

## Taxonomic Studies of Calliptaminae and Coptacridinae (Acrididae: Orthoptera) in Uttar Pradesh (India)

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### Abstract

Survey was made to collect the grasshoppers from different ecosystems in Uttar Pradesh, India, during the period of 2011-2013. Grasshoppers are the members of family Acrididae, which constitute an important group of pests causing significant damage to agricultural crops, grasslands and pastures all over the world. *Acorypha insignis* of the subfamily Calliptaminae and *Eucoptacra praemorsa* of the subfamily Coptacridinae have been recorded from Uttar Pradesh. Grasshoppers of these subfamilies are regarded as minor pest of agricultural crops and also destroy the vegetations. Both the grasshoppers are extensively found in mixed vegetations of herbs, shrubs and grasses and causes damage to agricultural crops and grasses through defoliation.

**Keywords:** Taxonomy, Calliptaminae, Coptacridinae, Acrididae, grasshoppers, Uttar Pradesh, India

### Introduction

Orthoptera is one of the largest order of insects, constituting 26,330 valid species and are found throughout the world (<http://Orthoptera.SpeciesFile.org>). Dated 20.3.2014) and out of that 1033 species, 400 genera and 21 families are known from India (Shishodia *et al.*, 2010). The Order is divided into two suborders *i.e.* Caelifera called short horned grasshoppers and Ensifera called long horned grasshoppers (Ander, 1939). Acrididae is the family under the Caelifera called grasshoppers and locust, comprising 8,000 species around the world and out of that 136 species and 28 genera are endemic (Chandra and Gupta, 2013).

In general members of the family Acrididae are called grasshoppers and locusts. Grasshoppers are medium to large sized insects found all over the world and best known for their ability to jump incredible heights and distances. They can migrate over long distances when the weather gets too cold. They live in grassy areas such as fields and meadows and forest and woodland. Antennae of the grasshopper are known to be remarkably long in order to make sense of their surroundings. Grasshoppers have six jointed legs that are incredibly powerful for such a small creature, as grasshoppers are able to jump extraordinary distances. The two back legs of the grasshopper are long and powerful and are just for jumping, where the four front legs of the grasshopper are primarily used to hold onto prey and to help it to walk. Despite their large size, grasshoppers are herbivores and have a diet that consists solely of plant matter. Grasshoppers eat grasses, weeds, leaves, shrubs, bark and numerous other species of plants that surround them. They cause considerable damage to agricultural crops, pastures and forests (Joshi *et al.*, 1999). The primary diet for grasshoppers are grasses and forbs (Behmer and Joern, 1993). It is primarily graminivorous, feeding on several common grasses and sedges (Mulkern, 1967).

Grasshoppers belonging to subfamily Calliptaminae not recorded as a major pest from the country, they cause minor damage to agricultural crops thus regarded as minor pest. The taxonomy of these grasshoppers have been done by Kirby (1914), Uvarov (1943), Bei-Beinko and Mishchenko (1951), Termier (1991), Soomro and Wagan (2005) Indian Sub-Continent. Recently taxonomy of these species have been done by Usmai *et al.*, (2010) from Western Uttar Pradesh, Usmani and Nayeem (2012) from Bihar, Nayeem and Usmani from Jharkhand (2012),

Kumar and Usmani (2013) from Rajasthan and consolidated study of the subfamily in Uttar Pradesh not known and present authors tried to find out these grasshoppers in order to make the record up to date.

Members of the subfamily Coptacridinae also have been described by Kirby (1914), Bei-Beinko and Mishchenko (1951) from Sub Continent whereas Chandra *et al.*, (2007), Shishodia and Gupta (2009), Usmai *et al.*, (2010), Usmani and Nayeem (2012), Nayeem *et al.*, (2013), Shishodia *et al.*, (2010) and Chandra and Gupta (2013) recorded from different parts of country. Above study indicates that subfamily Calliptaminae and coptacridinae has not been subject to recent study thus taxonomy and distribution of these species should be undertaken in order to make data of Uttar Pradesh, India, up to date.

Uttar Pradesh located at 26.8500° N, 80.9100° E has a humid temperate climate, demarcated into three distinct regions: the Himalayan region in the north, the Gangetic plains in the centre and the Vindhya hills and plateau to the south. The state is bordered by Rajasthan to the west, Haryana and Delhi to the northwest, Uttarakhand and the country of Nepal to the north, Bihar to the east, Jharkhand to the southeast, and Madhya Pradesh to the southwest. The climate varies from moderately temperate in the Himalayan region to tropical monsoon in the central plains and southern upland regions. In the plains, the average temperatures vary from 12.5°C to 17.5°C in January and 27.5°C to 32.5°C in May and June. Rainfall in the state ranges from 40-80 inches in the east to 24-40 inches in the west. It is the second largest state of India by economy, the leading sector is agriculture and majority of the population depends upon farming as its main occupation. The western region of the state is more advanced in terms of agriculture. Majority of the population depends upon farming as its main occupation. Wheat, rice, sugar cane, pulses, oil seeds and potatoes are its main products.

Taxonomic and ecological work on the grasshoppers fauna of Aligarh Fort have been done by Akhtar *et al.*, (2012) and ecological work done by Usmani *et al.*, (2012) whereas taxonomic and ecological work on the grasshoppers fauna of Aligarh have done by Usmani *et al.*, (2012), Pulses of Uttar Pradesh by Usmani *et al.*, (2012), rice ecosystem of Uttar Pradesh by Akhtar *et al.*, (2012), Singh and Singh (2014) from Eastern Uttar Pradesh (Rafi and Usmani, 2013) from Poorvanchal region of Uttar Pradesh but there is not any description of these two species, it is therefore vital to make the study on the taxonomy of these species to update the record.

## **Material and Methods**

### **A. Collection and killing**

During survey in Uttar Pradesh, authors collected *Acorypha insignis* and *Eucoptacra praemorsa* from agricultural fields and grasses. They were caught by the ordinary aerial insect net and through hand picking as well. The collected specimens were killed in bottles having soaked cotton with ethyl acetate.

### **B. Identification**

Specimens were identified with the help of binocular stereoscopic microscope (Nikon SMZ 1500) upto species level on the basis of characters like size, colour and texture, and available literature and keys. Thereafter, specimens were relaxed stretched and pinned on stretching box, and left for three days to dry to avoid odour.

### **C. Morphometry**

Measurement in mm of four important differentiating parts of body (Body length, pronotum, tegmina and hind femur) has been done with the help of Vernier Calliper. Mean value, Standard Deviation of male and female of both the species.

### **D. Genitalic studies**

For these studies apical parts of male and female were cut off and boiled in 10% KOH, clearing was done in clove oil and were mounted separately on cavity slides in Canada balsam. Slides were examined under the microscope

and drawings of the structures (Supra anal plate, Sub genital plate, Epiphallus, Aedeagus, Ovipositor and Spermatheca) were made with the help of Camera Lucida of the conventional microscope.

#### E. Preservation

Pinned specimens labeled with reference number, locality, date of collection and name of host plants were kept in store boxes and cabinets for further studies on their morphological structures. Naphthalene balls were kept in boxes to prevent decomposition of dry specimens and for wet preservation specimens are stored in plastic vials using 70 % ethyl alcohol.

#### Results

One species of grasshopper of the subfamily Calliptaminae i.e., *Acorypha insignis* and another species i.e., *Eucoptacra praemorsa* of the subfamily Coptacridinae have been recorded for the first time from Uttar Pradesh.

#### Taxonomic Account

##### *Acorypha insignis* (Walker, 1870) (Fig. 1)

*Caloptenus insignis* Walker, 1870. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum*.4:701.

*Caloptenus spissus* Walker, 1871. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum Supplement*. 70. Syn.by Kirby, 1910. *A ynonymic Catalogue of Orthoptera (Orthoptera Saltatoria, Locustidae vel Acridiidae)*. 3 (2): 551.

*Acorypha insignis* (Walker); Nayeem & Usmani. 2012. *Munis Entomology & Zoology*. 7(1):410.

*Acorypha insignis* (Walker); Kumar, H. & Usmani. 2014. *Journal of Entomology and Zoology Studies* 2(3):134

**Diagnostic characters:** Body medium sized; pronotum apparently smooth, metazona finely tectiform and considerably longer than prozona, median carina prominent, crossed by two transverse sulci; mesosternal interspace open, lobes rounded, wider than long, lower margin considerably angular; antennae uniformly filiform, nearly equal to head and pronotum together; fastigium of vertex elongate, narrow, sloping downwards, parabolic, with weak longitudinal concavity bordered by lateral carinulae, carinula of vertex easily perceptible; tegmina fully developed but comparatively shorter, more distinctly narrowed distally, discoidal area hyaline beyond middle, apex round; wings hyaline; arolium small.

**Distribution: India:** Bihar, Jharkhand, Madhya Pradesh, Rajasthan, Uttarakhand, Uttar Pradesh and West Bengal.

**Elsewhere:** Saudi Arabia, Oman and Pakistan.

**Material Examined: India: Uttar Pradesh:** Ghazipur, 2♂, 1♀, 09-X-2010, On grasses; Deoria, 3♂, 1♀, 12 -X-2010, On grasses; Kushinagar, 1♂, 12♀, 13 -X-2010, On grasses; Gorakhpur, 4♂, 2♀, 14 -X-2010, On grasses; Faizabad, 1♂, 1♀, 24-X-2010, On grasses; Sultanpur, 2♂, 4♀, 25 -X-2010, On grasses; Hamirpur, 3♂, 2♀, 04 -IX-2011, On grasses; Fatehpur, 3♂, 3♀, 11 -IX-2011, On grasses; Meerut, 2♂, 3♀, 21 -VIII-2012, On grasses; Saharanpur, 2♂, 2♀, 23-VIII-2012, On grasses.

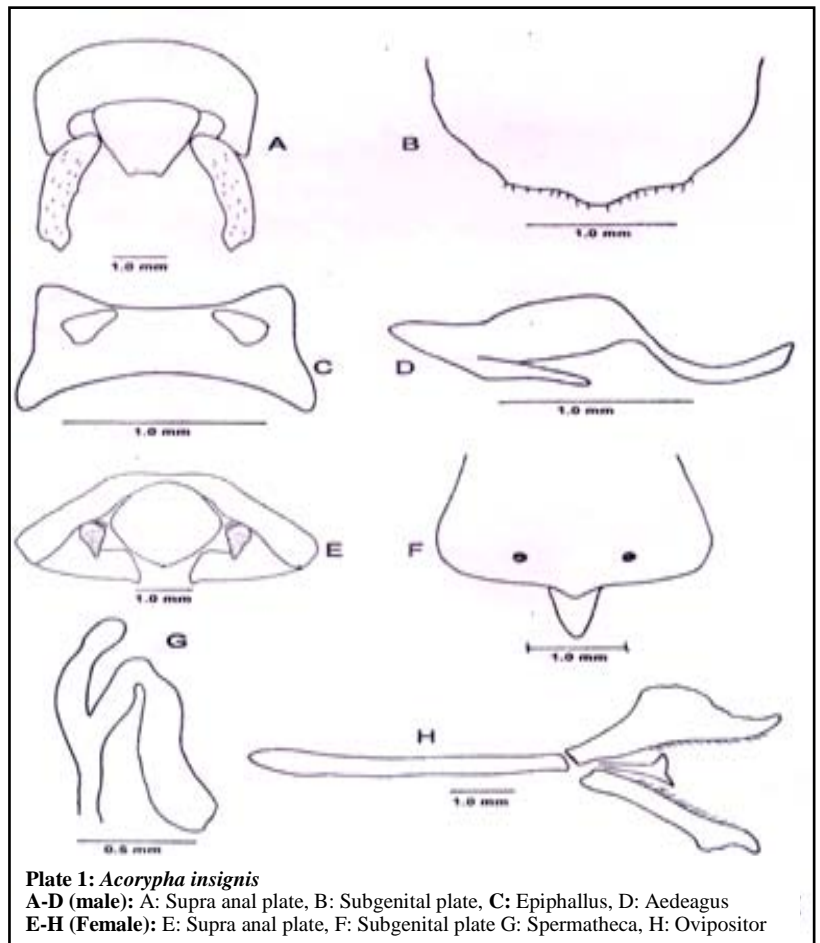
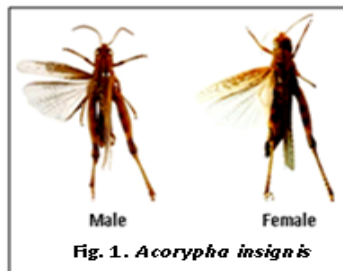
**Male:** Supra-anal plate acutely angular, longer than wide with attenuate apex; cercus robust, incurved, longer than supra-anal plate with bilobate apex; sub-genital plate short, triangular, wider than long, basally broad with obtusely rounded apex; epiphallus bridge shaped, wide and undivided, ancorae small, lophi absent; aedeagus flexured, apical valve narrow, apex acute, connected with basal valve with flexure, basal valve slightly broad basally, narrowing towards its obtuse apex (Plate 1, A-D).

**Female:** Supra-anal plate angular, longer than wide, apex obtuse angular; cercus short and conical, apex obtuse; sub-genital plate short with posterior margin not straight rather wavy, postero-lateral margin setose, egg-guide short, broad and narrowing apically, apex obtuse; spermatheca with apical diverticulum long, narrow, tubular with dilated apex, narrower and shorter than pre-apical diverticulum; pre-apical diverticulum long, broad and curved back. ovipositor with dorsal valve broad and curved, apical tip long, curved and blunt, external edge dentate while ventral valve broad and curved with apical tip small, curved and blunt (Plate 1, E-H).

**Table 1. Morphometry of *Acorypha insignis***

Measurement (mm)	Male	Female	Mean $\pm$ SD	
			Male	Female
Body length	20.68-22.89	22.56-24.39	21.87 $\pm$ 0.78	23.94 $\pm$ 0.58
Pronotum	03.78-04.81	04.79-05.68	04.46 $\pm$ 0.33	05.09 $\pm$ 0.28
Tegmina	17.82-19.25	21.34-22.28	18.41 $\pm$ 0.50	21.81 $\pm$ 0.32
Hind Femur	16.71-18.37	18.45-19.54	17.62 $\pm$ 0.61	18.88 $\pm$ 0.44

Standard deviation of 0.33 in case of male pronotum, 0.50 in case of tegmina, 0.61 in case of hind femur and 0.78 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may vary with little fractions among individuals of the species. Standard deviation of 0.28 in case of female pronotum, 0.32 in case of tegmina, 0.44 in case of hind femur and 0.58 in case of body length indicates that size of pronotum, tegmina, hind femur and body length are not of much variable and may vary with little fractions among individuals of the species.



***Eucoptacra praemorsa* (Stal, 1861) (Fig.2)**

*Acridium* (*Catantops*) *praemorsum* Stal, 1861[1860]. *Kongliga Svenska fregatten Eugenie Resa omkring jorden under befäl af C.A. Virgin aren 1851-1853 (Zoologi)*. 2 (1): 330.

*Acridium saturatum* Walker, 1870. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum*. 4: 704. Syn. by Bolivar, 1917. *Rev. Real Acad. Cienc. Exact., Fisic. Natur.* 16: 404.

*Caloptenus obliterans* Walker, 1870. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum*. 4: 712. Syn. by Bolivar, 1917. *Rev. Real Acad. Cienc. Exact., Fisic. Natur.* 16: 404.

*Caloptenus sinensis* Walker, 1870. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum*. 4: 704. Syn. by Bolivar, 1917. *Rev. Real Acad. Cienc. Exact., Fisic. Natur.* 16: 404.

*Caloptenus strigifer* Walker, 1871. *Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum Supplement*. 66. Syn. by Bolivar, 1917. *Rev. Real Acad. Cienc. Exact., Fisic. Natur.* 16: 404.

*Coptacra cyanoptera* Brunner, 1893. *Ann. Mus. Civ. Stor. Nat. Genova*, 2 [13] (33): 159. Syn. by Bolivar, 1917. *Rev. Real Acad. Cienc. Exact., Fisic. Natur.* 16: 404.

*Eucoptacra praemorsa* (Stal); Nayeem & Usmani. 2012. *Munis Entomology & Zoology*. 7 (1): 401.

**Diagnostic characters:** Body medium sized; antennae filiform, longer than head and pronotum together; head sub-conical; fastigium of vertex wide, slightly depressed; frontal ridge wide; pronotum rugose, dorsum crossed by three transverse sulci; prosternal process small, conical with obtuse apex; mesosternal interspace open, wide, lobes rounded, slightly wider than long; metasternal pits deep and not so close; tegmina fully developed; wings slightly parchment-like rather than hyaline, wingspan wide; hind femora widened basally, abruptly narrowed distally, upper carina serrated with black tipped spines, lower carina smooth, external upper carinula sharp with intermittent tubercles in middle part, lower one comparatively thick or obtuse and smooth; hind tibiae straight, moderately hairy; arolium of medium size.

**Distribution: India:** Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Orissa, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand and West Bengal. **Elsewhere:** China, Myanmar, Taiwan and Tenasserim.

**Material Examined: India: Uttar Pradesh:** Allahabad, 2♂, 3♀, 06-X-2010, On grasses; Azamgarh, 3♂, 3♀, 08-X-2010, On grasses; Kushinagar, 2♂, 3♀, 13 -X-2010, On paddy & grasses; Sultanpur, 2♂, 3♀, 25 -X-2010, On pulses & grasses; Jhansi, 3♂, 2♀, 01 -IX-2011, On forest & grasses; Lalitpur, 3♂, 3♀, 02 -IX-2011, On forest & grasses; Hamirpur, 4♂, 3♀, 04 -IX-2011, On paddy & grasses; Jalaun, 1♂, 2♀, 05 -IX-2011, On grasses; Kanpur Dehat, 2♂, 2♀, 06-IX-2011, On grasses; Meerut, 3♂, 3♀, 21-VIII-2012, On grasses; Saharanpur, 4♂, 3♀, 23-VIII-2012, On grasses.

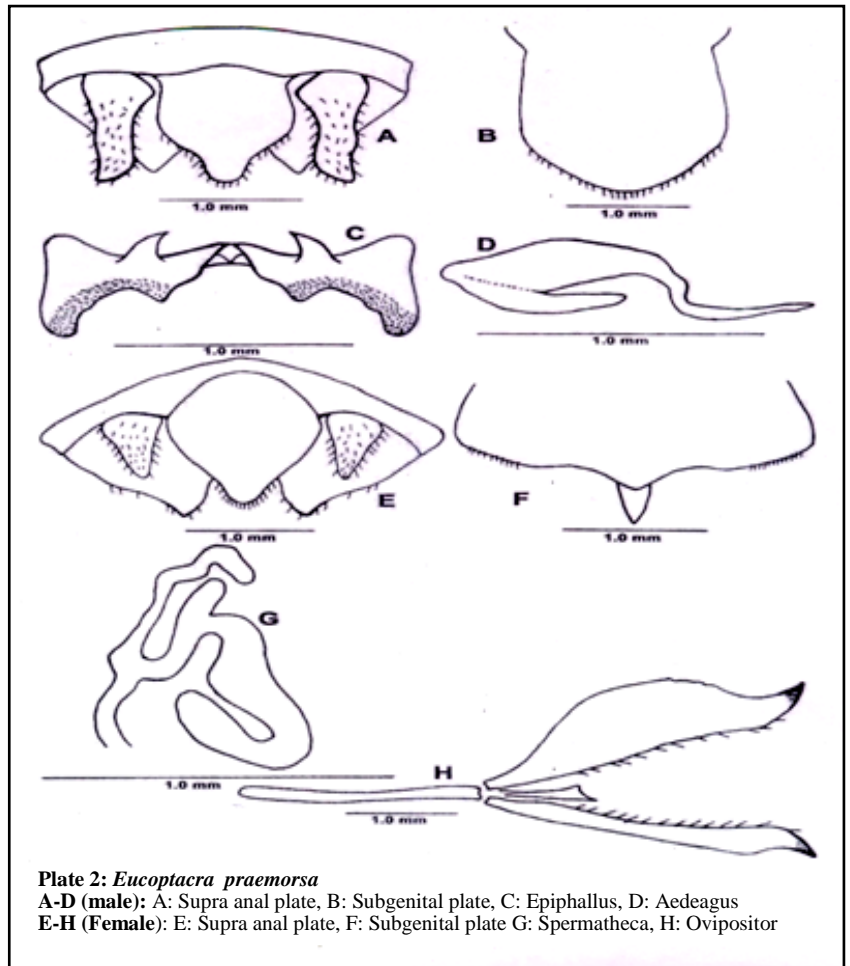
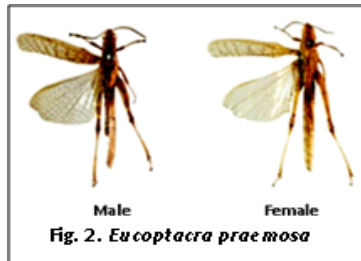
**Male:** Supra-anal plate longer than wide with medially curved lateral margins, apex round; cercus compressed laterally shorter than supra-anal plate with obtusely rounded apex, sub-genital plate short with obtusely rounded apex, epiphallus bridge narrow and divided medially, ancorae large and incurved, anterior projection broad with obtuse apex, posterior projection broad with rounded apex, lophi large and lobiform; aedeagus flexured, apical valve narrow, apex obtuse, connected with basal valve with flexure, basal valve slightly broad, narrowing towards its apex (Plate 2, A-D).

**Female:** Supra-anal plate longer than wide with obtuse- angular apex; cercus short and conical; sub-genital plate broad, posterior margin angled medially, setose marginally; egg-guide short with pointed apex; spermatheca with long apical diverticulum, slightly bent apically, pre-apical diverticulum tubular, bent in the middle; ovipositor with dorsal valve long and broad, longer than lateral apodeme, apical tip long and blunt, ventral valve narrow and curved, mesial valve curved apically with acute apex (Plate 2, E-H).

**Table 2. Morphometry of *Eucoptacra praemorsa***

Measurement (mm)	Male	Female	Mean ± SD	
			Male	Female
Body length	16.89-18.22	21.94-23.40	17.70±0.52	22.63±0.51
Pronotum	03.71-04.24	04.12-04.58	03.91±0.18	04.37±0.15
Tegmina	18.48-19.22	22.54-23.62	18.84±0.31	22.74±0.36
Hind Femur	10.56-11.72	14.62-15.95	11.19±0.47	15.32±0.58

Standard deviation of 0.18 in case of male pronotum and 0.31 in case of tegmina 0.47 in case of hind femur and 0.52 in case of body length indicates that size of pronotum, tegmina, hind femur and body length are not of much variable and may vary with small fractions among individuals of the species. Standard deviation of 0.15 in case of female pronotum and 0.36 in case of tegmina 0.58 in case of hind femur and 0.51 in case of body length indicates that size of pronotum, tegmina, hind femur and body length are not of much variable and may vary with small fractions among individuals of the species.



## **Discussion**

Grasshoppers feed on plant foliage, with a particular fondness for grasses and spurges. When grasshoppers populations increase to the point of crowding, can completely defoliate grasslands and agricultural crops over large areas. They are dominant ground invertebrates in cultivated crops and natural vegetations, cause considerable damage to agricultural crops, pastures and forests and are well reputed for their destructiveness all over the world. The primary diet for grasshoppers are grasses and forbs. It is primarily graminivorous, feeding on several common grasses and sedges. Three special type of vegetation namely Savanah, Tropical rain forest and Alpine forest, faster the grasshopper population.

There is no previous record of these grasshoppers from Uttar Pradesh. Present study indicates that these species are frequently distributed throughout the state in grasses and paddy fields. When present in large numbers they feed on leaves and severe defoliation is caused, followed by arrested growth and size of plants, which results in low yield or no yield at all. Hoppers are more dangerous than adults and no more differences observed among them except wing, hoppers are usually wingless which later transforms into developed wings. Population of these species of grasshoppers fluctuates on first shower of monsoon in the month of June/July relatively becomes low with decreasing temperature from the month of November. In the present study taxonomy and mode of damage have been discussed and distribution revealed that these grasshoppers extensively found in grasses than crops. On the absence of grasses feeds upon crops, thus cultivation techniques should be modified in such a way that grasses which support population of grasshoppers may be grown around the crop field to reduce damage.

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