STUDIES ON TAXONOMY AND BIOLOGY OF SOME GROUSE LOCUSTS (ORTHOPTERA: TETRIGOIDEA) OF PUNE REGION WITH SPECIAL REFERENCE TO *EUSCELIMENA HARPAGO* SERVILLE

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SYNOPSIS OF A THESIS TO BE SUBMITTED TO,

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Grasshoppers probably first hopped on Earth towards the end of the Palaezoic era, when only primitive plants were around. As more advanced plants evolved, more advanced grasshoppers evolved to feed upon them. This lead to the formation of modern species, which abound today. But some grasshoppers remained primitive, specialising to feed on plants such as algae, mosses and ferns which were shunned by most modern grasshoppers (Blackith, 1985). These so called "primitive grasshoppers" were then suitably classified into 2 - 3 separate groups, the most important one of which is Tetrigoidea. This groups of insects is now one of the s-uperfamilies included under Caeliferan Orthoptera and consists of small sized insects. These insects are variously known as grouse - locusts, groundhoppers, pigmy locusts or grouse grasshoppers. The diagnostic characters which distinguish them from otner 'short - horned' hopper are the enormous, mostly, backwardly extended pronotum and absence of arolia between the claws of the legs.

Tetrigoidea includes about 185 genera and nearly 1000 species, which, in distribution, cover most of the world (Kevan, 1982). They are predominantly tropical and occur abundantly in the Oriental region. Steinmann (1970) has reported the occurrence of 433 species (about 50 %) of tetrigids in the oriental region. Furthermore, it is interesting to note that Indian region is richer in certain groups of tetrigids such as Scelimeninae and these are found to be lacking in many parts of the world.

This group has several interesting features in relation to habitat selection, polymorphism, polychromatism, food and feeding habits as well as reproductive behaviour. Despite several interesting features and relative predominance in the Oriental region, this group has received very little attention of entomologists. Available literature on tetrigids mainly consists of check - lists and systematic studies but it is absolutely scanty on bionomics (Kirby, 1914; Hancock, 1915; Gunther, 1938) Regarding taxonomic studies there is also a considerable diversity in views amongst workers and mainly due to nomenclature changes, most of the workers feel that a taxonomic revision of Tetrigidae is very necessary.

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Almost complete lack of ethoecological and biological information on Indian tetrigids in general and Euscelimena harpago in particular indicated the need of undertaking such studies. Hence, an attempt has been made to study the following aspects with special reference to E. harpago.

Survey of Pune City and selected nearly localities was carried out practically for the first time to understand distribution pattern, population dynamics and ethoecological features of tetrigid insects. The field observations and the subsequent data collected during survey work revealed that the tetrigids were abundant during post monsoon and winter season but their population gradually declined at the end of winter and many species were scarce during summer, it was also observed that drought conditions have a profound effect on the occurrence of these insects.

Grouse locusts were collected from various localities and studied taxonomically. In the present studies, 14 species of grouse locusts were identified in the area, which belong to 10 genera and 3 subfamilies. The insects were described taxonomically and the keys were also prepared for easy indentification of grouse locusts in the field. Furthermore, some of the species form the first record from this region.

Field and laboratory observations revealed several interesting features in relation to habitat selection, food and feeding habits as well as reproductive behaviour. The ecological survey made at various localities showed that tetrigids are very specific in their habitat selection. The great majority of tetrigids were found on moist ground, particularly in the vicinity of water. Moreover, the forms belonging to scelimeninae were semiaquatic and were therefore usually observed very close to water, in the muddy regions or even hear a rushing stream or torrent of the hilly regions. A few species were also observed in the forests with greater altitude. Some species of Scelimeninae, especially E. harpago, were capable of active swimming in water and remained submerged for considerable time, for which they showed special adaptations.

Tetrigids insects were variously coloured and closely mimicked soil, rocks, bryophytes, lichens and dead-decaying vegetation. By and large the colouration in tetrigids afforded these small insects to blend nicely with the surroundings.

Many species of Tetriginae got attracted to sources of illuminations at night, during post monsoon and winter and in the process showed a unique phenomenon of "local migration."

The study of feeding habits of grouse locusts was attempted by different methods. Most of the species were observed feeding on lower plants such as algae, bryophytes, fungi, lichens and also on humus and detritus material. It is also interesting to note that many species of Scelimenids were necrophagous. Furthermore, grouse loust belonging Tetriginae were observed feeding on various cereal crops and grasses, especially at the sprouting stage. The tough-texured leaves of monocot and dicot plants were not preferred by grouse locusts. Thus, with respect to food and feeding behaviour grouse locusts indicated herbivory thru omnivory. This confirmed the observations made by Gangwere (1961) on Michigan tetrigids. The observations and the data collected during field work suggested that grouse locusts are harmful to the paddy crop especially during seedling stage. Hence, these species are probably of economic importance in the paddy growing areas of the country.

The type of food and mode of feeding showed interesting structural correlation with respect to mouth parts and the nature and armature of foregut. Although the mouth parts were typically of biting and chewing type, the molar region of mandible did not show acridid type of molar dentes and instead characteristically showed peculiar, denticulate, comb-like ridges alternating with grooves. These structural details were revealed further clearly with SEM studies and have been recorded for the first time. The labrun was a broad, oval plate and the epipharyngeal surface of the clypeolobrum was filled with an abundance and variety of hair tracts and spicules. There were three main types of hair tracts namely alpha, beta and gamma. In between these hair tracts were observed A1, A2, A3 and A10 types of sensillae. These sensillae in grouse locusts were relatively less in number as well as in variety as compared to acridid insects.

Another structural correlation in accordance to the food refers to the foregut armature. Since tetrigids prefer rather soft and pulpy food, there is poor development of foregut armature. The foregut is also relatively shortened and the gastric caecae were with only anterior prolongation.

The salivary glands also showed interesting morphological features. The histological studies of the alimentary canal in E. harpago revealed that different parts of the gut showed same basic layers as seen in the acridid insects.

The tetrigid insects also showed some basic similarities and few structural differences as compared with the reproductive systems and reproductive behaviour of the acridid insects. In grouse locusts, testes were paired but separate. Each testis was in the form of a cluster and consisted of many, short, chille-like follicles. The male genitalia were structurally reduced, relatively simple and appeared to be primitive. The ovary was made up of a bunch of panoistic ovarioles. The ovipositor has serrated valves ending in a curved spiny structure and is functionally well suited to the characteristic hanitat.

In tetrigids the site of oviposition and nature of eggs is also different as compared to acridid insects. Grouse locusts laid eggs in marshy soil and in the form of loose cluster. The egg has a chorionic filament at its anterior end. These eggs hatched in about 15-20 days. The life cycle involved 5-7 nymphal stages and is completed in 50-55 days during favourable conditions.

E.harpago showed interesting adaptations with respect to its semiaquatic mode of life. The insect is capable of active swimming with the help of modified oar-like, lamellated hind legs. It remained submerged under water for considerable time and belonged to the category of gas bubble utilizing insects. The underside of the hood-like pronotum showed complex net work of air pockets interlinked by tracheoles and trachea. The air bubble, carried under the pronotum, performed different functions as a physical gill, oxygen reserve as well as hydrostatic organ. Eggs, which were usually laid in moist soil, also showed normal development, when submerged under water.

Phylogenetically speaking the tetrigids represent a primitive superfamily of the Caeliferan Orthoptera. They show striking basic similarities with their systematically closely related tridactylids on one hand and acridids on the other, with specialised features of their own.

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Thus, Tetrigoidea is a special assemblage of moisture loving, primitive group of insects which have retained many biological peculiarities.

The present work is first of its kind on the tetridigs of Pune region. It will be an essential contribution towards the study of taxonomy, ecology, feeding and reproductive behaviour of this longtime neglected group. This work will also provide useful information for comparative studies of Orthopteroid insects.

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