

## STUDIES ON THE SOUND PRODUCING APPARATUS THROUGH ELECTRON MICROSCOPE OF THE FIRST NEMOBIINE SPECIES *SPEONEMOBIUS DECOLYI* CHOPARD (ORTHOPTERA: GRYLLIDAE) FROM PAKISTAN WITH EXCLUSIVE SUB-FAMILIAL CHARACTERS

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### ABSTRACT

Materials of Nemobiine cricket species *Speonemobius decolyi* Chopard from Thatta, Sindh is for the first time described here with reference to its stridulatory organs by using Scanning Electron Microscope (SEM). These organs are described highlighting the characters of length of file, number and structure of teeth, teeth density, structure and venation of Tegmen. The exclusive sub familial stridulatory characters are also emphasized.

**Key-words:** sound producing apparatus, Nemobiine cricket, *Speonemobius decolyi*, Thatta, Sindh, Pakistan

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### INTRODUCTION

Earlier the crickets of the family Gryllidae were identified in Pakistan with the help of their external morphological characters including those of their external male and female genitalia. Almost at the beginning of the 20<sup>th</sup> century the systematists of this group concentrated on the calling signals of the males to attract their conspecific female partners. This behavioural character was found most reliable when Fulton (1932) revealed for the first time the use of sound to distinguish closely related cricket species.

Allard (1910) for the first time noted geographical variation in the sounds of field crickets. Only males produce sounds for the attraction of mate, leading to courtship behaviour or to show aggressive behavior (Parkes 1972; McIntyre 1974), but female and immature crickets do not stridulate (McIntyre 1977).

Different species-specific calling songs were observed in the crickets (Bennet-Clark, 1989). Earlier genus *Pictonemobius*, was known as monospecific. On the basis of its calling song characteristics, stridulatory organs, morphology and habitat characters also revealed that this so-called monospecific genus actually was found to comprise a group of four sibling species (Scott *et al.*, 1989).

The present studies confirmed the earlier statement that most subfamilies of crickets could be identified on the basis of file teeth structure (Walker and Carlysle, 1975).

### MATERIALS AND METHODS

Nemobiine cricket species *S. decolyi* were collected from Thatta, Sindh, were stretched and pinned as per conventional procedures. The pinned dry male specimen was plunged in boiling water for a few minutes to soften the specimen, to detached the right tegmina. It was then placed on a slide, then covered with a clean cover slip for taking photograph by using Nikon Cool Pix 5400 digital camera by placing it over Nikon SMZ 800 Binocular microscope. For Scanning Electron Microscopy the ventral surface of tegmen was mounted on a stub, placed into an auto coater JEOL model No. JFC-1500 Japan gold target coating, which coated up to 300<sup>0</sup>A then placed for SEM by using JEOL Japan model No. JSM 6380A and taking pictures of the file, from Centralized Science Laboratory, University of Karachi, Karachi by courtesy of Mr. Yousuf Khan.

#### **Tegmina:** (Fig.1)

Tegmina well developed, larger than abdomen. Apical field very short, with a row of few cells, apical margin oval with one diagonal vein, long, round, joining to mirror without cross vein. Chords three, 1st and 2nd strongly convex, originating from a single Y-shaped vein, 3<sup>rd</sup> straight. Oblique vein long, complete, convex at middle, starting at basal end of stridulatory file. Lateral field having four sub-cubital veins, smooth long, straight with equal distance among them. Mirror large, divided by curved veins forming three small cells, having round apices. Two median veins, distant from each other at middle, two cubital veins present, not joining to each other, having equal

distance between them, unbranched. Stridulatory files straight. Wings long. Length of tegmina 3.5-3.8 mm., width 1.7-1.9 mm.

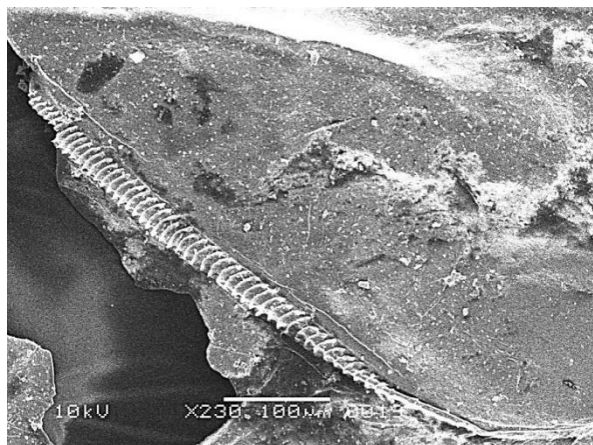


Fig. 1 Stridulatory File

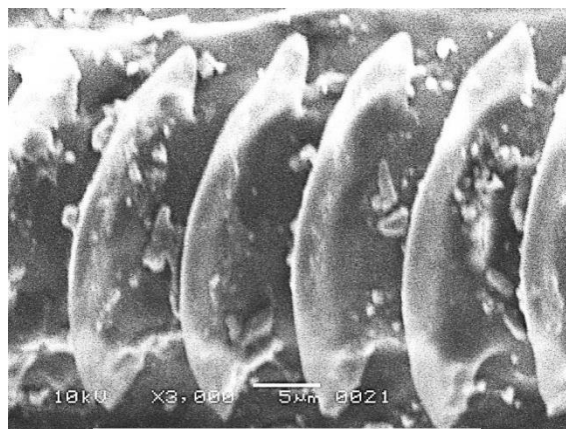


Fig. 2. Stridulatory Teeth

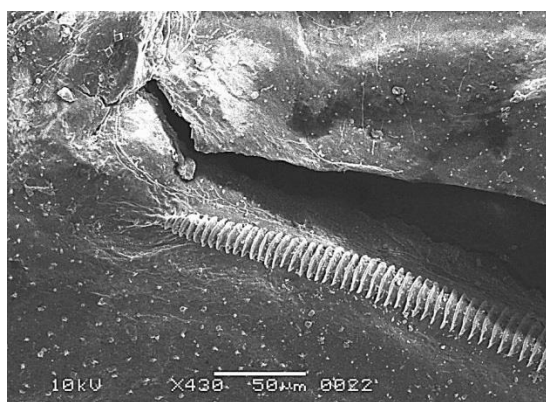


Fig. 3. Anal Teeth

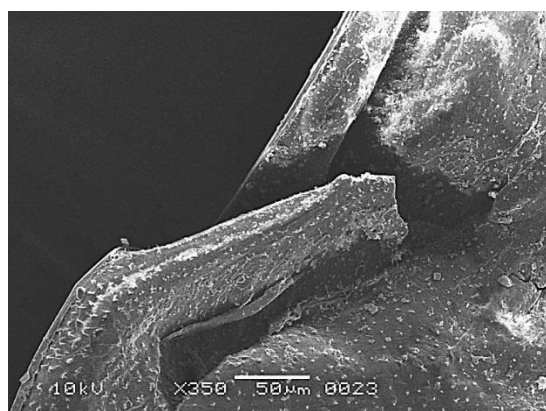


Fig. 4 Plectrum



Fig. 5 Anal Region

Fig.1-5. *Speonemobius decolyi*; 1=Tegmina; 2-5= Pars stidens.

**Pars stridens:** (Figs. 2-5)

Teeth evenly distributed on entire file, starting at basal end of stridulatory file. Distance between teeth variable, terminal regions having maximum distance. Morphology of a single tooth in *S. decolyi* resembling with those of other species of this genus. Teeth large, axe-like, base broad, cusp narrow, strongly curved at middle, without any wrinkle, narrow, basal area large, broad, dorsoventrally flattened, apical area thick. Anterior wing longer and narrower than posterior wing, acute at lateral margin, basal margin broad, narrow, flattened. Posterior wing shorter and broader than anterior wing, sub-acute at lateral margin, basal margin broad, flattened. Both wings curved at their apical margin pointing, towards anal region. Costal and anal teeth smaller, but similar to median teeth, having maximum distance. Terminal teeth of variable shape, having minimum distance.

Plectrum acute at anterior region, pointed at posterior region. Anal margin straight, thin, costal margin broad, convex. Microtrachea scarce, a few present.

Length of file 0.9 mm, plectrum 01 mm, total number of teeth 101-105, including minor and asymmetrical teeth. Density 112-116 teeth per millimeter.

## DISCUSSION

In Pakistan the members of the family Gryllidae were described earlier on the basis of their external morphological characters including those of male and female genital components (Kamaluddin and Khan 2005; Khan and Kamaluddin, 2006). These characters in the developed world are considered as obsolete now because characters pertaining calling song and those morphological characters of the organs which produce these songs especially stridulating file, the structure of each stridulatory tooth of different regions, morphology of each region of the file and plectrum (Figs. 1-5). The importance of these organs became much more prominent for the identification of especially sibling cricket species. With the advancement of electron microscopy with high powered resolution, when became available and morphometric packages now available highlighting the characters of stridulum, different structures and number of teeth in file, density of teeth per millimeter, size, structure and length of file, these characters are remarkably helpful for the meaningful separation of species especially siblings species. These characters provide most sensitive and much more reliable differences in some of the closest species. A particular species has its particular number, density and structure of stridulating teeth, with its particular length of file.

Jacobson and Bianchi (1905), Chopard (1969), Vickery and Jhonstone (1970), Kai li *et al.* (2010) and Kamaluddin and Khan (2012) classified the genus *Speonemobius* on the basis of its genital characters and the later recognized for its cladistic analysis plesiomorphic and autapomorphic characters, of the genital components. The members of the genus *Speonemobius* when analyzed in the present studies, these appeared to be clearly marked and isolated among all other genera of Gryllidae by the characters of the sound producing organs, i.e., length of stridulatory file (0.9-1.0) mm, number of teeth (100-110) with density 101-112 (teeth) per mm and with axe-shaped teeth.

This genus appears most closely related to *Pteronemobius* Jacobson and Bianchi in having, tegmina longer than abdomen with one oblique vein, mirror having more than two cells, but can easily be separated from the same in having teeth narrow, longitudinal, axe-shaped, and density of teeth 110-120 per millimeter as compared to teeth broad, oblong, oar-shaped and density of teeth 190-290 per millimeter in *Pteronemobius*.

The characters of stridulating file and structure and density of teeth of different regions and plectrum are shared with the members of the sub-family Nemobiinae and isolate these from those of the sub-family Gryllinae with tegmina longer than abdomen, apical field reduced having a few cells. One diagonal vein, with one long, curved oblique vein. Mirror large divided into 3-6 small cells having variable size and shape. Lateral field short with 4-6 sub-cubital veins. Teeth oblong, oar shaped.

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