

ASPECTS OF SOUND PRODUCING ORGANS IN GRYLLINE CRICKETS WITH SPECIAL REFERENCE TO *SCIOBIA* SP. (ORTHOPTERA: GRYLLIDAE) AND THEIR SYSTEMATIC STATUS

Imtiaz Ahmad^{1*} and Nasreen Khan²

¹Department of Agriculture Agro-business, University of Karachi,
Room No. 15, M.A.H. Qadri Biological Research Centre, University of Karachi, Pakistan

²Department of Zoology, Jinnah University for Women, Karachi, Pakistan

*Corresponding author e-mail: iahmad3141@yahoo.com

ABSTRACT

Studies on sound producing organs of grylline crickets are reviewed with reference to their impact on ascertaining systematic status in these crickets. In this light these characters in *Scioبيا* Burmeister are reviewed and on this basis the systematic position of this genus is briefly discussed.

INTRODUCTION

Acoustic communication is an important behavioural character in male crickets through which these communicate with conspecific partner for courtship. The males sing to call female for mating or aggressive song is also played to protect the territory from the conspecific male attackers (Chopard, 1938; Huber *et al.*, 1989). Until the first half of the last century, all United States *Gryllus* spp., were categorized as a single species, then Fulton (1952) recognized that four species could be isolated in North Carolina. Walker (1969) worked on pars stridens characteristics and calling songs and realized that these provide very important characters for ascertaining their taxonomic status. By studying pars stridens of different species, it was revealed that, they showed small but consistent differences between closely related species. (David *et al.*, 2003). In Gryllidae, Ensiferen acoustic evolution is concentrated on wing stridulation. (Alexander, 1962; Bailey, 1991; Otte, 1992).

Stridulation is a significant character for confirming species status. Number of stridulatory teeth, length of files, size and distance of teeth of the file appear to be associated with stridulation. (Alexander and Thomas, 1959; Alexander and Bigelow, 1960; Walker, 1962, 1963).

David *et al.* (2003) stated that in *Gryllus* spp., songs produced play an important role in recognizing possible, cryptic species. The Pars stridens morphology and their morphometric characters can help and contribute to highlight speciation process.

MATERIAL AND METHODS

The grylline are collected from different plants, viz. graminaceous plants including common grasses and rice (*Oryza sativa* L.), and dicotyledonous plant cotton (*Gossypium hirsutum* L.), tobacco (*Nicotiana tabacum* L.), tomato (*Lycopersicon esculentum* Mill), tea (*Camellia sinensis* L.), and also from decaying leaves in wet places of different fields and from different houses.

After preservation, these specimen in the pinned dry condition were placed in boiled water to soften their body, and then the right tegmen was detached and placed on a slide, then cleaned with a brush. Finally it was covered with a clean cover slip for taking photographs by using Nikon Cool Pix 5400 digital camera after placing it under Nikon SMZ 800 Binocular microscope.

For the morphological study and for analyzing characters of the file teeth, plectrum, and microtracheae Scanning Electron Microscope was used. The prepared tegmen was mounted on a stub placed in a desiccator with Silica gel to dry. The sample was placed to coat with auto coater into JEOL model No. JFC-1500 Japan having gold target, which coated up to 300⁰A, then scanned through Scanning Electron Microscope, JEOL Japan model No. JSM 6380A and studied after taking SEM photographs.

RESULTS AND DISCUSSION

Scioبيا Burmeister (Khan and Ahmad, 2014) appears closely related to the genus *Brachytrypes* Serville in having mirror with a quadrate cell and apical margin of teeth wrinkled, but can easily be separated from the same in having 03-04 oblique veins, teeth having long wings and density of teeth 50-62 per millimeter as compared to having 5-6 oblique veins, teeth having reduced wings and density of teeth 19.7-20.2 per millimeter in the species of the genus *Brachytrypes* Serville.

Sciobia sp., was described on the basis of its stridulatory organs, including: stridulatory file, stridulatory teeth, structure and number of teeth, teeth density, structure of plectrum, microtracheae, shape of mirror and number of oblique veins (Khan and Ahmad 2014).

The specimen has thick, broad, tegmen, darker in colour, apical margin broad, rounded, apical field short, 03 oblique veins 02, diagonal veins, slightly curved, mirror quadrate, having squared cell. Lateral field short having a few sub-cubital veins.

Teeth large, narrow at base, cusp thick, curved at middle, broad, having wrinkles, broad basal margin, broad and around, dorsoventrally flattened, thick at apical margin. Posterior wings longer than anterior wings. Anterior margin narrow, pointed at lateral margin, basal margin broad, rounded, flattened. Posterior wing longer than anterior wing, broad, pointed at lateral margin, basal margin broad, thick. Both wings feebly curved towards anal region.

Otte and Cade (1984), and Otte (1987) identified the sub-family Gryllinae with reference to their external morphology, genital characters and correlated them with their sound pattern. Presently the representatives of the sub-family Gryllinae were identified for the first time from Pakistan on the basis of their stridulatory file, teeth profile and song patterns.

Plectrum straight at anterior margin, pointed at posterior margin. Anal margin slightly curved, thin, costal margin round. Microtrachea dense, long, curved, pointed at apex.

Length of file 1.6-1.8 mm, plectrum 1.0-1.2 mm, total number of teeth 95-100, including minor and asymmetrical teeth. Density 53.3-55.0 teeth per millimeter.

As reported above, this genus appears most closely related to the genus *Brachytrypes* in the characters shown in Table 1 and described in the first paragraph; “under results and discussion:

Table 1. Showing comparative characteristics of sound producing organs in the members of *Sciobia* and *Brachytrypes*

	Mirror shape	Apical margin of teeth	No. of Ob. veins	Density of teeth per mm	Size of wing
<i>Sciobia</i> spp. Burmeister	Quadrate	Wrinkled	03-04	50-62	Long
<i>Brachytrypes portentosus</i> Serville	Quadrate	Wrinkled	05-06	19.7-20.2	Reduced



Fig. 1. Oblique veins on Tegmen.



Fig. 2. Stridulatory tooth

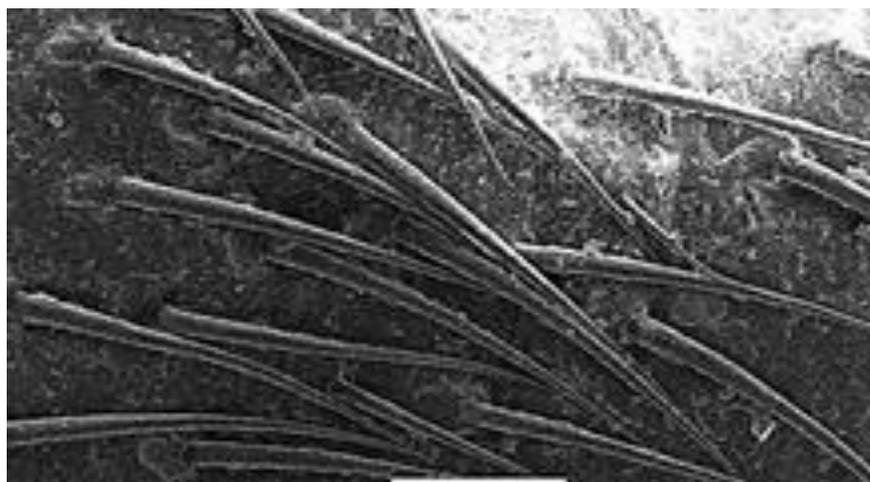


Fig. 3. Microtrachea.

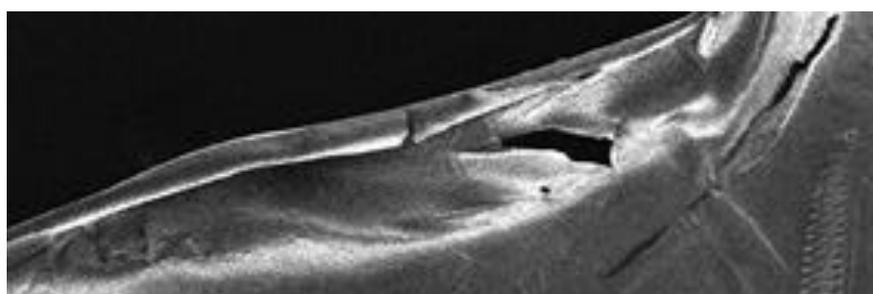


Fig. 4. Plectrum.

References

- Alexander, R.D. (1962). Evolutionary change in cricket acoustical communication. *Evolution*, 16: 443-467.
- Alexander, R.D. and R.S. Bigelow. (1960). Allochronic speciation in field crickets and a new species *Acheta veletis*. *Evolution*, 14: 334-46.
- Alexander, R.D. and E.S. Thomas. (1959). Systematic and behavioral studies on the crickets of the *Nemobius fasciatus* group (Orthoptera: Gryllidae: Nemobiinae). *Ann. Entomol. Soc. Amer.*, 52: 591-605.
- Bailey, W.J. (1991). Acoustic behavior of insects: an evolutionary perspective. *Chapman and Hall*, New York.
- Chopard, L. (1938). Orthoptera, Dictyoptera, Phasmodea, Ensifera. In: *Mission Scientifique de l'Omo*, 4(33): 89-134. In *Memoires du Museum National d'Histoire Naturelle, Nouvelle serie, Tome VIII*.
- David, J.A.O., E. Zefa and C.S. Fontanetti. (2003). Cryptic species of *Gryllus* in the light of biocoustic (Orthoptera, Gryllidae). *Neotropical Entomology*, 32: 75-80.
- Fulton, B.B. (1952). Speciation in the field cricket. *Evolution*, 6(3): 283-295.
- Huber, F., T.E. Moore and W. Loher. 1989. Cricket behavior and neurobiology. *Ithaca, Cornell University Press*, 1-565.
- Khan, N. and I. Ahmad. (2014). A study of the sound producing organs of *Sciobiasp.* (Orthoptera: Gryllidae). *Int. J. Biol. Biotech.*, 11(1): 00-00.
- Otte, D. (1987). African crickets (Gryllidae). 9. New genera and species of Brachytrupinae and Gryllinae. *Proceeding of the Academy of Natural Sciences of Philadelphia*, 139: 315-374.
- Otte, D. (1992). Evolution of cricket songs. *J. Orthop. Res.*, 1: 25-49.
- Otte, D. and W. Cade. (1984). African crickets (Gryllidae). 6. The genus *Gryllus* and some related genera (Gryllinae: Gryllini). *Proceeding of the Academy of Natural Sciences of Philadelphia*, 136(1): 98-122.
- Walker, T.J. (1962). Factors responsible for intra-specific variation in the calling song of cricket. *Evolution*, 16:407-428.
- Walker, T.J. (1963). The taxonomy and calling songs of United States tree crickets (Orthoptera: Gryllidae: Oecanthinae). 11. The *nigrieornis* group of the genus *Oecanthus*. *Ann. Ent. Soc. Amer.*, 56(6): 772-789.
- Walker, T.J. (1969). Systematics and acoustic behavior of United States crickets of the genus *Cyrtoxipha* (Orthoptera: Gryllidae). *Ann. Entomol. Soc. Am.*, 62(5): 945-952.

(Received February 2014; Accepted April 2014)