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Research Article

Exploring the diversity of Acridomorpha in Mehrano Forest from Khairpur Mirs

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Abstract

This study has been carried out to study the biodiversity fauna of Acridomorpha in Mehrano Forest from Khairpur Mirs, Sindh, Pakistan. In this study, total of 305 specimens of grasshoppers was captured and sorted out into 02 families and 7 species: family Acridoidea: *Duroniella laticornis* (Krauss, 1909) *Phlaeoba tenebrosa* (Walker, 1871) *Truxalis Eximia eximia* Eichwald, 1830 *Truxalis fitzgeraldi* Dirsh, 1950) and family Pyrgomorphoidea: *Chrotogonus (Chrotogonus) homalodemus homalodemus* (Blanchard, 1836) *Chrotogonus (Chrotogonus) trachypterus trachypterus* (Blanchard, 1836) *Tenuitarsus orientalis* Kevan, 1959. In this study, morphological characters, morphometric measurements, host plants, and the global distribution of each species also has been done. Such a finding furnishes a factual basis for knowing the various Acridomorpha of Sindh. Indeed, the present finding will be the first of its kind and will prove a helpline for people associated with pest management and other control agencies in Pakistan and abroad. Additionally, the present study's findings will be useful in predicting the relationship between the species and for accurate identification in the future.

Keywords: Acridomorpha, Diversity, Mehrano, Grasshoppers, Pest management

Introduction

Acridomorpha is, like most invertebrates, a little-studied taxon and is rarely considered in the management of natural space. Some species cause considerable damage to perennial and cultivated crops (Joshi *et al*., 1999). They also constitute an important component of the food chain for avifauna and mammals (Mayya *et al*., 2005). They are good indicators of the fact of their

sensibility to changes in the structure of the vegetation as well as to habitat fragmentation. In moderate zones, they are associated with perennial habitats and threatened in intensive agricultural zones. Differences in habitats cause considerable variation in the species richness and composition. The species richness and composition of Acridids vary considerably with the proportion of prairies and therefore affect locust diversity. Anthropizied and disturbed zones generally have low species richness and a high abundance (number of individuals).

The grasshopper insect fauna generally is grouped as short-horned grasshoppers (Caelifera) and long-horned grasshoppers (Ensifera). Considerable taxonomic work has been done on Caelifera of Pakistan, e.g., Ahmed 1980, Wagan and Naheed 1977, Yousaf 1996 and Riffat and Wagan, 2015, but no attention has been paid to long-horned grasshoppers Ensifera. Some species belonging to Ensifera (Orthoptera) are important Pests of agricultural crops, orchards and forests.

Many co-workers, i.e. (Stall, 1974; Brunner, 1978, 1993, 1895; Retdenbacher, 1891; Ragge, 1956, 1961; Bei-Bienko, 1956; Ingrish, 1990; Ingrish & Shishodia, 1988; Riffat *et al*, 2014 and Panhwar, 2015) had carried work on taxonomy, distribution and incidence of acridomorpha. In contrast to the other short-horned grasshoppers, there is no monographic treatment of the Acridomorpha of Mahrano of Khairpur mirs. But no such effort was taken from Sindh; therefore, the present study is designed to collect and discover the hidden wealth of this group and then identify them accurately so that proper species diagnosis could be possible. Such a type of finding furnishes a solid basis to know the various groups of Acridomorpha of Sindh. Certainly, the present finding will be the first of its kind. It will provide a helpline for people associated with pest management and other control agencies in Pakistan and abroad. Additionally, the present study's findings will be useful in making a prediction about the relationship between the species and for accurate identification in the future.

Material and methods

Study Site

The study site of the various habitats of Mehrano of Khairpur mirs is located about two miles from Kotdiji town and 20 miles away from the city of Khairpur. The word Mehrano is derived from the Sindhi word Mehran, which means the Indus. The survey was carried out to collect as many specimens of grasshoppers including Acridomorpha and Pyrgomorphidae species. The material was collected from the agricultural land, forests, fruit orchards, hilly and semi-desert/ desert areas of Sindh. The Acridomorpha and Pyrgomorphidae groups occur in a wide variety of habitats, i.e.

trees, shrubs, herbs, forests and grasses were inspected. The sampling procedure were conducted from August to July in 9 sites, including 3 natural herbaceous fellows, 3 forests and 3 cultivated fields. In each division, the specimens of grasshoppers were collected once a month. Collected grasshoppers were further prepared in order to avoid organic decomposition. The prepared specimens were then identified with a binocular magnifying glass with the specialized identification keys. Then the specimens were submitted to morphological and taxonomy studies.

Killing and preservation of specimen

The specimens were killed with potassium cyanide in standard entomological bottles or with chloroform. After that, specimens were pinned and stretched out on a stretching board, with special care given to the antenna position, wings, and legs to identify important taxonomic characteristics. The specimens that had fully dried were then taken off the stretching boards and placed in insect boxes with labels identifying the location, the date, and the collector.

Identification of samples

Identification of the collected material was made using external features. The taxonomic material was mounted, labeled, and sorted correctly. Taxonomic material was collected, and photographs of the various species were taken.

Statistical analysis

The data from the experimental groups were subjected to a one-way analysis of variance (ANOVA) with repeated measure (SPSS 16.0 Software), and significant means were determined using the least indicated range difference (LSD). Measurements of various body parts were calculated in millimetres (mm) using the microscope (Oculas), 10 × 10 graph, compass, divider, and ruler. Abbreviations used in the text are as follows.

A.S Antennal Segment

A.L Antennal Length

D.B.T.A Distance between two Antennae

L.H Length of Head

D.B.E Distance between Eyes

L.P Length of Pronotum

L.T Length of Tegmina

L.W Length of Wing

L.F Length of Tibia

T.B.L Total body Length

Results

A. Acridoidea

Acrididae

Acridinae

***1.Duroniella laticornis* (Krauss, 1909)**

Morphological characteristics

Antennae with 18 segments. Strong dark brown and light brown bands on the front and lateral sides of the head and pronotum, with or without one or two parallel dark lines on the dorsal surface. Pronotum with lateral and median carinae. Kind of open mesosternum Tegmina with a yellow scapular line and a few light dots along the center. Thin, narrow, and paler brown in the hind femur. 10–13 black-tipped spines on either side of the much slender, much paler brown hind tibia. Body size small to medium, color dusty brown. The body is a dusty brown color overall. On the dorsal surface of the head, there are two parallel black lines, and the front and lateral sides of the head and pronotum have visible dark brown and pale bands. A yellow scapular line and a few distinct black dots can be seen on the tegmina—lighter brown on the hind femur.

Morphometry :Male (n=05), A.S,19.4± 0.54; A.L,5.39 ± 0.39, D.B.T.A,0.29 ± 0.04, L.H,2.48 ± 0.14;D.B.E,0.50 ± 0.13; L.P**,**2.83 ± 0.14; L.T,14.1 ± 0.96;L.W**,**12.6 ± 0.96; L.F,10.7 ± 0.75, L.T**,** 9.3 ± 0.83; T.B.L,16 ± 0.79.

Female (n=05), A.S,19.6 ± 0.54; A.L**,**5.56 ± 0.26; D.B.T.A**,** 0.62 ± 0.09; L.H,3.25 ± 0.23; D.B.E**,**0.87 ± 0.12; L.P**,**4.02 ± 0.17; L.T,12.4 ± 0.96; L.W,17.2 ± 0.57, L.F,13.8 ± 0.75, L.T,12.4 ± 0.96 T.B.L**,**22.8 ± 0.75.

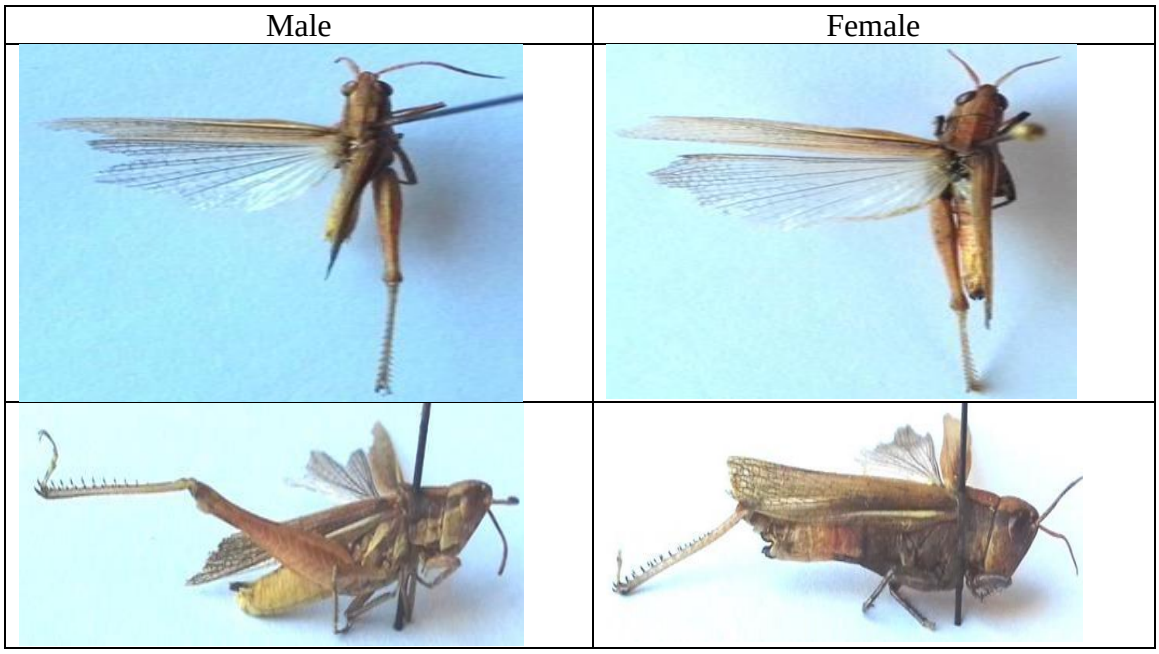

Figure 1. shows the lateral and dorsal view of *Duroniella laticornis*

Affected host plants

This species was found in fields of grass (*Panicum turgidum*), milkweed *(Calotropis procera)*, jowar (*Sorghum vulgare*), cluster beans (*Cyamopsis tetragonoloba*), and barley *(Hordeum vulgare)*. However, most specimens were gathered from grass and cluster bean fields.

Global distribution

India, Pakistan, Palestine, and Turkey. Its presence in the Mehrano forest district of Khairpur, Sindh Pakistan

Remarks

This species was found in Sindh (Moeed,1971 and Wagan, 1990). Malik *et al.* 1993 confirmed its existence in Punjab (Pakistan). (Suhail *et al.*, 1999) This species was found among sugarcane, sorghum grasses in meadows, near roadsides, and in moist fields in Pakistan .Recently During the current Mehrano forest survey, the majority of the collection was made in grasses, along the roadside, sorghum fields, cluster beans, and barley from Mehrano forest, Khairpur

*2.**Phlaeoba tenebrosa*** **(Walker, 1871)**

Morphological characteristics

Medium-sized, antennae with 20-21 segments as long as head and pronotum. Head conical, shorter than pronotum, numerous carinulae. Vertex-angular fastigium. Frontal ridge strongly sulcate. Rugose pronotum with carinute on each side between lateral and median carina. Indicated or absent

pronotum lateral carinule. Long, wide mesosternal inerspace. Wings and tegmina developed. Tegmina longer than wings, abdomen small, hind femur thick. Black-tipped hind tibia. Medium-sized arolium. Paler dusty body. Tegmina with small brownish spots along margin. Wing hyaline, slightly bluish base, focus at apex. Brownish hind tibia.

Morphometry:

Male (n=05): A.S, 20.5 ± 0.55; A.L**,** 3.15± 0.18; D.B.T.A, 0.17 ± 0.03; , L.H, 1.43 ± 0.14; D.B.E, 0.49 ± 0.05; ,L.P, 1.84± 0.09; L.T**,** 18.6 ± 0.6; L.W,16.67± 0.58; L.F**,** 11.6 ± 0.6; L.T**,** 10.34 ± 0.29; T.B.L**,** 17.34 ± 1.26

Female (n=05): A.S, 20.5 ± 0.55; A.L, 4.03 ± 0.18; D.B.T.A, 0.25± 0.04; L.H, 1.58 ± 0.18; D.B.E, 0.64 ± 0.06; L.P, 2.28 ± 0.18; L.T**,** 23 ± 1.04; L.W, 21 ± 1.13; L.F**,** 16 ± 1.08; L.T, 13.64 ± 1.01; T.B.L**,** 26 ± 1.12

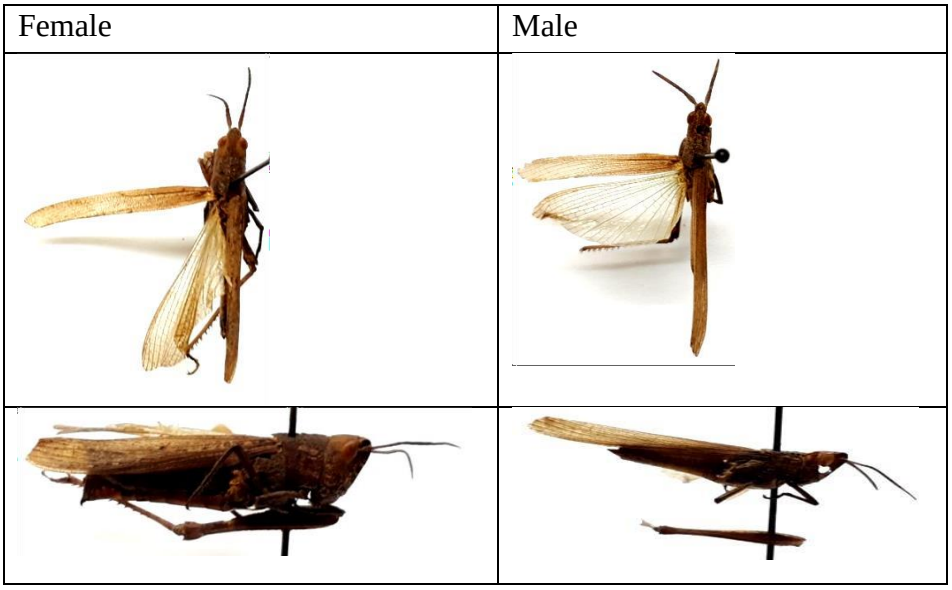

Figure 2. shows the lateral and dorsal view of *Phlaeoba tenebrosa*

Affected host plants

This species was mainly found in *Cynodon dactylon*, a common lawn grass.

Global distribution

Bangladesh, China, India, and Pakistan. Its prevalence in Sindh, Pakistan Mehrano forest Khairpur.

Remarks

Moeed,1966 collected individual specimens of this species from the Mehrano Forest near Khairpur, Sindh (Pakistan). Furthermore, (Wagan 1990) reported from the grassy fields of Sindh's

Thatta, Hyderabad, Badin, Khairpur, and Sukkur districts (Pakistan). (Kumar and Usmani,2014) harvested grass in Rajasthan (India). (Kumar and Usmani,2016) Also provided information from Punjab (India). During this study, many specimens were collected in the grass and cultivated regions around Kotdiji distract Khairpur.

***3.Truxalis eximia eximia* Eichwald, 1830**

Morphological characteristics

Antennae with 18 segments. The body is large, elongated, almost stick-like, and green, with a pale line running from behind the eyes on either side of the head, pronotum, and tegmina. The head is longer than the pronotum, and the vertex is narrower on the anterior side. The posterior sulcus crosses the dorsal side of the pronotum. Mesosternal interspace is available. Medium-sized arolium. The hind femur is long and thin. Female purple-blue wings from the dorsal side. The hind tibia is whitish, with 25-28 black-tipped spines on either side. The body is generally green, with a pale line on either side of the head starting from behind the eyes. Pronotum and tegmina are reddish brown, as are the antennae and eyes. Hyaline females possess purplish-blue wings on the dorsal side. Dusty brownish colour and an angular apex on the hind femur. Tibia with brownish or black-tipped spines on either side.

Morphometry: (♀**)** (n=05), A.S(♀**)**#19 ± 1.35, A.L (♀**)**#18.77 ± 0.59, D.B.T.A (♀**)**# 0.45 ±0.07, L.H(♀**)**#11.63 ± 0.39, D.B.E (♀**)**# 1.27± 0.20, L.P (♀**)**# 10.35 ± 2.03, L.T (♀**)**# 53.5± 2.97, L.W (♀**)**#50.7 ± 3.17**,** L.F(♀**)**# 40.3 ± 2.29, L.T (♀**)**#38.9 ± 2.95, T.B.L (♀**)**#62.9 ± 2.69

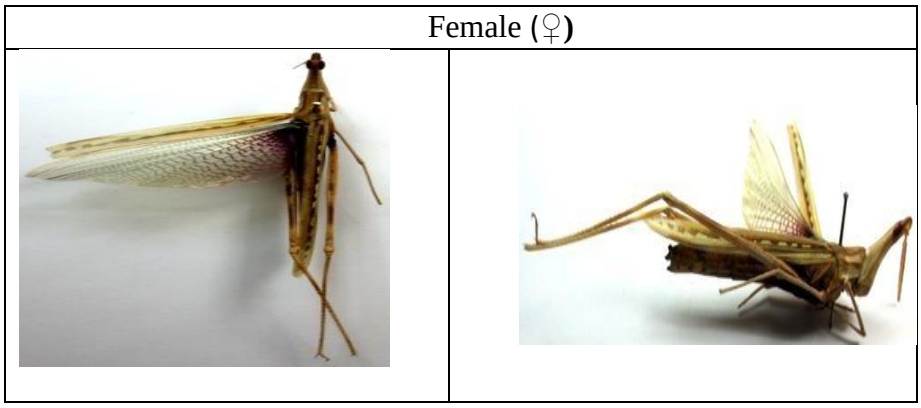

Figure 3. shows the lateral and dorsal view of *Truxalis eximia eximia*

Affected host plants

This subspecies' specimens are actually terri-graminicoles rather than actual graminicoles. Most of the collection was made from the tall, lush flora bordering roadside ditches, agricultural crops, and water channels. This species damages valuable crops and plants, including millet *(Pennisetum typhoides)*, jowar (*Sorghum vulgare)*, watermelon *(Citrullus vulgaris)*, lawn grass *(Cynodon dactylon)*, and lawn grass/Khabar gaah.

Global distribution

Arabian Peninsula, India, Iran, Pakistan, and Turkey. Its presence in the Mehrano forest in Khairpur, Sindh, Pakistan.

Remarks

Suhail *et al.* (2000) verified the existence of this subspecies in Pakistan. Riffat *et al*. (2013) collected this subspecies from Umer Kot Sindh Pakistan. However, Kumar and Usmani (2014) collected this subspecies from Rajasthan (India) on grasses and in Jowar fields. During the current study, more specimens were collected from Mehrano forest Khairpur than from other locations in the Nara desert; however, only female specimens were taken from the tall and lush vegetation of grasses.

***4.Truxalis fitzgeraldi* Dirsh, 1950**

Morphological characteristics

Antennae with 18 segments. Body shape is stick-like, elongated, large, dusty, or green. The head is acutely conical and somewhat longer than the pronotum. Apex of the vertex is considerably rounded. Only the posterior sulcus crosses the pronotum. Mesosternum of the open type. Tegmina and wing are both fully formed. Tegmina has a consistent median band. The base of the wing is bright crimson. The hind tibia is brownish in colour and has 27-28 black pointed spines. The hind femur is slender and lengthy. Medium-sized arolium. This subspecies has two body colours: green and dusty. Tegmina with a consistent middle band and a bright red wing near the base. The hind tibia is brownish in colour and has 27-28 black-tipped spines on either side.

Morphometry: (♂) (n=05), A.S **(♂)#**19 ± 1.28, A.L **(♂)#**13.17 ± 0.77, D.B.T.A **(♂)#** 0.36 ± 0.25, L.H **(♂)#**7.59 ± 0.73, D.B.E **(♂)#**0.82 ± 0.21, L.P **(♂)#** 5.37 ± 0.21, L.T **(♂)#**28.67 ± 3.22, L.W **(♂)#**26.67 ± 3.21, L.F (♂)#23.6 ± 1.74, L.T **(♂)#** 21.67± 0.77, T.B.L **(♂)#**36.34 ± 1.53

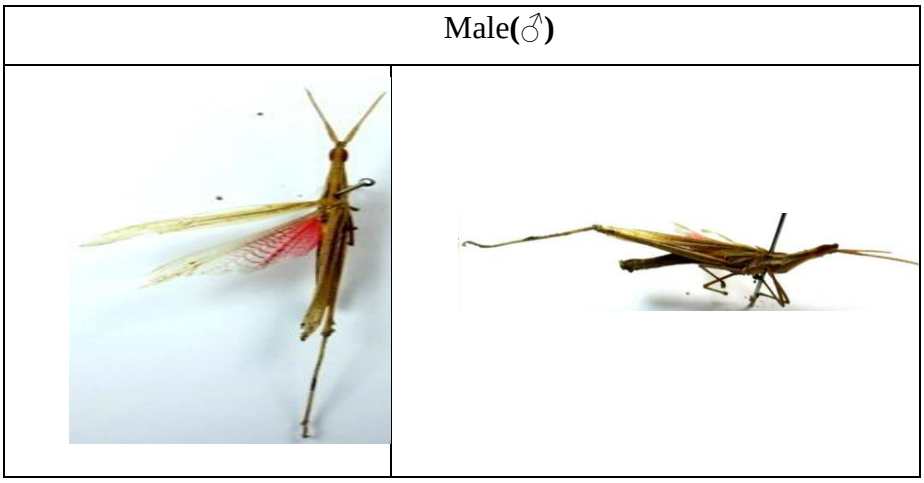

Figure 4. shows the lateral and dorsal view of *Truxalis fitzgeraldi*.

Affected host plants

This subspecies is a minor pest of millet *(Pennisetum glaucum*), maize *(Zea mays)*, and jowar *(Pennisetum glaucum) (Sorghum bicolor*).

Global distribution

India, Iran, and Pakistan. Its presence in Sindh Pakistan, Meharno forest Khairpur

Remarks

This species was reported by (Wagan and Riffat 2013) from all provinces of Pakistan. This species was discovered in the Thar Desert by (Riffat *et al*.2013). (Riffat and Wagan 2015) also collected specimens of this species from various Pakistan areas. Unfortunately, only male specimens were collected in April and May between District Umerkot and Tharparkar locations in planted maize, jowar field, and tall and lush vegetation of grasses along roadsides.

B. Pygomorphoidea

Pyrgomorphidae

Pyrgomphinae

***5.Chrotogonus (Chrotogonus) homalodemus homalodemus* (Blanchard, 1836)**

Morphological characteristics

Antennae with 16–18 segments. Small, uniformly reddish grey in colour (sand), barely paler below, and highly granulose. The pronotum is shorter than the head. Scutellum of vertex depressed, pronotum and median carina obsolete, and obtusely directed forward. Several huge tubercles cover the body. With a median row of small, light-colored, dark-marked tubercles, the tegmina are about the same length as the abdomen and taper rather sharply. The wing is one-half

as long as the hyline and tegmina. The outer carinae of the hind femur have black spots, and the tips of the terminal spines on the hind tibia are black. Sandy or reddish grey in colour. Brownish eyes. There are huge tubercles on the head and pronotum. The pronotum is a flat white colour. Hyaline wings with semi-transparent tegmina. Femur with a white and light brownish ring. Tibia has a light color.

Morphometry: :♂ (n=05)♀ (n=05), A.S**(**♂**)**#16.5 ±0.90, (♀**)**#16.9 ±0.84, A.L**(**♂**)**#2.04 ± 0.16, (♀**)**#2.60 ± 0.40, D.B.T.A**(**♂**)**#0.08 ± 0.01, (♀**)**#0.13 ± 0.02,L.H**(**♂**)**#0.91 ± 0.19, (♀**)**# 1.26 ± 0.19, , D.B.E(♂**)**#0.35 ± 0.0(♀**)**#0.7 ± 0.0, L.P**(**♂**)**#15.0 ± 0.0, (♀**)**# 19.00 ± 0.52,L.T**(**♂**)**#16.6 ± 1.15, (♀**)**#17 ± 3.47, L.W**(**♂**)**#14.7± 1.15, (♀**)**# 15.5 ± 2.25, L.F**(**♂**)**# 10.6 ± 0.89, (♀**)**#13.4 ± 0.89, L.T**(**♂**)**# 9.6 ± 0.87, (♀**)**#12 .1± 1.1, T.B.L**(**♂**)**#17.4 ± 0.85, (♀**)**# 20.5 ± 1.15

Affected host plant

This subspecies can rarely be found on grass *(Cynodon dactylon),* barley *(Hordeum vulgare),* bajra *(Pennisetum glaucum),* and jowar, in addition to open surfaces and moist clay soil.

Global distribution

Africa, Arabia, Egypt, Iraq, Northern Africa, Senegal, Somalia, Syria, and Pakistan are just a few of the continents. Its location is in Sindh, Pakistan.

Remarks

This subspecies is different from other species in the genus by possessing many tubercles on its surface. This subspecies was previously reported in Egypt, Somalia, Syria, Arabia, and Iraq by (Kevan 1959). Except for Sindh, (Wagan and Riffat 2013) collected this species across several Pakistani districts. We have described this subspecies for the first time from the Mehran forest, and numerous specimens of it have also been found in the localities of Khairpur in dense vegetation next to roadside habitats and sandy and rocky habitats. In addition, the most significant number of these subspecies was captured between August and October.

***6.Chrotogonus* (*Chrotogonus*) *trachypterus trachypterus* (Blanchard, 1836)**

Morphological characteristics

Antennae with 13 segments. Brown, rugose, and tuberculate body. The head is small, rugose, and wide. Eyes are prominent, brown, gleaming, and span three-quarters of the length of the head. The pronotum is large and short, with many tubercles covering the whole body. Tegmina is brown and shorter than the abdomen. The wing is hyaline and as long as the tegmina. Abdomen dark,

somewhat yellowish underneath with brown dots. The forelegs are small, slender, rugose, and yellowish with brown markings. Hind legs are short, the femur is as long as the abdomen and has two black spots, one at the base and the other at the end, and the tibia has short pale spines. Supra and plate large, longer than wide, and conical at the top. The cerci are small, shorter than the epiproct, and conical at the tip. Epiproct is more extensive than paraproct. Triangular subgenital plate with a longer, obtusely conical tip. Brownish eyes and a sandy body. Head sandy in color with many small dark tubercles. Pronotum has large dark tubercles. Tegmina is pale in color with dark spots. Wings transparent. The femur is brownish, and the tibia is pale in color.

Morphometry: :♂ (n=05)♀ (n=05), A.S**(**♂**)#**12.6 ± 0.11, (♀**)#**13.3 ± 0.24, A.L**(**♂**)#**3.86 ± 0.36, **(**♀**)#**4.70 ± 0.77, D.B.T.A**(**♂**)#**0.07 ± 0.02(♀**)**0.13 ± 0.03, L.H **(**♂**)#** 2.07 ± 0.09 (♀**)** #2.42 ± 0.32, D.B.E**(**♂**)#**0.8 ± 0.0 (♀**)#** 0.95 ± 0.16, L.P**(**♂**)#**2.63± 0.18, (♀**)#** 16.11 ± 1.35, L.T **(**♂**)#**12.5± 0.55, (♀**)#**16.11 ± 1.35, L.W**(**♂**)#**11.5± 0.55, (♀**)#**16.1 ± 1.42, L.F**(**♂**)#**7.8 ± 0.28,10.5 ± 0.90, L.T **(**♂**)#**7.3 ± 0.28, (♀**)#** 9.2 ± 0.66, T.B.L, **(**♂**)#**14.1 ± 0.62, (♀**)#**20.1 ± 1.52.

Affected host plant

Grass (*Cynodon dactylon*), Barley *(Hordeum vulgare),* Maize *(Zea mays),* Jawar *(Sorghum vulgare),* and pearl millet all contain this subspecies *(Pennisetum glaucum)*.

Global distribution

Pakistan, Afghanistan, Bangladesh, India, Iran, and Nepal. Its location is in Khairpur, Sindh, Pakistan.

Remarks

C.trachypterus trachypterus surface grasshoppers were identified as a pest of barley, maize, jowar, bajra, and pearl millet, among other crops. Most of the specimens collected during the current survey were from April and August. The colour pattern varies greatly; they appear in brown or reddish, brown sternum yellowish, and occasionally white bands with black spots. Body colour is similar to the soil and is commonly shown in grasses along roadsides and in ploughed fields. Earlier, Mahmood and Yousuf reported this from Azad Jammu and Kashmir (2000), and data was collected from India by Kumar *et al.* (2014).

***7. Tenuitarsus orientalis* Kevan, 1959**

Morphological characteristics

Antennas 13-segmented. Its head is tubercle-free and has a very distinct median carina. The pronotum no longer has the rows of hair and the bright median carina. Fully formed wings and tegmina. Tegmina are slightly longer than wings, and the bases of the wings are transparent but bluish. With spurs employed in burrowing to shield them from danger, the middle legs are almost as long as the hind legs. Tibia has 11 brown-tipped spikes. The abdominal wall is smooth, the ventral side is spotless, and the prosternal process is open type. Cerci larger than the epiproct and conical at the apex, supra-anal plate as wide as it is long. Also larger and narrower than the epiproct. The apex of the subgenital plate is angularly rounded. The body is medium in size, yellowish in colour, and covered in rust-like markings on the dorsal side. The body is golden with scattered, tiny dark dots. Brownish eyes. Tegmina is sandy and has tiny spots. Hyaline wings that are a pale bluish tint. Tibia is a light, white colour.

Morphometry: :♂ (n=05)♀ (n=05), A.S**(**♂**)#**13 .1 ± 0.0, (♀**)#**14.3 ± 0.1, A.L**(**♂**)#** 3.72 ± 0.32, (♀**)#**3.71 ± 0.19,D.B.T.A. 0.11 ± 0.03, (♀**)#**0.11 ± 0.03, L.H**(**♂**)#**1.83 ± 0.16,(♀**)#**1.97 ± 0.20, D.B.E**(**♂**)#**0.64 ± 0.16(♀**)#**0.8 ± 0.0, L.P**(**♂**)#**15.5 ± 1.95, (♀**)#**3.30 ± 0.20, L.T**(**♂**)#**15.5 ± 1.95, (♀**)#**16.5 ± 0.90,L.W**(**♂**)#**14.7 ± 2.20, (♀**)#**15.5 ± 0.90, L.F**(**♂**)#**11.7± 1.52, (♀**)#**12.7 ± 0.55, L.T**(**♂**)#**9.03 ± 1.3,(♀**)#**10.3 ± 0.45, T.B.L**(**♂**)#**9.03 ± 1.3, (♀**)#**19.2 ± 0.84

Affected host plant

In addition to Crowfoot grass *(Dactyloctenium scindicum)*, Desert grass *(Panicum turgidum)*, Deep root grass *(Desmostachya bipinnata)*, White grass *(Sehima nervosa)*, Puncture vine *(Tribulus terestris)*, and Bitter apple, this species is also occasionally seen in open sandy places (*Citrulus colocynthis*).

Global distribution

Pakistan and India. Geo-referenced technology has proven its presence in Khairpur, Sindh.

Remarks

It was noted that specimens of this species collected from the locality Khairpur were slightly smaller than specimens collected from the locality Meharno forest of the Nara Desert. This species occurs in sandy areas; most specimens were collected from dry land. Its body is light yellowish in

colour. Besides this, its wings had a light bluish base and a white center. Earlier, this species was collected in India by (Kumar *et al*. (2014). Except for Forest and Nara desert, this species was collected by (Wagan and Riffat 2013) in Sindh.

Conclusion

This study has been carried out to study the biodiversity fauna of Acridomorpha in mehrano Forest from Khairpur Mirs, Sindh, Pakistan. In this study, total of 305 specimens of grasshoppers was captured and sorted out into 02 families and 7 species: family Acridoidea: *Duroniella laticornis*,Krauss, 1909 *Phlaeoba tenebrosa* ,Walker, 1871 *Truxalis Eximia eximia*,Eichwald, 1830 *Truxalis fitzgeraldi* ,Dirsh, 1950 and family Pyrgomorphoidea: *Chrotogonus (Chrotogonus) homalodemus homalodemus*, Blanchard, 1836 *Chrotogonus (Chrotogonus) trachypterus trachypterus*,Blanchard, 1836 *Tenuitarsus orientalis*, Kevan, 1959. In this study, morphological characters, morphometric measurements, host plants, and the global distribution of each species also has been done. Such a type of finding furnishes a definite basis for knowing the various groups of Acridomorpha of Sindh. Certainly, the present finding will be the first of its kind. It will provide a helpline for people associated with pest management and other control agencies in Pakistan and abroad. Additionally, the present study's findings will be useful in making predictions about the relationship between the species and for accurate identification in the future.

Table 1. Checklist of species of insects from rice, cotton, maize, and other vegetation area Mehmarno from Khairpur Mirs

Order	Families	Month &Years	Species	Community				
				Rice	Cotton	Maize	Wheat	Other Vegetation
Orthoptera	Family Acridoidea	March 2021	*Duroniella laticornis*	3	2	3	2	0
			Phlaeoba tenebrosa	2	2	2	1	1
			Truxalis eximia eximia	2	2	2	1	1
			Truxalis fitzgeraldi	3	0	2	2	2
	Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	4	3	2	1	2
			Chrotogonus (*Chrotogonus*) *trachypterus trachypterus*	2	2	2	1	1
			Tenuitarsus orientalis	4	3	2	3	0
	Family Acridoidea	April 2021	*Duroniella laticornis*	4	3	4	2	1
			Phlaeoba tenebrosa	4	0	4	4	2
			Truxalis eximia eximia	3	1	2	3	0
			Truxalis fitzgeraldi	2	3	0	2	1
	Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	4	0	3	3	3

			Chrotogonus (*Chrotogonus*) *trachypterus trachypterus*	3	3	1	1	1
			Tenuitarsus orientalis	5	2	3	3	2
	Family Acridoidea	May 2021	*Duroniella laticornis*	5	3	5	0	3
			Phlaeoba tenebrosa	4	0	3	3	3
			Truxalis eximia eximia	2	2	0	2	3
			Truxalis fitzgeraldi	4	3	5	0	1
	Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	2	2	2	1	2
			Chrotogonus (*Chrotogonus*) *trachypterus trachypterus*	2	3	2	2	1
			Tenuitarsus orientalis	2	2	3	1	2
	Family Acridoidea	June 2021	*Duroniella laticornis*	4	2	2	2	3
			Phlaeoba tenebrosa	3	2	2	2	5
			Truxalis eximia eximia	2	2	1	2	2
			Truxalis fitzgeraldi	3	0	3	2	1
	Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	4	2	3	2	0
			Chrotogonus (*Chrotogonus*) *trachypterus trachypterus*	3	1	2	0	4
			Tenuitarsus orientalis	2	2	1	2	3
	Total number of grasshopper **individual**			97	52	66	50	54
	Total number of grasshopper **species**			28	23	26	27	24

Table 2. Comparison of grasshopper diversity from different crop communities based on different diversity parameters

Order	Months&Years	Community	Species richness	Abundance	Shannon Index (H)	Margalef index (d)	Evenness index (E)	Simpson index (D)	Equitability (J)
Orthoptera	March 2021	Rice	7	20	1.904	2.003	0.958	0.845	0.978
		Cotton	6	14	1.772	1.989	0.980	0.173	0.989
		Maize	7	15	1.934	2.216	0.988	0.853	0.993
		Wheat	7	11	0.846	2.502	0.905	0.826	0.948
		Other	5	7	1.550	2.056	0.942	0.775	0.963
	April 2021	Rice	7	25	1.912	1.864	0.9671	0.848	0.982
		Cotton	5	12	1.545	1.610	0.938	0.777	0.960
		Maize	6	17	1.712	0.955	0.922	0.8097	0.955
		Wheat	7	18	0.839	2.076	0.935	0.160	0.965
		Other	6	10	1.696	2.171	0.908	0.8	0.9464
	May 2021	Rice	7	25	1.912	1.864	0.9671	0.848	0.9828
		Cotton	5	12	1.545	1.61	0.938	0.777	0.960
		Maize	6	17	1.712	1.765	0.922	0.809	0.955
		Wheat	7	18	1.879	2.076	0.593	0.839	0.965
		Other	6	10	1.696	2.171	0.908	0.8	0.9464
	June 2021	Rice	6	20	1.765	1.669	0.973	0.825	0.985
		Cotton	4	10	1.314	0.947	0.930	0.720	0.947
		Maize	5	14	1.512	1.516	0.907	0.765	0.939
		Wheat	6	15	1.714	1.846	0.925	0.808	0.956
		Other	5	8	1.494	1.924	0.891	0.750	0.928

Table 3. Checklist of relative abundance of various species of Mehrano Forest Khairpur Mirs

Families	Month &Years	Species	Relative Abundance (%)
Family Acridoidea	March 2021	*Duroniella laticornis*	3.278
		Phlaeoba tenebrosa	2.622
		Truxalis eximia eximia	2.622
		Truxalis fitzgeraldi	2.950
Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	3.934
		Chrotogonus (Chrotogonus) trachypterus trachypterus	2.622
		Tenuitarsus orientalis	3.934
Family Acridoidea	April 2021	*Duroniella laticornis*	4.590
		Phlaeoba tenebrosa	4.590
		Truxalis eximia eximia	2.950
		Truxalis fitzgeraldi	2.622
Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	4.262
		Chrotogonus (Chrotogonus) trachypterus trachypterus	2.950
		Tenuitarsus orientalis	4.918
Family Acridoidea	May 2021	*Duroniella laticornis*	5.245
		Phlaeoba tenebrosa	4.262
		Truxalis eximia eximia	2.950
		Truxalis fitzgeraldi	4.262
Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	2.950
		Chrotogonus (Chrotogonus) trachypterus trachypterus	3.278
		Tenuitarsus orientalis	3.278
Family Acridoidea	June 2021	*Duroniella laticornis*	4.262
		Phlaeoba tenebrosa	4.590
		Truxalis eximia eximia	2.950
		Truxalis fitzgeraldi	2.950
Family Pyrgomorphoidea		*Chrotogonus (Chrotogonus) homalodemus homalodemus*	3.606
		Chrotogonus (Chrotogonus) trachypterus trachypterus	3.278
		Tenuitarsus orientalis	3.278

Table 4. Occurrence of Family Acridoidea & Pyrgomorphoidea and species from different host plants in Mehrano Forest Khairpur Mirs

S.No	Family	Name of Species	Rice	Cotton	Maize	Wheat	Other Vegetation	Total no of specimen	%
01	Acridoidea	*Duroniella Laticornis (Krauss, 1909)*	15	08	15	08	07	53	17.37%
02		*Philaeoba Tenebrosa* (Walker, 1871)	14	09	16	05	05	49	16.06%
03		*Truxalis Eximia Eximia Eichwald, 1830*	09	09	08	05	04	35	11.47%
04		*Truxalis Fitzgeraldi Drish*, 1950)	09	09	10	05	06	39	12.78%
05	Pyrgomorphoidea	*Chrotogonus (Chrotogonus) homalodemus homalodemus* (Blanchard, 1836)	09	08	10	11	07	45	14.75%
06		*Chrotogonus* (*Chrotogonus*) *trachypterus trachypterus* (Blanchard, 1836)	13	04	02	12	05	37	12.14%
07		*Tenuitarsus orientalis* Kevan, 1959	11	10	09	09	08	47	15.40%
								305	

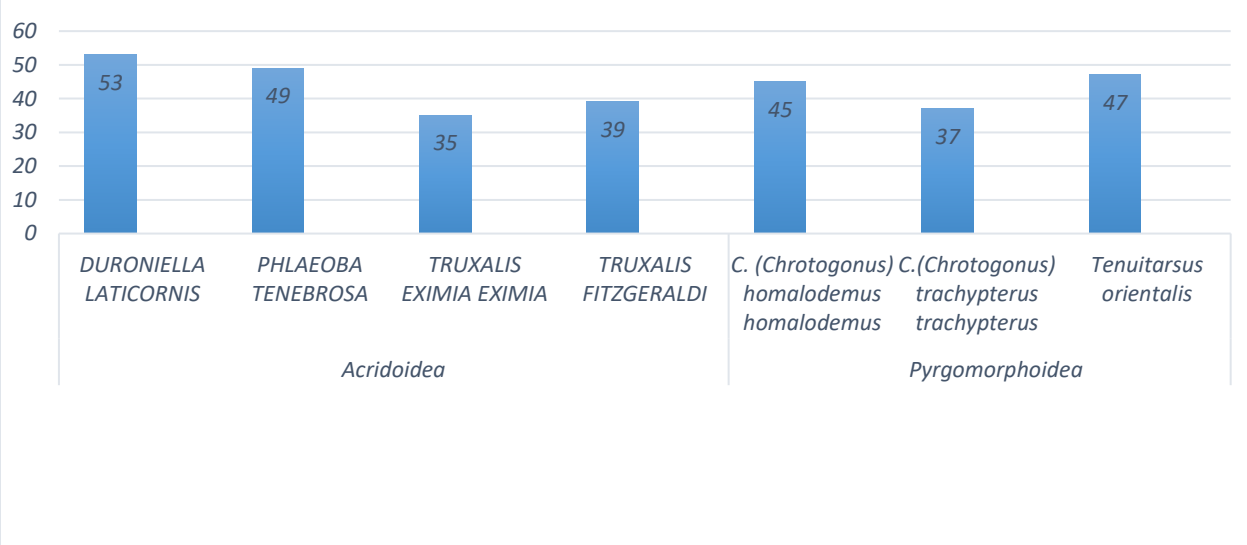

Figure 8. Number of specimens collected from various localities of Mehrano forest, Khairpur Mirs

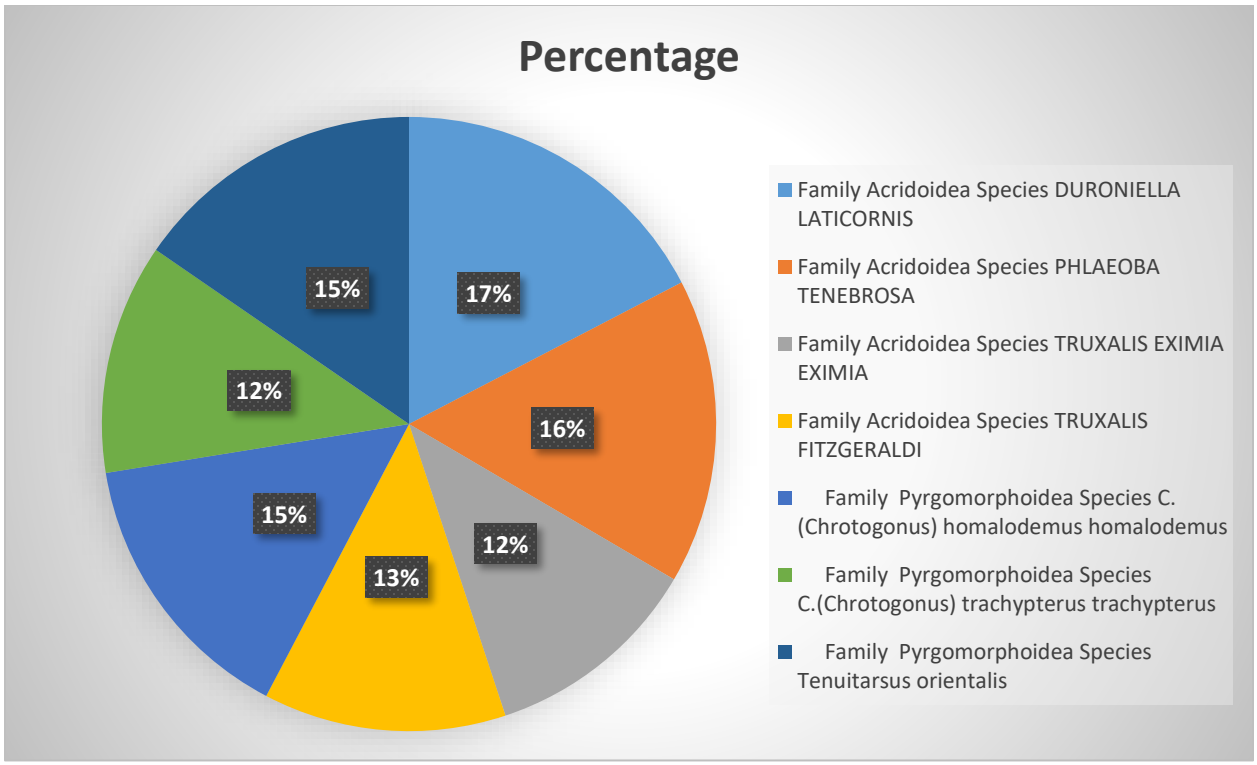

Figure 9. Percentage % of specimens collected from various host plants of Mehrano forest Khairpur Mirs

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