
**DIVERSITY AND ALTITUDINAL DISTRIBUTION OF ACRIDIDAE:
ORTHOPTERA FROM HIMACHAL PRADESESH (INDIA)**

Pardeep Kumar*

ABSTRACT

In hilly state, Orthoptera distribution shows a zonation of species from lowland to upland i.e. altitude-specific adaptations and environmental constraints. Present study deals with the 82 species of Acrididae represent the 11 sub families. Sub family Oedipodinae stand for the 27 % species followed by subfamily Acridinae with 21%. Calliptaminae, Tropidopolinae sub families symbolize the least one. Altitudinal gradient studied revealed the remarkable decrease in the number of species from 500 meter masl to 4600 meter masl. Bryodema luctuosum indum (Sauss.), Sphingonotus savignyi Sauss , S. kashmirensis are the typically altitudinal indicator species

Key words: Orthoptera, Acridoidea, Diversity,

* Department of Education, Haryana

INTRODUCTION

India's immense biological diversity encompasses 75-80% insects of the total animal species on this planet. Insects are predominant biota on all continents including Antarctica. The Himachal Pradesh is with varied physiographic of foothills to the high mountain peaks and trans Himalayan ranges. The Orthopterans are important groups of insects known as pest of agricultural crops, vegetables and forest. They play a dominant role in the socio economic of country and have significant contribution in the sustainable development of the environment. Family Acrididae are commonly called grasshoppers. All of them have large hind legs for jumping. They have short antennae and short ovipositor. Males sing during day by rubbing legs against sides of their forewings. Some species include a visual display of bright colours on legs or wings. Female's ovipositor egg masses protected by a foamy substance, under the ground or in plants. Most of them have an annual life cycle. Most species feed on grasses. Some species feed on other vegetation including leaves, stems. Some even feed on dead eucalyptus leaves. Some species, under some conditions, will migrate in a dense swarms form, known as locusts, bring large damage to the crop. The distribution of 82 orthopteran species in the state is analyzed on the basis of quantitative data on their vertical distribution at altitudes of 500 to 4600 m above sea level. Plain and mountain species, as well as those widespread at any altitudes, are distinguished by the pattern of the altitudinal distribution.. It deals primarily with altitudinal gradient but considers other ecological aspects. It is the first comprehensive summary of the distribution of Orthoptera along as altitudinal gradient in the Shivalik to Himalyan mountain.

MATERIAL AND METHODS:

The present study is based upon the collection of Orthoptera brought by various survey parties of ZSI, Solan, India. The collections of Orthoptera are habitat specific and the state habitat is sub mountainous to mountainous, forest, scrub jungles, adjoining agricultural field and river basins etc. Orthoptera are basically terricoles (ground); aquaticoles (floating leaves); arborescens (trees); herbicoles (herbs and shrubs) and graminicoles (grasses). Altitudinal studies were made from 500 masl to 4600 masl. The grasshoppers were fixed by ethyl acetate and were usually preserved dry in paper packets in the field. For study, the insects were preserved dry after relaxation and pinned, labelled and stored in the collection boxes with insecticides.

RESULTS

Classification followed here is after Drish (1965) and Uvarov (1966). Bhowmik (1985) is also a useful guide for family Acrididae. Authors like Bolivar, (1917), Henary (1940), Chopard (1969), Tandon and Shishodia (1976), Bhowmik (1985a, 1993), Julka *et.al.* (1982), Bhowmik and Halder (1983), Shishodia *et.al.*, 2003, Saini & Mehta, 2007 and Shishodia & Gupta, 2009 studied the Orthoptera of Himachal Pradesh. Present studies divulge the total of 82 species of family Acrididae with 11 sub families are reported in *in-vivo* and literature from Himachal Pradesh. Table 1 illustrate the concise outcome of current species from the state, with percentage distribution of sub families in figure 1.

Table-1 Species distribution

Subfamilies	No of Species
Acridinae	17
Oedipodinae	22
Gomphocerinae	10
Hemiacridinae	05
Oxyinae	04
Coptacridinae	02
Tropidopolinae	01
Cyrtacanthacridinae	05
Eypreocnemidinae	09
Catantopinae	06
Calliptaminae	01

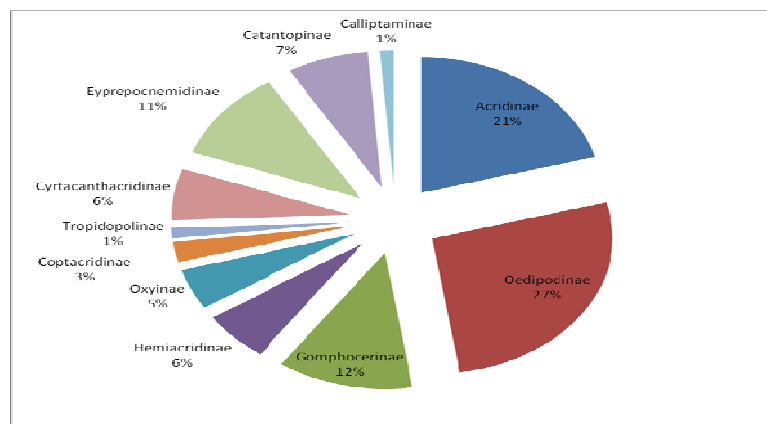


Fig 1 represents the percentage distribution of species

Altitudinal gradient of 11 sub families reveals the significant habitat of the species distribution. Table 2 authenticates the gradient distribution of species. *Oedaleus abruptus* (Thunberg), *Trilophida annulata* (Thunberg), *Xenocatantops humilis humilis* (Serville), *Catantops pinguis innotabilis* Stal are typically euryaltitudinal species. *Bryodema luctuosum indum* (Sauss.), *Sphingonotus savignyi* Sauss, *S. kashmirensis* are the altitudinal indicator species.

Table-2 Shows the species distribution along altitudinal gradient

Altitude Gradient	Habitat	No. of Species
500 masl to 1200 masl	Sal missed Forest, Grassland, Riverside, Stony, Agriculture Field	37
1300 masl to 2600 masl	Chir pine and Deodar forest, Grassland, Semi aquatic	32
2800 masl to 3800 masl	Sub mountain to mountain meadows and pastures	16
3800 masl to 4600 masl	High altitude passes, alpine meadows and pastures	11

Discussion

Present study is the addition to the earlier study of Bhowmik and Halder (1983) in which he studied the 29 species from the state. According to the Bhowmik (1993) the Western Himalaya (Kumaon (U.P.) to Kashmir and also western part of Tibet) including Himachal Pradesh comprised of 59 species of family Acrididae with a 25 endemism species. Foreign influence on the grasshopper fauna in the state is also recoded. The endemic *Oedipoda himalayana* and *Eyrepocnemis rosea* species are representation in Africa and Palaearctic regions are available here. Studies on the habitats of Orthoptera revealed that *Acrida exaltata* were most abundant in the open grassland and *Gasrimargus a. africanus* in the stony dry riverian. *Oxya fuscovitata*, *Ceracris nigricornis*, *Trilophida annulata* and *Eyrepocnemis rosea* were mainly found in the agricultural fields. Beside these other who evenly distributed in the forest area, open grassland and cultivation fields are *Eyrepocnemis a. alacris*, *Spathosternum pra. prasiniferum*, *Atractomorpha cranulata*, *Catantops pinguis innotabuls*, *Xenocatanopus h.humilus*.

Although our collecting did not give us numbers per unit area, our qualitatively exhaustive technique did provide a basis for comparing relative population densities as well as species numbers at different altitude. In the present study there is a rapid drop in numbers of orthoptera species with increasing altitude. Several studies have found a decreasing trend in species richness with altitude (Kikkawa and Williams 1971; Hagvar, 1976; Wolda 1987; Bruhl, *et.al*, 1999; Nathan, and Werner. 1999). Grasshoppers are generally feeders of vegetation and most of the species have a very wide range of host plants, particularly those to agricultural crops of Graminae. Several species are pest of seedlings and saplings of forest tree. Important species of forestry are *Oxya velox*, etc. The Orthoptera is one of the most important groups of herbivorous insect living in these grassland systems. Herbivorous insects involved in “bottom up” resource control, which makes them sensitive to changes of habitat structure particularly changes of the grass layer, such as occurs during grazing and mowing (Bock & Bock, 1991; Chambers & Samways, 1998; Gebeyehu & Samways, 2002). Based on their sensitivity, relative high species richness and easy sampling and identification orthopterans are commonly used indicators of habitat heterogeneity, ecosystem biodiversity and environmental stress (Andersen *et al.*, 2001). The significant results would suggest that some Orthoptera could be considered as “Climatic bioindicator” as they are very sensitive to regional climate. However, the interpretation of the results should be tempered as the whole relationship is not well understood and probably involves very complex interactions at different scales. Therefore, they might be bioindicator of other environmental factors. The family Acrididae is the dominant inhabitant of high altitude areas. An endemic species *Bryodema luctuosa* found in many stony localities and may be collected up to an elevation of 4600 meters.

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REFERENCES:

1. Andersen, A. N., Ludwig, J. A., Mowe, L. M. & Rentz, D. C. F. 2001. Grasshopper biodiversity and bioindicators in Australian tropical savannas: Responses to disturbance in Kakadu National Park. *Austral Ecol.* 26: 213-222.

2. Bhowmick, H.K. 1985. Contribution to the gryllidae fauna of the Western Himalayas (Orthoptera: Gryllidae) *Records of the Zoological Survey of India, Occasional Paper* No. 73, pp 1-74.
3. Bhowmick, H.K. and Halder, P. 1983. Preliminary distribution with remarks on little known species of Acrididae (Orthoptera: Insecta) from the western Himalayas (Himachal Pradesh). *Records of the Zoological Survey of India* 81 (1&2):167-191.
4. Bhowmik, H.K. 1985. Outline of distribution with an index catalogue of Indian grasshoppers (Orthoptera: Acridoidea). *Rec. Zool. Surv. India. Occ. Pap. No. 78*: 1-47
5. Bhowmik, H.K. 1993. On the biogeographical region of India in relation to studies in the endemism of Acrididae fauna of India. *Rec. Zool. Surv. India, Occ Pap. No. 131* :1-56
6. Bock, C. E. & Bock, J. H. 1991. Response of grasshoppers (Orthoptera: Acrididae) to wildfire in a southeastern Arizona grassland. *Am. Midl. Nat.* 125: 162-167.
7. Bruhl, C. A., M. Mohamed, and K. E. Linsenmair. 1999. Altitudinal distribution of leaf litter ants along a transect in primary forests on Mount Kinabalu, Sabah, Malaysia. *Journal of Tropical Ecology* 15:265–277.
8. Chambers, B. Q. & Samways, M. J. 1998. Grasshopper response to a 40-year experimental burning and mowing regime, with recommendations for invertebrate conservation management. *Biodivers. Conserv.* 7: 985-1012.
9. Chopard, L. (1969) Fauna of India Orthoptera Grylloidea Vol.2. 421 pp. Published by the *Zoological Survey of India, Calcutta*.
10. Drish, V.M. 1965. The African genera of Acridoidea. University Press Cambridge, 579pp +8.
11. Gebeyehu, S. & Samways, M. J. 2002. Responses of grasshopper assemblages to long-term grazing management in semi-arid African Savannah. *Agric., Ecosyst. Environ.* 95: 613-622.
12. Hagvar, S. 1976. Altitudinal zonation of the invertebrate fauna on branches of birch (*Betula pubescens* Erh.). *Norwegian Journal of Entomology* 23:61–74.
13. Henry, G.M. 1940. New and little known south Indian Acrididae (Orthoptera). *Trans.R.ent.Soc. Lond.*, 90:497-540.
14. Julka, J.M., Tandon, S.K., Halder, P. and Shishodia, M.S. 1982. Ecological observation on the grasshoppers (Orthoptera: Acrididae) dist Solan (H.P.), India. *Oriental Insects* 61: 63-71.

15. Kikkawa, J., and E. E. Williams. 1971. Altitude distribution of land birds in New Guinea. *Search* 2:64–65.
16. Nathan, R., and Y. L. Werner. 1999. Reptiles and breeding birds on Mt. Hermon: patterns of altitudinal distribution and species richness. *Israel Journal of Zoology* 45:1–33.
17. Tandon, S.K. and Shishodia, M. S. 1976. On a collection of Acridoidea (Orthoptera) from Rajasthan, India. *Newsl. Zool. Surv. India*, 2: 7-11.
18. Uvarov, B.P. 1966. Grasshoppers and locusts. A Handbook of General Acridology, Vol.1 University Press, Cambridge, 1-481, 245 figs.
19. Wolda, H. 1987. Altitude, habitat and tropical insect diversity. *Biological Journal of the Linnean Society* 30: 313–323.
20. Saini, K and Mehta, H.S. 2007. An Inventory of the Orthoptera Insects of Himachal Pradesh. *Biuonotes* 9 (3) : 76-78
21. Shishodia, M.S., Mehta, H. S., Mattu, V.K. and Thakur, S.K. 2003. Orthoptera (Insecta) from Pong Dam Wetland, District Kangra, Himachal Pradesh, India.. *Zoo's Print J*, 18(3): 1047-48
22. Shishodia, M.S. & S. Gupta .2009. Checklist of Orthoptera (Insecta) of Himachal Pradesh, India. *Journal of Threatened Taxa* 1(11): 569-572.
23. Bolivar, I. 1917. Contribucion al concocimiento de la fauna Indica. *Rev Acad Cienc Madr.*, **16** : 278-412