TAXONOMY AND FIELD OBSERVATIONS OF GRASSHOPPER AND LOCUST FAUNA (ORTHOPTERA: ACRIDOIDEA) OF JHARKHAND, INDIA

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ABSTRACT: The state of Jharkhand (India) is a biodiversity hotspot owing to its topography and geographical features and is blessed with tropical zone dry and wet forests. The mainstay of tribal communities is agriculture. Acridoids have long been credited as forest and crop pest and till date there is no consolidated work dealing with the distribution of locusts and grasshoppers from the state. Keeping this in view the area was surveyed and acridoid fauna has been listed in addition to worked out taxonomy. Keys to subfamilies and genera have been provided. The interaction of concerned samples with their natural habitat was observed very closely and has been listed wherever required. Collection of 421 samples has been worked out that comprised 41 species belonging to 28 genera of 10 subfamilies, 3 families and 4 tribes.

KEY WORDS: Observation, Taxonomy, Acridoidea, Jharkhand (India).

Orthoptera is one of the most diverse orders of class Insecta with superfamily Acridoidea being most noted pest of agriculture and forest areas. It is because of this reason that attempt has been made to work out the taxonomy of the same alongwith some ecological or field observations that help us to understand the interaction and behavior of this fauna. The order orthoptera consists of insects with incomplete metamorphosis, including the grasshoppers, crickets and locusts. Many insects in this order produce sound (known as a "stridulation") by rubbing their wings against each other or their legs. They are also well adapted for flight since both direct and indirect muscles work together during flight movements and thus explains the reason for these insects to cover long distances during swarming conditions that mainly results from overcrowding and scarcity of food. Grasshoppers are beneficial to a healthy, vigorous, grassland ecosystem when they are at low to moderate (noneconomic) densities. This family of insects preceded today's rangeland plant species and vertebrate animal life by millions of years (Carpenter, 1953). Grasshoppers developed in the rangeland ecosystem during a long period of coevolution with other flora and fauna. Grasshoppers' ecologic role (Van Hook, 1971) of providing food for wildlife, stimulating plant growth, creating plant litter for the soil, and cycling elements and nutrients was developed as a functional part of the whole ecosystem.

Acridoidea is one of the important superfamilies of suborder Caelifera (Short-horned grasshoppers with three segmented tarsi and a short ovipositor), rest being Tridactyloidea, Tetrigoidea and Eumastacoidea. Tetrigoidea is easily distinguishable from Acridoidea by the elongate pronotum, usually extending beyond the end of the body, by the absence of an arolium between the claws and the two-segmented tarsi of the fore and middle legs. The other Superfamilies of Caelifera are easily recognizable at sight and are not frequently encountered. Superfamily Acridoidea has shown maximum diversity and divided into various families of which family Acrididae, Catantopidae and Pyrgomorphidae are widely

distributed in India. Members of Superfamily Acridoidea harm chiefly by defoliation, that on the other hand drastically affect the produce by decreasing the overall photosynthetic area or we can say that they are capable enough to affect the green cover (forest and wetlands) negatively.

Since earlier days to present time locusts are the main pests in countries bordering deserts as for example Africa, where swarms of locusts have resulted in famine like conditions many a times. A notable taxonomical work on Acrididae was made by Kirby (1914) in the series 'Fauna of British India' and he divided the family Acrididae into eight subfamilies. Uvarov (1921, 1924, 1927, 1942) studied in detail Indian Acrididae. Agarwala (1952) contributed some studies on female copulatory structures in relation to oviposition sites while Roonwal (1956) contributed some studies on the nymphal structures and ecology on Acrididae. Dirsh (1965, 1975), Tandon (1976), Shishodia (1987, 1997, 1999), Tandon & Shishodia (1969-1989), Usmani & Shafee (1980-1990), Kumar & Virktamath (1991a,b), Murlirangan & Srinivasan (1992), Hazra et al. (1993), Priya & Narendran (2003), Kulkarni & Shishodia (2004, 2005) and Usmani (2005) have contributed works on the taxonomy of this group. More recently, Tandon & Khera (1978), Julka et al. (1982), Shishodia & Hazra (1986) and Dey & Hazra (2003) have done work on the taxonomy as well as on the ecology of this group.

The state of Jharkhand was formed on 15 November 2000 with 18 districts, which were formerly part of south Bihar. Most of the state lies on the Chota Nagpur Plateau, which is the source of the Koel, Damodar, Brahmani, Kharkai and Subarnarekha rivers, whose upper watersheds lie within Jharkhand. Much of the state is still covered by forest. Jharkhand has a rich variety of flora and fauna. Soil content of Jharkhand state mainly consist of soil formed from disintegration of rocks and stones, and soil composition is further divided into Red Soil, found mostly in the Damodar valley and Rajmahal area; Micacious soil (containing particles of mica), found in Koderma, Jhumeritilaiya, Barkagaon and areas around the Mandar hill; Sandy soil, generally found in Hazaribagh and Dhanbad; Black soil, found in Rajmahal area and finally Laterite soil, found in western part of Ranchi, Palamu, and parts of Santhal Parganas and Singbhum.

Although the territory of Jharkhand holds a rich store of minerals; yet agriculture in Jharkhand is the mainstay for most of the tribal communities. In fact, about 80% of the total population practices agriculture in Jharkhand. It is noteworthy that the total area of agricultural lands in Jharkhand is about 2.57 hectares, which produces a total of 37.85 tonnes of food grains. Among the important crops that form an important part of agriculture of Jharkhand are Paddy, Wheat, Pulses, Oilseeds, Maize, Til, Sugarcane, Bajra, etc. These crops largely support the socio-economic condition of the people of Jharkhand. It is noteworthy that climate in Jharkhand largely support the cultivation of crops within the territory.

Brief descriptions of the species spotted in this region have been provided with notes on their colouration. In the present study the authors uphold recent workers in classifying Acridoidea with a few generally accepted changes. The Superfamily Acridoidea is here understood in the same sense as by Uvarov (1966). No survey work so far has been done exclusively for this group from the state of Jharkhand. There are very few reports on the taxonomy of Acridoidea from this region. There is no systematic study on the locusts and grasshoppers belonging to the Superfamily Acridoidea from Jharkhand, a hot spot of Biodiversity. Keeping in view the above fact, the present work is aimed at studying one of the Superfamilies of Orthoptera which is most widely distributed and show a very high degree of biological diversity in this land of forest.

MATERIAL AND METHODS

About 421 specimens of grasshoppers were collected from various agricultural and pasture areas along with forest habitat of Jharkhand which served the basis for the present critical study. A complete record was also maintained indicating the reference number, locality, date of collection and name of host plants etc.

I) Collection of adult grasshoppers

The authors surveyed various agricultural areas of Jharkhand during the period 2010-2011 for the collection of grasshoppers and locusts. They were caught by hands and by the ordinary aerial insect net. The net was used for catching insects individually or by sweeping on grasses, bushes and other vegetables. Since some Acridoidea live on trees, it is sometimes highly rewarding to investigate the branches of trees. Attempts were made to collect the specimens from their host plants. Different parts of crops were examined. Attention was also given to fruits and vegetables. The collected specimens were killed in cyanide bottles.

II) Field Observations during the period of collection

The concerned insects were closely studied in their natural habitat. Their interaction with the particular host plant, mode of damage caused, response to predator, camouflage pattern, activity during different phases of day, mode of flight in response to some approaching danger, their natural enemies were some of the common points of interest that have been worked upon.

III) Preparations for morphological studies

Dry mounts were also prepared for better understanding of certain characters like size, colour, texture etc. For this purpose, the specimens were first relaxed, stretched and later, they were pinned and labeled. Permanent collections of pinned specimens were kept in store boxes and cabinets for further studies on their morphological structures.

IV) Preparations for genitalic studies

For a detailed study of the various components of genitalia, the permanent slides were prepared and examined under the microscope in order to make a detailed study of the genitalic structures. Drawings were initially made with the help of a camera lucida. Details were filled in by conventional microscope examination.

Key to subfamilies and genera of Acridoidea MacLeay based on Indian specimens

1. Prosternal process present; hind tibia with or without external apical spine; epiphallus disc or bridge shaped, bridge divided or undivided; spermatheca with apical and pre-apical diverticula tubular.....**2**

--- Prosternal process usually absent, if present, body strongly elongate and antennae ensiform; hind tibia without external apical spine; epiphallus bridge shaped, bridge undivided; spermatheca with apical diverticulum short or rudimentary, pre-apical diverticulum sac like.....**10**

2. Lower knee lobe of hind femur spined; valves of ovipositor serrate or spined; hind tibia flattened.....**OXYINAE** BRUNNER, 1893..... ***Oxya*** Serville, 1831

--- Lower knee lobe of hind femur never spined; valves of ovipositor never serrate or spined; hind tibia never flattened.....**3**

3. Hind femur much robust, never reaching beyond apex of abdomen; epiphallus disc shaped, ancorae finger shaped, articulated in the middle of the disc, lophi absent; male circus large, strong, curved and toothed apically.....
.....**CALLIPTAMINAE** TINKHAM, 1940..... ***Acorypha*** Krauss, 1877
--- Hind femur never much robust, usually reaching beyond apex of abdomen; epiphallus bridge shaped, ancorae usually curved, articulated with bridge, lophi present; male circus never toothed apically.....**4**

4. Radial area of tegmen with a series of regular, parallel, thickened, transverse stridulatory veinlets; valves of aedeagus divided or connected by small or indistinct flexure; arolium large..... **HEMIACRIDINAE** DIRSH, 1956 **.....13**
--- Radial area of tegmen without transverse stridulatory veinlets; valves of aedeagus flexure; arolium of variable size **5**

5. Hind femur with lower basal lobe as long as upper one; tegmino-alar stridulatory mechanism present ..... **ROMALEINAE** BRUNNER 1893..... ***Teratodes*** Gray, 1832
--- Hind femur with lower basal lobe shorter than upper one; tegmino-alar stridulatory mechanism absent **6**

6. Mesosternal interspace closed; hind femur with dorsal carina smooth; external apical spine of hind tibia present.....
.....**TROPIDOPOLINAE** JACOBSON, 1905.....***Tristria*** Stal, 1873
--- Mesosternal interspace open; hind femur with dorsal carina finely denticulate, sometimes smooth; external apical spine of hind tibia usually absent..... **7**

7. Mesosternal lobes rectangular; ancorae small or indistinct; pronotum with median carina slightly raised; spermatheca with apical diverticulum very long and slender.....
..... **CYRTACANTHACRIDINAE** KIRBY, 1902.....**20**
--- Mesosternal lobes rounded; ancorae well developed and curved; pronotum with median carina never raised; spermatheca with apical diverticulum moderately long..... **8**

8. Body small to medium size; integument rough; last abdominal tergite in male with well developed furcula; male subgenital plate with transverse fold; bridge of epiphallus divided medially..... **COPTACRIDINAE** BRUNNER, 1893.....**23**
--- Body medium to large size; integument smooth; last abdominal tergite in male without well developed furcula; male subgenital plate without transverse fold; bridge of epiphallus usually undivided medially..... **9**

9. Pronotum with lateral carinae linear; male circus strongly compressed, apex downcurved.
..... **EYPREPOCNEMIDINAE** BRUNNER, 1893.....**26**
--- Pronotum without lateral carinae, if present, never linear; male circus variable, never strongly compressed, apex normal ..... **CATANTOPINAE** BRUNNER, 1893.....**31**

10. Stridulatory serration on inner side of hind femur absent..... **11**
--- Stridulatory serration on inner side of hind femur present..... **12**

11. Body usually slender; frons oblique; medial area of tegmen usually without intercalary vein, if present, never serrated in both sexes..... **ACRIDINAE** MAC LEAY, 1821.....**33**
--- Body rather sturdy; frons usually vertical; medial area of tegmen with intercalary vein usually serrated..... **OEDIPODINAE** WALKER, 1871.....**38**

12. Body very slender; antennae flattened, ensiform; eyes nearer to apex of head than to its base; hind femur long and narrow, its stridulatory file represented by closely set rigid tubercles and articulated bristles..... **TRUXALINAE** WALKER, 1870
--- Body moderately slender; antennae normally filiform but tend to be compressed and ensiform in species with elongated body; eyes never nearer to apex of head than to its base; hind femur never extremely narrow, its stridulatory file with articulated pegs.....
..... **GOMPHOCERINAE** FIEBER, 1853.....**47**

13. HEMIACRIDINAE: Prosternal process antero-posteriorly compressed; elytra or wings fully developed, much longer than pronotum; dorsum of pronotum flattened, lateral carina present .....***Spathosternum*** Krauss, 1877
--- Prosternal process conical, never compressed, elytra or wings fully developed or shortened, dorsum of pronotum rounded or flattned, lateral carinae present or absent..... ***Hieroglyphus*** Krauss, 1877

14. CYRTACANTHACRIDINAE: Prosternal process vertical or slightly bent towards mesosternum, but not touching it, usually laterally compressed..... ***Schistocerca*** Stal, 1873
--- Prosternal process strongly bent towards mesosternum, touching or nearly touching it, necer laterally compressed **24**

15. Integument slightly granulose and punctuate-dotted; pronotum with median carina low, weakly interrupted by the transverse sulci; epiphallus with lophi long and narrow..... .....***Cyrtacanthacris*** Walker, 1870
--- Integument strongly granulose; pronotum with median carina high, crest like, distinctly interrupted by transverse sulci; epiphallus with lophi broadly triangular..... .....***Chondracris*** Uvarov, 1923

16. COPTACRIDINAE: Pronotum with median carina well raised, crossed by posterior transverse sulcus only, aedeagus with apical valve less than half the length of basal valve ....***Epistaurus*** I. Bolivar, 1889
--- Pronotum with median carina low; crossed by three transverse sulci; aedeagus with apical valves more than half the length of basal valve, frontal ridge between antennae much wider than vertex between the eyes; prosternal process cylindrical..... ..... ***Eucoptacra*** I. Bolivar, 1902

17. EYPREPOCNEMIDINAE: Hind tibia with dense spines; prosternal process with apex bilobate..... .....***Tylotropidius*** Stal, 1873
--- Hind tibia with sparse spines; prosternal process with apex never bilobate **27**

18. Fastigium of vertex without depression; male subgenital plate excised at apex..... ..... ***Cataloipus*** I. Bolivar, 1890
--- Fastigium of vertex with depression; male subgenital plate never excised at apex, male cercus narrow, weakly compressed, apex acute ..... ***Eyprepocnemis*** Fieber, 1853

19. CATANTOPINAE: Pronotum at least slightly constricted in middle; prosternal process conical..... .....***Xenocatantops*** Dirsh, 1953
--- Pronotum never constricted in middle.....**29**

20. Frontal ridge sulcate; prosternal process laterally compressed..... .....***Stenocatantops*** Thunberg, 1815
--- Frontal ridge flat or slightly depressed; prosternal process cylindrical or slightly antero-posteriorly compressed with rounded apex.....***Diabolocatantops*** Jago, 1984

21. ACRIDINAE: Head elongate; hind femur very long and slender..... .....***Acrida*** Linnaeus, 1758
--- Head never elongate; Hind femur never very long and slender.....**31**

22. Pronotum with lateral carinae straight, nearly parallel..... ***Phlaeoba*** Stal, 1861
--- Pronotum with lateral carinae diverging in metazona..... ***Orthochtha*** Karsch, 1891

23. OEDIPODINAE: Dorsum of pronotum with numerous longitudinal parallel ridges..... .....***Morphacris*** Walker, 1870
--- Dorsum of pronotum without longitudinal ridges.....**33**

24. Dorsum of pronotum with X-shaped pattern.....***Oedaleus*** Fieber, 1853
--- Dorsum of pronotum without X-shaped pattern **34**

25. Pronotum with median carina crossed by two transverse sulci.....**35**
--- Pronotum with median carina crossed by one transverse sulcus or not crossed at all.....**36**

26. Pronotum with median carina strongly raised in prozona forming two tooth like projections, sharp in metazona.....***Trilophidia*** Stal, 1873
--- Pronotum with median carina equally raised in prozona and metazona, not forming tooth like projection, lateral carinae irregular, tuberculate, sometimes absent in metazoan.... ..... ***Acrotylus*** Fieber, 1853

27. Pronotum with median carina weak.....***Aiolopus*** Fieber, 1853
--- Pronotum with median carina well developed.....**37**

28. Median carina of pronotum, in profile, not excised at posterior sulcus, pronotum strongly crest-like, anteriorly projecting above vertex; frontal ridge flat..... ..... ***Gastrimargus*** Saussure, 1884
--- Median carina of pronotum, in profile, excised at posterior sulcus.....**38**

29. Median carina of pronotum strongly raised in prozona and moderately in metazona; deeply excised by posterior transverse sulcus; frontal ridge sulcate..... .....***Oedipoda*** Latreille, 1829
--- Median carina of pronotum equally raised in prozona and metazona; slightly excised by posterior transverse sulcus; frontal ridge flat.....**39**

30. Pronotum strongly tectiform; mesosternal interspace as long as wide..... .....***Locusta*** Linnaeus, 1758
--- Pronotum slightly tectiform; mesosternal interspace much wider than long..... .....***Chloebora*** Saussure, 1884

31. GOMPHOCERINAE: Fastigial foveolae weak, hardly visible from above; fastigium of vertex without median carinula; pronotum with lateral carinae angularly incurved; arolium of small size.....**41**
--- Fastigial foveolae deep, visible from above; fastigium of vertex with median carinula; pronotum with lateral carinae straight, slightly diverging in metazoan; arolium of medium size.....**42**

32. Body of small size; vertex without lateral carinulae; frontal ridge sulcate; hind tibia with inner spur of inner side about as long as external one.....***Leva*** I. Bolivar, 1909
--- Body of medium size; vertex with lateral carinulae; frontal ridge flat; hind tibia with inner spur of inner side slightly longer than external one..... ***Stenohippus*** Uvarov, 1926

33. Valvulae of ovipositor covered by supra anal plate ..... ***Dociostaurus*** Fieber, 1853
--- Valvulae of ovipositor exserted, free **43**

34. Pronotum not constricted; lateral carinae entirely dorsal..... ..... ***Aulacobothrus*** Bolivar, 1902
--- Pronotum constricted ..... ***Chorthippus*** Fieber, 1852

TAXONOMIC ACCOUNT

Superfamily Acridoidea MacLeay, 1821
Family Acrididae MacLeay, 1821
Subfamily Oxyinae Brunner von Wattenwyl, 1893
Tribe Oxyini Brunner von Wattenwyl, 1893

Oxya japonica japonica (Thunberg, 1815)

Diagnostic characters: Antennae as long as or slightly longer than head and pronotum together. Lateral longitudinal ridges on ventral surface of female sub genital plate without spines except at apices. Ovipositor valves with short dents. Posterior ventral basivalvular sclerite with a large spine on its inner ventral margin, male cercus with sub-acute or truncate apex.
Material examined: 1♂, 14-V-2010, on underlying grasses in vegetable field, Dhab, Koderma; 1♀, 5-VII-2010, on paddy, Balu, Latehar.
Morphometry: (Length in mm)
Male : Body 11.7, Tegmina 19.9, Hind femur 10.7, Pronotum 7.8
Female: Body 14.9, Tegmina 23.5, Hind femur 14.9, Pronotum 9.0
Field observations: Spotted feeding on the upper half portion of cereal crops usually paddy. It is a major pest of paddy crop.
Natural enemies: No natural enemies are recorded.
Distribution: Uttar Pradesh, Rajasthan, Tamil Nadu, Tripura, West Bengal, Gujarat, Bihar, Jharkhand, Assam, Manipur, Karnataka, Kerala, Punjab.

Oxya hyla hyla (Serville, 1831)

Diagnostic characters: Body of medium size, antennae filiform, longer than, as long as, or shorter than head and pronotum together; fastigium of vertex short, without mid-longitudinal carinula, frontal ridge sulcate, dorsum of pronotum slightly flattened, crossed by three transverse sulci, median carina weak, lateral carinae absent, metazona shorter than prozona, posterior margin rounded or obtusely angular. Ovipositor valves with long hook like dents posterior ventral basivalvular sclerites with very small spinelets on its inner ventral margin. Male circus with subacute or truncate apex.
Material examined: 1♀, 13-V-2010, on paddy, Sarabh, Hazaribagh; 2♀, 24-V-2010, on paddy, Baramasia, Dumka.
Morphometry: (length in mm)
Female: Body 13.8, Tegmina 22.2, Hind femur 13.4, Pronotum 8.2
Field observations: Spotted feeding on the upper half portion of cereal crops usually paddy. Voraciously feeds on the leaf tips that are comparatively soft. Reputed pest of paddy.
Natural enemies: No natural enemies recorded.
Distribution: Punjab, Haryana, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Tamil nadu, West Bengal, Assam, Meghalaya, Manipur.

Oxya velox (Fabricius, 1787)

Diagnostic characters: Posterior ventral basivalvular sclerites of ovipositor without any well defined spines on its lower inner margin. Median pair of spines on posterior margin of subgenital plate set wider apart. Male circus conical with subacute apex.
Material examined: 1♀, 15-V-2010, on grasses, Ramgarh; 1♀, 24-VII-2010, on paddy saplings, Namkum, Ranchi; 1♀, 25-V-2010, on gourd, Amarpur, Godda.
Morphometry: (length in mm)
Female: Body 13.7, Tegmina 23.05, Hind femur 14.65, Pronotum 8.85
Field observations: Camouflages easily and mostly encountered in the saplings of paddy plant feeding on nearly all plant parts. Commonly spotted in paddy saplings rather than the crop.
Natural enemies: Red mite *Eutrombidium trigonum* also observed parasitizing this species.

Distribution: Bihar, Jharkhand, Uttar Pradesh, Arunachal Pradesh, Haryana.

Subfamily Hemiacridinae Dirsh,1956
Tribe Hieroglyphini

Hieroglyphus banian (Fabricius, 1798)

Diagnostic characters: Green including the antennae. Pronotum smooth with four sulci, narrowly lined with black, the first obsolete above, the second on the sides and the last two continuous. Tegmina subhyaline, densely reticulated and greenish at the base, with green nervures, wings as long as the tegmina, greenish hyaline. The three sub-terminal ventral segments with silky tufts of hair on the middle. Hind tibiae blue with black tipped spines. Antennae with the basal joint yellowish green, the rest dark green tipped with yellow.
Material examined: 1♀, 4-VII-2010, on sugarcane, Kobna, Chatra.
Morphometry: (length in mm)
Female: Body 49.0, Tegmina 33.1, Hind femur 23.9, Pronotum 9.4
Field observations: Feeds on entire leaf and jumps off large distances when disturbed because of strong wings.
Natural enemies: The authors found small reddish mites possibly *Trombidium* sp. on adults but doubted whether they caused any mortality. 15% of egg pods dug up near Bangalore was parasitized by *Scelio hieroglyphi* (Channa Basa, 1953). Many vertebrates including frogs, snakes, lizards, birds and mammals occasionally feed on *H. banian* but none is regarded as an important predator.
Distribution: West Bengal, Andhra Pradesh, Sikkim, Himachal Pradesh, Bihar, Jharkhand, Orissa, Rajasthan, Maharashtra, Tamil Nadu, Uttar Pradesh.

Hieroglyphus nigrorepletus (Bolivar, I., 1912)

Diagnostic characters: Body medium to large; antennae filiform, longer than head and pronotum together, fastigium of vertex rounded or trapezoidal, flat, with obtuse lateral carinulae, frons oblique, frontal ridge sulcate, dorsum of pronotum cylindrical, crossed by three deep transverse sulci, median carina weak, lateral carinae absent,Dorsum of pronotum with two broad black parallel bands connecting all sulci.
Material examined: 1♂,12-VII-2010, on paddy, Patia, Gumla.
Morphometry: (length in mm)
Male: Body 42.0, Tegmina 26.9, Hind femur 17.4, Pronotum 6.0
Field observations: Feeds on entire leaf and jumps off large distances when disturbed because of strong wings. Possesses comparatively low camouflage potential and can be spotted easily on the crops.
Natural enemies: Myna perched on the trees surrounding the plot preyed upon it very efficiently.
Distribution: Uttar Pradesh, Jharkhand, Punjab.

Tribe Spathosternini Krauss, 1877

Spathosternum prasiniferum (Krauss, 1877)

Diagnostic characters: Small, green, integument finely rugose almost smooth. Head conical, fastigium of vertex obtusely angular or parabolic. Filiform antennae, frontal ridge narrow and sulcated. Two broad blackish band or dark greenish band running behind the lower part of the eyes and below the lateral carinae of the pronotum which is banded above by a narrow pale yellow line and lateral carinae present, Prosternal process large, strongly, antero–posteriorly compressed, spatulated, inclined backwards.
Material examined: 2♀, 16-VII-2010, on moong, 1♀1♂, 1-VII-2010, on grasses, Ketar, Garhwa; 2♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu; 2♀3♂, 9-VII-2010, on grasses, Kisko, Lohardaga; 6♀, 15-VII-2010, on paddy, Malsara, Simdega; 1♀2♂,16-VII-2010, on grasses, Kutipi, West Singbhum; 4♀, 18-VII-2010, on grasses, Maluka, West Singhbhum; 2♀, 21-VII-2010, on grasses, Khunti; 3♀, 24-VII-2010, on grasses, Namkom,

Ranchi; 1♂3♀, 25-VII-2010, on grasses, Sonahata, Ranchi; 1♀, 13-V-2010, on grasses of brinjal field, Sarabh, Hazaribagh; 1♂, 14-V-2010, on grasses, Dhab, Koderma; 2♀, 15-V-2010, on grasses, Ramgarh; 12♀4♂, 16-V-2010, on grasses, Birni, Giridih; 8♀4♂, 19-V-2010, on grasses, Gomoh, Dhanbad; 2♀1♂, 21-V-2010, on grasses, Mohanpur, Jamtara; 4♀1♂, 22-V-2010, on grasses, Sarawan, Deogarh; 2♂, 24-V-2010, on grasses, Baramasia, Dumka; 8♀, 25-V-2010, on grasses, Amarpur, Godda; 2♂, 26-V-2010, on grasses, Maharajpur, Sahibganj; 2♀1♂, 28-V-2010, on grasses, Pakur; 12♀, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 17.5, Tegmina 12.8, Hind femur 8.65, Pronotum 2.85
Female: Body 19.2, Tegmina 14.5, Hind femur 9.65, Pronotum 3.0
Field observations: Predominantly present on roadside grasses, grassy patches along the periphery of crop field, even in wild vegetation but on the grass present here and there. One can comment that this genus is cosmopolitan in distribution.
Natural enemies: No natural enemies recorded.
Distribution: West Bengal, Andhra Pradesh, Arunachal Pradesh, Bihar, Jharkhand, Goa, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh.

Subfamily Teratodinae Brunner von Wattenwyl, 1893

Teratodes monticollis (Gray, 1832)

Diagnostic characters: Body of medium size; antennae filiform, much shorter than head and pronotum together, head broad, fastigium of vertex rounded, frontal ridge sulcate, much widened between antennae, pronotum much compressed, forming a high crest, covering the head anteriorly and half of abdomen posteriorly, never crossed by transverse sulci, lateral carinae absent, prosternal process short, straight, apex pointed, mesosternal interspace open, tegmina and wings developed, tegmino-alar stridulatory mechanism present, hind femur short, stout, tuberculate, lower basal lobe about as long as upper one, hind tibia without external apical spine.
Material examined: 1♀, 13-V-2010, on dry leaves, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 28.15, Hind femur 12.15, Pronotum 17.15.
Remarks: Exceptionally high, raised collar like pronotum. The sample is light brown in colour.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Maharashtra, Gujarat, Tamil Nadu.

Subfamily Tropidopolinae Jacobson, 1902
Tribe Tristriini Mishchenko, 1945

Tristria pulvinata (Uvarov, 1921)

Diagnostic characters: Prosternal tubercle is strongly bent backward, Lower surface very broad, concave, trapezoidal with lateral margins raised and hind margin lying on mesosternum. Elytra not reaching the apex of abdomen, wings fully developed.
Material Examined: 1♀1♂, on grasses, 28-V-2010, Pakur; 1♀1♂, on grasses, 16-VII-2010, Kutipi, West Singbhum; 2♀6♂, on grasses, 4-VII-2010, Kobna, Chatra; 2♀, on sugarcane, 12-VII-2010, Patia, Gumla; 4♀, on grasses, 21-VII-2010, Khunti; 6♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu, 12♀, on grasses, 24-VII-2010, Namkom, Ranchi.
Morphometry: (length in mm)
Male: Body 29.75, Tegmina 18.55, Hind femur 15.25, Pronotum 4.35
Female: Body 48.0, Tegmina 25.1, Hind femur 19.8, Pronotum 5.5
Field observations: The species is graminivorous. It is a grassland species and is found in many species of grasses. At some of the sites the species was present in abundance.
Natural enemies: No natural enemies recorded.

Distribution: West Bengal, Andhra Pradesh, Assam, Bihar, Jharkhand, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh.

Subfamily Cyrtacanthacridinae Uvarov, 1923
Tribe Cyrtacanthacridini Kirby, 1902

Schistocerca gregaria gregaria (Forskal, 1775)

Diagnostic characters: Body of large size, integument finely punctuate, antennae filiform, shorter than head and pronotum together, fastigium of vertex trapezoidal, with shallow longitudinal depression, frontal ridge low, narrower than interocular distance, pronotum constricted, crossed by three transverse sulci, median carina low, sometimes indistinct in prozona, lateral carinae absent, metazona about as long as prozona, posterior margin rounded, prosternal process cylindrical, moderately bent towards mesosternum but not touching it, tegmina fully developed, apex obliquely rounded, veinlets in the apical part more or less perpendicular to the veins, hind femur with lower basal lobe shorter than upper, external apical spine of hind tibia absent.
Material Examined: 1♀1♂, 16-V-2010, on shrubs, Birni, Giridih.
Morphometry: (length in mm)
Male: Body 47.15, Tegmina 38.5, Hind femur 21.15, Pronotum 9.0
Female: Body 67.0, Tegmina 52.8, Hind femur 30.65, Pronotum 13.4
Field observations: Well reputed for gregarisation in superfamily Acridoidea and was sampled from shrubs bordering wheat crop. Jumps over long distances when disturbed and spotted easily owing to its size. Body being dull yellowish with brown patterns perfectly merges with the surroundings.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Jharkhand.

Chondacris rosea (De Geer, 1773)

Diagnostic characters: Body of large size, integument strongly granulose, antennae filiform, longer than head and pronotum together, fastigium of vertex trapezoidal, frontal ridge slightly narrowed at apex, Pronotum tectiform, crossed by three transverse sulci, median carina raised, lateral carinae absent, Prosternal process large, strongly bent towards mesosternum, nearly touching it, mesosternal interspace open, lobes rectangular. Supra anal plate weakly trilobite, cercus compressed, apex slightly attenuate and incurved, subgenital plate elongate, acutely conical, Epiphallus bridge undivided, ancorae absent, lophi broadly triangular. Ovipositor valves comparatively slender, with curved apices, ventral valve with angular lateral projection on outerside.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda.
Morphometry: (length in mm)
Male: Body 67.7, Tegmina 51.75, Hind femur 32.7, Pronotum 16.2
Female: Body 91.3, Tegmina 69.45, Hind femur 43.85, Pronotum 22.6
Field observations: Sampled from pigeon pea field, exceptionally large in size and flies over large distances. Found feeding on upper portions of the plant that is tough as compared to other parts, may be because of the presence of strong mandibles.
Natural enemies: No natural enemies recorded.
Distribution: Meghalaya, Bihar, Jharkhand.

Cyrtacanthacris tatarica tatarica (Linnaeus, 1758)

Diagnostic characters: Body large, integument slightly granulose and punctuate-dotted, antennae filiform, about as long as head and pronotum together, pronotum moderately tectiform and slightly constricted, crossed by three transverse sulci, median carina low, lateral carinae absent, prosternal process large, widened in middle and gradually narrowing towards subacute apex. Supra anal plate slightly trilobite, with angular apical lobes, cercus compressed, subconical, apex subacute. Subgenital plate elongate, acutely conical, Female subgenital plate with posterior margin having a conical projection medially.

Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda; 3♀, 29-V-2010, on wheat, Murkum, Saraikela; 2♀, 22-V-2010, on shrubs surrounding wheat field, Sarawan, Deogarh; 4♀1♂, 13-V-2010,on pigeon pea, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Male: Body 52.0, Tegmina 41.25, Hind femur 25.75, Pronotum 9.7
Female: Body 61.7, Tegmina 45.6, Hind femur 29.65, Pronotum 12.5
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours and from the dense wild vegetation surrounding the same field during early evening hours. The observed activity was high during morning while below moderate activity was noticed during evening hours.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Coptacridinae Brunner Von Wattenwyl, 1893

Epistaurus sinetyi (Bolivar, I., 1902)

Diagnostic characters: Body pale reddish, wings with borders hyaline, outer side of hind femur obliquely trifasciate, abdomen red, spotted dorsally,antennae slightly widened apically, as long as or longer than head and pronotum together, fastigium of vertex narrow, concave with sharp lateral carinulae, frons almost vertical, frontal ridge flat, narrowed at the fastigium.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea, Amarpur, Godda.
Morphometry: (length in mm)
Male: Body 14.4, Tegmina 10.9, Hind femur 7.54, Pronotum 2.87
Female: Body 17.80, Tegmina 12.49, Hind femur 8.15, Pronotum 4.17
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours. The insects exhibited moderate activity and hovered around spiny bushes bodering the crop field.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand

Eucoptacra praemorsa (Stal, 1861)

Diagnostic characters: Tegmina with few irregular oblique dark spots; pronotum with posterior transverse sulcus placed a little before the middle, ovipositor with dorsal valve much longer than lateral apodeme, preapical diverticulum of spermatheca with a long protuberance basally.
Material Examined: 1♀1♂, 25-V-2010, on pigeon pea
Morphometry: (length in mm)
Male: Body 21.21, Tegmina 16.03, Hind femur 10.26, Pronotum 3.61
Female: Body 27.41, Tegmina 22.03, Hind femur 13.65, Pronotum 4.64
Field observations: The specimen was sampled from the stubbles of pigeon pea and wheat during morning hours and from the dense wild vegetation surrounding the same field during early evening hours. The observed activity was high during morning while below moderate activity was noticed during evening hours.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Eyprepocnemidinae Brunner Von Wattenwyl, 1893
Tribe Eyprepocnemidini Brunner Von Wattenwyl, 1893

Tylotropidius varicornis (Walker, 1870)

Diagnostic Characters: Body of medium size; antennae filiform, slightly shorter than head and pronotum together, fastigium of vertex almost parabolic, apex slightly truncate, frons oblique, frontal ridge flat, moderately wide, dorsum of pronotum slightly tectiform, median carina sharp, lateral carinae obtuse, excurved and slightly divergent backwards, metazona

shorter than prozona, posterior margin rounded or widely obtuse-angular, prosternal process antero-posteriorly compressed, with bifid apex, tegmina fully developed or shortened, hind femur very slender, elongate, hind tibia with dense spines, external apical spine absent, arolium of medium size.
Material examined: 2♂, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 33.16, Tegmina 25.68, Hind femur 22.14, Pronotum 5.12
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Bihar, Jharkhand, Uttar Pradesh, Assam, Manipur, Meghalaya, Kerala, Andhra Pradesh.

Cataloipus indicus (Uvarov, 1942)

Diagnostic Characters: Body of large size, antennae filiform, slightly widened in apical half, longer than head and pronotum together, fastigium of vertex parabolic, globular without concavity and median carinula, frons oblique, frontal ridge wide, flat, dorsum of pronotum weakly tectiform, crossed by three deep transverse sulci, prosternal process almost tongue shaped, externo-median area of hind femur along upper edge with a black stripe reaching middle of length, hind tibia light blue.
Material examined: 1♂, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 30.30, Tegmina 18.55, Hind femur 22.44, Pronotum 5.56
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Tamil Nadu, Uttar Pradesh, Kerala, Andhra Pradesh, Bihar, Jharkhand.

Eyprepocnemis alacris alacris (Serville, 1838)

Diagnostic characters: This is a typical species of the genus. It can easily be separated from other members of genus in having bluish grey hind tibia with two whitish signs at the base and reddish apex and tarsus, male cercus gradually narrowing towards apex incurved and down curved. Fastigium of vertex round, frontal ridge with characteristic dark brown markings on lateral carinae, prosternal process cylindrical and antero-posteriorly compressed. Elytra and wings fully developed, elytra with numerous brown spots, bluish grey hind tibiae.
Material examined: 2♀, 5-VII-2010, on sugarcane, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 51.55, Tegmina 37.39, Hind femur 28.25, Pronotum 8.65
Field observations: It is a polyphagous species.
Natural enemies: No natural enemies are recorded.
Distribution: Tamil Nadu, Uttar Pradesh, Assam, Manipur, Meghalaya, Kerala, Andhra Pradesh, Bihar, Jharkhand.

Subfamily Catantopinae Brunner Von Wattenwyl, 1893

Stenocatantops splendens (Thunberg, 1815)

Diagnostic Characters: Frontal ridge sulcate; prosternal process laterally compressed Body of medium size, antennae filiform, longer than head and pronotum together, fastigium of vertex parabolic, slightly depressed with median and lateral carinulae, apex obtuse, frons oblique; frontal ridge flat and of medium width, dorsum of pronotum flattened or weakly tectiform, with sharp median and lateral carinae, lateral carinae straight, sometimes diverging backwards or weakly incurved, metazona slightly shorter than prozona, posterior margin broadly rounded, prosternal process subcylindrical or slightly antero-posteriorly compressed, slightly inclined backwards, tegmina fully developed or shortened, hind femur slender, hind tibia with sparse spines, external apical spine absent.

Material examined: 4♀, 18-VII-2010, Maluka, on maize, West Singhbhum; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀,22-V-2010, on pigeon pea, Sarawan, Deogarh; 1♀1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 4♀, 29-V-2010, on pigeon pea, Murkum, Saraikela; 6♀,12-VII-2010, on sugarcane, Patia, Gumla; 12♀, 25-VII-2010, on shrubs, Sonahata, Ranchi.
Morphometry: (length in mm)
Male: Body 29.9, Tegmina 24.1, Hind tibia 13.0, Pronotum 5.65
Female: Body 32.7, Tegmina 25.8, Hind tibia 14.8, Pronotum 7.01
Field observations: *C. pinguis innotablis* is widely distributed in pulse crop and is commonly found in shrubs and herbs (wild vegetations).
Natural enemies: In Thailand adults are affected by the fungus *Entomophthora grylli* Fres. (Roffey, 1965). Red mite *Eutrombidium trigonum* also observed parasitizing this species.
Distribution: Orissa, Goa, Uttar Pradesh, Tamil Nadu, Bihar, Jharkhand.

Tribe Catantopini Brunner von Wattenwyl, 1893

Diabolocantops pinguis (Stal, 1861)

Diagnostic characters: Reddish brown, rather stout. Frontal ridge finely punctured, slightly expanded between the antennae, lateral carinae, distinct, slightly divergent, antennae filiform, Pronotum closely punctured, obtusely angulated behind, carina slight, continuous, with the sulci well marked. Abdomen with a short narrow dorsal stripe behind. Hind femora stout, with two transverse black spots above, the first extending into the externo–median area, the lower outer area blackish brown and the upper carinae slightly serrated, hind tibiae and tarsi red, the former with black tipped spines. Cerci of the male slightly expanded at the tips. The species is easily identified by the cercus which is upcurved, more broadened apex and projecting, upper apical angle is more projecting. The species is also easily identified by the character of the hind femur.
Material examined: 4♀, 18-VII-2010, Maluka, on maize, West Singhbhum; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀,22-V-2010, on pigeon pea, Sarawan, Deogarh; 1♀1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 4♀, 29-V-2010, on pigeon pea, Murkum, Saraikela; 6♀,12-VII-2010, on sugarcane, Patia, Gumla; 12♀, 25-VII-2010, on shrubs, Sonahata, Ranchi.
Morphometry: (length in mm)
Male: Body 29.9, Tegmina 24.1, Hind tibia 13.0, Pronotum 5.65
Female: Body 32.7, Tegmina 25.8, Hind tibia 14.8, Pronotum 7.01
Field observations: *C. pinguis innotablis* is widely distributed in pulse crop and is commonly found in shrubs and herbs (wild vegetations).
Natural enemies: In Thailand adults are affected by the fungus *Entomophthora grylli* Fres. (Roffey, 1965). Red mite *Eutrombidium trigonum* also observed parasitizing this species.
Distribution: Orissa, Goa, Uttar Pradesh, Tamil Nadu, Bihar, Jharkhand.

Xenocatantops karnyi (Kirby, 1910)

Diagnosis: Body of medium size, antennae slightly longer or shorter than head and pronotum together, fastigium of vertex with slightly raised carinulae between eyes, median carina never strongly raised, frontal ridge never projecting between antennae, tegmina reaching beyond apex of abdomen, tegmina and wings fully developed, pronotum at least slightly constricted in middle, prosternal process conical.
Material examined: 1♂,24-V-2010, on pigeon pea Baramasia, Dumka; 1♀, 21-V-2010, on pigeon pea, Mohanpur, Jamtara; 2♀, 13-V-2010, on pigeon pea, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 31.45, Tegmina 25.65, Hind femur 14.1, Pronotum 5.9
Male: Body 29.6, Tegmina 23.25, Hind femur 11.78, Pronotum 4.2
Field observations: Somewhat less active as compared to *Catantops pinguis innotabilis*. May be spotted in pigeon pea and ripe sugarcane crop easily.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Jharkhand.

Subfamily Acridinae MacLeay, 1821

Orthochtha indica (Uvarov, 1942)

Diagnostic characters: Body of median size, antennae ensiform, much longer than head and pronotum together; head conical, never elongate, fastigium of vertex depressed, with lateral carinulae, fastigial foveolae absent, frontal ridge sulcate, pronotum elongate, constricted in middle, median carina crossed by posterior transverse sulcus only.
Material examined: 1♀, 15-VII-2010, on paddy, Malsara, Simdega; 1♀, 25-VII-2010, on grasses, Sonahata, Ranchi.
Morphometry: (length in mm)
Female: Body 29.90, Tegmina 21.40, Hind femur 15.31, Pronotum 3.79
Field observations: Female member is much active as compared to males.
Natural enemies: No natural enemies have been recorded.
Distribution: Jharkhand, Punjab.

Tribe Acridini MacLeay, 1821

Acrida exaltata (Walker, 1859)

Diagnostic characters: Head conically ascending. Fastigium broad, laminate and truncate at apex.Transverse sulcus of pronotum present about the middle of pronotal disc. Male subgenital plate comparatively long. Tegmina a little produced beyond the hind knee and wings slightly shorter than tegmina.
Materials examined: 4♀, 1-VII-2010, on paddy, Ketar, Garhwa; 2♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu, 1♀4♂,4-VII-2010, on grasses, Kobna, Chatra; 2♀6♂, 5-VII-2010, on paddy, Balu, Latehar; 1♀2♂, 9-VII-2010, on paddy, Kisko, Lohardaga; 6♀,12-VII-2010, on paddy, Patia, Gumla; 2♀,15-VII-2010, on grasses, Malsara, Simdega; 3♀,24-VII-2010, on grasses, Namkom, Ranchi; 2♂, 13-V-2010, on lentil, Sarabh, Hazaribagh; 1♀,15-V-2010, on grasses, Ramgarh; 2♂, 25-V-2010, on grasses, Amarpur, Godda; 6♀, 26-V-2010, on grasses present in gourd field, Maharajpur, Sahibganj; 4♀1♂, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 52.8, Tegmina 44.8, Hind femur 31.4, Pronotum 6.8
Female: Body 48.25, Tegmina 30.0, Hind femur 24.55, Pronotum 8.2
Field observations: It is abundantly found on grasses and paddy fields. Females very sluggish and can be sampled with bare hands while male members show moderate to good activity. This species indicates its presence through stridulatory sounds that are very prominent and can be heard clearly. The females are much larger in size than males.
Natural enemies: This species was found to be parasitized by *Eutrombidium trigonum*. Very common and known from many localities in India
Distribution: Jharkhand, Punjab, Haryana, Uttarakhand, Madhya Pradesh, Sikkim, Kashmir, Assam, Uttar Pradesh, Bihar.

Acrida gigantea (Herbst, 1786)

Diagnostic characters: Head conically ascending. Fastigium broad, laminate and truncate at apex. Transverse sulcus of pronotum present about the middle of pronotal disc. Male subgenital plate comparatively long. Tegmina a little produced beyond the hind knee and wings slightly shorter than tegmina. Lateral carinae with black inner margins.
Material examined: 1♀, 1-VII-2010, on paddy, Ketar, Garhwa; 2♀, 5-VII-2010, on paddy, Balu, Latehar; 2♂, 9-VII-2010, on paddy, Kisko, Lohardaga; 6♀, 26-V-2010, on grasses present in gourd field, Maharajpur, Sahibganj; 4♀1♂, 31-V-2010, on grasses, Bhalki, East Singbhum.
Morphometry: (length in mm)
Male: Body 31.45, Tegmina 22.0, Hind femur 17.3, Pronotum 4.3
Female: Body 50.1, Tegmina 45.65, Hind femur 31.4, Pronotum 9.65

Field observations: Usually found in paddy and grasses and produces very striking stridulatory sound. Rest observations same as that of *Acrida exaltata*. Its camouflage potential is low as compared to *Acrida exaltata* and colour changes according to the surroundings.
Natural enemies: This species was found to be parasitized by *Eutrombidium trigonum*.
Distribution: Bihar, Uttar Pradesh, Punjab, Haryana, Himachal Pradesh, Rajasthan, Jharkhand, Uttarakhand.

Tribe Phlaeobini Brunner von Wattenwyl, 1893

Phlaeoba infumata (Brunner von Wattenwyl, 1893)

Diagnostic characters: Antennae ensiform. Lateral carinae of pronotum straight, disc of pronotum rugose. Wings fusco-hyaline, infumated towards the apex. Subgenital plate of male acute.
Material examined: 1♀, 24-V-2010, on dead vegetation, Baramasia, Dumka; 4♀, 24-VII-2010, on dead vegetation, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 32.1, Tegmina 23.5, Hind femur 16.4, Pronotum 5.0
Field observations: This species occur in sugarcane fields and widely encountered in dead and decaying vegetations. The samples are usually uniformly brown and very active. Sometimes can also be located in rice crop.
Natural enemies: No natural enemies have been recorded.
Distribution: Arunachal Pradesh, Assam, Bihar, Jharkhand, Haryana, Himachal Pradesh, Manipur, Tamil Nadu, Uttar Pradesh, West Bengal.

Phlaeoba panteli (Bolivar. I., 1902)

Diagnostic characters: Body slender and of moderate size, antennae ensiform, median carinula present, frons oblique, frontal ridge sulcate, median carina excised by anterior and posterior sulcus each, hind wings hyaline, lateral carinae linear.
Material examined: 2♀, 15-VII-2010, on dead vegetation, Malsara, Simdega; 1♀, 25-VII-2010, on grasses, Sonahata, Ranchi.
Morphometry: (length in mm)
Female: Body 29.6, Tegmina 24.0, Hind femur 16.5, Pronotum 5.6
Field observations: Usually spotted on dead and decaying plant material lying on ground. Differs from *Phlaeoba infumata* in having striped patterns on upper half of the body usually along lateral sides of head and pronotum.
Natural enemies: No natural enemies have been recorded.
Distribution: Uttar Pradesh, Jharkhand, Punjab.

Subfamily Oedipodinae Walker, 1871

Morphacris fasciata (Thunberg, 1815)

Diagnostic characters: Body of medium size; antennae filiform, longer than head and pronotum together, fastigium of vertex angular, strongly concave, with high lateral carinulae, frontal ridge moderately narrow, sulcate, dorsum of pronotum tectiform, with sharp parallel longitudinal ridges, median carina raised, crossed by posterior transverse sulcus only, lateral carinae absent, dorsum of pronotum with numerous longitudinal parallel ridges
Material examined: 1♀,16-VII-2010, on paddy, Kutipi, West Singbhum
Morphometry: (length in mm)
Female: Body 29.58, Tegmina 22.81, Hind femur 13.51, Pronotum 5.75
Field observations: Pronotum is unique with many parallel ridges, body is comparatively soft and the insect usually feeds on the distal or rather apical part of the leaves.
Natural enemies: No natural enemies observed.
Distribution: Punjab, Haryana, Rajasthan, Bihar, Jharkhand, Uttarakhand, Himachal.

Chloebora grossa (Saussure, 1884)

Diagnostic characters: Large sized insect with nearly round eyes, Median carina well developed but lateral carinae show slight presence in metazona, tegmina membranous at apical one third part, hindwing membranous and bears a complete fascia midway, hind tibia is markedly shorter than femur.
Material examined: 1♂, 13-V-2010, on grasses, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Male: Body 35.6, Tegmina 27.45, Hind femur 14.2, Pronotum 6.55
Field observations: It shows its presence in forest areas in and around bushes and exhibits good camouflage with the surrounding rocks.
Natural enemies: No natural enemies have been recorded.
Distribution: Bihar, Jharkhand, Tamil Nadu.

Chloebora marshalli (Henry, G. M., 1933)

Diagnostic characters: Large sized insect with nearly round eyes, Median carina well developed but lateral carinae show slight presence in metazona, Pronotum indistinctly tuberculate, wings in female, without fascia if present very diffuse; hind tibia carmine red.
Material examined: 1♀, 13-V-2010, on grasses, Sarabh, Hazaribagh.
Morphometry: (length in mm)
Female: Body 50.13, Tegmina 37.98, Hind femur 22.55, Pronotum 8.46
Field observations: Jumps to great distances when sensed any disturbance and had colour pattern that matched perfectly with the surrounding rocks so, is very tough to notice unless shows some eye catching movement.
Natural enemies: No natural enemies have been recorded.
Distribution: Uttar Pradesh, Jharkhand.

Tribe Trilophidiini Shumakov, 1963

Trilophidia annulata (Thunberg, 1815)

Diagnostic characters: Small insect, antennae filiform with black yellow bands, eyes somewhat bulging, pronotum saddle shaped, median carina forming tooth like projections in prozona, apex of tegmina truncated, hind femur with a yellow band just above the basal lobe.
Material examined: 2♀1♂,16-VII-2010, on paddy, Kutipi, West Singbhum; 1♀, 24-VII-2010, on grasses, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 22.8, Tegmina 18.6, Hind femur 9.8, Pronotum 3.85
Male: Body 19.48, Tegmina 16.4, Hind femur 7.6, Pronotum 2.25
Field observations: Commonly found in paddy and ploughed wheat fields the body is broader in the upper half. Colour pattern differs considerably with changing surroundings and the ones that were light brown to brownish yellow were covered with dense fine hairs. These exhibit moderate activity throughout the day.
Natural enemies: Red mite *Eutrombidium trigonum* was observed parasitizing this species.
Distribution: Punjab, Haryana, Rajasthan, Bihar, Jharkhand, Uttarakhand, Himachal, Arunachal Pradesh, Tripura, Meghalaya.

Trilophidia repleta (Walker, F., 1870)

Diagnostic characters: Body of medium size; inner side of hind femur with two pale bands; basal disc of wings yellow; hind tibia with two broad ochraceous rings.
Material examined: 1♀, 13-V-2010, on grasses, Sarabh, Hazaribagh; 1♀,22-V-2010, on grasses, Sarawan, Deogarh.
Morphometry: (length in mm)
Female: Body 21.6, Tegmina 17.2, Hind femur 9.0, Pronotum 3.2

Field observations: Usually encountered in brownish colour but rare in the concerned area when compared to *Trilophidia annulata*.
Natural enemies: Red mite *Eutrombidium trigonum* was observed parasitizing this species.
Distribution: Punjab, Bihar, Jharkhand, Meghalaya.

Tribe Epacromiini Brunner Von Wattenwyl, 1893

Aiolopus simulatrix (Walker, 1870)

Diagnostic characters: It is popularly known as Sudan Plague locust and is a serious pest of grain and many other crops. The species is variable in general coloration, size, relative length of tegmina and width of hind femur. It can easily be distinguished by its broad hind femur which is longer than hind tibia and by the form of frontal ridge and pronotum.
Material examined: 4♀2♂, 1-VII-2010, on paddy, Ketar, Garhwa; 2♀, 2-VII-2010,on paddy, Shahpur, Daltonganj Palamu; 2♂, 4-VII-2010, on paddy, Kobna, Chatra; 6♀4♂, on paddy, 7-VII-2010, Dhangtartola, Latehar; 1♀, 25-VII-2010, on paddy, Sonahata, Ranchi; 3♂, 13-V-2010, on paddy, Sarabh, Hazaribagh; 2♀, 16-V-2010, on brinjal, Birni, Giridih; 2♂, 25-V-2010, on paddy, Amarpur, Godda.
Mophometry: (length in mm)
Male: Body 11.2–11.7, Pronotum 6.4–7.1, Tegmina 17.3–17.7 Hind femur 7.3–7.8
Female: Body 13.3–13.9, Pronotum 7.1–8.3, Tegmina –22.3–23.1, Hind Femur 11.3 – 11.7
Field observations: A common pest of agricultural crops. Observed in paddy and brinjal, as well as grasslands.
Natural enemies: No natural enemies recorded.
Distribution: Andaman & Nikobar Islands, Bihar, Jharkhand, Delhi, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Punjab, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

Aiolopus thalassinus thalassinus (Fabricius, 1781)

Diagnostic characters: Medium sized insect, tegmina and wings fully developed, head acutely conical, antennae filiform, as long as or longer than head and pronotum together, fastigium of vertex elongate-angular, slightly concave, with well developed lateral carinulae, frons oblique; frontal ridge flat, pronotum slightly tectiform and slightly constricted in prozona, median carina weak, medial area of tegmen with intercalary vein well developed and finely serrated, hind femur slender, hind tibia with inner pair of spines longer than external one, external apical spine absent, arolium of small size, Frontal ridge of uniform width with nearly parallel margins, foveolae shorter, hind tibia coloured as in *tumulus* but with a dark ring before the middle and without the bluish median part.
Material examined: 4♀, 5-VII-2010, on paddy, Balu, Latehar; 2♂, 7-VII-2010, on paddy, Dhangtartola, Latehar; 1♂, 12-VII-2010, on paddy, Patia, Gumla.
Morphometry: (length in mm)
Male: Body 25.8, Tegmina 20.05, Hind femur 11.85, Pronotum 3.75
Female: Body 33.1, Tegmina 26.75, Hind femur 16.2, Pronotum 5.15
Field observations: Commonly found in vegetable fields of brinjal, lady finger, tomato and also in paddy fields.
Natural enemies: Red mite identified as *Eutrombidium trigonum* was found to infect the insect.
Distribution: West Bengal, Bihar, Uttar Pradesh, Uttarakhand, Jharkhand, Haryana, Punjab.

Aiolopus thalassinus tamulus (Fabricius, 1798)

Diagnostic characters: Very commonly found in paddy fields and coloured in combination of black and green. Frontal ridge gradually tapered towards the fastigium, foveolae longer, hind tibia in the basal third with a straw-coloured band, in the median part usually bluish, the apical part reddish.

Material examined: 1♀, 4-VII-2010, on paddy, Kobna, Chatra; 1♂, 9-VII-2010, on grasses, Kisko, Lohardaga; 3♀, 15-VII-2010, on paddy, Malsara, Simdega; 4♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Male: 24.4, Tegmina 18.2, Hind femur 8.2, Pronotum 3.4
Female: 33.5, Tegmina 26.9, Hind femur 15.2, Pronotum 4.75
Field observations: Many of the paddy fields were heavily infested but may also be encountered in wheat, maize, and grassland areas surrounding the fields.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Uttar Pradesh, Uttarakhand, Jharkhand, Haryana, West Bengal.

Tribe Acrotylini Shumakov, 1963

Acrotylus insubricus insubricus (Scopoli, 1786)

Diagnostic characters: Body of medium size, pronotum saddle shaped and shorter than width, eyes somewhat bulging, tegmina with infuscated spots beyond middle, hind wings with lunate incomplete fascia.
Material examined: 4♀, 15-VII-2010, on paddy, Malsara, Simdega; 2♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 26.0, Tegmina 20.35, Hind femur 7.7. Pronotum 2.8
Field observations: It has been found damaging rice crop and the bulging pattern of eyes can be noticed with much ease. The observed activity was moderate throughout the day.
Natural enemies: No natural enemies have been recorded.
Distribution: Andhra Pradesh, Bihar, Goa, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, Jharkhand.

Tribe Locustini Kirby, 1825

Oedaleus abruptus (Thunberg, 1815)

Diagnostic characters: Body small to medium size, antennae filiform, longer than head and pronotum together, fastigium of vertex angular, flat or slightly concave, with obtuse lateral carinulae, hind wings fascia broadly interrupted anterior termination of hind wing fascia flattened, reaching or just surpassing second anal vein, pronotum with posterior transverse sulcus placed much before the middle.
Material examined: 4♀1♂, 5-VII-2010, on grasses, Balu, Latehar; 8♀, 15-VII-2010, on grasses, Malsara, Simdega; 3♀, 15-V-2010, on grasses, Ramgarh; 3♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Male: Body 20.45, Tegmina 15.7, Hind femur 10.2, Pronotum 3.4
Female: Body 25.8, Tegmina 19.6, Hind femur 13.2, Pronotum 4.25
Field observations: commonly encountered in areas close to some water source or if the soil showed good signs of moisture. Thriving population was observed on grasses in such plots and these were even present in shadowed areas of orchards or tree plantations.
Natural enemies: No natural enemies recorded.
Distribution: Andhra Pradesh, Jharkhand, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Meghalaya, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

Locusta migratoria migratoria (Linnaeus, 1758)

Diagnostic characters: It occurs in green and brown form in the solitary phase. The species can easily be identified from other Locusts by the absence of prosternal process, the slight yellow tinting of the wings and the black anal veins are distinctive features of the species.
Material Examined: 4♀2♂, 4-VII-2010, on maize, Kobna, Chatra
Morphometry: (length in mm)

Male: Body 44.85, Tegmina 37.65, Hind femur 20.15, Pronotum 7.77
Female: Body 60.4, Tegmina 48.8, Hind femur 25.6, Pronotum 10.0
Field observations: Though quite strict graminivorous and capable of causing considerable damage to grain crops, very many plants belonging to different families have been recorded as food.
Natural enemies: It is sometimes heavily infested with mites.
Distribution: Assam, Bengal, Kashmir, Jharkhand, Bihar, Uttar Pradesh, Himachal Pradesh, West Bengal, Maharashtra.

Gastrimargus africanus africanus (Saussure, 1888)

Diagnostic characters: Body medium to large size, antennae filiform, as long as or shorter than head and pronotum together, fastigium of vertex slightly concave with weak median and well developed lateral carinulae, frontal ridge flat, pronotum tectiform, constricted in prozona, anteriorly projecting above vertex, median carina almost crest-shaped, crossed by posterior transverse sulcus only, lateral carinae absent.
Material examined: 1♂, 4-VII-2010, on wild vegetation, Kobna, Chatra.
Morphometry: (length in mm)
Male: Body 32.92, Pronotum 5.81, Tegmina 27.47, Hind Femur 16.75.
Field observations: This species is very active and jumps great distances. Mostly female members are encountered.
Natural enemies: No natural enemies have been recorded.
Distribution: West Bengal, Assam, Jharkhand, Himachal Pradesh, Madhya Pradesh, Maharashtra, Sikkim, Karnataka and Uttar Pradesh.

Tribe Oedipodini Walker, 1871

Oedipoda miniata miniata (Pallas, 1771)

Diagnostic characters: Wings mostly rugose so the dark band often pale brown, strongly bowed reaching upto IXth or Xth section of anal fan and not touching hind margin (Harz, 1975). Integument often less rugose and less callous. Facial carinula mostly without projections. Dark fasciae of wings extending towards the base by one longitudinal band into the anterior field.
Material examined: 4♀, 25-VII-2010, on paddy, Sonahata, Ranchi; 5♀, 15-V-2010, on wheat stubbles, Ramgarh; 6♀, 22-V-2010, on wheat stubbles, Sarawan, Deogarh; 3♀, 24-V-2010, on wheat stubbles, Baramasia, Dumka; 4♀2♂, 29-V-2010, on wheat stubbles, Murkum, Saraikela.
Morphometry: (length in mm)
Female: Body 45.55, Tegmina, 36.0, Hind femur, 20.7, Pronotum 9.6
Male: Body 42.5, Tegmina 33.65, Hind femur 18.8, Pronotum 8.2
Field observations: This species was abundantly present in harvested wheat fields with stubbles, hiding in them. Exhibited good flight response.
Natural enemies: No natural enemies recorded.
Distribution: Uttar Pradesh, Bihar, Punjab, Himachal pradesh, Rajasthan, Jharkhand.

Subfamily Calliptaminae Tinkham, 1940

Acorypha glaucopsis (Walker, F., 1870)

Diagnostic characters: Body of medium size; integument finely dotted, antennae filiform, shorter than head and pronotum together, fastigium of vertex moderately long, with longitudinal concavity and strong lateral carinulae, frons vertical, frontal ridge flat, Lower inner spur of hind tibia with the apex simply recurved bearing sparse hairs, Pronotum with metazona slightly longer than prozona; prosternal process slightly transverse.
Material Examined: 1♀1♂,12-VII-2010, on lentil, Patia, Gumla; 2♀1♂,21-VII-2010, on wild vegetations, Khunti; 1♀, 16-V-2010, on shrubs, Birni, Giridih; 4♀, 22-V-2010, on shrubs, Sarawan, Deogarh, 1♂, 2-VII-2010, on grasses, Shahpur, Daltonganj Palamu.tristria

Morphometry: (length in mm)
Male: Body 16.0, Tegmina 12.5, Hind femur 9.35, Pronotum 3.3
Female: Body 24.0, Tegmina 20.7, Hind femur 14.4, Pronotum 5.65
Field observations: Very active and has exceptionally robust hind femur.
Natural enemies: No natural enemies recorded.
Distribution: Bihar, Rajasthan, Tamil Nadu, Jharkhand.

Acorypha insignis (Walker, F., 1870)

Diagnostic characters: Body of medium size; integument finely dotted, antennae filiform, shorter than head and pronotum together, lower inner spur of hind tibia with the apex prominent beyond the base of the claw, in the shape of obtuse tubercle bearing dense and long hairs, pronotum with metazoan much longer than prozona, prosternal process strongly cylindrical.
Material examined: 1♂, 26-V-2010, on shrubs, Maharajpur, Sahibganj.
Morphometry: (length in mm)
Male: Body 17.76, Tegmina 13.17, Hind femur 10.20, Pronotum 3.31
Field observations: Mostly present in wild greens that have comparatively low human interference. Exhibits high activity and jumps over short distances.
Natural enemies: No natural enemies recorded.
Distribution: Jharkhand, Bihar, Haryana.

Subfamily Gomphocerinae Fieber, 1853
Tribe Gomphocerini Fieber, 1853

Leva indica (Bolivar, I., 1902)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge sulcate, hind tibia with inner spur of inner side about as long as external on, fastigium of vertex elongate-angular, concave, without median carinula, shorter than eye length, fastigial foveolae not visible from above; frontal ridge shallowly sulcate, pronotum subcylindrical, slightly constricted.
Material examined: 1♀, 5-VII-2010, on grasses, Balu, Latehar.
Morphometry: (length in mm)
Female: Body 16.84, Tegmina 12.68, Hind femur 8.73, Pronotum 1.83
Field observations: It is a large species of Gomphocerinae other than those already recorded. It may well become minor pests at times.
Natural enemies: No natural enemies have been recorded.
Distribution: Jammu & Kashmir, Uttar Pradesh, Punjab, Jharkhand.

Chorthippus indus (Uvarov, 1942)

Diagnostic characters: Colour variable, green, testacious or brown. Antennae sub depressed, longer than the head and pronotum together. Pronotum with transverse sulcus placed about the middle, the head not carinated above, the pronotum strongly tricarinate, the median carina slightly raised, the lateral carinae slightly incurved before the middle and then diverging. Tegmina longer than abdomen in a male usually shorter in the female, sometimes with longitudinal yellow scapular lines. Wings hyaline with brown nervures. Pectus and front leg pilose, legs not spotted, hind tibia with twelve small spines, decreasing in size towards the base. Subgenital plate in the male is curved, pubescent, valves of the ovipositor unarmed.
Material examined: 1♂, 5-VII-2010, on grasses, Balu, Latehar.
Morphometry: (length in mm)
Male: Body 17.15, Tegmina11.7, Hind femur 10.6, Pronotum 3.7
Field observations: It is a large species of Gomphocerinae other than those already recorded. It may well become minor pests at times.
Natural enemies: No natural enemies have been recorded.

Distribution: Jammu & Kashmir, Uttar Pradesh, Punjab, Jharkhand.

Stenohippus mundus (Walker, F., 1871)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge between antennae flat, tegmina much longer than abdomen.
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 18.53, Tegmina 12.87, Hind femur 9.14, Pronotum 2.91.
Remarks: It is very small species. Abundantly found on grasses and paddy crops. The samples were very active and rested usually on ground or lower portions of the crop but not noticed feeding on paddy.
Natural enemies: No natural enemies are recorded.
Distribution: West Bengal, Delhi, Tamil Nadu, Tripura, Uttar Pradesh.

Tribe Dociostaurini

Dociostaurus apicalis (Walker, F., 1871)

Diagnostic characters: Body of small size, antennae filiform, longer than head and pronotum together, head subconical, shorter than pronotum, vertex without lateral carinulae, frontal ridge between antennae flat, tegmina shorter than abdomen.
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 16.4, Tegmina 10.95, Hind femur 7.8, Pronotum 2.5.
Remarks: It is very small species. Abundantly found on grasses and paddy crops. The samples were very active and rested usually on ground or lower portions of the crop but not noticed feeding on paddy.
Natural enemies: No natural enemies are recorded.
Distribution: West Bengal, Delhi, Uttar Pradesh, Jharkhand.

Tribe Arcypterini Shumakov, 1963

Aulacobothrus luteipes luteipes (Walker, F., 1871)

Diagnostic characters: Frontal ridge convex; fastigial foveolae elongate rhomboidal, dorsum of head and pronotum with a pale stripe extending from anterior margin of fastigium to posterior margin of pronotum with posterior transverse sulcus placed in the middle, frontal ridge sulcate, tegmina without dark spots on radial area .
Material examined: 1♀, 24-VII-2010, on paddy, Namkom, Ranchi.
Morphometry: (length in mm)
Female: Body 12.8, Pronotum 6.8, Tegmina 17.2, Hind Femur 12.4.
Field observations: This species can be recognized in field because of pale yellow stripe present dorsally but much less active as compared to *Leva* sp.
Natural enemies: No natural enemies have been recorded.
Distribution: West Bengal, Assam, Bihar, Jharkhand, Himachal Pradesh, Madhya Pradesh, Maharashtra, Sikkim, Karnataka and Uttar Pradesh.

RESULTS AND DISCUSSION

Survey of the state yielded many interesting results as per field observations. The behavior or rather response of the concerned group to habitat factors, when observed in detail, lead to interesting conclusions. Many of them are summarized as under:

- Grasshoppers were observed to rest on upper half or on top portion of vegetation in morning hours but shifted to lower portions by noon. In the morning hours the inolation (Sunlight) has low intensity and the grasshoppers being cold blooded warm up their bodies and this explains the behavior.
- The disturbed insect changes its body orientation away from the approaching person and jumps off, may be because it senses the currents of movement and tries to move away from the approaching danger.
- In early morning hours the insects were very lethargic while in late afternoons they exhibited mild activity. The same insects showed maximum activity during noon and afternoon, roughly from 1100 hrs to 1500 hrs. This is so because the insect is cold blooded and thereby its activity frequency fluctuates according to sunlight intensity and duration.
- Many a times the behavioral response exhibited by the grasshoppers indicated some thought oriented responses e.g. jumping in thorny bushes nearby upon disturbance.
- Leguminous crops showed maximum infestation of members of subfamily Catantopinae and to some extent by Oedipodinae. The members of the two groups are blessed with strong mandibles and this explains the activity.
- Paddy was infested mostly by *Aiolopus* sp. followed by *Oxya* sp.
- Wheat showed very minor infestation, the samples were mostly collected from the tracts around the field and when these tracts were walked over, the grasshoppers jumped into the sown area. Leaves of paddy when compared to wheat are more subtle may be because of more water content and so it is commonly infested by acridoids.
- In case of vegetables, lady finger tops the list while gourd showed some signs of infestation. Other vegetables in the area were nearly free of Acridoid pest infestation.
- Mites such as *Eutrombidium trigonum* were found adhering to the body parts such as legs, wings and lower abdomen in many of the samples.
- Myna and sparrow were seen feeding efficiently on the grasshoppers that had low camouflage potential i.e. those species that had some color other than the surrounding vegetation were easily spotted.
- Frogs, toads and praying mantis were also spotted feeding on the grasshoppers.
- The area surrounding any plot that had chilies, onion or garlic plantations were very much free from acridoid infestation. These crops act as biocontrol agents and help to repel insects because of their pungent odour.
- The plots that were treated with oil based pesticides were nearly free form grasshopper infestation while those that were subjected to dust or water based formulations exhibited fair presence of the pest. Oil based formulations adhere to the parts on which they are applied while dust or water based formulations are not able to withstand climatic disturbances and fall off to the ground.
- Absence or very rare occurance was observed in the Industrial cities like Bokaro Steel City, Dhanbad etc. The state of Jharkhand (India) is very rich in mineral and coal deposits and therefore supports Iron and Steel industry, Chemical industry, Coal based industries and these all liberate

many noxious substances in mediums such as air, water and soil. Many of the air pollutants ultimately fall off to the ground and this explains the absence of these insects from the concerned area.

- In the morning hours, patches of crop field that had been harvested had fairly good population of grasshoppers as compared to the plots that had standing crops. The harvested area is more appropriate for the insects to warm up their bodies in sun as compared to the plots with standing crops and hence the insects migrate to the harvested plots in the morning hours.

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LITERATURE CITED

Agarwala, S. B. D. 1952. A comparative study of the ovipositor in the Acrididae - I. Indian Journal of Entomology, I. 13: 147-181.

Agarwala, S. B. D. 1952. A comparative study of the ovipositor in the Acrididae - I. Indian Journal Enomology, II. 14: 61-75.

Carpenter, F. M. 1953. The geographical history and evolution of insects. American Scientist, 41: 256–270.

Dey, A. & Hazra, A. K. 2003. Diversity and distribution of grasshopper fauna of Greater Kolkata with notes on their ecology. Memoirs, 19 (3): 1-118.

Dirsh, V. M. 1965. The African genera of Acridoidea. Anti-Locust Research Centre, Cambridge University Press, London, 579 pp.

Dirsh, V. M. 1975. Classification of Acridomorphoid insects. Faringdon, Oxon, E.W. Classey, 171 pp.

Hazra, A. K., Tandon, S. K., Shishodia, M. S., Dey, A. & Mandal, S. K. 1993. Insecta: Orthoptera: Acridoidea. In Fauna of West Bengal, State Fauna Series 3. Part, 4: 287-354.

Julka, J. M., Tandon, S. K., Halder, P. & Shishodia, M. S. 1982. Ecological observation on grasshoppers (Orthoptera: Acridoidea) at Solan, Himachal Pradesh, India. Oriental Insects, 16: 63-75.

Kirby, W. F. 1914. The fauna of British India, including Ceylon and Burma. Orthoptera (Acrididae). ix+276 pp., London.

Kulkarni, P. P. & Shishodia, M. S. 2004. Insect: Orthoptera Fauna of Pench National Park. Conservation Area Series, 20: 207-225.

Kulkarni, P. P. & Shishodia, M. S. 2005. Insect: Orthoptera Fauna of Melghat Tiger Reserve. Conservation Area Series, 24: 317-340.

Kumar, P. & Viraktamath, C. A. 1991a. Illustrated keys for identification of common species of short-horned grasshoppers (Orthoptera: Acridodea) of Karnataka and short notes on their ecology and behaviour. Hexapoda, 3 (1-2): 53-70.

Kumar, P. & Viraktamath, C. A. 1991b. Taxonomic significance of the male genitalis (Epiphallus) of some species of short-horned grasshoppers (Orthoptera: Acridoidea). J. Bombay Natural History Society, 88 (2): 200- 209.

Murlirangan, M. C., Srinivasan, C. & Suresh, P. 1992. Studies on shorthorned grasshoppers (Acridoidea) of Tamil Nadu- Part II. Hexapoda, 4 (2): 149-166.

Priya, A. V. & Narendran, T. C. 2003. A key and a checklist of the genera of short-horned grasshoppers (Orthoptera: Acridoidea) of Kerala. Entomon, 28 (3): 223-230.

Roonwal, M. L. 1956. Bibliographica Acrididorum. Records of Indian Museum, 56: 1-611.

Shishodia, M. S. & Hazra, A. K. 1986. Orthoptera fauna of Silent Valley Kerala. Records of Zoological Survey of India, 84: 191-228.

Shishodia, M. S. 1987. Orthoptera Fauna of Assam. State Fauna Series no. 1: 91-102.

Shishodia, M. S. 1997. Orthoptera Fauna of Delhi. State Fauna Series: Zoological Survey of India, 173-176.

Shishodia, M. S. 1999. Orthoptera fauna of Patalkot, chhindwara, Madhya Pradesh, India. Records of Zoological Survey of India, 97 (4): 33-43.

Tandon, S. K. 1976. A Check-list of the Acridoidea (Orthoptera) of India Part I Acrididae. Records of Zoological Survey of India Occasional, paper no. 3: 1-48.

Tandon, S. K. & Khera, P. 1978. Ecology and distribution of grasshoppers (Orthoptera: Acridoidea) in Arunachal Pradesh, India and impact of human activities on their ecology and distribution. Memoirs of the School of Entomology, Agra, 6: 73-92.

Tandon, S. K. & Shishodia, M. S. 1969. On a collection of Acridoidea (Orthoptera) from the Nagarjuna Sagar Dam Area. *Oriental Insects*, 3 (3): 265-267.

Tandon, S. K. & Shishodia, M. S. 1976a. On a collection of Acridoidea (Orthoptera) from Rajasthan, India. Newsletter of Zoological Survey of India, 2 (1): 7-11.

Tandon, S. K. & Shishodia, M. S. 1976b. Acridoidea (Insecta: Orthoptera) collected along the bank of river Tawi (J&K) India. Newsletter of Zoological Survey of India, 2 (2): 58-61.

Tandon, S. K. & Shishodia, M. S. 1976c. On a collection of Orthoptera (Insecta) from the Kanha National Park, Madhya Pradesh, India. Newsletter of Zoological Survey of India, 2 (6): 269-271.

Tandon, S. K. & Shishodia, M. S. 1989. Fauna of orissa. State Fauna Series 1 (part 2): 93-145.

Usmani, M. K. 2006: Taxonomic significance of female subgenital plate in some Indian grasshoppers (Orthoptera : Acridoidea). Sebha University Journal, 4 (1): 51-66.

Usmani, M. K. & Shafee, S. A. 1980. Female genitalia in some India species of Pyrgomorphinae (Orthoptera: Acrididae). Journal of Entomological Research, 4: 41-44.

Usmani, M. K. & Shafee, S. A. 1982. Taxonoimic significance of ovipositor in some Indian grasshoppers (Orthoptera: Acrididae). Journal of Bombay Natural History Society, 79 (3): 576-580.

Usmani, M. K. & Shafee, S. A. 1983. A new genus and two new species of the subfamily Acridinae (Orthoptera: Acrididae) from India. Bulletin of Entomological Society of Switzerland, 56: 401-403.

Usmani, M. K. & Shafee, S. A. 1984. A new tribe of Oxyinae (Orthoptera: Acrididae). Bulletin of Entomological Society of Switzerland. 57: 295-296.

Usmani, M. K. & Shafee, S. A. 1985a. A new species of the genus *Ramakrishnaia* I. Bolivar (Orthoptera: Pyrgomorhidae) from India. Journal of Entomological Research, 27 (3): 204-207.

Usmani, M. K. & Shafee, S. A. 1985b. A revision of the Indian species of *Oxya* (Oxyinae: Acrididae). Oriental Insects, 19: 311-322.

Usmani, M. K. & Shafee, S. A. 1990. Classification of Indian Acrididae (Orthoptera: Acridoidea). Indian Journal of Systematic Entomology, 7 (2): 89-102.

Uvarov, B. P. 1921. Notes on Orthoptera in the British Museum. I. The group Euprepocnemini. Transactions of Entomological Society of London, 1921: 106-144.

Uvarov, B. P. 1924. A revision of the old world Cyrtacanthacrini, Annual Magazine of Natural History, 13 (9): 1-19.

Uvarov, B. P. 1927. Distributional records of Indian Acrididae. Records of Indian Museum, 29: 233-239.

Uvarov, B. P. 1942. Differentiating characters of Oedipodinae and Acridinae. Transactions of American Entomological Society, 67: 303-361.

Uvarov, B. P. 1966. Grasshoppers and Locusts. A Hand book of General Acridology. Cambridge, XI + 481 pp.

Van Hook, R. I. 1971. Energy and nutrient dynamics of spider and orthopteran populations in a grassland ecosystem. Ecological Monographs, 41: 1-26.

Yu, J. H. 1988. Locust-eating birds and their recruitment in prairies of Tianshan Mt. Chinese Journal of Biological Control, 4 (2): 68-70.

Table I. Showing host and habitat of Indian species represented in Jharkhand region.

Species	Host and Habitat
1. *Oxya japonica japonica* (Thunberg, 1815)	Underlying grasses in vegetable field and paddy
2. *Oxya hyla hyla* (Serville, 1831)	Present along the upper half of Paddy plantations but as per observation it is not a voracious feeder.
3. *Oxya velox* (Fabricius, 1787)	Can be easily encountered in grasses surrounding crop fields, paddy saplings and gourd.
4. *Hieroglyphus banian* (Fabricius, 1798)	Sugarcane
5. *Hieroglyphus nigrorepletus* (Bolivar, 1912)	Sampled from paddy crop and can easily be traced in the crop owing to its black stripes along the pronotum.
6. *Spathosternum prasiniferum prasiniferum* (Walker, 1871)	This species is very much cosmopolitan in terms of distribution and may be present in a wide variety of crops and vegetations like lentil, grasses, paddy, underlying grasses of brinjal field.
7. *Teratodes monticollis* (Gray, 1832)	The species was sampled from dead leaves underlying dense vegetation.
8. *Eyprepocnemis alacris alacris* (Serville, 1838)	Present in cultivated grounds and. Chiefly sampled from sugarcane crop resting on the leaves in the morning hours. Its strong mandibles aid its feeding on such rough leaves of concerned crop.
9. *Cataloipus indicus* (Uvarov, 1942)	Jumps very effectively may be because of presence of elongated hind legs. The movement was very fast and restricted over the top potions of the plant. Sampled from sugarcane.
10. *Tylotropidius varicornis* (Walker, 1870)	Same as above.
11. *Eucoptacra praemorsa* (Stal, 1861)	The insect exhibits moderate activity and the population was concentrated in the shadowed portion of crop field of pigeon pea that was surrounded by mango plantations.
12. *Epistaurus sinetyi* (Bolivar, 1902)	Same as above.
13. *Acorypha glaucopsis* (Walker, F., 1870)	This is very active genus and very common in rocky areas but was also sampled from lentil. Its thick hind femur assist its powerful jumps over long distances. The thrust was sometimes felt on fingers during sampling and surely it can jump off if loosely held.
14. *Acorypha insignis* (Walker, F., 1870)	Same as above but was only sampled from wild vegetation Sampled from shrubs.
15. *Diabolocantops pinguis* (Stal, 1861)	This species has also been gifted with strong hind femur and very strong mandibles. Usually seen feeding on leguminous crops and jumps off great distances. Its body colour pattern perfectly matches with the surrounding vegetation and may only be spotted once the vegetation is disturbed. Sampled from maize, pigeon pea, sugarcane, shrubs.

16. *Xenocatantops karnyi* (Kirby, 1910)	This species is not so active as above one and also the hind femur is moderately thick. Was sampled from pigeon pea.
17. *Stenocatantops splendens* (Thunberg, 1815)	Same as *Diabolocatantops pinguis*.
18. *Schistocerca gregaria gregaria* (Forskal, 1775)	Present in arid and semi-arid conditions. It is polyphagous pest that damages both cultivated and non-cultivated crops. Sampled from shrubs.
19. *Chondacris rosea* (De Geer, 1773)	Large in size and sampled from pigeon pea.
20. *Cyrtacanthacris tatarica tatarica* (Linnaeus, 1758)	The insects are present in the fields for short time period and usually present in the tall grasses around the field. When disturbed these insects shifted more inside the grasses. Sampled from pigeon pea, wheat and shrubs.
21. *Tristria pulvinata* (Uvarov, 1921)	This is predominantly a grassland species and was even sampled from the same. The crop field around the grassland had some of the members may be those that migrated from grassland when disturbed. Sampled from grasses and sugarcane.
22. *Acrida exaltata* (Walker, 1859)	Chiefly grassland pest and colouration perfectly matches with the vegetation. Females of the genus are very lazy while the males are much active. The males produce a striking stridulatory sound that indicate the presence of species in the particular area. Sampled from paddy, grasses, bottle gourd, lentil.
23. *Acrida gigantea* (Herbst, 1786)	Grassland species but can be easily identified because of the presence of a pair of black linings along lateral carinae of the pronotum. Sometimes polymorphism may be observed in same field. Two polymorphic forms are green and brown in colour. Sampled from paddy and grasses in bottle gourd field.
24. *Phlaeoba infumata* (Brunner von Wattenwyl, 1893)	Mainly inhabits plots having dead and decaying vegetations. Upon disturbance it moves more inside the vegetation rather than jumping away from disturbed site. Integument is much rough and hardy as compared to *Acrida* sp. Sampled from dead vegetation.
25. *Phlaeoba panteli* (Bolivar, 1902)	Same as above but lateral sides of pronotum with striped wooden markings and sampled from dead vegetation and grasses.
26. *Orthochtha indica* (Uvarov, 1942)	Sampled from paddy.
27. *Trilophidia annulata* (Thunberg, 1815)	The sample has strikingly bulging eyes and the median carina forms tooth like projections. More commonly found as compared to other species of the genus. Sampled from paddy and grasses.
28. *Trilophidia repleta* (Walker, 1870)	Less common than *T. annulata*. Sampled from grasses.
29. *Aiolopus simulatrix* (Walker, 1870)	This is a grassland species usually found in moist grassland, irrigated land. Has been recorded as a serious pest of foodgrains and other crops. Sampled from paddy and brinjal.
30. *Aiolopus thalassinus thalassinus* (Fabricius, 1781)	Chiefly graminivorous. May be present in grasslands both extensive and in patches. This species has been observed to get attracted to night light. Sampled from paddy.
31. *Aiolopus thalassinus tamulus* (Fabricius, 1798)	Same as above.
32. *Chloebora grossa* (Saussure, 1884)	Large size insect. Mostly brown in colour. Present in rocky areas with somewhat arid conditions. Sampled from grasses.
33. *Chloebora marshalli* (Henry, G.M., 1933)	Same as above.
34. *Acrotylus insubricus insubricus* (Scopoli, 1786)	Present in sparsely vegetated places and has been observed feeding on cabbage, cauliflower, wheat. Sampled from paddy.

35. *Oedaleus abruptus* (Thunberg, 1815)	Prefers to inhabit moist areas and not very dry ones. Abundantly present in grasses along some ditches filled with water. Sampled from grasses and paddy.
36. *Morphacris fasciata* (Thunberg, 1815)	The insect is moderately active and has been observed feeding on apical part of leaves. Sampled from paddy.
37. *Oedipoda miniata miniata* (Pallas, 1771)	Chiefly present in the abandoned crop fields. Females fly long distances and the insects have been observed to move into the crevices in the ground may be to avoid sunlight. Sampled from paddy and wheat stubbles.
38. *Locusta migratoria migratoria* (Linnaeus, 1758)	Sampled from maize.
39. *Gastrimargus africanus africanus* (Saussure, 1888)	Mobile member of Acridoidea. Sampled from wild vegetation.
40. *Leva indica* (Bolicar, 1902)	Very small sized insect sampled from grasses.
41. *Chorthippus indus* (Uvarov, 1942)	Abundantly present in paddy and grasses. Is a big insect as compared to other members of the subfamily Gomphocerinae. Sampled from grasses.
42. *Stenohippus mundus* (Walker, 1871)	Very small in size. Present mostly in crop fields. Near about absent from wild vegetations and leguminous crops. Sampled from paddy.
43. *Dociostaurus apicalis* (Walker, 1871)	Same as above.
44. *Aulacobothrus luteips luteips* (Walker, 1871)	Same as above.

Figure I. Map of India depicting state's geographic position.

Figure II. Map of Jharkhand.