is not recorded from India. The apprehensions of Traub and Wisseman (1974) regarding the authenticity of reports of *L. deliense* above 1200m in the Himalayas stand confirmed. *L. deliense* is present only in peninsular India and the submontane and temperate zones of the Himalayas. As in the Himalayan surveys of Pakistan (Traub and Nadchatram, 1967a; Traub and Wisseman, 1968; Traub *et al.*, 1967; Vercammen-Grandjean and Langston, 1976), *L. deliense* was found well below 1200m in the Indian Himalayas. Several closely related *Leptotrombidium* species including *L. jayewickremei* and *L. oreophilum*, however, were collected at higher elevations.

The tribe Gahrlepiini comprising 52 species is observed to be well represented particularly in peninsular India, with 17 new species being described from the Western Ghats of Pune District. *Schoengastiella ligula* has been reported from almost every type of habitat in India upto elevations of 2000m (Traub and Morrow, 1955, 1957), 2500m (Srivastava and Wattal, 1971), and 3000m (Saxena, 1985). The widespread distribution and adaptability of this species is evident from this study. It has been taken along with *S. kalrata* and several new Gahrlepiini species at elevations above 3000m in the Indian Himalayas. Their distribution is of significance as Traub and Wisseman (1974) suggest that certain Gahrlepiini species may play a role in the maintenance of the rickettsial disease cycle in animals.

The study of the Indian Himalayan collection further indicates the extensive distribution of certain species including *Shunsennia wissemani*, *Helenicula kohlsi*, *H. lanius*, *L. (L.) dooleyi*, *L. (L.) dux*, *L. (L.) dihumeralis*, *L. (L.) irregulare*, *L. (L.) jayewickremei*, *L. (L.) parapalpale*, *L. (L.) rupestre*, *L. (L.) tithwalense*, *L. (E.) murphyi*, *Microtrombicula buxtoni*, *M. perissochaeta*, and *M. rajoriensis* reported earlier from the Himalayan regions of Pakistan (Traub and Nadchatram, 1966a, 1966b, 1967a) and Nepal (Nadchatram, 1970c; Nadchatram and Traub, 1971).

The chigger species recorded here provide a representative sample of the Indian fauna, but this list needs to be supplemented by more extensive and intensive surveys. While certain regions including the Himalayas have now been well surveyed, several States like Andhra Pradesh, Arunachal Pradesh, Bihar, Haryana, Kerala, Meghalaya, Nagaland, Punjab, Tamil Nadu and Tripura have not been studied. It must also be noted that the Indian chigger collections have been taken predominantly on small mammal hosts. This bias in the collection of host species (Audy, 1954a) has, undoubtedly, affected the record of chigger species and their abundance.

Vercammen-Grandjean's proposal (1969) to use larval morphology as the only basis for trombiculid classification has been popularly followed by chigger taxonomists for practical reasons (Nadchatram and Fernandes, 1989). This has often resulted in the multiplication of taxa of doubtful validity. The inadequacy of the classical approach in taxonomy has been continually experienced in the study of the rich Indian trombiculid fauna. The morphological criterion remains basic, no doubt, but requires confirmation. Shirai et al. (1984) have pioneered a new approach in chigger taxonomy using karyotype studies to confirm the distinction between 3 chigger species.

Hoogstraal (1978) has used an integrated approach in tick systematic studies. Modern innovative approaches used in systematics include: chromosomal mapping (Oliver, 1977), scanning electron microscopy in the elucidation of fine organ structure differences (Homsher and Sonenshine, 1975; Keirans and Clifford, 1978), study of isoenzyme profiles by starch gel electrophoresis to clarify taxonomic status (Wallis and Miller, 1983), and the utilization of behaviour and ecological data as tools in systematic research (Nagar, 1968; Jagannath et al., 1974).

The confirmed presence of *Leptotrombidium* vector species of chigger-borne rickettsiosis in India, and the widespread distribution of species which may be involved in the intrazootic rickettsial cycle, highlight the necessity for accurate species determination. The novel approaches tested in modern systematic studies provide important avenues for further research in trombiculid taxonomy.

SUMMARY

This study records 204 trombiculid mite species belonging to 28 genera in the subfamilies Leeuwenhoekiinae and Trombiculinae (Acari: Trombiculidae). Of these, 57 are described as new to science. This work is based primarily on an exhaustive taxonomic study of the chigger collections of the National Institute of Virology, Pune, made between 1966 and 1988 in diverse ecogeographical regions of the Himalayas and peninsular India. It includes a complete revision of earlier published Indian trombiculid taxa in the light of modern concepts in chigger taxonomy and systematics. Detailed descriptions or redescriptions with standard data, collection records and critical remarks are presented for each species, while diagnostic illustrations are provided for 160 species. Keys have been given to all the genera and species. The presence of *Leptotrombidium* (*L.*) *deliense* (Walch 1922) and other vector species of chigger-borne rickettsiosis in India, as well as of certain trombiculid species apparently involved in the maintenance of the intrazootic rickettsial cycle is confirmed.

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Fr. Stan Fernandes, S.J., a Jesuit priest, completed his postgraduate studies in Zoology from the University of Poona, and was Lecturer in Life Sciences at St. Xavier's College, Mapuca, Goa, in 1982 – 83. As an ICMR Research Fellow (1983 – 88), he did extensive studies on chigger taxonomy at the National Institute of Virology, Pune, under the guidance of Dr. S.M. Kulkarni. He completed his doctoral studies on the Trombiculid mite fauna of India, from the University of Poona in 1992. He is presently the Provincial of the Pune Province of the Society of Jesus.



After obtaining his M.Sc. degree from the University of Poona, Dr. S.M. Kulkarni joined the National Institute of Virology, Pune, as a Research Officer in 1967. He worked at NIV for some 28 years, retiring as Senior Grade Deputy Director in 1995. He completed his Ph.D. under Dr. Ramachandra Rao on the ecology and biology of Trombiculid mites. At the NIV, he has done research primarily on the ecology of haematophagous arthropods in the Himalayas, in relation to the various diseases transmitted by them. He has also worked (1979 – 82) on malaria research and control in the Bastar District of Madhya Pradesh. During his research career, he has published 66 papers in national and international journals.

Trombiculid mites, members of the family TROMBICULIDAE Ewing 1944, have attracted special attention among acarologists due their importance in public health. The larval trombiculids or 'chiggers' are widespread parasites of many groups of animals, primarily rodents, reptiles and ground-dwelling birds. Some twelve species have been incriminated as vectors of 'scrub typhus', which is known to be endemic in the Oriental and Asia-Pacific regions, including India. Chigger studies in India have remained incomplete and neglected despite the medical importance of this group. This comprehensive study reveals the rich and diverse trombiculid fauna of India, recording 204 species belonging to 28 genera. Of these, 57 are described as new to science.

This work includes a complete revision of earlier published trombiculid studies in the light of modern concepts in chigger taxonomy and systematics. Detailed descriptions or redescriptions with standard data, collection records and critical remarks are presented for each species, while diagnostic illustrations are provided for some 160 species. Keys have been given for identification of all the Indian trombiculid genera and species. This monograph meets a long standing need for a consolidated reference manual to the Indian trombiculid mite fauna. It is intended to assist as an illustrated guide to acarologists, entomologists and public health workers who are not familiar with complex chigger taxonomy. This taxonomic information is also of immense value for accurate determination of vector species of 'chigger-borne rickettsiosis', and for the planning of preventive and control measures.