

DISTRIBUTION AND ETHO-ECOLOGY OF GROUSE LOCUSTS
OF CERTAIN LOCALITIES IN MAHARASHTRA
WITH
A NOTE ON THE STATUS OF TETRIGID TAXONOMY

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INTRODUCTION

Superfamily Tetrigoidea comprises of small sized, short-horned Orthopteran insects. These tetrigids are commonly known as grouse locusts. The diagnostic characters which distinguish them from grasshoppers are, the large generally backwardly extended pronotum, absence of arolia between the claws of all legs. The hood-like pronotum covers the entire or the greater part of the body and shows several structural and colour variations. Fore-wings are reduced and scale like whereas hind-wings mostly folded and hidden under the extended pronotum, are normal, membranous and useful in flight. Stridulatory and auditory organs are wanting.

Tetrigoidea includes about 185 genera and approximately 1000 species (Kevan, 1982). They are predominantly tropical or subtropical and occur abundantly in the Oriental Region. A few species also occur at high altitudes, in both temperate and tropical regions. Indian subcontinent is quite rich in many forms of tetrigids and there are certain semi-aquatic species which exclusively occur in India.

Survey of certain eco-geographically varying districts of Maharashtra State (Western India) was carried out to study the occurrence, identification, habit and

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habitat of the collected species of grouse locusts. The localities under study showed great variations in terms of ecological and geographical characteristics such as altitude, rainfall, humidity, temperature, soil, topography and cultivation of plants. (For example, the range in variations in two distant localities is as follows : Dhule : Lat. $20^{\circ}54'$ N, Long. $74^{\circ}47'$ E, Alt. 245 m, Rainfall : 674 mm, Temp. 25.8° to 40.7°C . and

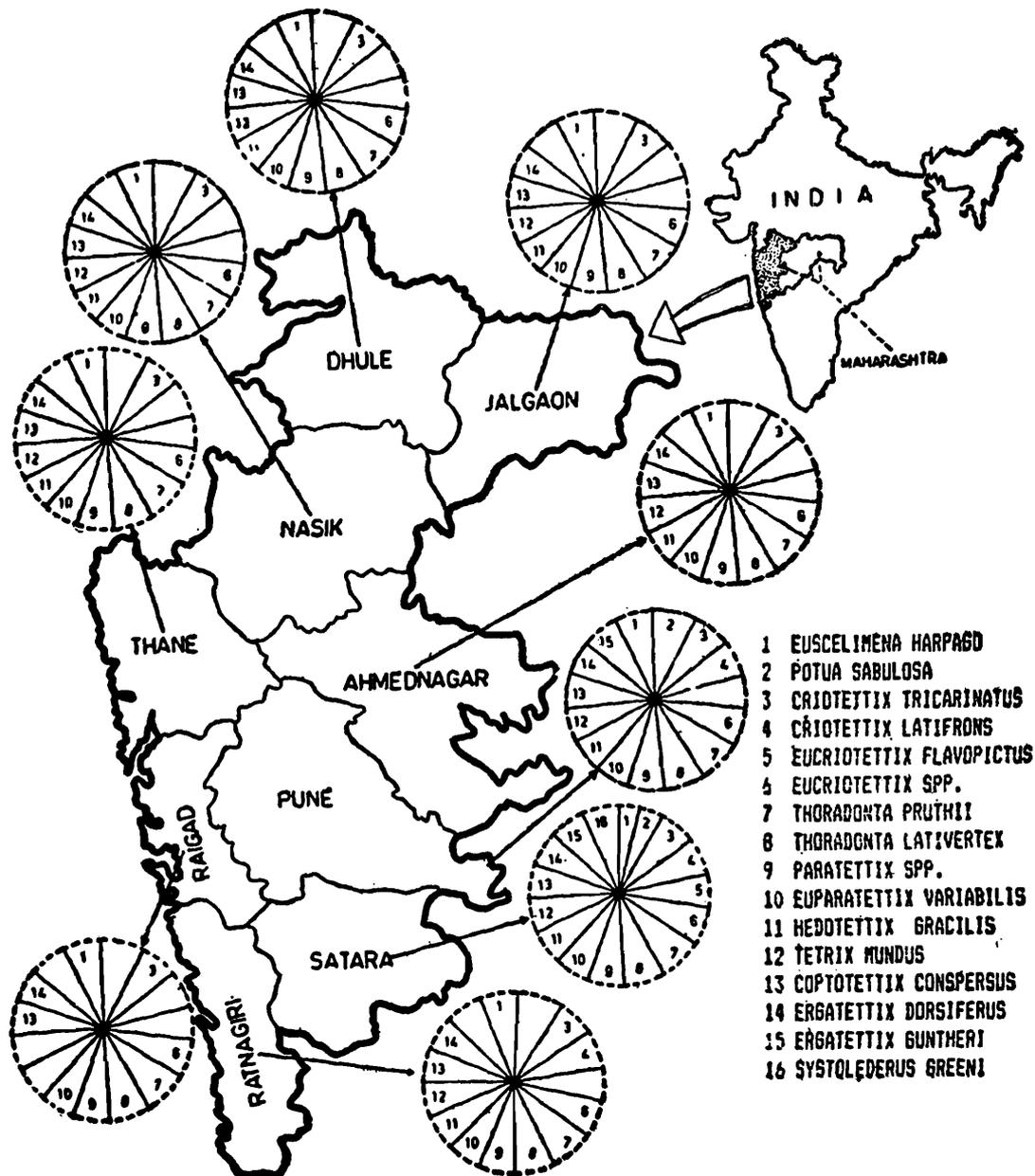


Fig. 1 : Nine eco-geographically varying districts in the state of Maharashtra.

Table 1

Identification report on *Tetrigidae* of certain localities of Maharashtra

SYSTEMATIC POSITION :

- Order : ORTHOPTERA
 Suborder : CAELIFERA
 Infraorder : TETRIGIDEA, TETRIGODEA
 Superfamily : TETRIGOIDEA
 Family : TETRIGIDAE

TAXANOMIC CHECK-LIST :

- (I) Subfamily : CLADONOTINAE
 i) *Potua sabulosa* Hancock
- (II) Subfamily : SCELIMENINAE
 i) *Euscelimena harpago* Seville
 ii) *Eucriotettix tricarinatus* Bolivar
 iii) *Eucriotettix flavopictus* Bolivar
 iv) *Eucriotettix* Spp.
 v) *Criotettix latifrons* Hebard
 vi) *Thoradonta lativertex* Gunther
 vii) *Thoradonta pruthii* Gunther
- (III) Subfamily : METRODORINAE
 i) *Systolederus greeni* Bolivar
- (IV) Subfamily : TETRIGINAE
 i) *Paratettix femoralis* Bolivar
 ii) *Paratettix dorsifer* Walker
 iii) *Euparatettix personatus* Bolivar
 iv) *Hedotettix gracilis* de Hann
 v) *Hedotettix lineifera* Walkar
 vi) *Coptotettix conrpersus* Hancock
 vii) *Ergatettix guntheri* Steinmann

Humidity : 55% ; Ratnagiri : Lat. 16°59' N, Long. 73°20' E, Alt. 35 m, Rainfall : 3023 mm, Temp. 23.1° to 30.8°C and Humidity : 76%). The localities surveyed were purposely selected to understand the effect of these various parameters on the occurrence, distribution and behaviour of grouse locusts.

OBSERVATIONS

In the present studies, 16 species of grouse locusts were collected from nine eco-geographically varying districts in the state of Maharashtra, India (Fig. 1). These represent 11 genera and 4 subfamilies. The subfamilies are Cladonotinae, Scelimeninae, Metrodorinae and Tetrigenae. Some of the species form the first record in this region. A list of identified specimens of grouse locusts collected at various localities is given in Table 1. Illustrations of the four representative grouse locusts (Fig. 2) and their diagnostic characters (Table 2) are presented with a view to facilitating field studies.

The distribution pattern and etho-ecological observations on four subfamilies are given below :

Subfamily : (I) CLADONOTINAE

Out of the 45 genera, only a single genus namely, *Potua* is commonly distributed in India and Indo-Malayan region (Rehn, 1952). In our study area, we came across only one pigmy locust namely, *Potua sabulosa* Hancock under this subfamily.

Ethoecological observations : *P. sabulosa* is found in various parts of Panchgani, Mahabaleshwar (Dist. Satara) and Sinhagad (Dist. Pune). These localities are situated in Western Ghats at an altitude of about 1340 to 1370 m from sea level, with an annual rainfall of about 3000 to 6600 mm. *Potua sabulosa* is typically found on the walls of old buildings, large trunks of plants, rocks and similar other habitats, that are generally covered with moss and other bryophytes. These insects are very sluggish and feed on humus, moss and other bryophytes. During summer the population of these insects gradually declines and practically no pigmy locust is easily observable in the months of March, April and May, as the aestivating forms remain hidden in crevices etc.

Table 2

Dignostic characters for field identification of the four representative grouse locusts of the subfamilies under study.

TETRIGIDAE

Small sized, short-horned hoppers, Greatly extended pronotum, arolia absent. Forewings reduced, & scale like, hindwings normal. Ovipositor slender and serated. Found in moist places.

Potua sabulosa

(Fig. 2 : a & b)

(Subfamily : Cladonotinae)

Smallest and bizarre form. Body tuberculated and dull brown. Head and femora large in size. Pronotum compressed, Shorter in length and with two large humps in the shoulder region. Wings considerably reduced to small scales. Found on the damp, moss-covered rocks and trees of forest.

Euscelimena harpago

(Fig. 2 : c & d)

(Subfamily : Scelimeninae)

Largest and massive form. Colour dull greyish black. Pronotum elongated with tubercles on shoulder. Lateral lobes of pronotum with yellow, triangular straight spines. Tegmina reduced, hind wings well developed. Tibiae and tarsi of hind legs lamellated. Found on the rocks very close to the water bodies,

Systolederus greeni

(Fig. 2 : g & h)

(Subfamily : Metrodorinae)

Large sized greyish insect. Head considerably higher than pronotum. Eyes large very close and higher than vertex. Antennae long. Presence of white or greyish granules on the pronotum. Lateral lobes slightly produced. Hindwings extend to the tip of the pronotum. Hind femur with oblique wrinkles. Found on the wet rocks, present near large water bodies.

Paratettix dorsifer

(Fig. 2 : e & f)

(Subfamily : Tetriginae)

Small sized, agile insect. Eyes prominent and raised about the level of pronotum. Presence of yellowish white patch on the shoulder region of pronotum. Lateral lobes of pronotum depressed and rounded. Hindwings longer than pronotum Hind femur with large tubercles. Found in moist places of river banks and fields.

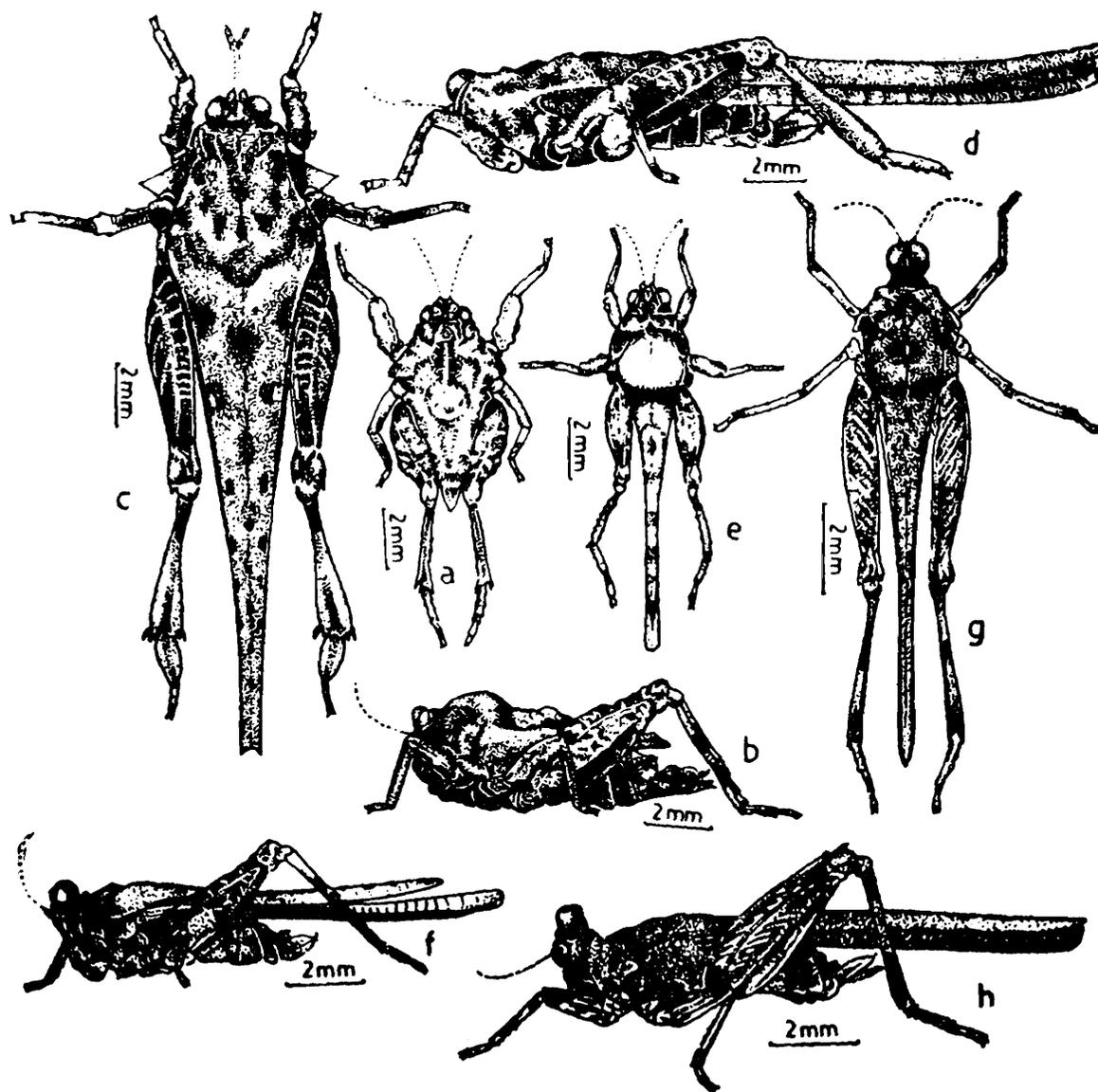


Fig. 2

a&b : *Potua sabulosa* ; c & d : *Euscelimena harpago* ;
g&h : *Systolederus greeni* ; e&f : *Paratettix dorsifer*.

Subfamily : (II) SCELIMENINAE

The members of the subfamily Scelimeninae occurring in the area under study belong to four genera and seven species.

Ethoecological observations : A large proportion of the members of Scelimeninae are widely distributed in the surveyed parts of Maharashtra. They are exclusively

dependent on the permanent fresh water bodies such as rivers, streams and lakes. The grouse locusts are generally found near the water line, on the solid substratum or in the muddy areas of the bank. Some species of scelimeninae are more aquatic and usually observed in the hilly regions, especially near the rushing mountain torrents.

Most of the species of Scelimeninae are comparatively larger in size, greyish black in colour and resemble very well with the substratum. They show various kinds of adaptations for semi aquatic mode of life. Different species of Scelimeninae feed on algae, moss and decaying vegetation. In some Scelimenids the tibiae and tarsi of hind legs are expanded or lamellated for swimming under water. *E. harpago* of Scelimeninae can stay submerged in water for about 15 to 20 min. and shows "Gas bubble respiration".

The sample collections made during various seasons showed that these insects occur throughout the year. However, their number is appreciably large in the post-monsoon period and tends to considerably dwindle during the summer.

Subfamily : (III) METRODORINAE

In our survey, so far, we have come across only one grouse locust, *Systolederus greeni* Bolivar under this subfamily.

Ethoecological observations : *S. greeni* representing this subfamily has, so far, been recorded for the first time near the streams close to Koyana Dam (Dist. Satara). These insects are generally sluggish but occasionally fly actively with the help of well developed hind wings. This species of Metrodorinae is grey coloured and large in size. Pronotal surface shows whitish, granular pattern resembling very well with the rocky habitat. The insect feeds on humus, algae and moss. Further, studies on this insect are being undertaken.

Subfamily : (IV) TETRIGINAE

The members of this subfamily that occur in the area surveyed belong to 5 genera and 7 species (Table 1).

Ethoecological observations : The grouse locusts belonging to this subfamily are

more widely distributed in various localities but showing somewhat similar habitats. They live on ground, particularly in marshy, humid situations. Most of these insects inhabit places such as banks of rivers, ponds, artificial canals and adjacent to the paddy fields. Some forms are also found in the arid zones present slightly away from the large permanent water bodies. Certain habitats, where these insects occur, are highly polluted with sewage and industrial waste.

Tetriginae show polychromatism, or long series of colour patterns and correlated tones. These broad range of inter-specific and intra-specific colour patterns are useful in giving abundant protection. These grouse locusts feed on decaying vegetation, lower plants and small fragments of grass seedlings. The population of Tetriginae is considerable from post-monsoon to late winter and these insects are scarce during summer. These are active fliers and also leap when disturbed. Most of the members of Tetriginae get attracted towards bright light sources during late evenings and in this process they show a unique phenomenon of "local migration".

DISCUSSION

The taxonomic studies of the region under study revealed that most of the species identified, form the first record. The list of which is as follows : *Potua sabulosa* Hancock, *Criotettix latifrons* Hebard, *Eucriotettix flavopictus* Bolivar, *Thoradonta lativertex* Gunther, *Thoradonta pruthii* Gunther, *Systolederus greeni* Bolivar, *Paratettix femoralis* Bolivar, *Euparatettix personatus* Bolivar, *Coptotettix conspersus* Hancock and *Ergatettix guntheri* Steinman. In the latest, available Government of Maharashtra Gazetteer (1974) only 6 species of Tetrigidae (Acridiinae) are reported. The scientific names of species are as follows : *Scelimena harpago* Serville., *Scelimena uncinata* Serville., *Tettix* (*Paratettix*) *dorsifer* Walker., *Hedotettix gracilis* De Hann, *Hedotettix lineifera* Walker and *Acantholobus curticornis* Hancock. Moreover, these insects were mostly recorded from Bombay and nearby areas and names of some of the species also need to be revised due to nomenclatural changes which have taken place afterwards.

In the taxonomic literature on grouse locusts various synonyms are noticed after the valid names of different species. These synonyms also show interesting changes from the past to the latest years. For example, *Euscelimena harpago* showed striking variations in the generic names right from *Gryllus* to *Euscelimena* with two main changes in between viz., *Tetrix* and *Scelimena*. Similar type of changes were noticed in the remaining 15 species of tetrigid insects under study.

The present investigations also revealed the interesting distribution pattern amongst different species of grouse locusts. The survey work of nine districts of Maharashtra state clearly indicated that some species of grouse locusts, for example, *E. harpago*, *Criotettix latifrons*, *Thoradonta* Sps., *Paratettix* Sps., *Hedotettix* Sps., *Euparatettix personatus*, *Coptotettix conspersus* and *Ergatettix guntheri* are practically found in all the localities, whereas, certain species like *Potua sabulosa*, *Eucriotettix tricarinatus* and *Eucriotettix* Sp. are found only in the hilly regions with greater altitude. Similarly, a grouse locust species from subfamily Metrodorinae namely, *Systolederus greeni* is found only at one locality. This presumably means that besides the nature of habitat, certain other ecological conditions could be playing some role in the distribution of these insects.

The survey also revealed variations in the relative density in population of the collected species of tetrigids. For example, *E. harpago*, *Eucriotettix flavopictus* (subfamily Scelimeninae), *Paratettix* Sps., *E. personatus*, *C. conspersus* (Subfamily : Tetriginae) are found to be showing higher relative density. On the other hand grouse locusts such as *Eucriotettix* Sps., *C. latifrons* and *Thoradonta* Sps. (Subfamily : Scelimeninae) and *S. greeni* (Subfamily Metrodorinae) show very low relative density.

As is known, insect taxonomy and phylogeny are by and large constructed on the basis of morphological data. But these are often insufficient. Hence, the use of ethoecological information is very promising for the correct identification of species (Ghilarov, 1974). In the present work, therefore, besides morphological studies some etho-ecological observations are also carried out which revealed interesting peculiarities. The grouse locusts of one subfamily show same type of habitat and nature of food and feeding behaviour. Furthermore, individuals of a species also show a typical micro-habitat and speciality in relation to feeding behaviour. The population studies revealed that there is a marked fall in the total number of grouse locusts especially during dry, summer season. During all the trips of "night collection" none of the species of Scelimeninae was observed near the bright light source. However, large number of Tetriginae species were collected near the bright light sources during night. There are many occasional records of grasshoppers flying near artificial light sources at night, sometimes in a good number. Certain observations on grasshoppers and locusts suggest that night flights are more characteristics of non-swarming species and phases (Uvarov, 1977). Observations on night flight of Tetrigidae of South Africa revealed that many species get attracted to light at night (Johnsen, 1985). The exact purpose of local migration in grouse locusts is still unknown.

Despite the near universal distribution, the information on the bionomics and ethoecology of grouse locusts has been very scanty. Moreover, practically there was

Table 3

Status/Nomenclature changes in the taxa of grouse locusts

Hancock 1906	Kirby 1914	Hancock 1915	Rehn 1952	Steinmann 1970	Kevan 1982
Order ORTHOPTERA	Order ORTHOPTERA	Order ORTHOPTERA	Order ORTHOPTERA	Order ORTHOPTERA	Order CAELIFERA
Family ACRIDIDAE	Family ACRIDIDAE	Family TETRIGINAE	Superfamily ACRYDOIDEA	Familia TETRICIDAE	Suborder TETRIGODEA
Subfamily TETRIGINAE (ACRYDIINAE)	Subfamily ACRYDIINAE		Family TETRIGIDAE		Infraorder TERIGIDEA
					Superfamily TETRIGOIDEA
					Family (i) TETRIGIDAE (ii) BATRACHIDEIDAE

Table 4

Nomenclature changes at the family level in grouse locusts

During 19th Century		During 20th Century	
1815	Acrydida : Leach	1902	Paratettigidae ; Krauss
1837	Acrydiadae (Sic) : W. Kirby	1902	Acrydidae : Krauss
1838	Tetridides (Sic) : Rambur	1902	Tetrigidae : Karuss
		(July)	
1838	Tetricidites : Audinet Serville	1902	Tetrigidae : Yakobson
		(Sept.)	
1840	Tetrigidae : Burmeister	1910	Acrydiinae : W. F. Kirby
1844	Peritrachelia (part). Tetrigidea, Tetricideae, Tetrigideae, Tettigidea, : Fieber	1955	Tetrigides : Beier
1846	Tettiges : Fischer von Waldheim	1956	Tetrigoidea : Kl Gunther
1853	Palyparyphea (part) : Feibr	1967	Tetricidae : Steinmann
1868	Tetricides : Scudder	1976	Tetrigoidea : Kevan
1870	Tettigidae : F. Walker		
1872	Tettigi : C. Thomas		
1895	Tettigides : Sharp		

no work on the biochemical studies on these insects. The relative abundance of Tetrigids in India and the total lack of bioecological and biochemical information on Indian Tetrigids indicated the need of initiating such studies. For the last few years, therefore, such studies are being carried out. An attempt on these lines resulted into publication of certain interesting findings and the approach has been well received at National and Interantional levels (Paranjape & Bhalerao, 1985 ; (Paranjape 1985 ; Bhalerao & Paranjape. 1986 ; Paranjape *et. al*, 1987(a) ; Paranjape *et al.*, 1987 ; Bhalerao & Paranjape, 1992).

Further etho-ecological observations and biochemical studies on various species of grouse locusts are in progress and the results seem to be promising.

Table 5

Status/Nomenclature changes in the Subfamilies of grouse locusts

Hancock 1906	Kirby 1914	Hancock 1915	Rehn 1952	Steinmann 1970	Kevan 1982
Section	Groups	Subfamilies	Subfamilies	Subfamilia	Subfamilies
Tripetalocerae	Tripetalocerini	Tripetalocerine	(Tripetalocerinae)	Tripetalocerinae	Tripetalocerinae
Cleostratae	(Cleostratini)	(Cleostratinae)	(Cleostratinae)	Cleostratinae	Cleostratinae
Discotettigidae	(Discotettigini)	(Discotettiginae)	(Discotettiginae)	Discotettiginae	Discotettiginae
Bufonidae	(Bufonidini)	(Bufonidinae)	(Bufonidinae)	(Bufonidinae)	(Bufonidinae)
Cladonotae	Cladonotini	Cladonotinae	Cladonotinae	Cladonotinae	Cladonotinae
Scelimenae	Scelimenini	Scelimeninae	Scelimeninae	Scelimeninae	Scelimenini (Tribe of Tetriginae)
Metrodoraе	Metrodorini	Metrodorniae	Metrodorniae	Metrodorniae	Amphorphopinae (= Metrodorniae)
Tettigiae	Acrydiini	Tettiginae	Tetriginae	Tetricinae	Tetriginae
Batrachidedae	Batrachidiini	Batrachidinae	(Batrnchidinae)	Batrachidinae	Batrachideidae (Family)

NOTE ON THE STATUS OF TETRIGID TAXONOMY

Tetrigid systematics is a seriously handicapped topic. Even the cursory survey clearly indicates that there is no unanimity in the available literature. There has been considerable diversity in the views amongst the workers. For example, Hancock (1915) considered Kirby's work (1914) inaccurate and incomplete. Gunther (1938) further revised Hancock's version, while Rehn (1952) states that Gunther's work has created added confusion.

The available information on the tetrigid taxonomy is rather difficult to follow due to various reasons. The major divisions of Tetrigidae have greatly changed from time to time. For the sake of brevity and clarity, these various changes in the taxa and their nomenclature are presented in Tables 3, 4 and 5.

It is a matter of relief that presently the tetrigid classification up to the subfamily level is largely agreeable and widely accepted by most workers.

However, the lack of unanimity yet persists largely at the generic and specific levels (vide supra : Discussion). According to Rehn (1952) these discrepancies are due to three important factors : namely, dimorphism or polymorphism, availability of neotenic forms and considerable polychromatism. Moreover, these variations occur largely within the species.

The above mentioned characteristics pose problems for taxonomists working on tetrigid insects. Blackith (1989), on the basis of multivariate analysis using even as many as 80 morphological characters, has felt that these characters are of limited use in finalising the taxonomy of Tetrigid insects.

In more recent years, Kevan (1982) has pointed out that the suprageneric classification is still unstable. Similarly, in the most recent catalogue of tetrigid insects, Blackith (1992) has attempted to synonymise many genera and species and has also experienced similar difficulties related to tetrigid determination.

Thus, even today the taxonomy of Tetrigidae is far from complete and most of the workers are of the opinion that a taxonomic revision of Tetrigid group is highly essential.

Considering the above mentioned problems, one feels that eventually recourse to some non-structural methods of taxonomic studies such as etho-ecological observations,

biochemical and immunological approaches may prove to be of great help and complementary to the morphological basis, in attempting to resolve the problem of taxonomic confusion in grouse locusts.

SUMMARY

The grouse locusts collected and studied during survey work of certain eco-geographically varying districts of Maharashtra State (Western India) belong to 16 species, 11 genera and 4 subfamilies of the family Tetrigidae. Findings of this survey are presented in the distribution-map. Etho-ecological observations on the four subfamilies indicate that these insects show interesting features in relation to habits and habitat, distribution pattern, polymorphism and polychromatism. The distribution pattern of most of the species forms the first record. The tetrigid taxonomic literature shows considerable diversity in views and nomenclature. A note on the status of the problem is therefore given specially at the end.

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