

Studies on distribution of Acridoidea (Orthoptera) of Patna district, Bihar (India)

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Abstract

The detailed study of species reveals that 14 species of grasshoppers belong to 3 families such as Acrididae, Catantopidae and Pyrgomorphidae (with 9, 3 and 2 species respectively). It had been an extensive survey for grasshoppers consist of diversified and rich flora as well as different ecological conditions, rainfall, humidity and temperature. Survey in various seasons to important agricultural areas in different regions of Patna district for collection of grasshoppers during the course of survey observations has been made on their geographical distribution, diversity, host range and pest incidence.

Keywords: Acrididae, Patna, distribution, diversity, families, flora

Introduction

The members of the family Acrididae and order Orthoptera comprises of locusts and Grasshoppers. Both of these insects are distributed worldwide. A locust refers to large acridids and small species are called grasshoppers. These insects often found in two phases: one solitary as well as other gregarious. A solitary-phase nymph has camouflage nature, do not exist in groups. A gregarious-phase nymph has black and yellow or orange colouration in a fixed pattern, exist in large groups. A solitary-phase comprises shorter wings, longer legs than gregarious phase. It is classified into two sub-orders viz. Califera or short horned grasshoppers and Ensifera or long horned grasshoppers. Earlier suborder is divided into four superfamilies viz. Acridoidea, Tridactyloidea, Tetrigoidea and Eumastacoidea. The basic characters of Acridoidea are short antennae usually shorter than the body, short ovipositor and three segmented tarsi. They comprise an economically important group of Orthopterous pests infesting a number of cultivated and non-cultivated agricultural crops.

They are distributed throughout the world but they relocate best in tropical and sub-tropical belts. The overall distribution of locusts and grasshoppers reduces along increasing number of latitudes and there density of population increases towards the equator. They feed on various unrelated plant species as they are polyphagous in feeding habits (Chapman, 1990; Chapman & Sword, 1997) [9, 8]. The difference in habitat basically depends on various abiotic factors such as ecosystem, altitude, latitude and rainfall. These insects are considered as good biotic messenger of threatened habitats which led to the conservation and preservation in potential areas. Grasshoppers are considered as primary consumers in grasslands world around (Branson *et al.* 2006) [5]. They play a vital role in the transfer of energy in trophic levels, they are primary consumers in the food chain and act as prey to others which provides a balance to the ecosystem. These process keeps the population within control but defense mechanisms exhibit through them led to predators and parasites a tight competition. These insects have shown increased migration towards natural vegetation such as crop fields and have proved themselves as major pests, eg.

Phlaeoba infumata, *Atractomorpha crenulata* and *Oxya fuscovittata*.

These insects will be observed in their natural habitat. The work is first as a whole with the given location. The location consists of Patna district in and around with agricultural sites, river side with fertile land, rural belt with forest and vegetation. The work is significant for taxonomists as well as for applied entomologists and will provide a bench mark for other inter disciplinary sections. Many of the economically important species of grasshoppers like *Hieroglyphus*, *Oxya*, *Atractomorpha*, *Pyrgomorpha*, *Spathosternum*, *Phlaeoba*, *Truxalis*, *Acrida* etc. have shown a direct effect on the agricultural areas like the one under consideration.

Review of Literature

Initially, Latereille (1802) gave the family group name Acrididae, based on the genus *Acrida* Linnaeus (1758) [37]. Serville (1838) [22] & Walker (1870, 1871) [33, 34] proposed the family group names Truxalidae and Oedipodidae respectively. Meanwhile, Macleay suggested Acridina and Locustina as sections in Orthoptera in the *Horae Entomologica*. Later, Thomas (1880) [24] named the family Acrididae and split it into three subfamilies: Acridiinae, Tettiginae, and Proscopiinae. He then classified Acridiinae into three tribes: Truxalini, Oedipodini & Acridini. Saussure (1884) defined Oedipodii and Tryxalii as tribes of the family Oedipodidae. Following this, Brunner (1893) [6] classified groups like Acrydiinae, Eumastacinae, Tryxalinae, Pyrgomorphinae, Pamphaginae, Catantopinae, Pneumorinae & Proscopiinae as subfamilies of the family Acrididae. Kirby (1914) [15] supported these classifications later on. Lefroy (1909) [16] divided the family Acrididae into nine subfamilies with names like Tetriginae, Pneumoninae, Mastacinae & others. Lucas (1920) [17] elevated the family Acrididae to sub-order status - known as Acridoidea. He further grouped these subfamilies to form new families like Tetrigidae and Pneumoridae among others. By Uvarov (1921b) [32] had proposed four subfamilies under the family Acrididae: Acridinae, Oedipodinae, Catantopinae & Pyrgomorphinae. Later on came a fifth subfamily: Pamphaginae. Dirsh (1965) [10] significant contribution was his book "African Genera of Acridoidea". He also published

papers on Angola’s acridoids (1966) and Congolese species by 1970. Harz focused on European taxa in 1975 while Willemse & Kruseman did work regarding Crete’s Orthoptera soon after. Moving towards Uttar Pradesh – Usmani researched thirty-three insect species within its western domain around year 2010 before Khan dipped into Taxonomic aspects concerning Female genitalia among other regions. Akhtar along with Usmani catalogued twenty-six creatures arising from rice ecosystems specifically reaching UP again circa late twenty-tens timeframe and recalibrating efforts alongside pulses/paddy fields forming Bihar-Jharkhand areas through consistent years thereafter till final culmination mid-aughts decade endeavors inclndntly bunching male genitalia aspects fully yet inclusive Usmani-Khan (2012) [26] summative affirmations thereby roughly rounded off somewhere neatly definitive conclusively decentralized formatting inclusively overall general thematic tightly indicative corpus structural formulated sensibly conclusive densely punctuated erratically stylistically variably rhythmical archaic deduced poignantly summarized.

Increasing density in grasshoppers led to damage crops as pest. Various species of grasshoppers are considered as pests for croplands by Murray (2016) [18]. Four grasshoppers species responsible for 90% crop damage by Zhang (2019) [38]. Cease (2017) [7] reported the relation of feeding to migratory phenotypes of Mongolean locust. Gupta and Chandra (2018) [11] studied two new species of slant faced grasshopper from central India while Anderson (2019) [4] studied on abundance and diversity of grasshoppers and their ectoparasitic mites from Dakota. Acrididae are diversified group among order Orthoptera (Panhwar 2018) [20]. The grasshoppers which belong to family Acrididae act as pests for agricultural crops (Ali and Panhwar 2017) [3]. Around 360 species of short horned grasshoppers reported (Sultana and Wagan 2015) [23]. Family A crididae are more dominant with 25000 species worldwide (Zahid *et al.*, 2017) [37].

Materials and Procedures

Grasshoppers were gathered in the morning and evening hours of 2021 and 2022 from Patna fields using the sweep net method. After that, the gathered specimens were placed in flasks with paper covers and ethyl acetate-soaked cotton for death. Both dry and wet preservation techniques were used to preserve the gathered specimens. Webography and Orthoptera fauna of India Kirby (1994) were used to aid in the identification process.

Examine Area

Patna earlier known as Patliputra is an old city which is located on the Southern banks of holy river Ganga from the east, Punpun from the north and Sone from the south. It is a fertile piece of agricultural land mainly consisting of plain region with no hills located at the eastern part of the Indo-Gangetic plain. The coordinates of patna is 25.611°N latitude and 85.144°E longitude. Temperature ranges between 1.1°C to 46.6°C (www.patnaonline.in) while average rainfall is recorded as about 120 cms, between June and September. The district is among one of the cold district of Bihar. The land consists of rich in alluvial soil. This place also comprises of mango orchads and bamboo clumps. These areas will be explored within the concerned time frame giving a spectacular view of distribution patterns of

these insects depending on topography and host plant. The survey will provide good number of specimens which will serve as base for present critical study. The examination of grasshoppers in various types of habitats The deep, rich green forest and semi-evergreen mixed forest dominate the surrounding area. This location is in the Indian state of Bihar's Patna district. The latitude and longitude of Patna are around 762 meters above sea level, with a temperature range of 14.75 to 16.75.

Results and Conclusions

During the survey about 14 species of grasshoppers with 292 total specimens collected from various habitats and various fields. The detailed study of species reveals that 14 species of grasshoppers belong to 3 families such as Acrididae, Catantopidae and Pyrgomorphidae (with 9, 3 and 2 species respectively). Extensive survey of various crops/habitats to collect grasshoppers from different agricultural areas had been conducted. Attempt has been made to collect the specimens from the host plants. It had been an extensive survey for grasshoppers consist of diversified and rich flora as well as different ecological conditions, rainfall, humidity and temperature.

The computation work forms the important component of the study. Computer has been used for preparation of data matrix. The result consists of tables, histograms showing the distribution, frequency of occurrence and dominance of different genera in the family. Survey in various seasons to important agricultural areas in different regions of Patna district for collection of grasshoppers during the course of survey observations has been made on their geographical distribution, diversity, host range and pest incidence.

Table 1: List of Grasshoppers from Patna.

S. No.	Family	Species
1	Acrididae	Acrida exaltata
		Acrida gigantea
		Phlaeoba infumata
		Phlaeoba panteli
		Trilophidia annulata
		Aiolopus simulatrix
		Chloebora grossa
		Acrotylus insubricus
		Oedipoda miniata
2	Catantopidae	Oxya hyla hyla
		Oxya velox
		Oxya japonica japonica
3	Pyrgomorphidae	Poekilocerus pictus
		Atractomorpha sinensis

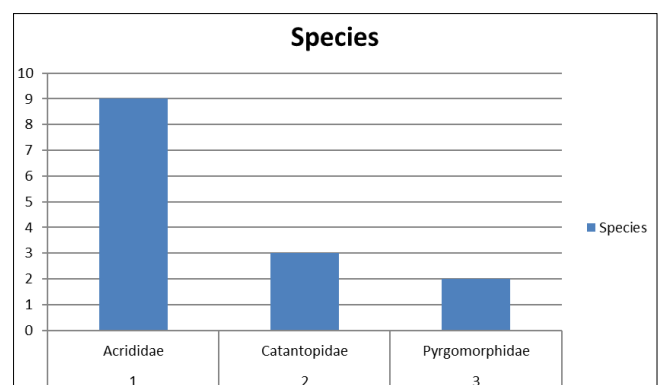


Fig 1

Table 2: No. of Species with Family.

S. No.	Family	Species
1	Acrididae	9
2	Catantopidae	3
3	Pyrgomorphidae	2

References

- Akhtar MH, Usmani MK, Nayeem MR, Kumar H. Species Diversity and abundance of Grasshopper fauna (Orthoptera) in rice ecosystem. *Ann Biol Res*,2012;3(5):2190-2193.
- Akhtar MH, Usmani MK, Nayeem MR. Impact of Abiotic Factors on Population of Acridoid Fauna (Orthoptera) in Aligarh Fort, Uttar Pradesh, India. *Trends Biosci*,2012;5(1):17-19.
- Ali S, Panhwar WA. A checklist of Acrididae (Orthoptera) of Hazara Division Khyber Pakhtunkhwa Pakistan. *J Entomol Zool Stud*,2017;5(5):96-100.
- Anderson E. Abundance and Diversity of Grasshoppers and their Ectoparasitic Mites in South Dakota [master's thesis]. *Electronic Thesis and Dissertations*, 2019, 3134.
- Branson DH, Joern A, Sword GA. Sustainable management of insect herbivores in grassland ecosystems: new perspectives in grasshopper control. *Bioscience*,2006;56:743-755.
- Brunner VWC. Revision du systeme des Orthopteres et description des especes rapportees par M. Leonardo Fea de Birmanie. *Ann Mus Stor Nat Genova*,1893;13(2):1-230.
- Cease AJ, Harrison JF, Hao S, Niren DC, Zhang G, Kang L. Nutritional imbalance suppresses migratory phenotypes of the Mongolian locust (*Oedaleus asiaticus*). *R Soc Open Sci*,2017;4:161039.
- Chapman RF, Sword GA. Polyphagy in the acridomorpha, in *The Bionomics of Grasshoppers, Katydid, and Their Kin*, 1997.
- Chapman RF. Food selection, in *Biology of Grasshoppers*. Chapman RF, Joern A, eds. New York, NY: John Wiley and Sons, 1990, 39-72.
- Dirsh VM. *The African genera of Acridoidea*. Cambridge,1965;8:579.
- Gupta SK, Chandra K. Two new species of slant-faced grasshopper genus *Acrida* (Acrididae: Acridinae) from India. *Halteres*,2018;9:131-140.
- Hazra AK, Mandal GP, Suman KK, Mondal SK, Sanyal AK. Faunal diversity of Nayachar, a newly emerged island: Orthoptera (Acridoidea). *Rec Zool Surv India*,2004;102(1-2):83-95.
- Khan MI, Usmani MK. Female genitalia in some Indian species of Acridoidea (Orthoptera) and their taxonomic significance. *Folia Heyrovskyana Ser A*,2010;19(1-4):159-175.
- Khan RM, Vyas HK, Vaish OP. Paddy pest of Rajasthan. *Rice News Teller*,1963;11(1):15-17.
- Kirby WF. *The fauna of British India including Ceylon and Burma, Orthoptera (Acrididae)*, 1. London: xi + 276, 1914.
- Lefroy HM. *Indian Insect Life. Manual of the Insects of Plains (Tropical India)*. 1909, 786.
- Lucas WJ. A monograph of the British Orthoptera. *Lond Rev Soc*. 1920, + 264.
- Murray DW. *The Biology, Ecology, and Management of the Migratory Grasshopper, Melanoplus sanguinipes* (Fab.). *Distance Master of Science in Entomology Project*. University of Nebraska: 2016.
- Nayeem MR, Usmani MK. Preliminary checklist of Acridoidea (Orthoptera) of Jharkhand, India. *J Entomol Res*, 2012, 36(2).
- Panhwar WA. Biodiversity of Caelifera (Orthoptera) from Gorakh Hill Station, Dadu Sindh Pakistan. *J Entomol Zool Stud*,2018;6(3):372-378.
- Saussure HDE. *Prodromus Oedipodiorum, insectorum ex ordine Orthopterorum*. Mem Soc Phys Geneve,1884;28:1-256.
- Serville JGA. *Histoire naturelle des Insects*. In collection des suites a Buffon Orthopteres, 1838, 776.
- Sultana R, Wagan MS. *Grasshoppers and Locusts of Pakistan*. Islamabad: Higher Education Commission, 2015, 1-430.
- Thomas C. Influence of meteorological conditions on the development and migrations of locusts. In: Riley CV, Packard AS, Thomas C, eds. *Second Report of the United States Entomological Commission for the years 1878 and 1879, relating to the Rocky Mountain Locust and the Western Cricket*. Washington, D.C.: Government Printing Office,1880:109-155.
- Usmani MK, Khan MI. A Preliminary Check List of Locusts and Grasshoppers (Orthoptera: Acridoidea) of North East India. *Trends Biosci*,2010;3(1):49-55.
- Usmani MK, Khan MI. Male genitalia in some Indian species of Acridoidea (Orthoptera). *J Entomol Res*,2012;36(2):165-171.
- Usmani MK, Akhtar MH, Nayeem MR. Diversity and taxonomic studies of Acridoid pests (Acridoidea: Orthoptera) of pulses from Uttar Pradesh, India. *Munis Entomol Zool*,2012;7(2):837-846.
- Usmani MK, Akhtar MH, Nayeem MR, Rafi U. Diversity, distribution and taxonomic studies of grasshopper fauna (Acrididae: Acridoidea: Orthoptera) of Aligarh, Uttar Pradesh, India. *Ann Entomol*,2012;30(1):31-40.
- Usmani MK, Akhtar MH, Nayeem MR. Diversity, distribution and taxonomic studies of Acridoid fauna (Orthoptera) of Aligarh Fort, Uttar Pradesh, India. *Adv Life Sci*,2012;1(1):36-40.
- Usmani MK, Khan MI, Kumar H. Studies on Acridoidea (Orthoptera) of Western Uttar Pradesh. *Biosystematica*,2010;4(1):39-58.
- Usmani MK, Rafi U, Shamael Z. Effects of temperature and humidity on growth and development of *Acrida gigantea* (Orthoptera: Acridoidea: Acrididae). *Folia Heyrovskyana Ser A*,2012;20(1-2):67-73.
- Uvarov BP. Notes on Orthoptera in the British Museum. I. The group Eupreprocnemini. *Trans Ent Soc Lond*,1921:106-144.
- Walker F. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum, Part I. Locustidae (concluded) and Acrididae (part)*. London: British Museum, 1870, 1-117.
- Walker F. *Catalogue of the specimens of Dermaptera Saltatoria in the Collection of the British Museum, Supplement, Part V*. London: British Museum, 1871, 49-89.
- Willemse C. Synopsis of the Acridoidea of the Indo-Malayan and adjacent regions (Insecta, Orthoptera) Part II. Fam. Acrididae, subfam. Catantopinae- Part one. *Public Nat Hist Gen Limburg*,1955;8:1-225.

36. Willemse F, Kruseman G. Orthopteroides of Crete. Tijdschr Ent,1976:119:123-164.
37. Zahid S, Panhwar WA, Sultana R, Azhar S. Study on food selection in two grasshopper species, Calliptamus barbarus (Costa, 1836) and Chorthippus biguttulus (Linnaeus, 1758) from Pakistan. J Entomol Zool Stud,2017:5(2):13-15.
38. Zhang L, Lecoq M, Latchininsky A, Hunter D. Locust and grasshopper management. Annu Rev Entomol,2019:64:15-34.
39. Patna Online. Available from: www.patnaonline.in