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Grasshopper and locust distribution in paddy field of Patna district, Bihar (India)

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Abstract
The detailed studying reveals that 24 species from different families like Acrididae having 14 species, Catantopidae with 6 and Pyrgomorphidae comprising 4 kinds. An extensive survey of different crops/habitats to be collected grasshoppers from many different agricultural locations had been conducted. The percentage wise distribution of Acrididae 58%, Catantopidae 25% and Pyrgomorphidae 17% from collected data. Survey there showed various seasonalities and important agricultural scenery in some regions of Patna district for the collections of the grasshoppers during survey observations. Observations on this geographical distribution, landscapes diversity, range of hosts as well as pest incidences.

Keywords: Acrididae, Patna, distribution, diversity, crop

Introduction

The members of the family Acrididae and of the Orthoptera are comprises locusts and grasshoppers. Both of these bugs was distribute worldwide. A locust referring to large acridids and small species is calling grasshoppers. This insects oftentimes existing in two phase: one solitary and other gregarious. A solitary-phase nymph has a camouflage nature that not existed in groups. The gregarious-phase of nymphs have black and yellow or sometimes orange colorations in fixed patterns that exist in large groups. A solitary phase have shorter wings and longer legs than them gregarious phases. It classified into two sub-orders like Californina or short horn grasshoppers and Ensifera or long horns grasshoppers. Earlier sub orders divides into four superfamilies viz Acridoidea Tridactyloidea Tetrigoidea and Eumastacoidea. The basic characters of Acridoidea was short antennas are usually shorter than the body, short ovipositors, and three segmented tarsus. They comprises economic important group of orthopterous pests infestation a number of cultivated plus non-cultivated agricultural crops. They are all over the world but they moves best in tropic and subtropical belts! The general distribution is decreasing with increase numbers of latitudes and their population density go high toward equators. Difference in habitats mostly depends on too many abiotic factor like ecosystem, height, latitude and rains. These little critters is considered a pretty good biotic messengers of threatened places which led to saving an potential area. They does important duty in transferring energy in food chains levels, being a main consumers and they act as a prey to others it brings balance the ecosystem. This things keep populations in control but defense mechanisms are showing by them causating to predators and parasites tight competitiveness. These insects had showed increase in migration toward crops fields and has becomes major pests, such as Phlaeoba influmata, Atractomorpha crenulata, and Oxya fuscovittata! These bugs will even be surveying in their natural habitats, thus pest-plants and plants-pests relationships is going to be watched. The location Patna district arounds with agricultural site, rivers with fertile lands, rural belts featuring forest and vegetations.

As cereal grain, it be the most importantly staple foods for a large chunks of world's human population. India is one among world's largest producers of white rice, accounting for twenty percent of all world rice productions. The former cultivation is depending on irrigation, while latter depends with Monsoons. Bihar are the sixth largest rice producing states of India. The climate varies from moderately temperance in the Himalayan region to tropical monsoon in central plains and southern upland regions. Temperature ranged between 1.1°C and 46.6°C (www.patnaonline.in) while average rainfall recorded is nearly 120 cm especially between from June and September. The western part of state are more advanced agriculture terms. Majority of population depending farming as main occupation. Wheats, rice, sugar cane, pulses, oil seeds and potatoes are main productses. Grasshoppers belongs to super family Acridoidea and Pyrgomorphoidea order Orthoptera suborder Caelifera. Grasshoppers of great economically importance, because they replace important groups of pests and oppose a constant threat to cereal crops, pulses, vegetables, orchards, grassland and forest plantations over the world. Both nymphs and adults feeding on leaves by cutting edge of leaves. When found in greater numbers can feed even midribs and total leaves causing extensive defoliations. However, no detailed works on diversity of grasshopper in paddy field in Bihar has been ever done till date. Keeping view this fact, here attempts been made to study diversity and distributions of grasshoppers in the area with views to replace pest incidences and increasing rice productivity!

Dey & Hazra (1993) and Hazra *et al*., (1997) [7] have done studies on taxonomy and ecology of grasshopper faunas Greater Kolkata and Damodar river of West Bengal. Hazra *et al*., (1981, 1984) [8] studies about ecology of grasshoppers on the grassland eco-systems in West Bengal. Thirty-three species of locust and grasshoppers being researched by Usmani *et al*., (2010) [13, 18] from Western Uttar Pradesh. Taxonomical importances of Females genetalias of Indian Acridoidea studied by Khan and Usmani (2010) [9, 13, 18].

Materials and methods

Grasshoppers were collected in morning & evening times during the years of 2022 and 2023 at Patna rice paddy fields

by the usage of sweep net methods afterword. The collected specimens were putted in flasks with papers covers and ethyl acetate-soaked in cotton to cause demises. Both drys and wets preservations technics was applied to preserved them collected bugs. Webography and Orthoptera fauna of the India Kirby from 1994 were useful for aiding, identification process.

Study area

Patna before was knowing as Patliputra, an old cities, which located on the Southern banks of holy River of Ganga from east, Punpun from north and Sone through the south. It are a fertile piece of agricultural lands mostly consisting plain regions without the hills locating at eastern portions of Indo-Gangetic plains. The coordinates of Patna is 25.611°N latitude and 85.144°E longitude. Temperature ranged between 1.1°C and 46.6°C (www.patnaonline.in) while average rainfall recorded is nearly 120 cm especially between from June and September. District are among one of the cold districts in Bihar. The land consists rich alluvial soil, the close associating with rivers providing a good to grow crops like rice, sugarcane and other grains for eating. Cash crops like vegetables and fruits are also grown in abundancy. This places also comprises of mango orchuds and bamboo clumps. These areas exploring within the concerned time frame give spectacular view of patterns distribution of insects depending on topography and host plant. Survey yielding good numbers of specimens that will serve base for present critical study. The examining grasshoppers in verious type of habitats. The deep, rich green forest and semi-evergreen mixed forest dominants the surround area. This location is at Indian state of Bihar's Patna district. The latitude and longitudes of Patna are around 762 meters far above sea level, with temperature range of 14.75 to 16.75."

Results and conclusions

While we were doing the survey about 24 species of grasshopper was collected with 675 whole specimens collected from varied habitats, and so many fields. The detailed studying reveals that 24 species from different families like Acrididae having 14 species, Catantopidae with 6 and Pyrgomorphidae comprising 4 kinds (Table 1). An extensive surveys of different crops/habitats to be collected grasshoppers from many different agricultural locations had been conducted, the attempt is made to collect specimen from their most plants. It has been an exhaustive survey consisted of diversified flora also rich, along with all the other conditions and rainfall, humidities and temperature. The percentage wise distribution of Acrididae 58%, Catantopidae 25% and Pyrgomorphidae 17% from collected data (Table 2).

Computational works form the important parts. Computer has been used to prepare for data matrices - The results consisting of tables, histogram and pie-chart shows the distribution plus frequency of occurrence, dominance varies genera in family. Survey there showed various seasonalities and important agricultural scenery in some regions of Patna district for the collections of the grasshoppers during survey observations. Observations on this geographical distribution, landscapes diversity, range of hosts as well as pest incidences. Twenty-six species of grasshoppers has received from rice ecosystem of Uttar Pradesh from Akhtar *et al*., (2012) [1, 2], whereas Usmani *et al*., (2012) [14, 15, 16, 17, 19] reporting thirty-four species of grasshoppers from pulses and paddy of Bihar and Jharkhand, India. Nayeem and Usmani (2012) [11, 14, 15, 16, 17, 19] show fourty-one species of grasshoppers from Jharkhand and thirty-seven species reported from Bihar by them. Fourteen species from pulses Usmani *et al*., (2012) [14, 15, 16, 17, 19] and twenty-six species from the Aligarh Fort of Uttar Pradesh reported by Usmani *et al*., (2012) [14, 15, 16, 17, 19] ecological habitats of grasshopper faunas of Aligarh Fort was compiled by Akhtar *et al*., (2012) [1, 2], thirty-two species of grasshoppers reported from Aligarh, Uttar Pradesh by Usmani *et al*.,(2012) [14, 15, 16, 17, 19] Male genetalias grouped by Usmani and Khan (2012) [14, 15, 16, 17, 19], you see.

Increasing densities of grasshoppers have leading to damages crops as the pest, various species of grasshoppers being considered as pests on croplands by Murray (2016) [10], you see. Four Grasshoppers species were responsible for 90% crop damages by Zhang *et al*., (2019) [20]. Cease *et al*., (2017) [5] report of feeding relations to migratory phenotypes of Mongolean locusts. Gupta and Chandra (2018) [8] studied two newest species of slant faced grasshopper from central India while Anderson (2019) [4] did research on abundance and diversities of grasshoppers and their ectoparasitic mites from the Dakota, Acrididae are diversified groups among Orthopteras (Panhwar 2018) [12]. The grasshoppers who belong to families Acrididae acts as pests of agricultural cropping (Ali and Panhwar 2017).

Table 1: List of grasshoppers from Patna

S. No.	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		Leva indica
14		Locusta migratoria
15	Catantopidae	Oxya hyla hyla
16		Oxya velox
17		Oxya japonica japonica
18		Oxya fuscovittata
19		Hieroglyphus banian
20		Acorypha glaucopsis
21	Pyrgomorphidae	Atractomorpha psittacina
22		Atractomorpha sinensis
23		Poekilocerus pictus
24		Chrotogonus trachypterus

Table 2: No. of species with family

S. No.	Family	Species	Percentage (%)
1.	Acrididae	14	58
2.	Catantopidae	6	25
3.	Pyrgomorphidae	4	17

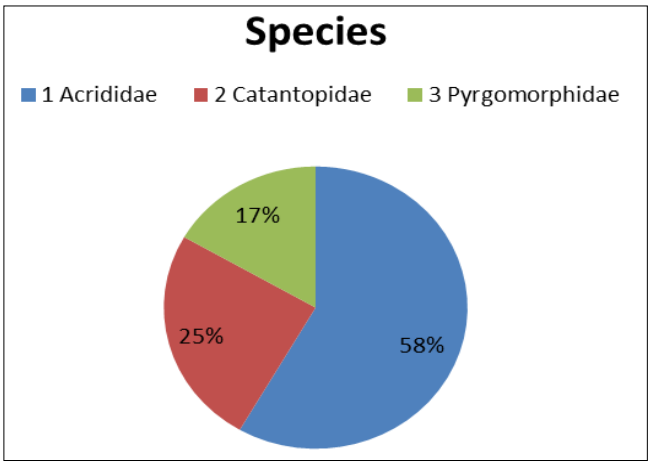

Fig 1

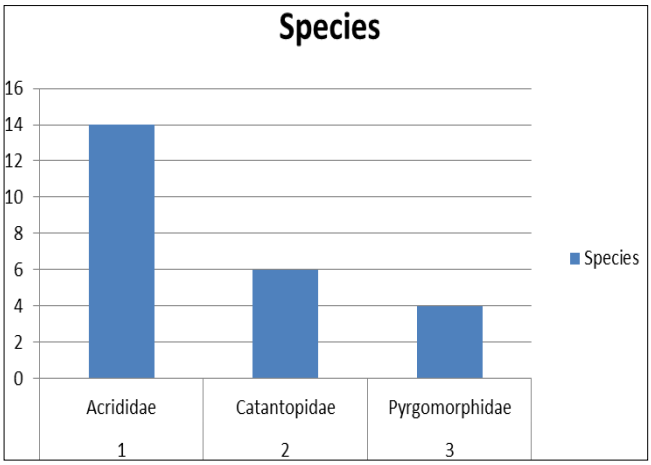

Fig 2

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