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## SOME OBSERVATIONS ON THE BIOLOGY OF *MICROTERMES UNICOLOR* SNYDER (TERMITIDAE) IN THE INDIAN DESERT

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### INTRODUCTION

Four species of *Microtermes* (Termitidae : Macrotermitinae) occurs in Rajasthan, viz. *M. mycophagus* (Desneux), *M. obesi* Holmgren (Syn. *M. anandi*), *M. unicolor* Snyder and *M. bharatpurensis* Rathore (Rathore, 1989). Out of the four species imagoes of first three are known (Chatterjee & Thakur, 1964) and can be separated as follows :

Sl. No.	Description / Species	<i>M. mycophagus</i>	<i>M. obesi</i>	<i>M. unicolor</i>
1.	Total Body length with wings	17.4–21.9 mm	14.1–14.8 mm	17.3–18.7 mm
2.	Total Body length without wings	09.8–12.3 mm	09.4–10.2 mm	09.4–10.8 mm
3.	Colour of head and body	Pale yellow brown	Dark chocolate	Pale yellow brown
4.	Eyes and ocelli distance	Not close	Not close	Very close
5.	Distribution (Vide Roonwal & Bose, 1964, 1969; Ahmad, 1955; Choudhary and Ahmed, 1972)	W. India and Pakistan (An Arid Zone species)	Widespread in India, Pakistan, Bangladesh and Srilanka	Widespread in N. India and Pakistan
6.	Status	Most common	Common	Rare

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All the four species are subterranean in habit (Roonwal, 1976) and they attack old timber as well as agriculture crops. Information on the biology is very scanty. In the present paper, data on swarming, post-swarming behaviour, oviposition, brood care, egg character, hatching and post hatching behaviour of newly formed nymph and predators of *M. unicolor* are described.

### MATERIAL AND METHODS

Both field (Swarming) and laboratory observations (breeding in glass petri dishes of diameter 75–100 mm) were taken at Jodhpur during the year 1996. Alates were collected from swarming population, which take place after the two or three monsoon showers. Alates were collected and kept in pairs in petri dishes containing sufficient quantity of moist soil with little humus and one or two pieces of wood as food. A few drops of water were added usually after the interval of 3 to 4 days gap to maintain adequate moisture in the petri-dishes. The outside air temperature (1996) of Jodhpur during June to August was hot, but was somewhat cooler in September. The mean maximum and minimum temperature (°C) were 38.3 and 27.5 in June, 34.9 and 26.2 in July, 31.9 and 24.3 in August and 29.6 and 23.5 in September 1996.

### RESULTS AND DISCUSSION

#### Swarming

Swarming occurs at night (8 PM to 8.30 PM) during a period of about 8 weeks, from end of June to the third week of August (26<sup>th</sup> June to 20<sup>th</sup> August), in the Jodhpur district (Jodhpur, Mandor, Banar) in sparse to dense swarms which are attracted to light. Similar swarms were collected by one of us from Jaisalmer district during year 1995.

The weather during swarming is always very calm, sultry and some time cloudy also. On some occasions, simultaneous swarming was recorded at same hour of the same day from different localities of Jodhpur, 1 to 5 km away from each other, suggesting some influence of the prevailing weather, such as rains, temperature and humidity. Each swarming session last about half an hour. The alates fly rapidly and often crowd around streetlights.

Elsewhere in India (Dehra Dun, Uttar Pradesh), swarming has been recorded as occurring, from tiny holes in the ground, in early June 5<sup>th</sup>, (Mathur and Sen-Sarma, 1960); similarly early swarm was reported by Thakur (1991) from April to August and in Doon Valley at night (1900–2100 hrs) in the month of June, usually after rainfall. In Pakistan (Ahmad, 1955) swarming occurs in July and August in Lahore on 13<sup>th</sup> July and in Mardan on 18<sup>th</sup> August.

#### Post-swarming behaviour

After flying for half an hour or so, sometimes less, the alates descend to the ground and by usual process of turning and twisting the body, casts off their wings. Immediately after this they

start running about in tandem pairs, a male closely following a female and touching her hind end with his fore mouth-parts, specially the antennae. Occasionally both male and female of the tandem couple may still be winged. In the field this tandem couple goes on crawling for period up to 1 hour, after which they disappear underground. In the laboratory, the dealates obtained from swarms were released in petridishes (75 mm to 100 mm diameter) in pairs. They immediately start digging in soil quickly, forming a small brood-chamber, later on extending it into zigzag tunnels. Tandem is strongly marked in this species.

### **Oviposition, eggs and hatching**

Early egg laying by primary reproductives was observed in the laboratory in individual pairs. In 4 separate oviposition by 4 females, 44 eggs were laid by them during the 27–29 days of their lives (after which all the four pair died by infection of fungi). The following are the principal conclusions :

- (i) The first oviposition occurs on 4th day after swarming. This gap has also been observed by Roonwal and Rathore (1974, 1975a, b), Nutting (1969), Rathore (1977, 1994) in other termites in different localities as well as in laboratory. Eggs are laid in clusters of 6–8.
- (ii) Thereafter eggs were laid on 7th day, in the “First spurt” of egg-laying which lasted 1–4 days during this phase 2 successive egg-laying occurred, the number of eggs laid per female being 9–13 (average 11.0). The number of eggs laid per female was highest at the 1st oviposition (average 7.2).
- (iii) The first spurt of egg-laying was followed by a “rest period” of 22 days.
- (iv) There was no second period of egg-laying in all the four pairs till their death (27–29 days).

### **Brood care and egg-shifting**

In single pair breeding, it was observed that while the female laid the cluster of eggs at different places in the brood chamber, then later on all the eggs lightly glued and gathered together in a single mass. For this purpose, the parents lift the egg cluster one by one with the mouthparts. The two parents in the brood chamber sit quietly for hours near the eggs though not necessarily touching them, but some time they pick up the egg mass and deposit it in another place in the tunnel.

### **Egg-character and size-increase during development (Fig. 2A)**

The freshly laid eggs of *M. unicolor* are suboval with rounded ends. The dorsal surface of egg is convex and the ventral slightly concave. It is paler in colour and measures 0.60–0.61 mm in length (L) and 0.30–0.31 mm in maximum width (W), the ratio W/L being 0.50; the egg is thus of the “broad type” as indicated by Roonwal (1973).

There are 10–12 micro-pyles situated on the convex dorsal surface of the egg near its posterior end. The micropylar apparatus is of the “concentrated type” and the canals are arranged in an irregular row with funnel mouth close (Fig. 3 A, B, C).

During development the egg increases in size (presumably by the imbibition of external water, (as happens in many other insects) by 12.5% in length and 12.5% in width and become, more turgid and plump (Fig. 2B & C). The egg-size increase as in Table 1.

A similar size increase has been noted in other termites from the Indian desert, viz. *Anacanthotermes macrocephalus* (Roonwal & Rathore, 1975a), *Angulitermes jodhpurensis* (Roonwal and Rathore, 1974), *Microtermes mycophagus* and *M. obesi* (Roonwal and Rathore, 1975b), *Eremotermes paradoxalis* (Rathore, 1977) and *Microcerotermes raja* (Rathore, 1994), as well as termites from other regions. It is observed that the growth rate of eggs in all the species follows a similar pattern.

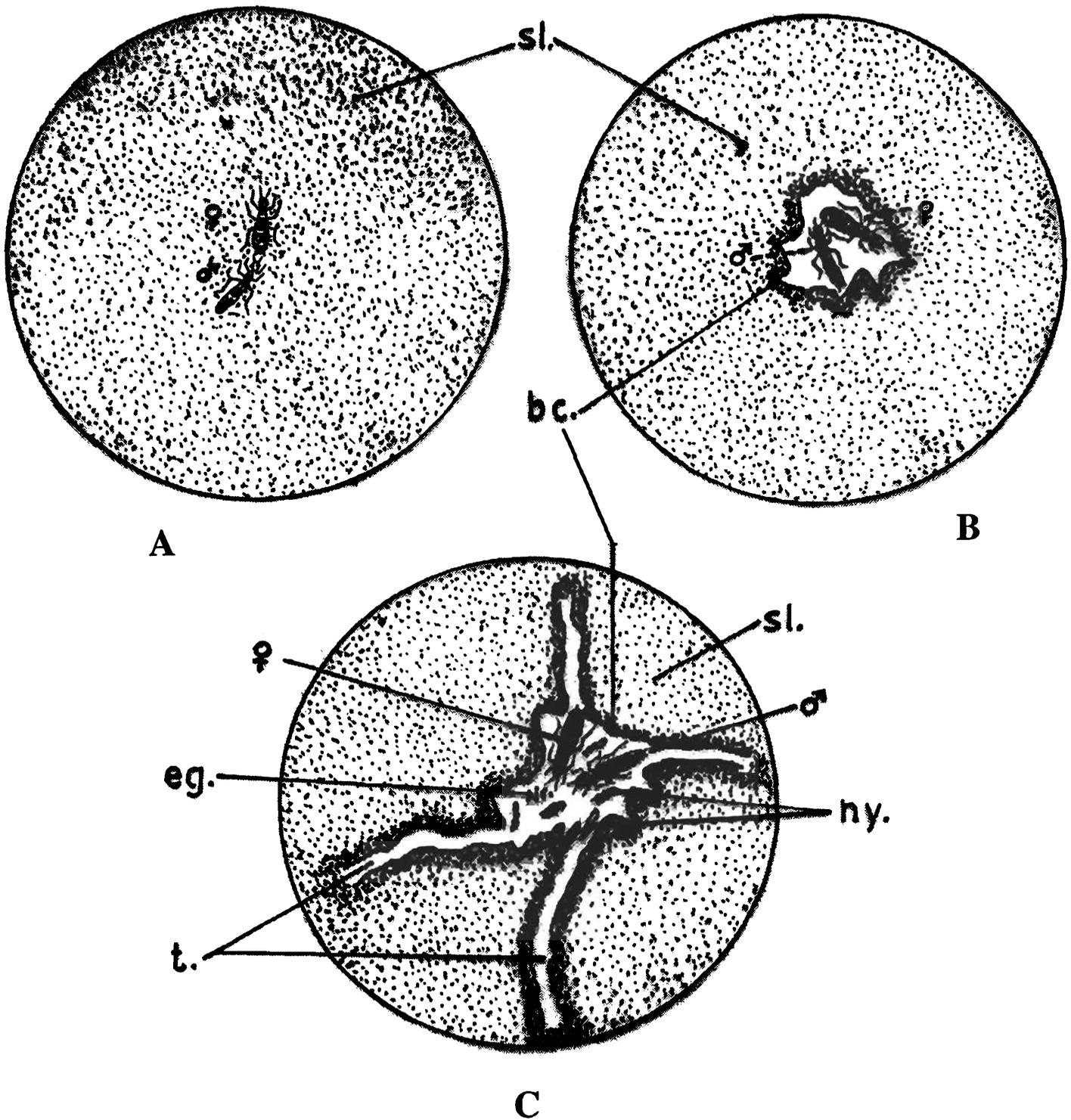
**Table 1.** : Increase in egg size.

Age of egg	Length (mm)	Maximum width (mm)
1 day	0.60–0.61	0.30–0.31
8 days	0.62–0.64	0.32–0.34
17 days	0.66–0.68	0.36–0.38

#### **Incubation period and hatching (Fig. 1)**

Thirteen eggs were laid in two sessions from 28<sup>th</sup> to 31<sup>st</sup> July 1996. These hatched from 14<sup>th</sup> to 16<sup>th</sup> August, 1996. The incubation period was 17–19 days. Data on incubation period of eggs in Isoptera are scanty and are limited to 17 species. In other species it is reported to be 15–90 days depending on air temperature (Roonwal & Rathore, 1974, 1975a, 1975b) (Rathore, 1977, 1994), (Mukherji, 1970; Waston *et al.* 1971).

Eggs were laid in the laboratory during July 1996 and hatching took place in August during a period spread over 3 days (14<sup>th</sup> to 16<sup>th</sup> August 1996); 13 eggs hatched during this period. The first egg hatched on 18 days after laying. A day or two before hatching, forwardly directed peristaltic movements on the dorsum of the embryo (covering the hind part of the head thorax and distal part of the abdomen) were noticed. The movements were weak and slow in the beginning but become quicker later on. With the aid of peristalsis and the “hatching spines”, on the head and body, the egg shell was burst at the head region and the head come out first from the egg. The embryo remained in this position for hours. Later on the whole body wriggled out of the egg-shell and thus hatching was completed.



**Fig. 1. :** *Microtermes unicolor*. Post-swarming activities of dealated imagoes as observed in single-pair breeding (1 male, 1 female) in small petridish diameter 75 mm, with soil. Swarming at Jodhpur at 8 P.M. on 24<sup>th</sup> July, 1996 at AFRI compound, Jodhpur. Except in Fig. A, Observations made from bottom of dish. (A) 25, July, 96 pair in courtship-tandem just after release in dish. (B) Dealates have made a cavity (brood chamber) in soil 25<sup>th</sup> July. (C) After 28 days colony with nymphs moving in zig-zag tunnels having direct connection with brood chamber. b.c., brood chamber; eg., eggs, ny., nymphs, sl. soil., t. tunnels.

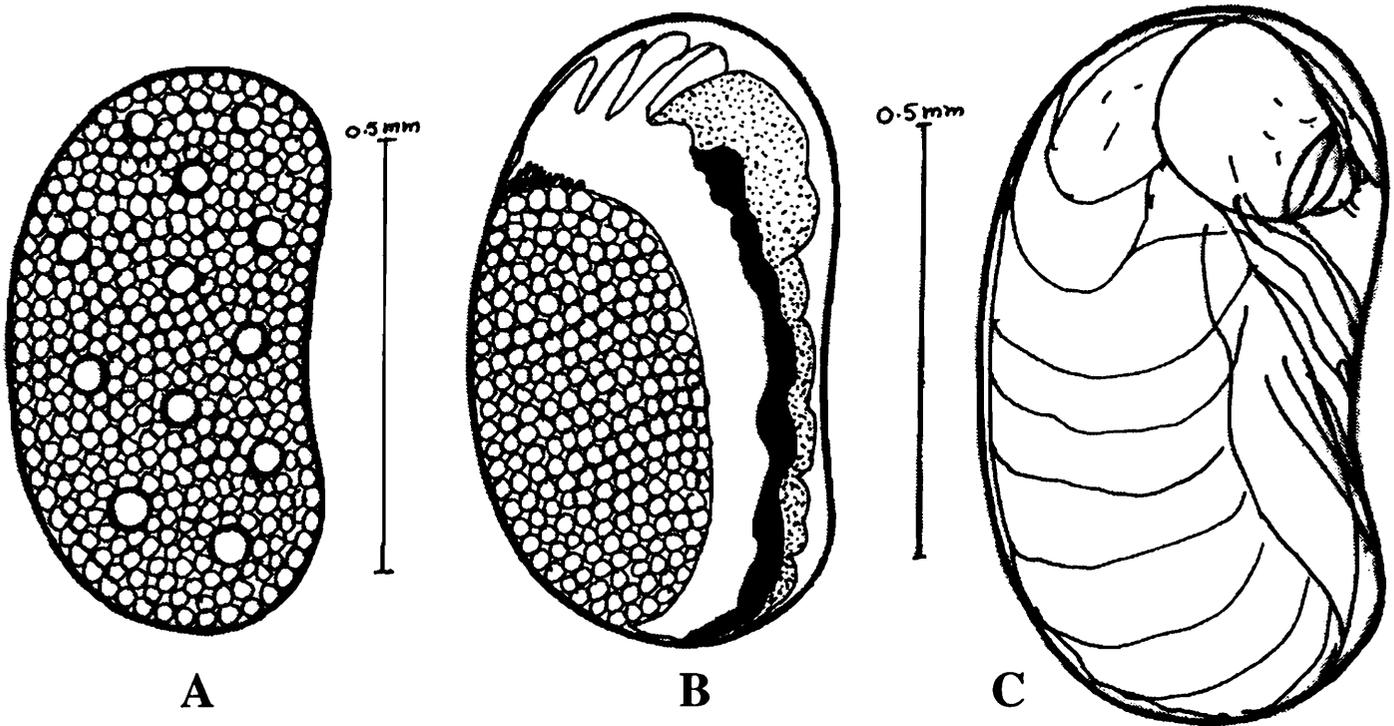


Fig. 2. : *Microtermes unicolor*. Egg from oviposition to near hatching. Breeding in the laboratory at Jodhpur July to August, 1996. (A) Outline of freshly laid egg. (B) Outline of 8 days old egg. (C) Egg one day before hatching, embryo seen through the translucent egg wall.

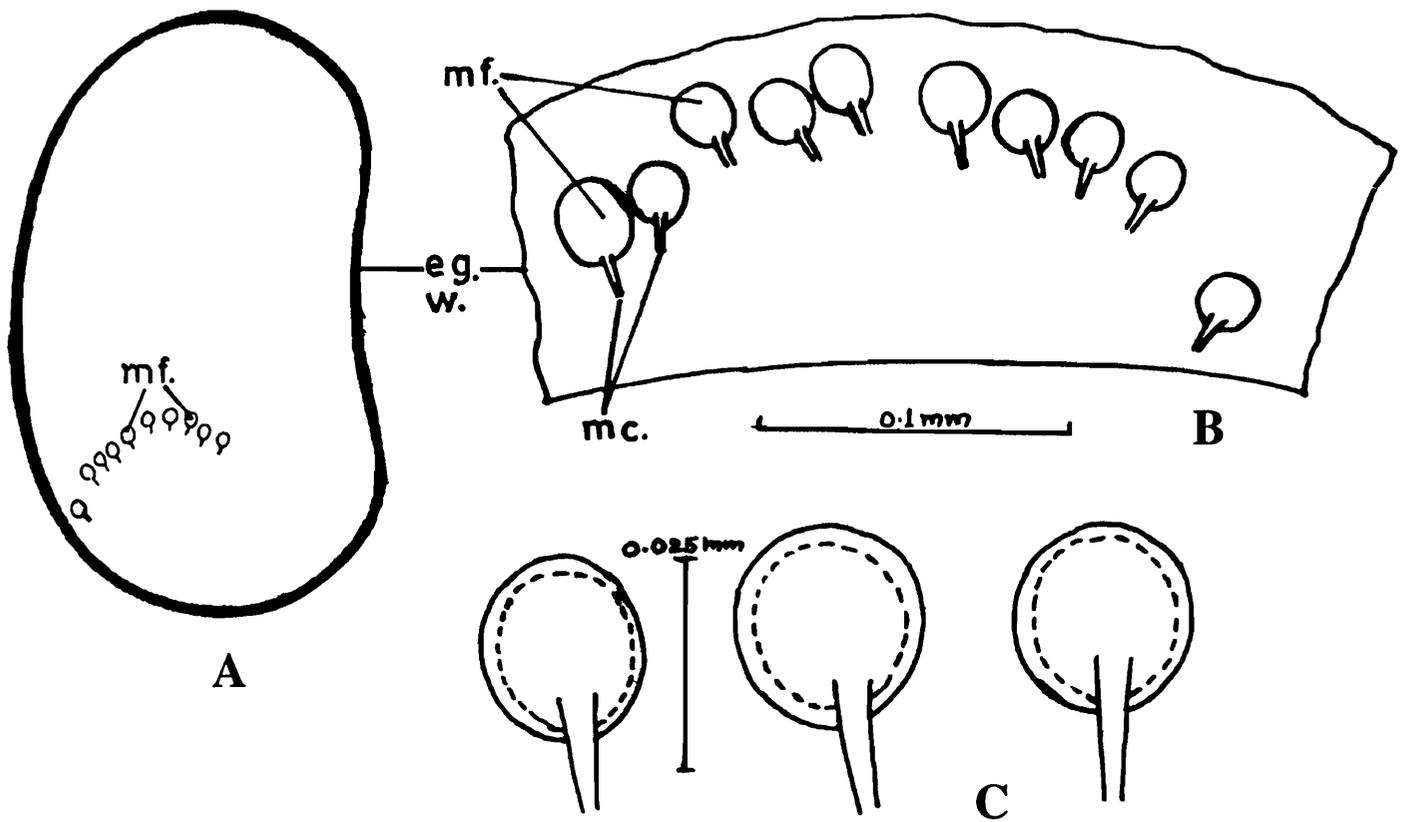


Fig. 3. : *Microtermes unicolor*. (A) Showing relative position of micropyles on dorsal surface. (B) Portion of egg wall showing arrangement of micropyles. (C) Same as 'C' but two micropyles enlarged. eg. w., egg wall, mc., micropylar canal., mf., micropylar funnel.

**First stage nymph (Fig. 4 A-G)**

A few minutes after hatching and cleaning of the body of the young by the parents, the first stage nymph started moving slowly in the brood chamber. The nymph was milky white in colour and its body was covered with small to medium sized hairs, being longest on the cerci. The antennae had 12 segments, the number in alates being 15, in soldier 14 and 14–15 in worker. The body measurements of the newly hatched nymph are as follows :

(1)	Total body length up to tip of Labrum	1.40–1.50 mm
(2)	Maximum width of Head	0.40–0.42 mm
(3)	Head length	0.44–0.46 mm
(4)	Length of Antennae	0.50 mm
(5)	Max. width of Pronotum	0.25 mm
(6)	Max. width of Abdomen	0.46–0.48 mm
(7)	Max. length of Style	0.08 mm
(8)	Max. width of Style	0.02 mm
(9)	Max. length of Cercus	0.06 mm
(10)	Max. width of Cercus	0.015 mm

**Predators**

At Jodhpur and other places swarming imagoes both at flight and when they alight on to the ground were seen to be eaten in large number by lizards, bats, toad, ants etc.

**SUMMARY**

Some aspects of the breeding biology of *Microtermes unicolor* are recorded. Swarming takes place at night during the end of June. Alates emerge from tiny holes in the ground. Egg-laying habits, brood-care hatching and post-hatching developments are recorded for the first time. After swarming and dealation, the dealates show strong tandem behaviour for few hours. They then go under ground and form a small brood-chamber along with some tunnels. Eggs are laid on the 4th day after swarming and again on the 7th day. This spurt of egg-laying activity continues for 1–3 days during which a female lays about 9–13 eggs. This is followed by a long rest period of about 22 days. Eggs increase in size during development, presumably by the imbibition of external water. The incubation period is 17–19 days. The hatching process and newly hatched nymph are described and its predators are also listed.

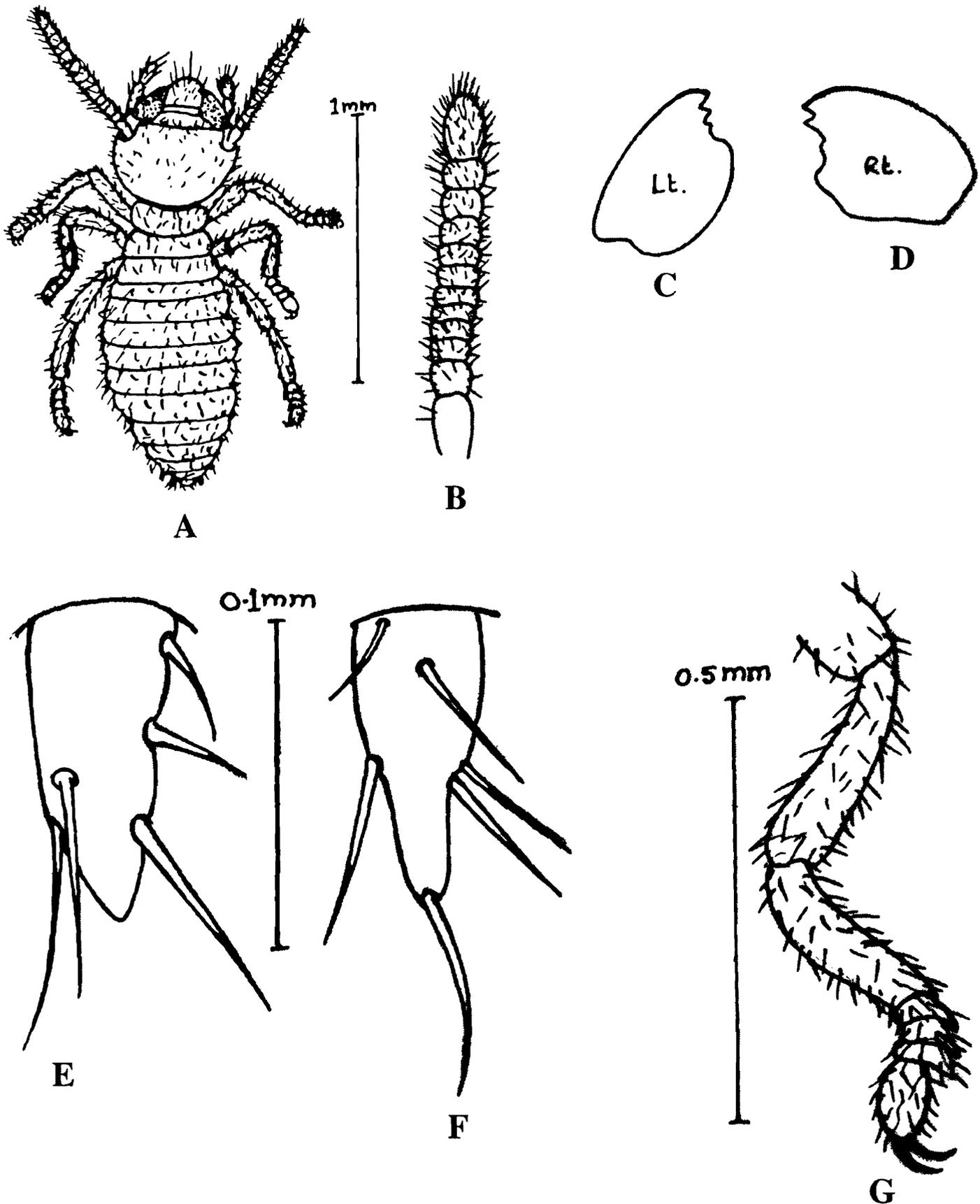


Fig. 4. : *Microtermes unicolor*. Freshly hatched first stage nymph (A) Nymph in dorsal view. (B) Right antenna, enlarged. (C & D) Right and left mandibles, enlarged. (E) Left style, enlarged. (F) Left cercus, enlarged. (G) Distal end of Left hind leg, enlarged.

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### REFERENCES

- Ahmed, M. 1955. Termites of West Pakistan. *Biologia*, Lahore, 1(2) : 202-264.
- Chatterjee, P. N. and Thakur, M. L. 1964. Revision of the termite genus *Microtermes* Wasmann (Isoptera : Termitidae : Macrotermitinae) from the India Region. *Indian Forest Records*, 10(11) : 219-260.
- Choudhary, M. L. and Ahmed, M. 1972. Termites of Pakistan. *Identity, Distribution and Ecological Relationships*. (Final Technical report) Pakistan Forest Inst., Peshawar. Xiv + 70 + 30 pp.; 15 + 2 pp. (errata), + 81 pp. (Figs.).
- Mathur, R. N., and Sen-Sarma, P. K. 1960. Notes on the habits and biology of Dehra Dun termites. Part-II. *J. Timber Dryers Preserv. Assoc. India*, Dehra Dun, 6(2) : 23-27.
- Mukherji, D. 1970. Embryology of termites. In : *Biology of Termites*, Vol. 2 (Eds. K. Krishna & F. M. Weesner). Academic Press, New York. pp. 37-72.
- Nutting, W. L. 1969. Flight and colony foundation. In : *Biology of Termites*, Vol. I (Eds. K. Krishna & F. M. Weesner). Academic Press, New York. pp. 233-282.
- Rathore, N. S. 1977. Some observations on the biology of *Eremotermes paradoxalis* (Isoptera : Termitidae : Amitermitinae). *J. Ind. Acad. Wood Sci.*, Bangalore, 8(2) : 111-119.
- Rathore, N. S. 1989. A new termite of genus *Microtermes* (Isoptera : Macrotermitinae) from Rajasthan, India. *Entomon*, 14(1 & 2) : 53-57.
- Rathore, N. S. 1994. Breeding biology of Indian desert termite *Microcerotermes raja* (Isoptera : Termitidae). *Annals of Arid Zone*, 33(1) : 61-66.
- Roonwal, M. L. 1973. On a new phylogenetically significance ratio (Width/Length) in termite eggs (Isoptera) (Abstract). *Abstr. Sympos. Orient. Entom.* Calcutta, Nov. 1973). pp. 10-11.
- Roonwal, M. L. 1976. Field ecology and ecobiogeography of Rajasthan termites : A study in desert environment. *Zool. Jahrb. abt. (Syst.)* 103 : 455-504.
- Roonwal, M. L. 1983. The ecology of termites swarming in the Indian Desert In : *Insect Interrelations in Forest and Agro ecosystem*. (Eds : P. K. Sen-Sarma, S. K. Sangal & S. K. Kulshreshtha), pp. 9-13, Dehra Dun (Jugal Kishore & Co.)

- Roonwal, M. L. and Bose, G. 1964. Termite fauna of Rajasthan, India. *Zoologica*, Stuttgart, **40**(3) : VI + 58 pp.
- Roonwal, M. L. and Bose, G. 1969. Fauna of Rajasthan, India. Part 4. A check-list of Rajasthan termites (Insecta : Isoptera). *Rec zool. Surv. India*. Delhi, **61**(3 & 4) (For 1963) : 437-450.
- Roonwal, M. L. and Rathore, N. S. 1974. Biological observations on three Indian Desert Termites, *Eremotermes paradoxalis*, *Microcerotermes raja* and *Angulitermes jodhpurensis* (Termitidae). *Ann. Arid Zone*, Jodhpur. **15**(3) : 237-258.
- Roonwal, M. L. and Rathore, N. S. 1975a. Swarming, egg-laying and hatching in the Indian Desert harvester termite, *Anacanthotermes macrocephalus* (Hodotermitidae) *Ann. Arid Zone*, Jodhpur, **14**(4) : 329-338.
- Roonwal, M. L. and Rathore, N. S. 1975b. Swarming, egg-laying and brood-care in termites of genus *Microtermes* (Termitidae) in Indian Desert. *J. Indian Acad Wood Sci.*, Bangalore, **6**(1) : 37-55.
- Roonwal, M. L. and Verma, S. C. 1977. Re-survey of termite fauna of Rajasthan, India and its Zoogeography. *Rec. zool. Surv. India*, **72** : 425-480.
- Thakur, M. L. 1991. Flight schedules of winged termites (Insecta : Isoptera) in Doon Valley, Uttar Pradesh. *J. Bombay nat. Hist. Soc.*, **88**(1) : 55-62.
- Watson, J. A. L., Nel, J. J. C. and Hewitt, P. H. 1971. The uptake of water by eggs of the termite *Hodotermes mossambicus* (Hagen) (Isoptera). *Insect Sociaux*, Paris, **10**(4) : 233-242.