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Research Article

Preliminary studies on morphology and distribution of field crickets (Gryllinae) from district Jacobabad, Sindh, Pakistan

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Abstract:

Field crickets were collected from agricultural fields and the surrounding vegetation of district Jacobabad through traditional insect nets and by hand picking. The collected specimens were 321, which were sorted out into single sub-family Gryllinae falling into 05 genera and 07 species, i.e. *Gryllodes sigillatus* (Walker, 1869), *Gryllodes supplicans* (Walker, 1859), *Gryllus bimaculatus* (De-Geer, 1773), *Acheta burdigalensis* (Latreille, 1804), *Acheta domesticus* (Linnaeus, 1758), *Gryllopsis histrio* (Saussure, 1877) and *Teleogryllus commodus* (Walker, 1869). The maximum population of *Acheta domesticus* (Linnaeus, 1758) was 36%, and *Gryllodes supplicans* (Walker, 1859) was 24%. While the minimum population of *Gryllopsis histrio* (Saussure, 1877) was 3%, and *Acheta burdigalensis* (Latreille, 1804) was 5%, respectively. Additionally, a detailed description of species and distribution is provided. Finding field crickets from this area will be instrumental for the farmers and researchers concerned with the biodiversity of this group.

Keywords: Gryllinae, Field crickets, Agriculture fields, Orthoptera, Morphology, Species, Biodiversity, Vegetation.

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1. Introduction

Crickets belong to the family Gryllidae of the order Orthoptera. The size of these crickets varies from one to another (15 millimetres to 25 millimetres). They are brownish or blackish in colouration. The body is dusty coloured. Males being larger than females is a unique characteristic. Female species can be seen with elongated ovipositors male species possess anal cerci. Females oviposit the eggs within the sand dunes and grounds. A few acts as predators of certain Lepidoptera (Warchałowska-Sliwa *et al.*, 1978). Crickets feed on the grasses and other vegetation. Generally, crickets feed on the eggs of moths, butterflies and grasshoppers. Spiders rob them and can be seen robbing these crickets when found at nearby sites. Many species of crickets are known throughout the world. Genera of ground crickets viz: *Gryllodes, Teleogryllus, Gryllus, and Acheta* are well known (Gray *et al.*, 2001).

The *Acheta* species are primarily found in houses, gardens, kitchens, bakeries and agricultural land. Due to their presence in the houses, these field crickets are also known as house crickets (Gangwere, 1961; Dutt, 1975). Crickets belonging to the subfamily Gryllinae are spread in all ecological zones but not in the polar region and ocean. They are key role players in the biocontrol and agroecosystems (Spann, 1934; Vickery & Johnstone, 1970). Chandra *et al.* (2007) reported that these are cosmopolitan by nature. The crickets migrate from one zone to another due to a lack of food (Uvarov, 1940; Panhwar *et al.*, 2023; Panhwar *et al.*, 2014; Panhwar, 2018).

Crickets are omnivorous and feed on every type of food. Some feed on fruits, flowers and foliage. Ground crickets eat leaves of plants, grasses, seedlings, and plants' shoots. Few feeds on invertebrate eggs (Huber *et al.*, 1989; Gorochov, 2002). Many feed the food of cattle also consume dead organic matter of fungi and decay of plants (Drayton *et al.*, 2010.) Several studies have been done in Pakistan by on the similar problems like Sultana *et al*. (2016), Riffat *et al.* (2012), Khan and Kamaluddin (2006), Khan and Kamaluddin (2009), Ahmad and Khan (2014), Kamaluddin *et al.* (2001), Kamaluddin and Khan (2005), Saeed *et al.* (2000), and Ghouri (1958) no work is done on morphology and the distribution of this subfamily from the study area.

2. Materials and Methods

The details of the methods and material used in this study is as follows:

2.1. Collection of Gryllinae

The samples of the selected type of species for this research study were caught from various agricultural lands of district Jacobabad. The species was collected from the fields with the help of the capturing nets. The district Jacobabad is considered a paddy-producing district of Sindh Province, Pakistan.

2.2. Killing of Gryllinae

Gryllinae were caught and taken into the lab at the Zoology Department. The Gyllinae were killed by using KCN (Potassium Cyanide) in killing Jar. The killed specimens were dried and pinned on the thorax region. Proper labelling was made and shifted into insect Cabines by putting naphthalene balls (Gorochov, 2002).

2.3. Gryllinae species identification and genitalia extraction

Gryllinae species were identified under the bi-ocular microscope. Taxonomic keys (Randell, 1964) were used, and the Orthoptera species file online site was used to confirm species. For genitalia extraction, dried samples were kept overnight in the desiccator. The abdominal part was separated and retained into a cavity slide with K.O.H. and water. Muscles were detached, and genitalia was separated and kept in vials with glycerine and drop alcohol (Kevan *et al.*, 1969; Panhwar *et al.*, 2013).

2.4. Morphometric study and photography

The morphometric analysis of the selected species was done and carried out with the help of a scale divider for this purpose. The measurements of the species were taken, and species photography was made with a Canon camera with 16 Mega Pixel (Yousuf *et al.*, 1998).

3. Results

The Morpho-taxonomical study of sub-family (Gryllinae) was conducted from district Jacobabad. The specimens were collected during the month of March 2023 to September 2023. 321 specimens were captured and identified. Moreover, the seven species of Gryllinae that belonged to five genera were identified. There are a total of seven species being identified; these species are, *Gryllodes sigillatus* (Walker, 1869), *Gryllodes supplicants* (Walker, 1859), *Gryllus bimaculatus* (De-Geer, 1773), *Acheta burdigalensis* (Latreille, 1804), *Acheta domesticus* (Linnaeus, 1758), *Gryllopsis histrio* (Saussure, 1877), *Teleogryllus commodus* (Walker, 1869).

3.1. Diagnostic features of *Gryllodes sigillatus* (Walker, 1869)

The *Gryllodes sigillatus* species contain short faces with yellow and clypeus spotted with brown colouration. these are longer in size and contain strongly feebly depressed pubescent. A narrowed one and a wide yellow transverse band above the brown head. Having a curved between ocelli. It has a transverse pronotum with an anterior feebly concave margin abdomen mottled with a yellowish-brown femur and very few brown spots. In males, the development of Elytra has been a remarkable difference noted, and females contain elongated cerci. At the apex, a pointed ovipositor is present (Figure A1a).

3.2. Diagnostic features of *Gryllodes supplicants* (Walker, 1859)

The diagnostic characteristics of *Gryllodes supplicans* containing both sexes to the abdominal area and extended elytra in extremely both sexes. They almost look like *G. sigillatus.* In males, the apical field of the elytra is rather long, and the wings are lengthily caudate, presenting 4 veins. In contrast, in females, the elytra are quite different from those of *G. sigillatus*, with spaced veins present on the dorsal field. At its basal half, a deeply constricted phallic complex and rounded cerci are present at its upper portion (Figure A1b).

3.3. Diagnostic features of *Gryllus bimaculatus* (De-Geer, 1773)

The diagnostic features of *Gryllus bimaculatus are* almost completely glabrous. In front feebly narrowing pronotum. A reddish margin is black at the base and interior, and there is a strong femur. On each margin, 5 or 6 long sharped spines armed tibia are present, super-internal as long as the median one apical spur. At base two, yellow spotted typical blackish Elytra extending to the apex of the abdomen, Elytra much smaller than the wings. Minute spines phallic complex, at its base thick cerci, are presented while at apex pointed cerci are presented. At its apex, elongated sword-shaped bifurcate ovipositor is present (Figure A1c).

3.4. Diagnostic features of *Acheta burdigalensis* (Latreille, 1804)

The diagnostic features of *Acheta burdigalensis* are small in size, acute angle front clypeal suture, middle obliterated, In between antennae, dark transverse spot with usually frons. In stridulatory organ, two oblique veins are present in male tegmina. In female tegmina ventrally with 6-7 vein overhanging, large ovipositor. At its base, a rounded phallic complex and at its apex, elongated pointed hair-like cerci are present (Figure A1d).

3.5. Diagnostic features of *Acheta domesticus* (Linnaeus, 1758)

The diagnostic features of *Acheta domesticus* contain medium-sized depressed pubescent. The body contains testaceous or light fulvous colouration. It also contains two wide transverse testaceous bands on the brown head. Two large brown spotted adorned pronotum. The elytra are usually shorter than the wings and extend to the abdomen's apex. A few brown spots containing yellowish legs. In female elytra, veins oblique with 6-7 spines armed tibia. Very long regular acute ovipositor. Acute long ovipositor is present at the base constricted deeply phallic complex, with Pointed cerci at its apex and at its base (Figure A1e).

3.6. Diagnostic features of *Gryllopsis histrio* (Saussure, 1877)

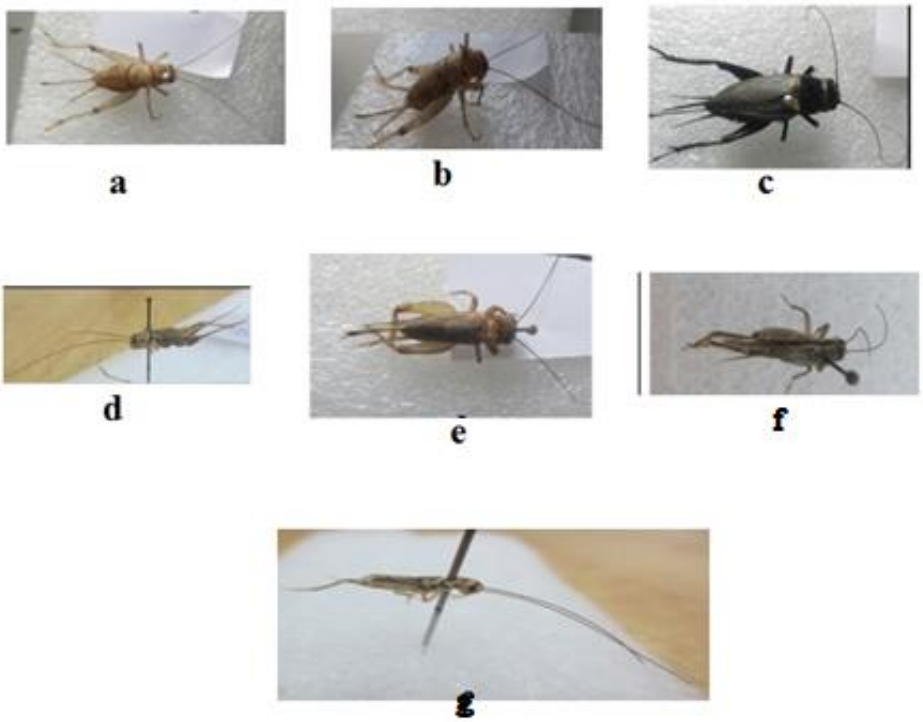
The *Gryllopsis histrio* species diagnostic features are very mucg related to *Gryllomorpha dalmatina* but differ in coloration and body size. The basic colouration is pale brown with dark brown spots. The thoracic gland is absent. Longer Antennae and Apterous body are

distinguished from all other species of sub-family Gryllomorphinae. At its base, there is a broader phallic complex compared to other species. They contain thinner cerci, which are not elongated (Figure A1f).

3.7. Diagnostic features of *Teleogryllus commodus* (Walker, 1869)

Wings are distinguished diagnostic features of *T. commodus* that are folded on the side of the body. This species is commonly known as the black field cricket and usually has black or brown colouration. They contain long antennae and adapted legs for jumping, and they can grow up to 30 mm long. On the abdomen, the nymph can be recognized by a white stripe. The male of *T. commodus* contains forewings with modified veins and hard pegs that play a role in song production. At the base, a narrower phallic complex is present and constricted short cerci (Figure A1g).

Figure A1: (a) Dorsal view *Gryllodes sigillatus*, (b) Dorsal view *Gryllodes supplicans*, (c) Dorsal view *Gryllus bimaculatus*, (d) Lateral view *Acheta burdigalensis*, (e) Dorsal view *Acheta domesticus*, (f) Lateral view *Gryllopsis histrio*, (g) Lateral view *Teleogryllus commodus*



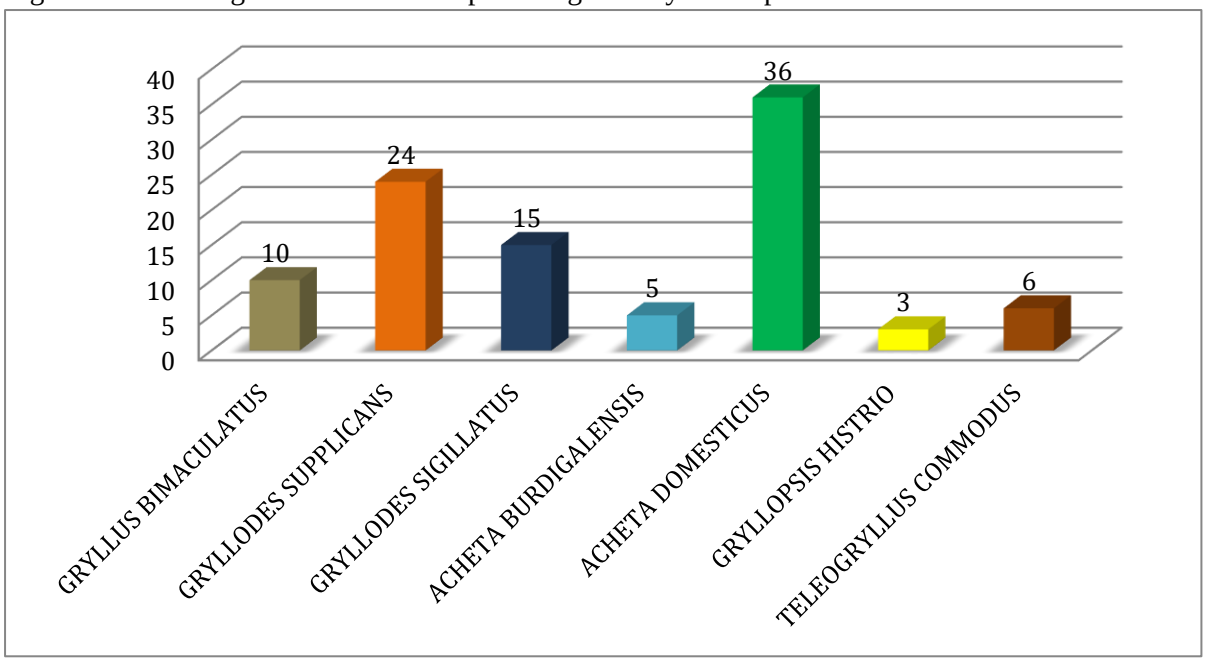
4. Discussion

Crickets belong to the family Gryllidae of the order Orthoptera. The size of these crickets varies from one another (15 millimetres to 25 millimetres). They are brownish or blackish in colouration. The body is dusty coloured. Males are larger than females in unique characteristics. Lim *et al*. (1973) documented that 12 species of Gryllinae were studied to determine the morphology and behaviour of their chromosomes in males with 19 to 31 diploid chromosomes. *Gryllus campestris* and "*G. bimaculatus*" anomalies in chromosome behaviour

and structure contain the discontinuities, polyploidy, lagging, stickiness, unfit segregation, C-mitosis, and non-disjunction and reduced fertility described from Singapore, G. velvet contains the 2*n* ♀ = 29 to 31: different chromosomes number, karyotypic variations. Alexander (1957) described the Various genera and species of Tettigoniidae and Gryllidae. Zefa *et al*. (2006) erected the life cycle and wet and dry seasonal samplings from the tropical distribution of *Eneoptera surinamensis* (Orthoptera, Gryllidae, Eneopterinae) (De-Geer, 1773). Seasonal Alluvial Semi-deciduous Forest were studied at Brazil (25º27'54.9" S; 54º34'27.9" W), Field investigations were made at 20 to 24-day intervals, starting on April 30th, 2002 to April 25th, 2003.

The studied species is univoltine and cyclic with regards to the dry and wet seasons, therefore being heterodynamic and surviving the dry season as adults. Field crickets were collected from agricultural fields and the surrounding vegetation of district Jacobabad through traditional insect nets and by hand picking. The collected specimens were 321 which were sorted out into single sub-family Gryllinae falling into 05 genera and 07 species i-e: *Gryllodes sigillatus* (Walker, 1869), *Gryllodes supplicans* (Walker, 1859), *Gryllus bimaculatus* (De-Geer, 1773), *Acheta burdigalensis* (Latreille, 1804), *Acheta domesticus* (Linnaeus, 1758), *Gryllopsis histrio* (Saussure, 1877) and *Teleogryllus commodus* (Walker, 1869). The maximum population of *Acheta domesticus* (Linnaeus, 1758) was 36%, and Gryllodes supplicans (Walker, 1859) was 24%. The minimum population of *Gryllopsis histrio* (Saussure, 1877) is 3% and *Acheta burdigalensis* (Latreille, 1804) at 5%, respectively (Figure A2). Additionally, a detailed description of the species and their distribution is provided. Finding field crickets from this area will be instrumental for the farmers and researchers concerned with the biodiversity of this group.

Figure A2: Showing the collection and percentage of Gryllinae species



5. Conclusion

Morphological studies were carried out of Sub-family Gryllinae, falling into 05 genera and 07 species i-e: *Gryllodes sigillatus* (Walker, 1869), *Gryllodes supplicans* (Walker, 1859), *Gryllus bimaculatus* (De-Geer, 1773), *Acheta burdigalensis* (Latreille, 1804), *Acheta domesticus* (Linnaeus, 1758), *Gryllopsis histrio* (Saussure, 1877) and *Teleogryllus commodus* (Walker, 1869). Additionally, the distribution of species gives an indication of their presence in the study area of Jacobabad, Sindh, Pakistan.

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