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Study on the Genus *Hedotettix* Bolívar, 1887 (Orthoptera: Tetrigidae) from Sukkur division Pakistan

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Abstract

During the present study three species of *Hedotettix* Bolivar, 1887, i-e *Hedotettix gracilis* (Haan, 1843), *H. lineifera* (Walker, 1871), and *H. attenuates*, Hancock, 1904, were collected from Sukkur division. Beside this, description of various species along with important illustration and identification key were also provided, this genus is recognizable by a long pronotum. It occurs in many agricultural crops i-e rice, maize and wheat. Beside this, mosses and algae also effective by this.

Keywords: *Hedotettix*, pronotum, description, mosses, algae, rice, Sukkur

Introduction

Hedotettix (Tetrigidae: Orthoptera) are diminutives, because of their small size they have been ignored from a long time. Tetrigidae (pygmy grasshoppers) is a diversified group, they often show morphological crypsis and have adapted predatory avoidance mechanism. These diminutives are primarily ground dwellers and mostly encountered among the leaf or in wet places, along the banks of the rivers, streams or in stagnant water Bhomik [3]. Pygmy grasshoppers usually exhibit the typical example of polymorphism. Different species show color-marking polymorphism. The degree of camouflage is different among the color-marking polymorphism patterns in each species Bhomik [4]. The grasshoppers belonging to the Tetrigidae are the severe pest of the agricultural crops in Sindh. Considerable taxonomic work has been done in the Sindh by Kirby [6], Bei-Bienko and Mischehko [2], Uvarov [18²], Ahmed [1], Wagan [19], Yousuf [21], Wagan and Naheed [20], Riffat and Wagan [9-17], but none of them provided a detailed taxonomic status of Tetrigidae.

Sukkur is the third largest city of Sindh province, it situated on the West side of the Indus River.

The Sukkur district covers an area of 5165 square kilometers. North sides of Sukkur shares with Shikarpur and Kashmore. Ghotki and Khairpur are located on the North-East and the South side respectively. The climate of Sukkur is very hot during the summer while winter is dry and cool. A high temperature and dry heat are also experienced during the summer and temperature can reach up to 50 °C (122°F), while winter is cool and night temperatures may fall below freezing. Sukkur is mainly known due to its fertility and cultivable land and forest along the banks of the Indus River. Tropical forests are also found on either side of the Indus River. The Sukkur has great economical importance. Due to attack of many pests on cultivated areas its agricultural efficiency has been reduced and has not attained a levelheaded yield per unit area over time (PCO,) [8]. Present study will help out to institutions / agencies dealing with the pest control.

Material and Methods

Sampling and killing

An extensive survey of pygmy grasshoppers has been carried out during the year of 2015-16. The material was collected from agricultural fields i.e. rice, maize, wheat, sugarcane cotton, under roots of trees, herbs, shrubs and grasses to swamps. Collected material was killed and preserved by the method of Vickery and Kevan [22]. After fixing on stretching board, specimens were removed to save in entomological boxes. Specimens were observed under Binocular Stereoscopic Microscope and line drawing and measurements were also taken to present authentic information.

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fixation of samples

Insects were fixed by insertion of different size of pins place in pronotum particular from transverse to posterior side. Median carina has sulcus. Wings set on the long axis of body and head somewhat bound downwards legs bent from posterior side below to body surface that reduce break-off of any part. Various important taxonomic features were also highlighted by terminal end, and these features were not variable until terminal end explore. After this, extra material and dust was also removed through camel-hair brush.

key construction and depository

This procedure was obtained by using dichotomous key that contained a couple of having two set of opposed characters to each other. All the captured samples were housed in the Sindh Entomological Museum (SEM), Department of Zoology, University of Sindh, Jamshoro with complete information such as ID No. collector's name, date and locality.

Classification

The terminology with regard to the classification was adopted from Bolivar [5].

Statistical analysis

One way analysis of variance (ANOVA) was carried out through software programme SPSS: version 16.0. However, difference in various body parts were indicated by Least Significant Difference (LSD) test through this significant and non-significant values were highlighted.

Results and Discussion**genus *hedotettix*, bolivar, 1887****Diagnosis**

Body ridged, wrinkled sturdy and short. Antennae filiform, placed before the eyes, near the ventral margin head is small but not raised above the level of pronotum, and it has a broad vertex. Median carinae is raised above the level of head but not elevated above the level of pronotum. Pronotum tactiform, much raised, varied in smoothness and texture surface truncated and much narrowed posteriorly. Tagmina oval, rounded at the apices.

In this genus three species has been reported and presented below:

key to the species of the genus *hedotettix*

1	Antennae 13 segmented, fastigium of head narrow, lateral ocelli not elevated.....	2
-	Antennae 14 segmented, fastigium of head broad, lateral ocelli and mouth elevated.....	<i>H. gracillis</i>
2	Pronotum with white longitudinal lines on the dorsal surface.....	<i>H. lineifera</i> ,
-	Pronotum without white longitudinal lines on the dorsal surface.....	<i>H. attenuates</i>

Hedotettixgracilis* (haan, 1843)*Description of Female**

Body longer, generally dusty brown in color. Antennae filiform with 14 segments. Head small, fastigium of vertex broader as compared to *Hedotettixlineifera*. Pronotum finely

sturdy, without definite color pattern spots behind the shoulder, median carina compressed. Tegmina oval, obtusely rounded at extremity. Cerci small pointed, with white spines. Valves of the ovipositor with fine teeth, or spine like projection, apex pointed and curved.

Table 1: Measurement of various body parts of *Hedotettix gracilis*

Parameters	Female (n=05)	
	Mean \pm SD (mm)	Range (mm)
Length of head	0.71 \pm 0.15 ^h	0.52-0.87
Width of head	1.15 \pm 0.07 ^g	1.05-1.22
Length of pronotum	13.2 \pm 1.3 ^a	12-15
Width of pronotum	3.15 \pm 0.35 ^e	2.8-3.5
Length of femur	4.97 \pm 0.45 ^c	4.55-5.6
Width of femur	1.65 \pm 0.17 ^f	1.48-1.92
Length of tibia	3.92 \pm 0.87 ^d	2.45-4.55
Width of tibia	0.31 \pm 0.05 ⁱ	0.26-0.35
Total body length	10.2 \pm 4.4 ^b	0.7-18

Note: (Mean in the same column followed by the same letters is not significantly different from one another at 5% probability)

Material Examined

Sindh: Sukkur, Mirpur Mathelo, Ghotki, Ubauro, Ghambat, Khairpur, Kingri, Kotdigi, Nara, Thari Mirwah, New Sukkur, Pano-Aqil and Rohri.

Habitat

This species has been collected from grasses, mosses and algae near water bodies especially swamps and along the banks of the River Indus in the places of Sukkur division.

Remarks

This species was originally described by Haan (1843) both male and females from Java (Krawang) and Sulawesi

(Tondano) while Wagan [19] reported this from Sindh (Nawab Shah, Jamshoro and Miani forest) and Majeed *et al.*, [7] reported this species from Thal area of Punjab Pakistan. During the present study, we have reported only female samples from the various places of Sukkur division and observed that, all have slightly longer pronotum than that of hind femora. This species is slightly different from *H. lineifera*, by having longer body, variable in color. Fastigium of vertex is broader as compared to *H. lineifera*. After examining, it was noticed that pronotum is sturdy, without white line along the dorsal surface, which makes it differ from the other.

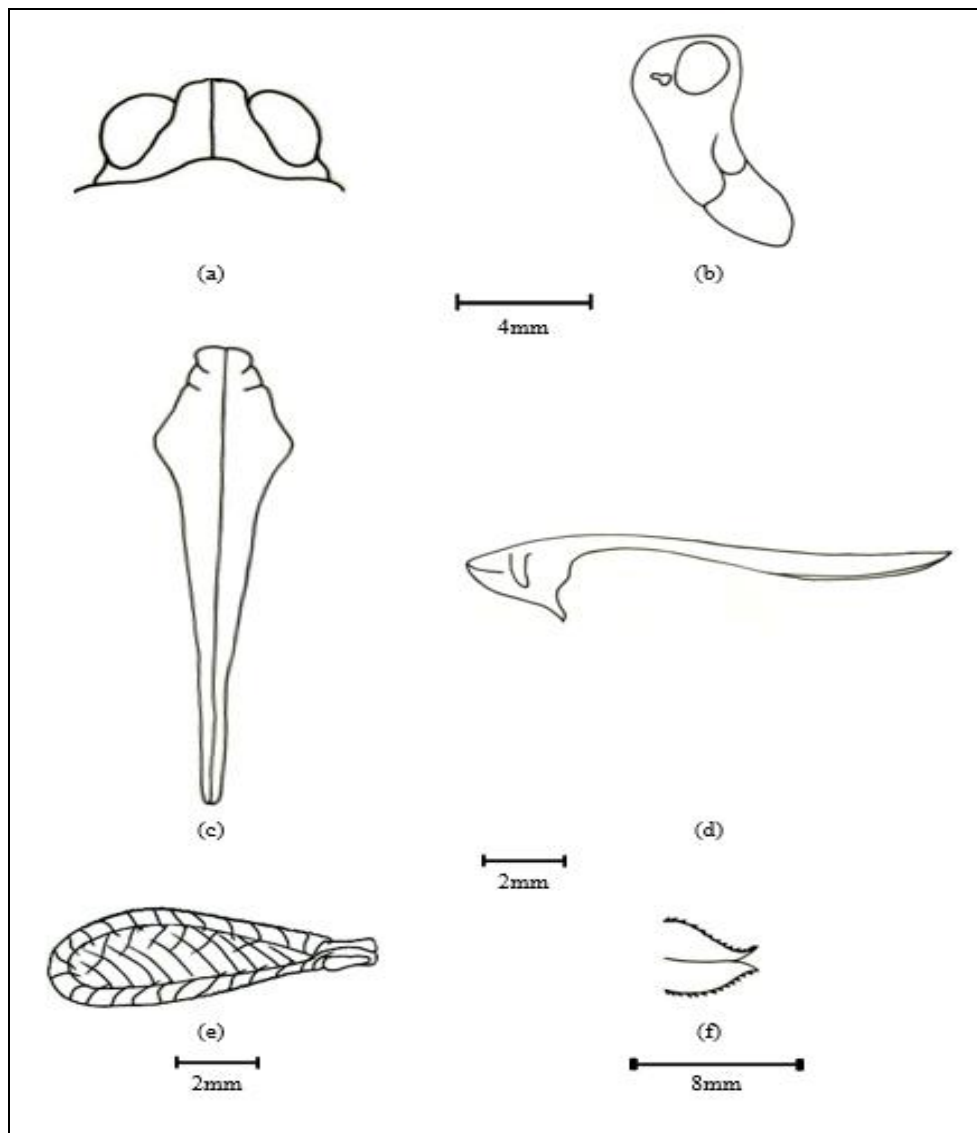


Fig 1: *Hedotettix gracillis* (♀) (a) Head dorsal view (b) Head lateral view (c) Pronotum dorsal view (d) Pronotum lateral view (e) Hind femur (f) Ovipositor.

Hedotettix lineifera (walker, 1871)

Description of Male

Body rigid, wrinkled and small. Antennae are filliform with 13-segments. Head is small, fastigium of vertex is narrow and carrying prominent median carina, frontal ridge is deeply sulcated above the lateral ocelli. Lateral ocelli are not much elevated. Pronotum contains compressed and undulating median carina. Dorsal carina is incomplete in the region of thorax. Straight white line runs longitudinally along the length of the dorsal surface. Tegmina are short and obtusely rounded at the margin. Wings are hyaline. Hind femur is broad towards the base and outer surface is convex in shape. Median

carina is serrated, interrupts before reaching the knee. Hind tibia is thin with 8-10 spines; first segment of tarsi is longer than the rest of the segments. Cerci are narrow and pointed at the apex, while its apical portion is white and dark at the base. Sub-genital plate is long and curved.

Description of Female

♀ similar to ♂ but slightly longer and stouter in appearance. Hind femur is broad towards the base and outer surface is convex, but it differs in color. Hind tibia is thin with 7-10 spines; Ovipositor's valves are long and serrated with the curved margins.

Table 2: Measurement of various body parts of *Hedotettix lineifera*

Parameters	Male (n= 05)		Female (n=05)	
	Mean \pm SD (mm)	Range (mm)	Mean \pm SD (mm)	Range (mm)
Length of head	0.58 \pm 0.04 ^g	0.53-0.61	0.7 \pm 0.09 ^h	0.61-0.79
Width of head	1.16 \pm 0.09 ^d	1.05-1.22	1.26 \pm 0.1b ^g	1.22-1.4
Length of pronotum	11.6 \pm 0.5 ^a	11-12	12.6 \pm 2.0 ^a	11-15
Width of pronotum	2.27 \pm 0.17 ^b	2.1-2.45	3.15 \pm 0.06 ^e	2.45-3.5
Length of femur	1.58 \pm 0.02 ^c	1.57-1.61	5.7 \pm 0.53 ^c	5.25-6.3
Width of femur	0.53 \pm 0 ^h	0.53-0.53	1.92 \pm 0.17 ^f	1.75-2.1
Length of tibia	1.10 \pm 0.09 ^e	1.05-1.22	4.78 \pm 0.53 ^d	4.2-5.25
Width of tibia	0.18 \pm 3.39 ⁱ	0.18-0.18	0.32 \pm 0.05 ⁱ	0.26-0.35
Total body length	0.8 \pm 13.9 ^f	0.7-0.8	11.3 \pm 4.1 ^b	0.8-16

Note: (Mean in the same Colum followed by the same letters is not significantly different from one another at 5% probability).

Material Examined

Sampling was done from same localities as mentioned above for *H. gracillis*.

Habitat

This species has been collected from roots of plants, grasses occur along the moist places while some specimens were collected from the seepage of a canal in the region.

Remarks

This species was described by (Walker, 1871). We have

reported *H. lineifera* from Sukkur for the first time. This species is closely related to *H. gracilis* (Haan, 1843), but it is smaller in size, fastigium of vertex is narrower. pronotum is compressed and undulating, white lines run longitudinally along the length of the dorsal surface which distinguishes the *H. lineifera* from remaining two reported species of *Hedotettix*. Dorsal carina of pronotum is incomplete in the region of thorax. The present study suggests that if more material will come in collection new morphological differences will be offered.

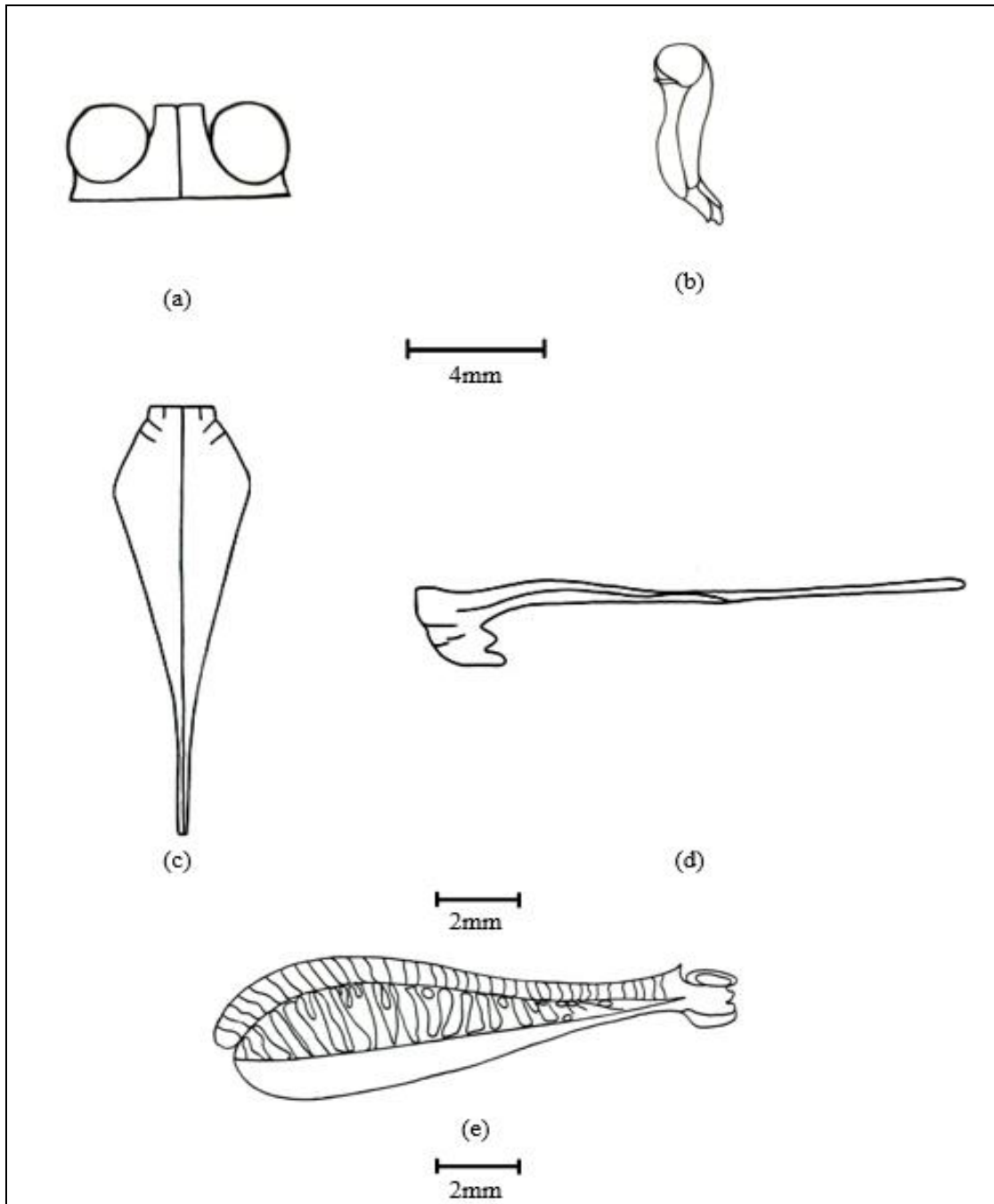


Fig 2: *Hedotettix lineifera* (♂) (a) Head dorsal view (b) Head lateral view (c) Pronotum dorsal view (d) Pronotum lateral view (e) Hind femur

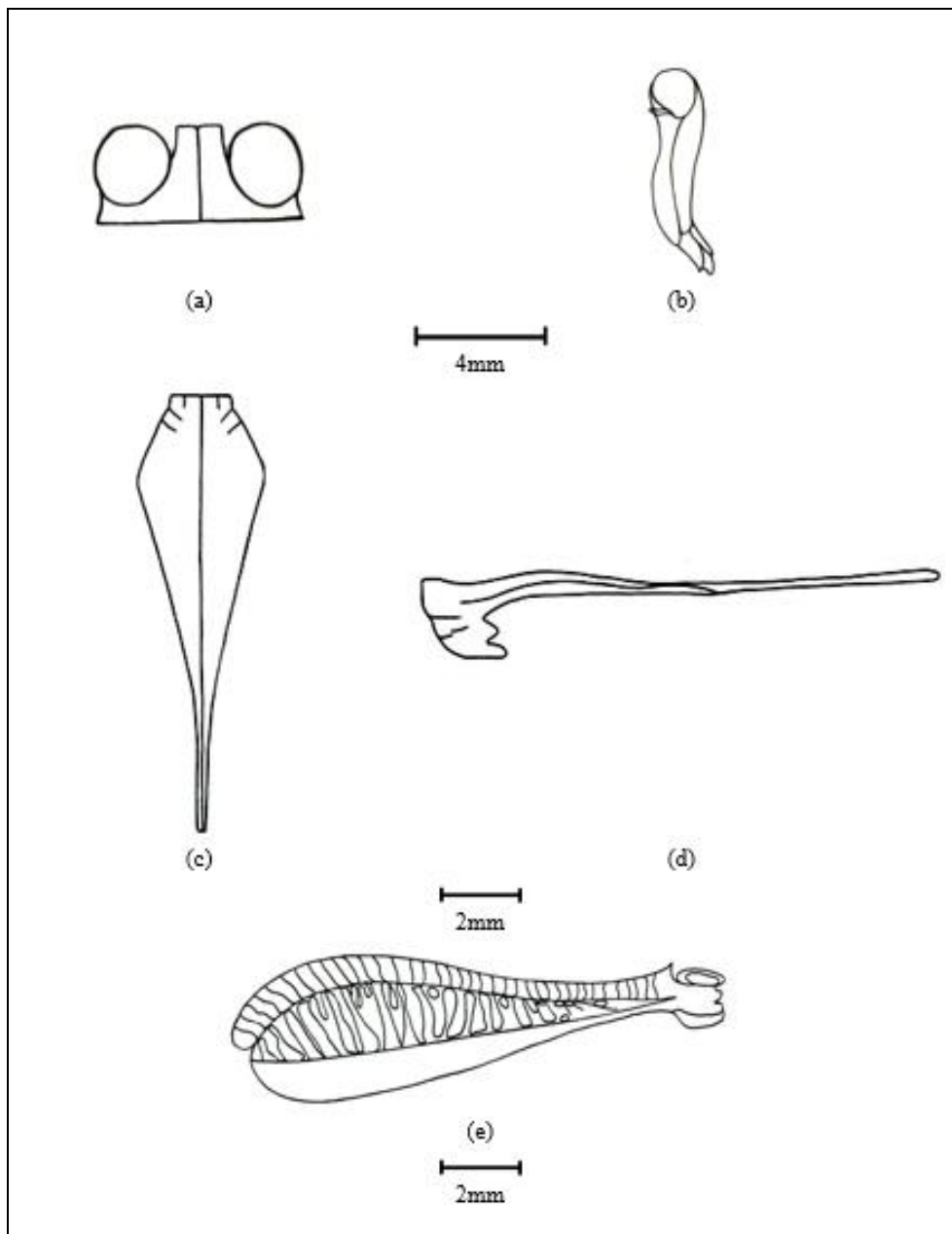


Fig 3: *Hedotettix lineifera* (♀) (a) Head dorsal view (b) Head lateral view (c) Pronotum dorsal view (d) Pronotum lateral view (e) Hind femur (f) Ovipositor.

***Hedotettix attenuates*, hancock, 1904**

Description of Male

Body moderate in size, vary in color dusty grey with yellowish patches. Antennae are filiform. Head is small. Fastigium of vertex is narrow and slightly curved with obscure carina. Pronotum is rigid and wrinkled. Median carina may or not be much compressed. Tegmina are elongated and rounded at the apex. Wings are hyaline. Hind femur is brown with yellowish patches, median carina is serrated. Hind tibiae with 8-9 spines. Cerci small narrow and pointed at the apex. Sub-genital plate is long and curved.

Measurement: ♂(01) Length of head, 0.78, Width of head, 1.48, Length of pronotum, 11, Width of pronotum, 2.53, Length of femur, 4.55, Width of femur, 1.4, Length of tibia, 4.2, Width of tibia, 0.26, Total body length, 15

Material Examined

Sindh: Sukkur: Kingri, 24.x.2016, 01 ♂ (Saiqa. S and Riffat. S).

Habitat

This species has been collected from rice field and shows color-marking polymorphism such kind of polymorphism has been adapted to provide a camouflage for the different species towards their natural backgrounds (crypsis), such as grasses, sand and stones.

Remarks

This species was described by Hancock in 1904. Majeed *et al.*,^[7] reported this species for the first time from Punjab. Many workers have worked on the taxonomy of Tetrigidae but nobody recorded *Hedotettix* from Sindh. During the present study, we have reported (♂) of *H. attenuates* for the first time. As compare to other species *H. attenuates* is smaller, slender and may vary in color as dusty grey with yellowish patches on the dorsal surface of the body. Pronotum is rigid and wrinkled with color pattern and it does not contain a white longitudinal line along the length of the pronotum while it is present in *H. lineifera*.

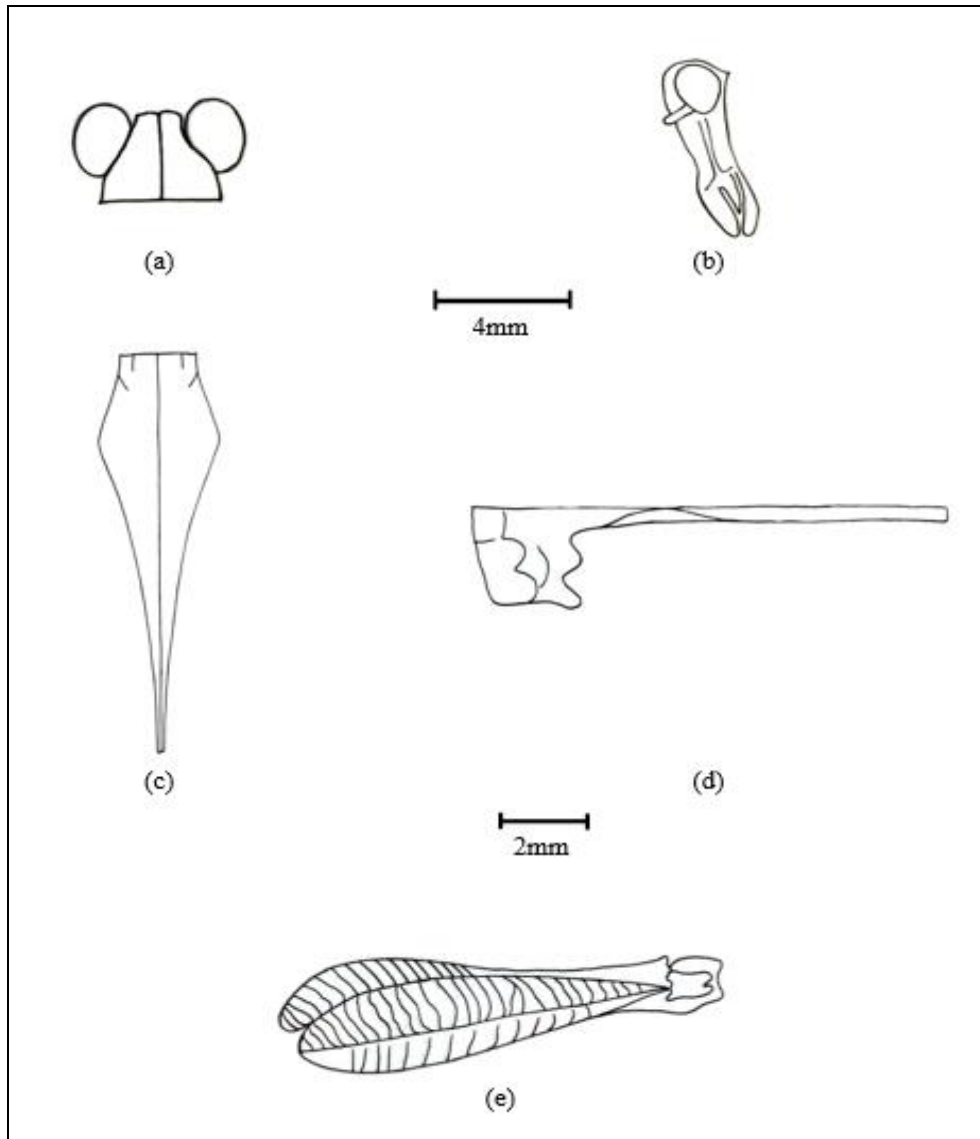


Fig 4: *Hedotettix attenuates* (♂) (a) Head dorsal view (b) Head lateral view (c) Pronotum dorsal view (d) Pronotum lateral view (e) Hind femur.

Table 3: Showing the distribution of genus *Hedotettix* from various sites of Sukkur division during the year 2015-2016

Genus / species	Localities														Total (578)
	MM	DA	GH	UB	GHA	KH	KIN	KOT	NAR	THA	N SUK	PA	R	SUK	
Genus <i>Hedotettix</i> Bolivar, 1887															
<i>H. gracilis</i> (Haan, 1843)	02	03	01	06	06	03	05	04	03	02	04	09	05	03	56
<i>H. lineifer</i> (Walker, 1871)	05	07	04	09	02	07	07	05	04	06	08	06	08	09	87
<i>H. attenuates</i> Hancock, 1904	-	-	-	-	-	-	01	-	-	-	-	-	-	-	01

Note: MM=Mirpur Mathelo, DA=Daharki, GH=Ghotki, UB=Ubauro, GHA=Ghambat, KH=Khairpur, KIN=Kingri, KOT=Kot Digi, NAR=Nara, THA=Thari Mirwah, N SUK=New Sukkur, PA=Pano Aqil, R=Rohri, SUK=Sukkur

Conclusion

The grasshoppers belonging to the Tetrigidae are the severe pest of the agricultural crops in the Sindh. They are the major pest of the wheat, rice, maize and deserts vegetations. Pygmy grasshoppers are less than 20 mm in length, and are recognizable by a long pronotum, that extends over the length of the abdomen. Pygmy grasshoppers usually found near water, such as ponds and steams. Occasionally found in dry habitats, woodlands, rice fields and in sandy areas with lichen. During the present study, 03 species of *Hedotettix* Bolivar, 1887, i-e *Hedotettix gracilis* (Haan, 1843), *H. lineifera* (Walker, 1871), and *H. attenuates*, Hancock, 1904, were reported. The high number of mosses species eaten by single Tetrigidae during a very short time can also reflects the high moving activity of hoppers occurred on ground and the high

diversity of mosses at a small area. Present study recommends that as Tetrigidae feed on algae, lichens small plants and detritus but there is little known information on the food preference of this group, this parameter should be studied in detail.

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