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Preliminary Checklist of Acridoidea (Orthoptera) of Patna District, Bihar (India)

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Abstract

The family Acrididae, which falls under the order Orthoptera includes locusts and grasshoppers. Insects are found all over the globe. In general, locusts refer to larger acridids, while smaller species are known as grasshoppers. The comprehensive study indicates that there are 19 species from various families, which include 12 species from Acrididae, 4 Catantopidae, and 3 from Pyrgomorphidae. A thorough investigation was carried out across different crops and habitats to gather grasshoppers from a variety of agricultural sites. The collected data showed that Acrididae made up 63%, Catantopidae 21%, and Pyrgomorphidae comprised 16% of the findings. The survey highlighted diverse seasonal patterns and significant agricultural landscapes in certain areas of the Patna district, pertinent to grasshopper collections during the observational studies. These observations also cover geographical distributions, landscape diversity, host ranges, and pest occurrences. Grasshoppers belong to the superfamily Acridoidea and the Pyrgomorphoidea order within the Orthoptera suborder Caelifera. These insects hold significant economic value as they can replace crucial pest groups and pose a continual threat to cereal crops, pulses, vegetables, orchards, grasslands, and forest plantations worldwide. Both nymphs and adults feed on leaves by cutting them into the edges. When their population increases, they can consume midribs and entire leaves, leading to severe defoliation. However, no comprehensive studies on the diversity of grasshoppers in Bihar's paddy fields have been conducted up to this point. Considering this, efforts are being made to investigate the diversity and distribution of grasshoppers in the area to help manage pest populations and enhance rice productivity.

Keywords: Acrididae, Patna, grasshopper, distribution, diversity

INTRODUCTION

The family Acrididae, which falls under the order Orthoptera includes locusts and grasshoppers. Insects are found all over the globe. In general, locusts refer to larger acridids, while smaller species are known as grasshoppers. These insects typically exist in two phases: solitary and gregarious. A solitary-phase nymph is adept at camouflage and does not form groups, whereas gregarious-phase nymphs display black and yellow, or sometimes orange, color patterns when part of large swarms. Solitary-phase nymphs possess shorter wings and longer legs compared to their gregarious counterparts. They are classified into two sub-orders: Caelifera, or short-horned grasshoppers, and Ensifera, or long-horned grasshoppers. The first sub-order is divided into four superfamilies: Acridoidea, Tridactyloidea, Tetrigoidea, and Eumastacoidea.

Acridoidea is characterized by short antennae, which are typically shorter than the body, along

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with short ovipositors and three-segmented tarsi. This group consists of economically significant Orthopterous pests that infest various cultivated and uncultivated crops. While they are found worldwide, their movement is most prominent in tropical and subtropical regions. Generally, their distribution diminishes as latitude increases, while their population density tends to rise towards the equator. The differences in their habitats are largely influenced by numerous abiotic factors, such as ecosystem type, altitude, latitude, and rainfall.

These small creatures are regarded as excellent biotic indicators of ecological health, helping to conserve potentially threatened areas. They play a crucial role in energy transfer within food chains, acting as primary consumers and serving as prey for other organisms, thus maintaining ecological balance. Their presence helps regulate populations, though they have developed defensive mechanisms to cope with competitive pressures from predators and parasites. Recently, there has been an increase in their migration towards agricultural fields, making them significant pests. Notable examples include *Phlaeoba influmata*, *Atractomorpha crenulata*, and *Oxya fuscovittata*. Surveys of their natural habitats will also consider pest-plant and plant-pest interactions. The Patna district, with its agricultural lands, fertile riverbanks, and rural areas rich in forests and vegetation, serves as a suitable location for this study.

As a cereal grain, rice is one of the crucial staple foods for a significant portion of the global population. India ranks among the producers of white rice, contributing 20% of the world's total rice output. The cultivation of rice primarily relies on irrigation, while the latter variety depends on monsoon rains. Bihar is the sixth-largest rice-producing state in India. The climate ranges from moderately temperate in the area to a tropical monsoon climate in the central plains and southern upland regions. Temperatures can vary between 1.1°C and 46.6°C [1], with average rainfall nearing 120 cm, especially from June to September. The western region of the state has more advanced agricultural practices. A large portion of the population relies on farming as their main source of income. Major agricultural products include wheat, rice, sugarcane, pulses, oilseeds, and potatoes.

Grasshoppers belong to the superfamily Acridoidea and the Pyrgomorphoidea order within the Orthoptera suborder Caelifera. These insects hold significant economic value as they can replace crucial pest groups and pose a continual threat to cereal crops, pulses, vegetables, orchards, grasslands, and forest plantations worldwide. Both nymphs and adults feed on leaves by cutting them into the edges. When their population increases, they can consume midribs and entire leaves, leading to severe defoliation. However, no comprehensive studies on the diversity of grasshoppers in Bihar's paddy fields have been conducted up to this point. Considering this, efforts are being made to investigate the diversity and distribution of grasshoppers in the area to help manage pest populations and enhance rice productivity.

Hazra et al. have conducted research on the taxonomy and ecology of grasshopper populations in Greater Kolkata and the Damodar River region of West Bengal [2, 3]. Studied the ecology of grasshoppers in the grassland ecosystems of West Bengal [4, 5]. Researched 33 species of locusts and grasshoppers in Western Uttar Pradesh. Additionally, [6] investigated the taxonomical significance of female genitalia in Indian Acridoidea.

MATERIALS AND METHODS

In Patna through agricultural fields in the years 2022 and 2023, grasshoppers were gathered in the morning and evening using sweep net techniques. The specimens that were gathered were placed in flasks covered with paper and soaked in cotton ethyl acetate to induce death. To preserve the gathered grasshoppers, both dry and wet preservation techniques were used. The India Kirby's 1994 webography and orthoptera fauna were helpful in the identification process.

Study Location

Formerly known as Patliputra, Patna was an ancient city situated on the southern banks of the Ganga River, which flows through the city from the east, Punpun from the north, and Sone from the

south. These are rich agricultural fields that are in the eastern parts of the Indo-Gangetic plains, primarily consisting of plains devoid of hills. Patna is located at latitude 25.611°N and longitude 85.144°E. The average recorded temperature was between 1.1°C and 46.6°C [7], with approximately 120 cm of rainfall, mostly between June and September. These districts are among Bihar's colder ones. Rich alluvial soil and the land's proximity to rivers make it ideal for growing food crops including sugarcane, rice, and other cereals. Fruits and vegetables are examples of cash crops (Tables 1 and 2).

Table 1. List of grasshoppers from Patna.

S.N.	Family	Species
1.	Acrididae	*Acrida gigantea*
2.		*Acrida exaltata*
3.		*Phlaeoba panteli*
4.		*Phlaeoba infumata*
5.		*Aiolopus thalassinus*
6.		*Aiolopus simulatrix*
7.		*Chloebora grossa*
8.		*Oedipoda miniata*
9.		*Trilophidia annulata*
10.		*Oedaleus seneglensis*
11.		*Acrotylus insubricus*
12.		*Truxalis nasuta*
13.	Catantopidae	*Oxya hyla hyla*
14.		*Oxya velox*
15.		*Oxya japonica japonica*
16.		*Oxya fuscovittata*
17.	Pyrgomorphidae	*Atractomorpha psittacina*
18.		*Atractomorpha sinensis*
19.		*Poekilocerus pictus*

Table 2. Number of species with family.

S.N.	Family	Species	Percentage (%)
1.	Acrididae	12	63
2.	Catantopidae	4	21
3.	Pyrgomorphidae	3	16

RESULTS AND CONCLUSIONS

While conducting the survey, we collected a total of 470 specimens belonging to 19 different species of grasshoppers from a variety of habitats. A closer examination revealed that these species are distributed across various families: 12 species from Acrididae, 4 from Catantopidae, and 3 from Pyrgomorphidae. We carried out extensive surveys in diverse agricultural locations, aiming to gather specimens from several types of plants. This thorough investigation encompassed a wide range of flora along with various environmental factors, such as rainfall, humidity, and temperature. According to the gathered data, Acrididae constituted 63%, followed by Catantopidae at 21%, and Pyrgomorphidae made up 16%.

Computational analysis plays a significant role in this research. We utilized computer software to generate data matrices, presenting results in tables, histograms, and pie charts that illustrate the distribution and frequency of occurrence, as well as the dominance of different genera within families. Our survey highlighted various seasonal trends and significant agricultural landscapes within certain

regions of the Patna district during the grasshopper collection observations. This includes insights into geographical distribution, landscape diversity, host ranges, and instances of pest occurrences. In Uttar Pradesh, [8] documented 26 grasshopper species within the rice ecosystem, while [9] reported 34 species associated with pulses and paddy in Bihar and Jharkhand, India. Additionally, [10] identified 41 species from Jharkhand and 37 from Bihar [11, 12]. Also noted 14 species from pulses and reported 26 species from Aligarh Fort, Uttar Pradesh [13]. Compiled ecological data on grasshopper fauna from Aligarh Fort, while [14] documented 32 species from the same region. Male genitalia were categorized [15].

The rising populations of grasshoppers have led to significant crop damage, with various species recognized as pests in agricultural lands, as noted by [16, 17] found that four species of grasshoppers were responsible for 90% of crop damage [18]. Discussed the feeding behaviors related to migratory phenotypes of Mongolian locusts [19]. Explored two newly identified slant-faced grasshopper species from central India, while [20] studied the abundance and diversity of grasshoppers alongside their ectoparasitic mites in Dakota. Acrididae are a diverse group within the Orthoptera [21], and species from the Acrididae family are known to be pests in agricultural settings [22]. As shown in Figure 1, the pie chart represents the percentage of species across different families. The distribution of species within families is depicted in Figure 2 using a histogram.

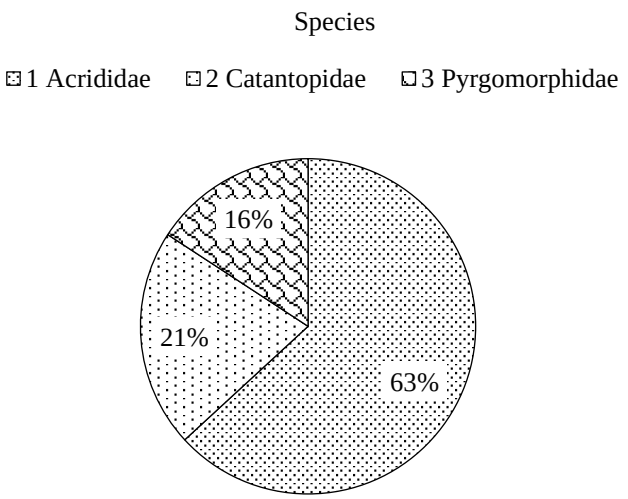

Figure 1. Pie chart: Number of species (percentage) with families.

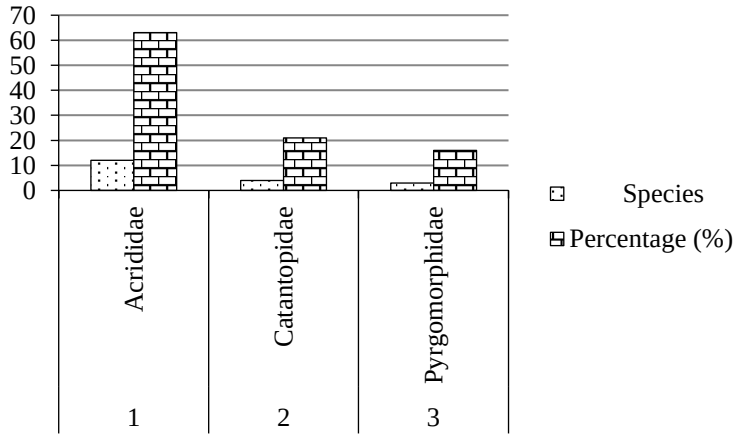

Figure 2. Histogram: Number of species with families.

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