



ORIGINAL ARTICLE

Taxonomic Studies of Stridulating Slant-faced Grasshoppers (Gomphocerinae: Acrididae: Orthoptera) in Uttar Pradesh, India

Md. Humayoon Akhtar, Md. Rashid Nayeem and Md. Kamil Usmani

Department of Zoology, Aligarh Muslim University, Aligarh-202002, U.P., India

Email: usmanikamil94@gmail.com

ABSTRACT

To record the availability of grasshopper species belonging to sub family Gomphocerinae, a survey was conducted in different habitats of Uttar Pradesh from 2010 to 2012. As per the literature, from the area, five species belonging to four genera are reported. Forty four species are reported from India, however twenty one tribe, two hundred genera and more than thousands of species are reported from the globe. The grasshoppers are small grass specialists, commonly heard in meadows chorusing during the day by producing sound with the help stridulatory pegs on hind femur thus also called as stridulating slant faced grasshoppers.

Key words: Taxonomy, Slant faced, Grasshoppers, Gomphocerinae, Uttar Pradesh

Received: 25th May 2017, Revised: 1st August 2017, Accepted: 10th August 2017

©2017 Council of Research & Sustainable Development, India

How to cite this article:

Akhtar M.H., Nayeem M.R. and Usmani M.K. (2017): Taxonomic Survey of Stridulating Slant-faced Grasshoppers (Gomphocerinae: Acrididae: Orthoptera) in Uttar Pradesh, India. *Annals of Natural Sciences*, Vol. 3[3]: September, 2017: 17-27.

INTRODUCTION

Gomphocerinae are also known as stridulating slant-faced grasshoppers because intraspecific communication through acoustic signals, which is species specific and their songs are useful tool for taxonomic purpose and also use to monitor the species at a particular unexplored habitats (Mol 2012). They are grassfeeders but may be dangerous to the standing crops, if their numbers increase arithmetically (Uvarov 1921, Be-Bienko and Mistshenko 1951, Jago 1971). Grasshopper use acoustic signals of different duration and frequency to attract the mates (Vedenina and Zhantiev 1990, Vedenina and Shestakov 2014). Calling songs of each species has different acoustic parameters with variable range (Bukhvalova and Zhantiev 1993, Tishechkin and Bukhvalova 2009). Subfamily Gomphocerinae has been first studied by Uvarov's (1966) and thereafter studied by various scientists *i.e.*, Jago (1971), Bhowmik (1985), Ingrish (1993), Vedenina and Mugue (2011), Nattier et al. (2011), Chapco and Contreras (2011), Defaut (2012), Rowell (2013) and Hodjat (2015). In India, six species representing three genera (*Chorthippus dorsatus*, *Leva apicalis*, *Leva cruciata*, *Leva mundus*, *Dnopherula decius* and *Dnopherula luteips*) have been reported from Kashmir (Reshi et al. 2008), nine species representing four genera (*Chorthippus Indus*, *C. hammerstroemi*, *C. biguttulus*, *C. vagans*, *Dnopherula luteipes*, *D. sinensis*, *D. socius*, *Madurea cephalotes* and *Mesopsis cylindricus*) from Himachal Pradesh (Shishodia and Gupta 2009), three species (*Leva indica*, *Chorthippus Indus* and *Aulacobothrus luteips*) from North eastern region of India (Usmani and Khan 2010), two species (*Leva indica* and *Chorthippus indus*) from Aligarh (Usmani et al. 2012), two species (*Aulacobothrus luteips* and *Leva indica*) from central and eastern Uttar Pradesh (Rafi, et al. 2014), three species (*Leva indica*, *Chorthippus indus* and *Leionotacris bolivari*) from Bihar

(Usmani and Nayeem 2012a), five species (*Leva indica* and *Chorthippus indus*, *Stenohippus mundus*, *Dociostaurus apicalis* and *Aulacobothrus luteips*) from Jharkhand (Usmani and Nayeem 2012b), single species (*Aulacobothrus luteips*) from Purvanchal region of Uttar Pradesh (Rafi and Usmani 2013) and four species representing three genera (*Ochrilidia gracilis*, *Stenohippus mundus*, *Aulacobothrus strictus* and *A. taeniatus*) from Rajasthan (Kumar and Usmani 2014).

The Orthoptera is one of the largest of order of insect and divided into caelifera and ensifera suborders (Ander 1939), and currently comprises 26,730 species worldwide (Eades, et al. 2015). Family Acrididae shows maximum diversity, comprising 8,000 species, of which 136 species under 28 genera are endemic importance (Chandra and Gupta 2013) and commonly known as grasshoppers and locusts, responsible for considerable damage to agricultural crops, pastures and forests (Joshi et al. 1999). The major work of Indian Orthoptera was published by Kirby (1914) in fauna of British India, wherein 329 species belonging to 124 genera and 8 subfamilies, under family Acrididae were reported.

Uttar Pradesh is the largest state of India, ranking top in terms of population. It located at 26.8500°N, 80.9100°E comprising humid temperate climate, bordered by Bihar to the east, Rajasthan to the west, Uttarakhand to the north, 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. Summers are extreme with temperatures fluctuating anywhere between 0°C and 50°C in different parts of the state. 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, agriculture is the leading sector upon which majority of the population depends.

MATERIALS AND METHODS

During survey grasshopper was collected by ordinary aerial insect net and also through hand picking as well. They were killed by exposing them to a small amount of ethyl acetate, a toxic fumigant and preserved by pinning and drying. Toxicants were used in conjunction with a specially prepared killing jar. Usually, killing is not desirable for the nymphs because they lack the identifying characters. The alcohol preservation was best placed to prevent excessive distortion. For pin mounting of adult, a pin was inserted into the dorsal surface of grasshoppers, with the point protruding from the ventral surface. The preferred location for pinning was usually the posterior area of the prothorax and to the right of the midline. The grasshopper was pushed up on the pin, so that not only the end, but a small amount of the shaft was protruding. Below the grasshopper's body, collection data are provided via a label. Data should be included on the label was date of collection, place of collection, and collector's name. Ecological data such as habitat or host plant may also be included.

To fully appreciate the beauty and to assist identification, at least one forewing and hind wing was spread. Most frequently left forewing perpendicular to the grasshopper body was spread. A stretching board was usually used to provide wing support. Whether or not the grasshopper wings were spread, grasshoppers must be dried to aid preservation. Once dried, the wings, antennae, and legs cannot be moved without breaking, so it is important to get the body parts aligned before drying. Dried specimens identified up to species level under stereoscopic microscope with the help of available literature and specimens collected before. Morphometry was also done with the help of Vernier Calliper and Mean and Standard Deviation were calculated to show the possible mean deviation of body size and also to determine the stability of data. Finally at the end mounted specimens were kept in storage boxes using naphthalene balls to prevent decomposition for future record. Specimens were deposited in the museum of the Department of Zoology, Aligarh Muslim University, Aligarh.

RESULTS

Five species belonging to four genera are reported from the area studied. Keys to the genera and species, description, distribution, materials examined and morphometry are given. This is the first study were done in detail.

SUBFAMILY GOMPHOCERINAE FIEBER, 1853

Gomphoceri Fieber, 1853. Lotos. 3: 90-104, 115-129, 138-154, 168-176, 184-188, 201-207, 232-238, 252-261.

Type-genus: *Gomphocerus* Thunberg, 1815. Mem. Acad. Imp. Sci. St. Peterburg. 5: 221.

Diagnostic characters: Body small to medium size, usually moderately slender, laterally compressed; antennae usually filiform; pronotum with median and lateral carinae; prosternal process usually absent, if present then antennae ensiform and body strongly elongate; expanded area of tegmina without medial veins; tympanum present; hind femur with stridulatory file represented by articulated pegs, lower lobe shorter than upper one. Four genera of this subfamily have been reported from the region and a key for their separation is given below.

Remarks: The Subfamily representing twenty one tribes, two hundred genera, more than thousands of species from the world (Eades et al. 2015), forty four species from India (Shishodia et al. 2010) and five species representing four genera have been reported from the area.

KEY TO INDIAN GENERA OF THE SUBFAMILY GOMPHOCERINAE FIEBER, 1853

1. Antennae filiform; prosternal process present; head obtusely conical; base of anterior margin of tegmina with projection.....2
- Antennae ensiform; prosternal process absent; head acutely conical; base of anterior margin of tegmina without projection.....*Ochrilidia* Stal, 1873
2. Fastigium of vertex lacking median carinula..... *Leva* Bolivar, 1909
- Fastigium of vertex with median carinula.....3
3. Fastigial foveolae weak, hardly visible from above; pronotum with lateral carinae angularly incurved; arolium of small size.....*Aulacobothrus* Bolivar, 1902
- Fastigial foveolae deep, visible from above; pronotum with lateral carinae straight; arolium of medium size.....*Chorthippus* Fieber, 1852

Genus *Ochrilidia* Stal, 1873

Ochrilidia Stal, 1873. Recencio Orthopterorum. Revue critique des Orthopteres decrits par Linne, De Geer et Thunberg. 1: 92, 104.

Type-species: *Ochrilidia tryxalicera* Stal, 1873. Recencio Orthopterorum. Revue critique des Orthopteres decrits par Linne, De Geer et Thunberg. 1: 92, 104.

Platypterna Fieber, 1853. Lotos. 3: 98.

Type-species: *Platypternatibialis* Fieber, 1853. Lotos. 3: 98.

Platypternella Salfi, 1928. Ann. Mag. nat. Hist. 10-2: 192-6. Syn.By Dirsh, 1958. Rev. Ent. Moçambique. 1: 239.

Type-species: *Platypternella pictifemur* Salfi, 1928. Ann. Mag. Nat. Hist. 10 2:193.

Platypternopsis Chopard, 1947. Rev. Franc. Ent. 13: 151. Syn. By Dirsh, 1958. Tijdschr.v. Entomologie. 101: 51.

Type-species: *Platypternopsis bivittata* Chopard, 1947. Rev. Franc. Ent. 13: 151.

Diagnostic characters: Body of medium size; integument finely rugose; antennae ensiform, as long as or slightly shorter than head and pronotum together; head conical, shorter than pronotum; fastigium of vertex angular, shorter than eye length, with median and lateral carinulae; fastigial foveolae elongate; frontal ridge narrow, sulcate; pronotum flattened, median carina well developed, crossed by posterior transverse sulcus, lateral carinae straight and parallel, or slightly incurved, or straight and slightly diverging backwards; metazona shorter than prozona, posterior margin obtuse-angular;

mesosternal interspace elongate, narrow, constricted; tegmina and wings fully developed, base of anterior margin of tegmen without projection; hind femur slender, inner margin of inner side with a row of stridulatory pegs; arolium of medium size.

Remarks: This genus representing 32 species worldwide (Eades et al., 2015), two species from India i.e., *geniculata* and *gracilis* (Shishodia et al., 2010) and represented by single species from the region.

***Ochrilidia gracilis gracilis* (Krauss, 1902)**

Platypterna gracilis Krauss, 1902. Verh. der Zoologisch-Botanischen Gesellsch. Wien. 52: 231, 236.

Platypterna acuta Bolivar, 1908. Bull. Soc. entomol. Fr. 244. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna curvifrons Bolivar, 1908. Bull. Soc. entomol. Fr. 245. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna aegyptia Uvarov, 1924. Bull. Minist. Agric. Egypt Tech. & Sci. Serv. 41: 18,20, 21. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna aethiopica Salfi, 1931. Eos. 7: 269. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna affinis Salfi, 1931. Eos. 7: 326. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna obtusa Salfi, 1931. Eos. 7: 268, 324. Syn. By Jago, 1977. Acrida. 6(3): 186.

Platypterna uvarovi Salfi, 1931. Eos. 7: 342. Syn. By Jago, 1977. Acrida. 6(3): 186.

Ochrilidia gracilis gracilis (Krauss); Massa, 2009. Jour. Orth. Res. 18(1): 86.

Diagnostic characters: Body medium sized; head conical; fastigium of vertex angular, slightly longer than wide, weakly concave, median and lateral carinulae sharp, apex rounded; fastigial foveolae elongate; frons strongly oblique; frontal ridge narrow, sulcate, slightly diverging posteriorly with sharp lateral carinulae; pronotum finely tectiform, median carina crossed by posterior transverse sulcus only, lateral carinae prominent, angularly incurved in prozona while diverging in metazona, prozona longer than metazona, anterior margin straight while posterior margin obtuse angular with obtuse apex; antenna ensiform, as long as head and pronotum together; prosternal process conical, apex acute; mesosternal interspace open, lobes rounded, slightly wider than long, mesosternal furcal suture strong; tegmina fully developed, exceeding abdomen; hind femur short, slender; hind tibia straight with two rows of dorsal spines; arolium of medium size.

Distribution:

India: Haryana, Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan and Uttar Pradesh.

Elsewhere: Aden, Algeria, Egypt, Ethiopia, Israel, Iraq, Iran, Jordan, Kenya, Libya, Mali, Niger, Pakistan, Somali Republican, Saudi Arabia, Sudan and Turkey.

Material Examined: India, Uttar Pradesh: Jaunpur, 3♂, 2♀, 07-X-2010, on grasses; Azamgarh, 2♂, 4♀, 08-X-2010, On paddy & grasses; Gorakhpur, 1♂, 2♀, 14-X-2010, On grasses; Faizabad, 1♂, 1♀, 24-X-2010, On paddy & grasses; Sultanpur, 4♂, 4♀, 26-X-2010, On paddy & grasses; Hamirpur, 3♂, 2♀, 04-IX-2011, On grasses; Fatehpur, 4♂, 1♀, 11-IX-2011, On grasses; Hathras, 4♂, 2♀, 02-VIII-2012, On grasses; Shahjahanpur, 3♂, 5♀, 14-VIII-2012, On grasses; Meerut, 1♂, 4♀, 21-VIII-2012, On paddy & grasses; Saharanpur, 4♂, 1♀, 23-VIII-2012, On paddy & grasses.

Morphometry:

Standard deviation of 0.26 in case of male pronotum, 0.44 in case of tegmina, 0.50 in case of hind femur indicates that size of pronotum, hind femur and tegmina are not of much variable whereas size of male body varies with little fractions among individuals of the species. Standard deviation of 0.21 in case of pronotum of female, 0.55 in case of hind femur and 0.74 in case of tegmina also shows that size of pronotum, hind femur and

tegmina are not of much variable and size of body of female varies with little fractions among individuals.

Measurement (mm)	Male	Female	Mean \pm SD	
			Male	Female
Body length	16.74-18.34	20.35-23.68	17.67 \pm 0.61	22.26 \pm 1.05
Pronotum	3.42-3.91	3.94-4.57	3.34 \pm 0.26	4.34 \pm 0.21
Tegmina	18.43-19.74	14.29-16.54	18.90 \pm 0.44	15.19 \pm 0.74
Hind Femur	10.41-12.15	21.73-22.68	11.28 \pm 0.50	21.95 \pm 0.55

Genus *Leva* Bolivar, 1909

Leva Bolivar, 1909. Bol. R. Soc. Esp. Hist. Nat. 9: 292.

Type-species: *Gymnbothrus indicus* Bolivar, 1902 (= *Leva indica*). Ann. Soc. Ent. Fr. 70: 596.

Bodenheimerella Uvarov, 1933. Ann. Mag. nat. Hist. 10-11: 667. Syn. By Jago, 1996. Jour. Orth. Res. 5: 87.

Type-species: *Bodenheimerella jordanica* Uvarov, 1933. Ann. Mag. nat. Hist. 10-11: 667.

Diagnostic characters: Body of small size; antennae filiform, longer than head and pronotum together; head subconical, shorter than pronotum; vertex without lateral carinulae; 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, median carina crossed by posterior transverse sulcus only, lateral carinae angularly incurved; metazona about half as long as prozona, posterior margin obtuse-angular; prosternal process absent; mesosternal interspace open; tegmina and wings fully developed, base of anterior margin of tegmina with small projection; hind femora slender; hind tibia with inner spur of inner side as long as external one; arolium small.

Remarks: This genus representing twenty species from the world (Eades et al., 2015), two species from India i.e., *indica* and *solute* (Shishodia et al., 2010) and represented by single species from the region.

Leva indica (Bolivar, 1902)

Gymnbothrus indicus Bolivar, 1902 [1901]. Ann. Soc. Ent. Fr. 70: 596.

Leva cruciata Bolivar, 1914. Trab. Mus. Cienc. Nat., Madrid (Ser. Zool.). 20: 65. Syn. by Jago, 1996. Jour. Orth. Res. 5: 94.

Leva indica (Bolivar); Nayeem & Usmani, 2012. Munis Entomology & Zoology 7(1): 410.

Diagnostic characters: Body small sized; head sub-conical in profile; fastigium of vertex acutely parabolic, concave with well-developed lateral carinulae, frons oblique; fastigial foveolae strong and visible from above; frontal ridge moderate, sulcate, diverging posteriorly, narrowing at apex with obtuse lateral carinae; pronotum with dorsum smooth, median carina prominent, crossed by posterior transverse sulcus only, lateral carinae sharp, crossed by posterior two transverse sulci; antennae filiform and slightly depressed; longer than head and pronotum together; tegmina fully developed, semi-transparent, exceeding abdomen; wings hyaline, apex fuscated, wingspan fair; hind femur slender, carinae smooth, external lower carinula with intermittent fuscous dots; hind tibia nearly straight with rows of dorsal black spines; arolium of small size.

Distribution:

India: Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Karnataka, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal.

Elsewhere: Sri Lanka.

Material Examined: India, Uttar Pradesh: Azamgarh, 3♂, 3♀, 08-X-2010, On grasses; Ballia, 2♂, 11-X-2010, On grasses; Deoria, 5♂, 3♀, 12-X-2010, On grasses; Kushinagar, 2♂, 1♀, 13-X-2010, On grasses; Gorakhpur, 1♂, 3♀, 14-X-2010, On grasses; Hamirpur,

3♂,4♀, 04-IX-2011, On grasses; Fatehpur, 1♂,1♀, 11-IX-2011, On grasses; Aligarh, 2♂,4♀, 01-VIII-2012, On grasses; Etawah, 7♂,4♀, 08-VIII-2012, On grasses; Meerut, 1♂,4♀, 21-VIII-2012, On grasses; Saharanpur, 3♂,2♀, 23-VIII-2012, On grasses; Bijnor, 5♂,3♀, 25-VIII-2012, on grasses.

Morphometry:

Standard deviation of 0.28 in case of male pronotum, 0.28 in case of tegmina, 0.38 in case of hind femur indicates that size of pronotum, hind femur and tegmina are not of much variable whereas size of male body varies with little fractions among individuals of the species. Standard deviation of 0.26 in case of pronotum of female, 0.38 in case of hind femur and 0.33 in case of tegmina also shows that size of pronotum, hind femur and tegmina are not of much variable whereas size of body of female varies with large fractions among individuals.

Genus *Aulacobothrus*

Measurement (mm)	Male	Female	Mean \pm SD	
			Male	Female
Body length	15.82-16.26	17.57-18.63	16.34 \pm 0.57	18.18 \pm 0.58
Pronotum	3.72-3.98	3.89-4.21	3.66 \pm 0.28	4.14 \pm 0.26
Tegmina	13.22-13.98	15.28-15.94	13.55 \pm 0.38	15.65 \pm 0.33
Hind Femur	10.31-10.95	11.58-12.34	10.61 \pm 0.32	11.93 \pm 0.38

Bolivar, 1902

Aulacobothrus Bolivar, 1902. Ann. Soc. Ent. Fr. 70: 597.

Type-species: *Aulacobothrus strictus* Bolivar, 1902. Ann. Soc. Ent. Fr. 70: 598.

Phorenula Bolivar, 1909. Bol. R. Soc. Esp. Hist. Nat. 9: 296. Syn. By Bey-Bienko and Mishchenko, 1951. Locusts and Grasshoppers of the U.S.S.R. and Adjacent Countries. 2: 437(61).

Type-species: Not available.

Diagnostic characters: Body small in size; head obtusely rounded, shorter than pronotum; antennae filiform, as long as or longer than head and pronotum together; fastigium of vertex angular, concave, without median carinula, shorter than eye length; frons oblique; fastigial foveolae of variable shapes, visible from above; frontal ridge flat; pronotum subcylindrical, median carina well developed, crossed by posterior transverse sulcus only, lateral carinae straight, angularly incurved or excurved; metazona as long as or shorter than prozona, posterior margin angular; prosternal process absent; mesosternal interspace open; tegmina and wings fully developed, base of anterior margin of tegmina with small projection; hind femora slender; hind tibia with inner spur longer than external one; arolium small.

The genus is represented by two species from the region. Key for their separation is given below

Remarks: This genus representing eighteen species from the world (Eades et al., 2015), nine species from India i.e., *jaganathi*, *luteipes inferrus*, *luteipes luteipes*, *rubripes*, *sinensis*, *socius*, *strictus*, *svenhedini* and *taeniatus* (Shishodia et al., 2010) and represented by two species from the area.

KEY TO SPECIES OF THE GENUS *AULACOBOTHRUS* BOLIVAR, 1902

1. Tegmina with cubital area much wider than medial area; posterior transverse sulcus distinctly behind middle *A. luteipes luteipes* (Walker, 1871)
- Tegmina with cubital area slightly wider than medial area; posterior transverse sulcus in or slightly behind middle *A. taeniatus* Bolivar, 1902

***Aulacobothrus luteipes luteipes* (Walker, 1871)**

Stenobothrus luteips Walker, 1871. Catalogue of the Specimens of Dermaptera Saltatoria in the Collection of the British Museum Supplement, 82.

Stauroderus bicolor Kirby, 1914. Fauna of British India, including Ceylon and Burma. Orthoptera (Acrididae), 127. Syn. By Jago, 1971. Proc. Acad. Nat. Sci. Philad. 123: 242.

Aulacobothrus luteipes luteipes (Walker); Nayeem and Usmani, 2012. Munis Entomology & Zoology. 7(1): 411.

Diagnostic characters: Body small sized; pronotum slightly tectiform, median and lateral carinae well developed, dorsum with three transverse sulci, median carina crossed by posterior transverse sulcus only; antenna filiform, longer than head and pronotum together; head rounded; fastigium of vertex angular, slightly wider than long; fastigial foveolae trapezoidal, visible from above; frons oblique; frontal ridge broad, sulcate, slightly constricted below median ocellus, nearly parallel with obtuse lateral carinulae; prosternal process absent; tegmina fully developed, surpassing apex of hind femur; wings slightly shorter, apical one-third region fuscated, wingspan moderate; hind femur stout, upper and lower carinae smooth, inner medial disc with stridulatory file; lower genicular lobe rounded; hind tibia straight with two rows of dorsal spines, twelve dorso-external and thirteen dorso-internal, inner pair of spurs slightly longer than outer pair; arolium of small size.

Distribution:

India: Andaman and Nicobar Islands, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere: Bangladesh, China, Europe, Japan, Myanmar, Nepal, North-America, Pakistan, Sri Lanka, Taiwan and Thailand.

Material Examined: India, Uttar Pradesh: Sonbhadra, 4♂,4♀,01-X-2010, on grasses; Mirzapur, 2♂,4♀, 02-X-2010, on grasses; Azamgarh, 2♂,5♀, 08-X-2010, On grasses; Ghazipur, 4♂,5♀, 09-X-2010, On grasses; Mau, 3♂,3♀, 10-X-2010, On grasses; Ballia, 2♂, 11-X-2010, On grasses; Deoria, 5♂,5♀, 12-X-2010, On grasses; Kushinagar, 1♂,3♀, 13-X-2010, On grasses; Gorakhpur, 2♂,4♀, 14-X-2010, On grasses; Hamirpur, 3♂,3♀, 04-IX-2011, On grasses; Fatehpur, 1♂,4♀, 11-IX-2011, On grasses; Aligarh, 3♂,2♀, 01-VIII-2012, On grasses; Etawah, 3♂,1♀, 08-VIII-2012, On grasses; Saharanpur, 3♂,2♀, 23-VIII-2012.

Morphometry:

Standard deviation of 0.14 in case of male pronotum, 0.30 in case of tegmina, 0.41 in case of hind femur and 0.51 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species. Standard deviation of 0.15 in case of pronotum of female, 0.55 in case of hind femur and 0.49 in case of tegmina and 0.64 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species.

Measurement (mm)	Male	Female	Mean ± SD	
			Male	Female
Body length	16.89-18.22	21.94-23.40	17.71±0.51	22.34±0.64
Pronotum	3.01-3.24	4.12-4.52	3.24±0.14	4.37±0.15
Tegmina	18.48-19.22	15.20-15.67	18.84±0.30	15.12±0.49
Hind Femur	10.56-11.21	21.67-22.54	11.15±0.41	21.86±0.55

***Aulacobothrus taeniatus* Bolivar, 1902**

Aulacobothrus taeniatus Bolivar, 1902. Ann. Soc. Ent. Fr., Paris. 70: 600.

Scyllina physopoda Navas, 1904. Bol. Soc. Arag. Cienc. Nat. 3: 133. Syn. By Ingrisch, 1993. Entomologica Scandinavica. 24(3): 328.

Aulacobothrus taeniatus Bolivar; Willemse, 1951. Publ. natuurhist. Genootsch. Limburg. 4: 62.

Diagnostic characters: Body small sized; head rounded; fastigium of vertex angular, slightly longer than wide, concave, median carinula extending up to middle, lateral carinulae sharp, apex obtuse angular; fastigial foveolae trapezoidal, visible from above; frons oblique; frontal ridge broad, flat, weakly depressed below median ocellus, nearly parallel with obtuse lateral carinulae; antenna filiform, longer than head and pronotum together; pronotum slightly tectiform, median and lateral carinae well developed, dorsum with three transverse sulci, median carina crossed by posterior transverse sulcus only, lateral carinae converging medially, prozona longer than metazona, anterior margin straight while posterior margin strongly excurved; prosternal process absent; mesosternal interspace open, lobes rounded, wider than long, mesosternal furcal suture strong; metasternal pits much closely set; tegmina fully developed, exceeding abdomen; wings slightly shorter, fascia lacking, wingspan moderate; hind femur stout, upper and lower carinae smooth; hind tibia straight with two rows of dorsal spines; arolium of small size.

Distribution:

India: Himachal Pradesh, Jammu and Kashmir, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

Elsewhere: China, Europe, Japan, Myanmar and North Africa.

Material Examined: India, Uttar Pradesh: Sonbhadra, 3♂, 2♀, 01-X-2010, on grasses; Mirzapur, 2♂, 3♀, 02-X-2010, on grasses; Azamgarh, 6♂, 5♀, 08-X-2010, On grasses; , Ghazipur, 2♀, 09-X-2010, On grasses; Mau, 4♂, 2♀, 10-X-2010, On grasses; Ballia, 4♂, 3♀, 11-X-2010, On grasses; Deoria, 5♂, 6♀, 12-X-2010, On grasses; Kushinagar, 2♂, 1♀, 13-X-2010, On grasses; Gorakhpur, 3♂, 3♀, 14-X-2010, On grasses; Jhansi, 4♂, 6♀, 01-IX-2011, paddy, forest & grasses; Lalitpur, 5♂, 3♀, 02-IX-2011, forest & grasses; Hamirpur, 4♂, 5♀, 04-IX-2011, On grasses; Fatehpur, 2♂, 4♀, 11-IX-2011, On grasses; Aligarh, 5♂, 6♀, 01-VIII-2012, On grasses; Etawah, 1♂, 08-VIII-2012, On grasses; Agra, 1♂, 1♀, 09-VIII-2012, On paddy & grasses; Ghaziabad, 1♂, 1♀, 17-VIII-2012, On paddy & grasses; Saharanpur, 4♂, 4♀, 23-VIII-2012, On grasses.

Morphometry:

Standard deviation of 0.34 in case of male pronotum, 0.60 in case of tegmina, 0.54 in case of hind femur and 0.50 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species. Standard deviation of 0.14 in case of pronotum of female, 0.66 in case of hind femur and 0.68 in case of tegmina and 0.88 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species.

Measurement (mm)	Male	Female	Mean ± SD	
			Male	Female
Body length	17.29-18.95	21.81-23.97	18.10±0.50	22.82±0.88
Pronotum	3.39-4.02	4.28-4.72	3.48±0.34	4.48±0.14
Tegmina	18.56-20.31	14.86-16.81	19.23±0.60	15.01±0.68
Hind Femur	10.78-12.29	21.02-22.92	11.55±0.54	22.16±0.66

***Chorthippus* Fieber, 1852**

Chorthippus Fieber. 1852. In Kelch. Grundlage zur Kenntnis der Orthopteren Gradflügler) Oberschlesiens, und Grundlage zur Kenntnis der Käfer Oberschlesiens, erster Nachtrag (Schulprogr.). Ratibor 1

Type species: *Acrydium albomarginatum* De Geer, 1873

Megaulacobothrus Caudell, 1921: 27. Syn. By Mishchenko, 1951 Catantopinae: 137

Type species: *Megaulacobothrus fuscipennis* Caudell, 1921

Plagiophlebis Houlbert, 1927: 94. Syn. By Mishchenko, 1951 Catantopinae: 137

Diagnostic characters: Body small to medium size; antennae filiform, longer than head and pronotum together; head subconical, shorter than pronotum; fastigium of vertex angular, shorter than eye length, depressed with median carinula; fastigial foveolae deep, visible from above; frontal ridge flat; pronotum flat, slightly tectiform, median carina crossed by posterior transverse sulcus only, lateral carinae straight and parallel in prozona and slightly diverging in metazona; metazona about as long as prozona, posterior margin obtuse-angular; mesosternal interspace open; tegmina and wings fully developed or shortened, base of anterior margin of tegmina with small projection; hind femora slender; arolium of medium size.

Remarks: This genus representing 206 species from the world (Eades et al. 2015), three species *almoranus*, *indus* and *hammerstroemi* (Shishodia et al. 2010) and represented by single species from the region.

***Chorthippus indus* Uvarov, 1942**

Chorthippus indus Uvarov. 1942. Eos 18: 98.

Chorthippus indus; Bey-Bienko & Mishchenko. 1951. Locusts and Grasshoppers of the U.S.S.R. and Adjacent Countries 2: 510(144).

Chorthippus indus; Singh. 2003. Rec. Zool. Survey India 101(3-4): 147-157.

Chorthippus indus; Nayeem & Usmani. 2012. Munis Entomology & Zoology 7(1): 410.

Diagnostic characters: Body small sized; pronotum tricarinate with transverse sulcus placed about the middle; lateral carinae of pronotum parallel, slightly diverging in metazona; Head subconical; fastigium of vertex angular, shorter than eye length, depressed with median carinula; fastigial foveolae deep, visible from above; frontal ridge flat; pronotum flat, slightly tectiform, median carina crossed by posterior transverse sulcus only; tegmina longer than abdomen in males and shorter in females; antennae sub depressed and longer than head and pronotum together; arolium of medium size

Distribution:

India: Himachal Pradesh, Jammu and Kashmir, Uttarakhand, Uttar Pradesh and West Bengal.

Elsewhere: Pakistan

Material Examined: India: Uttar Pradesh: Aligarh, 2♂, 2♀, 01-VIII-2012, On grasses; Jhansi, 3♂, 5♀, 01-IX-2011, On grasses; Meerut, 2♂, 3♀, 21-VIII-2012, On grasses; Saharanpur, 1♂, 1♀, 23-VIII-2012, On grasses.

Morphometry:

Standard deviation of 0.22 in case of male pronotum, 0.65 in case of tegmina, 0.57 in case of hind femur and 0.72 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species. Standard deviation of 0.30 in case of pronotum of female, 0.62 in case of hind femur and 0.47 in case of tegmina and 0.69 in case of body length indicates that size of pronotum, hind femur, tegmina and body length are not of much variable and may varies with little fractions among individuals of the species.

Measurement (mm)	Male	Female	Mean ± SD	
			Male	Female
Body length	14.45-15.89	16.46-17.84	15.22 ± 0.72	17.17 ± 0.69
Pronotum	3.42-3.87	3.32-3.92	3.64 ± 0.22	3.60 ± 0.30
Tegmina	12.46-13.76	14.39-15.34	13.15 ± 0.65	14.87 ± 0.47
Hind Femur	10.12-11.25	11.26-12.46	10.73 ± 0.57	11.96 ± 0.62

DISCUSSION

Gomphocerinae is the only group of grasshoppers in which males have a stridulatory peg on the inner side of the hind femur thus called as tooth legged grasshoppers, which is rubbed against veins of the tegmina to produce sound. These grasshoppers are sometimes creating confusion with the species of Oedipodinae, which has same stridulatory pegs on the tegmina instead of on the hind femur. Grasshoppers of the subfamily Oedipodinae also produce sound by rubbing legs against tegmina but the placement of the parts is opposite. Grasshoppers having the head appear rather pointed, face slanting backward, hind wings is usually clear, sometimes lightly tinted with color with at most some cloudy darkening toward the outer edge. Highly varied and occurring in the environment having green roof vegetation because most species utilize grasses or related plants as food but a smaller group prefer to bare ground.

Population of the grasshoppers is greatly influenced by the climate and availability of the host plant and damage caused is directly proportional to their population. The habitat of the grasshoppers tends to be tall grasses in open field and standing crops of the time, feeds on the softer part of the stem. Pest status of these grasshoppers has not been reviewed by any workers but may be fatal to the crop on population fluctuation. They blend in with stem and blades of the grass, making them difficult to detect until they move but can be detected by sound they produce and can be trapped during mating as they becomes less active. Emphasizing the overriding priority of maintaining high economic growth rates and biodiversity assessment, attention should pay to identify and control of these grasshoppers to raise living standards and sustainable development.

ACKNOWLEDGEMENT

Authors are thankful to University Grant Commission, New Delhi, for financial assistance under Maulana Azad National Fellowship (MANF-MUS-BIH-1999) and also grateful to The Chairman, Department of Zoology, Aligarh Muslim University, Aligarh for providing necessary facilities.

REFERENCES

1. Akhtar M.H., Usmani M.K. and Nayeem M.R. (2012): Impact of abiotic factors on population of Acridoid fauna (Orthoptera) in Aligarh Fort, Uttar Pradesh, India. *Trend. Biosci.*, 5(1): 17-19.
2. Ander (1939): Division of Orthoptera into two suborders, Ensifera and Caelifera. *Opuscul. Entomolog.*, 2: 306.
3. Bhowmik (1985): Outline of distribution with an Index Catalogue of Indian Grasshoppers (Orthoptera: Acridoidea). Part I. Subfamilies: Acridinae, Truxalinae, Gomphocerinae and Oedipodinae. Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper (Rec. Zool. Surv. India, Misc. Pub., Occas. Paper) 78: 1-51.
4. Bie-Bienko G.Y. and Mischenko L.L. (1951): Locusts and grasshoppers of USSR and adjacent countries. Part I & II. Monston, Jerusalem, pp: 1-400.
5. Bukhvalova M.A. and Zhantiev R.D. (1993): Songs in the communities of grasshoppers (Orthoptera, Acrididae, Gomphocerinae). *Zool. Zh.*, 72 (9): 47-62.
6. Chandra K. and Gupta S.K. (2013): Endemic Orthoptera (Insecta) of India. *Prommali*, 1: 17-44.
7. Chapco and Contreras D. (2011): Subfamilies Acridinae, Gomphocerinae and Oedipodinae are "fuzzy sets": a proposal for a common African origin. *J. Orthopt. Res.*, 20(2): 173-190.
8. Defaut (2012): Implications taxonomiques et nomenclaturales de publications récentes en phylogénie moléculaire: 1. Les Gomphocerinae de France (Orthoptera, Acrididae). *Matériaux Orthoptéri. Entomocénot.*, (Eades D., Otte C. D., Cigliano M.M. and Braun H. 2015)., 17: 15-20. *Orthoptera Species File. Version 5.0/5.0.* <<http://Orthoptera.SpeciesFile.org>>. Accessed on March 27, 2015.
9. Hodjat (2015): An introduction to subfamily Gomphocerinae Fieber, 1853 (Orthoptera; Acrididae) of Iran with keys to tribes and genera. *J. Entomol. Res. Soc.*, 17(1): 97-105.
10. Ingrisch (1993): Taxonomy and stridulation of the Gomphocerinae and Truxalinae of Thailand (Orthoptera, Acrididae). *Rev. Suisse Zool.*, 100(4): 931.
11. Jago (1971): A review of the Gomphocerinae of the world with a key to the genera (Orthoptera: Acrididae). *Proceedings of the Academy of Natural Sciences, Philadelphia*, 123: 222.
12. Jago N.D. (1977): Revision of the genus *Ochridia* Stal 1873, with comments on the genera *Sporobolius* Uvarov, 1941 and *Platypternodes* I. Bolivar, 1908 (Orthoptera, Acrididae, Gomphocerinae). *Acrida*, 6: 163-217.

13. Joshi P.C., Lockwood J.A., Vashishth N. and Singh A. (1999): Grasshopper (Orthoptera: Acridoidea) community dynamics in a moist deciduous forest in India. *J. Orthopt. Res.*, 8: 17-23.
14. Kirby W.F. (1914): The Fauna of British India including Ceylon and Burma. Orthoptera (Acrididae), London, 1: IX + 276 pp.
15. Kumar H. and Usmani M.K. (2014): Taxonomic studies on Acrididae (Orthoptera: Acridoidea) from Rajasthan (India). *J. Entomol. Zool. Stud.*, 2(3): 131-146.
16. Mol A. (2012). Song and morphology of some little known species of Gomphocerinae (Orthoptera, Acrididae) from Northern Anatolia with the description of a new species. *Entomolog. Fenn.*, 23: 127-139.
17. Nattier R., Robillard T., Amedegnato C., Couloux A., Cruaud C. and Desutter-Grandcolas L. (2011): Evolution of acoustic communication in the Gomphocerinae (Orthoptera: Caelifera: Acrididae). *Zoologi. Script.*, 40(5): 479-497.
18. Nayeem M.R. and Usmani M.K. (2012): Preliminary checklist of Acridoidea (Orthoptera) of Jharkhand, India. *J. Entomolog. Res.*, 36(2): 161-163.
19. Nayeem M.R. and Usmani M.K. (2012): Studies on taxonomy and distribution of Acridoidea (Orthoptera) of Bihar, India. *J. Threat. Taxa.*, 4(13): 3190-3204.
20. Rafi U. and Usmani M.K. (2013): Diversity and distribution of Acridid pests (Orthoptera: Acrididae) of Purvanchal region, Uttar Pradesh. *J. Bombay Nat. Hist. Soc.*, 110(1): 50-56.
21. Rafi U., Usmani M.K., Akhtar M.H. and Nayeem M.R. (2014): Population density, diversity and distributional pattern of grasshopper fauna (Acrididae: Acridoidea: Orthoptera) in Central and Eastern Uttar Pradesh, India. *Rec. Zool. Surv. India.* 114(1): 165-176.
22. Rowell (2013): The Grasshoppers (Caelifera) of Costa Rica and Panama, *The Orthopterists Soc.*, pp: 205.
23. Shishodia M.S. and Gupta S.K. (2009): Checklist of Orthoptera (Insecta) of Himachal Pradesh, India. 1(11): 569-572.
24. Tishechkin D.Y. and Bukhvalova M.A. (2009): Acoustic Communication in grasshopper Communities (Orthoptera: Acrididae: Gomphocerinae): Segregation of Acoustic niches. *Russian Entomol. J.*, 18: 165-188.
25. Usmani M.K. and Khan M.I. (2010): A preliminary checklist of Locusts and Grasshoppers (Orthoptera: Acridoidea) of North East India. *Trend. Biosci.*, 3(1): 40-55.
26. Usmani M.K., Akhtar M.H., Nayeem M.R. and Rafi U. (2012): Diversity, distribution and taxonomic studies of Grasshopper fauna (Acrididae: Acridoidea: Orthoptera) of Aligarh, Uttar Pradesh, India. *Ann. Entomol.*, 30 (1): 31-40.
27. Usmani M.K., Khan M.I. and Kumar H. (2010): Studies on Acridoidea (Orthoptera) of Western Uttar Pradesh. *Biosystemat.*, 4(1):39-58.
28. Uvarov B.P. (1921): On records and descriptions of Indian Acrididae. *The Annal. Magaz. Nat. Hist.*, (9)7: 480-509.
29. Uvarov (1966): Grasshoppers and Locusts. A Handbook of General Acridology, Cambridge University Press, London, pp: 1-418.
30. Vedenina V. and Mugue N. (2011): Speciation in Gomphocerine Grasshoppers: Molecular Phylogeny versus Bioacoustics and Courtship Behavior. *J. Orthopt. Res.*, 20(1): 109-125.
31. Vedenina V. and Shestakov L.S. (2014): Stable and variable parameters in courtship songs of Grasshoppers of the Subfamily Gomphocerinae (Orthoptera, Acrididae). *Entomolog. Rev.*, 94(1): 1-20.