SCANNING ELECTRON MICROSCOPY OF THE Pars Stridens OF Gryllus: TAXONOMIC IMPORTANCE.

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ABSTRACT

The genus *Gryllus* has several cryptic species, which cannot be distinguished by external morphological characters. The present paper analyses the *pars stridens* of 7 species under the scanning electron microscope. The results showed that the *pars stridens* of the species have morphological differences on teeth shape. Based on these results, we propose that an analysis of the *pars stridens* under the scanning electron microscope should always be performed in order to reveal characters utilized in *Gryllus* taxonomy, especially if associated with *pars stridens* morphometric data.

Key words: *Gryllus*, *pars stridens*, SEM, Cryptic species.

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INTRODUCTION

Acoustic communication in crickets has demonstrated to be a good instrument for evolutionary analysis, once this group is endowed with the most complex acoustics among the invertebrates. Studying the bioacoustics of several *Gryllus* species, Alexander (1966) illustrated the *pars stridens* and defined the main repertories produced by Gryllinae. *Gryllus* has one pair of forewings, named tegmens, and a pair of posterior wings, the lengths of which can varies among the species.

The tegmens have a lateral and a dorsal field. The dorsal field can be divided in 5 parts: basal, harp, mirror, cordal and apical areas. All of which are modified for stridulating with the exception of the apical area. The *pars stridens* is the structure that produces the sound and it is formed by a segment of the cubital-two (Cu2) vein, and is located in the ventral surface of the upper tegmen; the sound is emitted when the edge of the first anal vein slides upon the row of teeth that compose the *pars stridens* (WALKER & CARLYSE, 1975).

Several authors have discussed the acoustic and taxonomic implications of the *pars stridens* in crickets, pointing out that cospecific specimens have practically the same structure in *pars stridens*, while it can vary considerably among species. In this context, many authors have discerned *Gryllus* species based on morphometry and morphology of the teeth present on the *pars stridens* (OTTE et al., 1988; ALEXANDER, 1991; ZEFA, 1995; DAVID et al., 2003). DESUTTER (1990) studying *Gryllus* in South America observed that the specimens in her samples could be divided in two groups: one with many teeth (from 180 to 220) and other with few teeth (from 110 to 160).

In the present paper, the *pars stridens* of cryptic species of *Gryllus* from São Paulo State, Brazil, were analyzed using scanning electron microscopy, intending to perceive the importance of its morphology for the taxonomic understanding of *Gryllus.*

MATERIAL AND METHODS

Gryllus adult males were identified and separated according to their calling song, registered in AGFA tapes (PER 528, 6.3mm, ¼ in e 1200ft) with NAGRA E recorder and processed by the analyzer program Avisoft – Sonograph light (© Dipl. – Ing. Raimund Spencht, Hauptstrasse 52, D – 13158 Berlin, Germany).

The tegmens were extracted, cleaned in ultra-sound, placed in stubs and subsequently metallized with gold. The material was analyzed in a Philips scanning electron microscope.

List of species identified by the calling song:

- *Gryllus* sp1. collected in Rio Claro city, SP; calling song: fundamental frequency = 3,7kHz, with groups of 7-8 notes.
- *Gryllus* sp2. collected in Colômbia city, SP; calling song: fundamental frequency = 3,9kHz, with groups of 7-8 notes.
- *Gryllus* sp3. collected in Rio Claro city, SP; calling song: fundamental frequency = 5,3kHz, with groups of 3 notes.
- *Gryllus* sp4. collected in Campos do Jordão city, SP; calling song: fundamental frequency = 4,0 kHz, with groups of 2 notes.
- *Gryllus* sp5. collected in the district of São Francisco Xavier, São José dos Campos city, SP; calling song: fundamental frequency = 3,8kHz, with groups of 6-7 notes.
- *Gryllus* sp6. collected in São José dos Campos city, SP; calling song: fundamental frequency = 5,0 kHz, with groups of 2 notes.
- *Gryllus* sp7. collected in Itirapina, SP; calling song: fundamental frequency = 3,9kHz, with groups of 7-8 notes.

RESULTS

The *pars stridens* (Fig 1A) of all species presented constant morphology among the individuals. Also, in all species, the teeth presented similar sizes along the structure, with the exception of the ones located near the extremities, which are smaller (Fig. 1B, C). In all *Gryllus* species studied here, a cluster of bristles were observed at the distal extremity of the *pars stridens* (Fig. 1C).

The teeth have triangular and arched morphology and, while analyzing these results, we were able to divide the *pars stridens* in groups according to teeth morphology.

The first group (Fig. 2 A-C), is characterized by the presence of teeth with triangular morphology, while the second group (Fig. 3A-D) presented more rectangular teeth. Both morphologies are determined by the teeth lateral borders. Besides teeth shape and number, their distribution, as well as *pars stridens* size also differs among species, complying an important set of characters for taxonomic purposes.

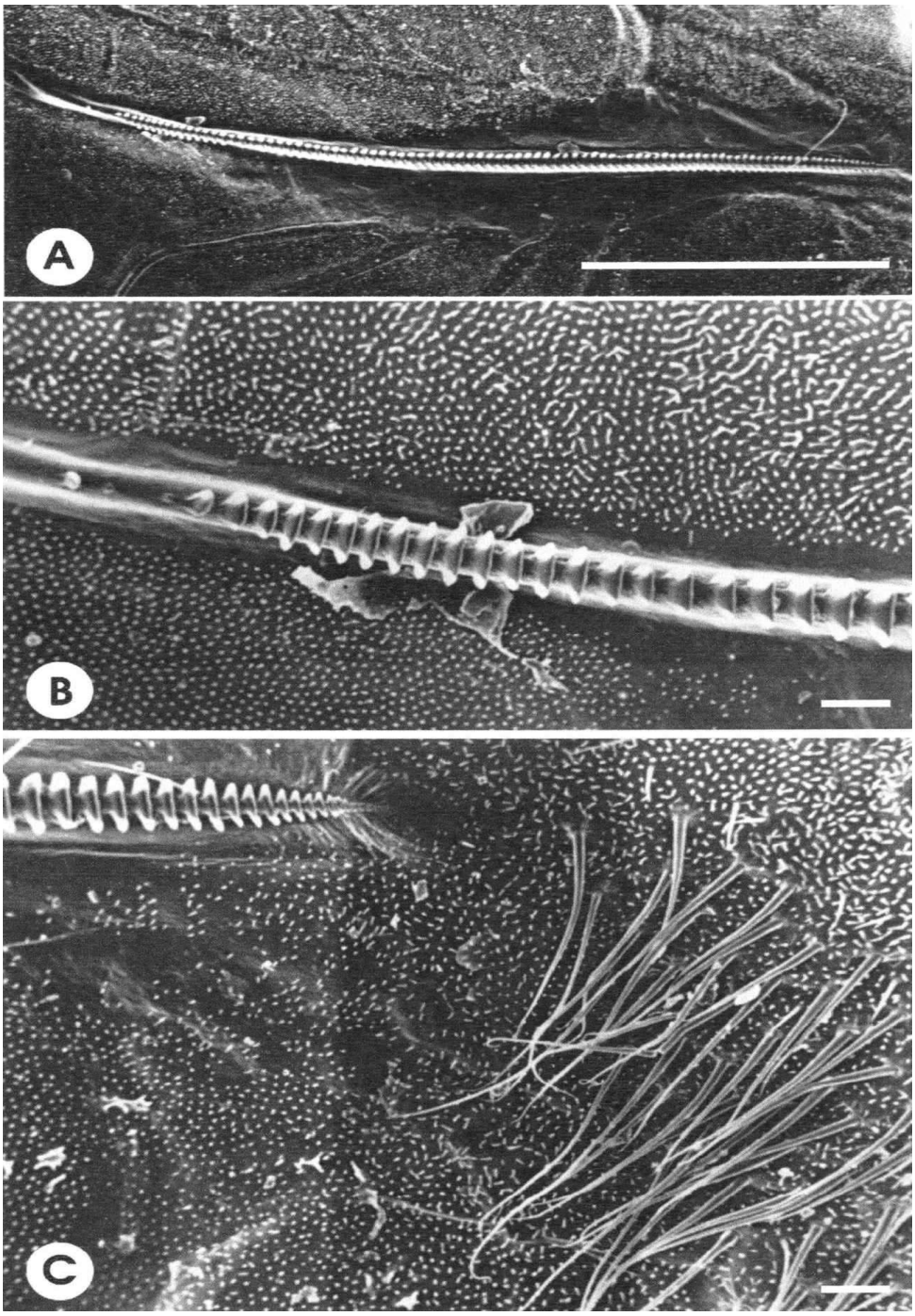


Figure 1. **A**. general view of the *pars stridens*. **B**. Medial extremity. **C**. Distal extremity, with cluster of bristles. Bars: **A** = 1mm; **B**, **C**= 0

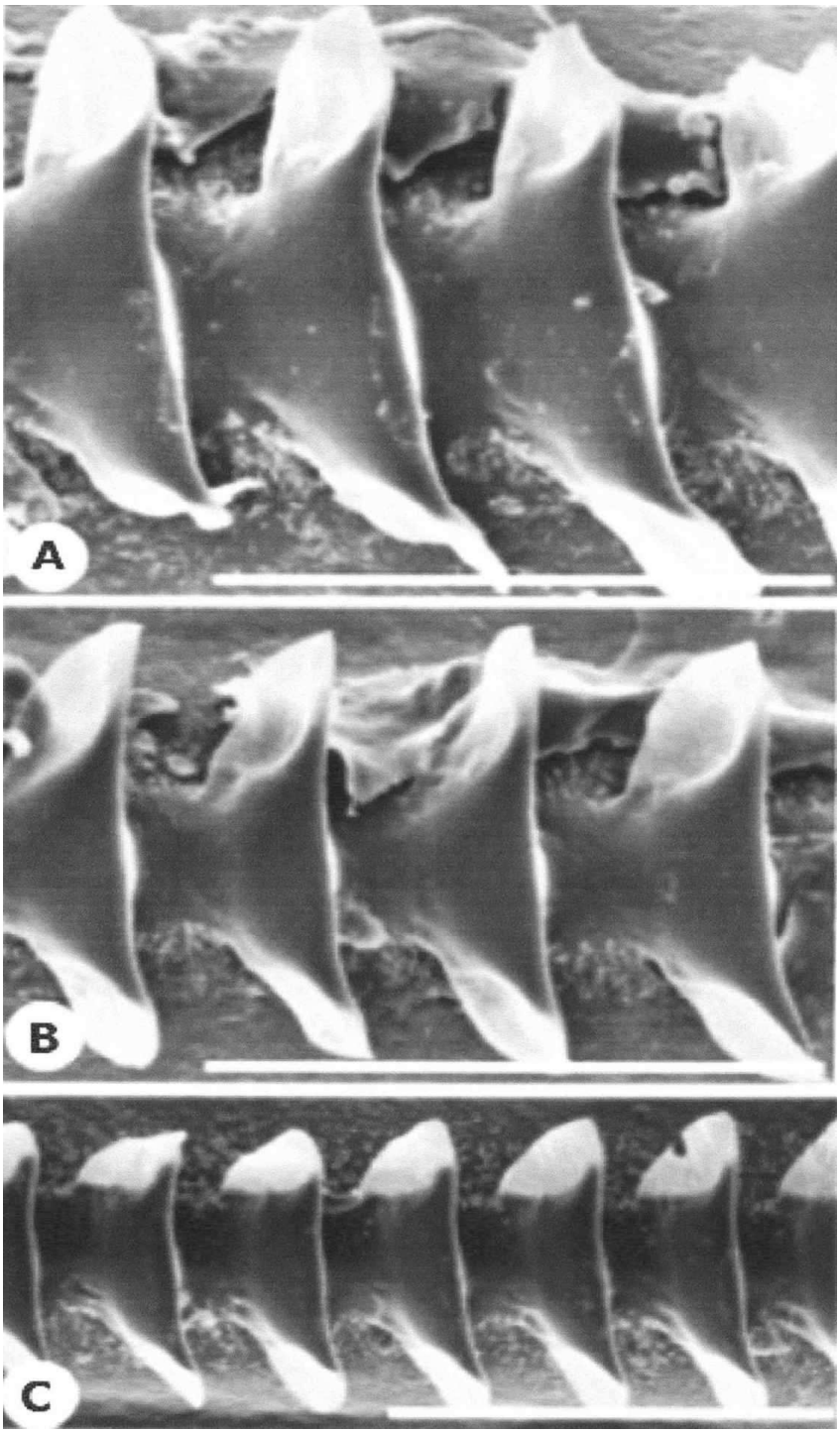
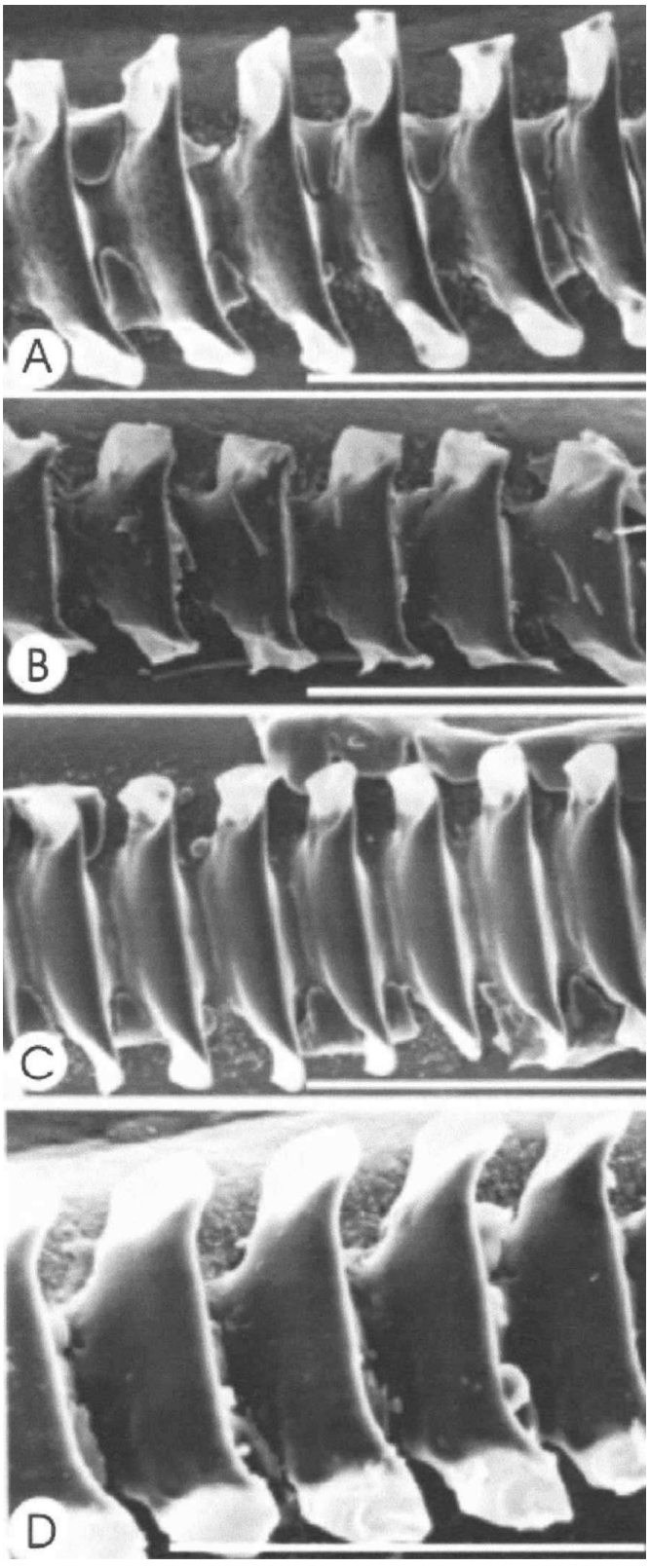

A
B
C

Figure 2. Triangular-bordered teeth. **A**. *Gryllus* sp1 (Rio Cllaro city); **B**. *Gryllus* sp2. (Colômbia city); **C**. *Gryllus* sp3. (Rio Claro city). Bars = 0,1mm.


A
B
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D

Figure 3. Rectangular-bordered teeth. **A**. *Gryllus* sp4. (Campos do Jordão city); **B**. *Gryllus* sp5. (district of São Francisco Xavier, São José dos Campos city); **C**. *Gryllus* sp6. (São José dos Campos city); **D**. *Gryllus* sp7. (Itirapina city). Bars = 0,1mm.

DISCUSSION

According to WALKER (1964), after recognizing cryptic species using the calling song, it is easier to locate morphological differences between cricket species; the *pars stridens* being a promising structure to look for bimodalities.

Pars stridens morphometry has been used as a taxonomically informative source of characters in crickets for a long time, due to the high specificity of teeth number, length, and density (WEISSMAN et al, 1981; OTTE et al, 1988; ALEXANDER, 1991; MAFLA & CEVALLOS, 1991, ZEFA, 1995, DAVID et al, 2003).

According to WALKER & CARLYSLE (1975) although individuals belonging to different species frequently have inequalities in *pars stridens*, this variability does not reflect in such patterns of the calling song as the fundamental frequency and group of notes. Some species with accentuated differences in *pars stridens* have, frequently, almost identical calling songs.

The results obtained here are good examples of how specimens that are apparently cospecific may have characteristics that make possible the recognition of morphological groups after separating the individuals according to their calling songs.

The function and morphology of the bristles observed in *pars stridens* are not totally clear. Few studies have suggested the presence of several sensorial structures associated to sound emission (ELLIOT & KOCH, 1983; SCHÄFFNER & KOCH, 1987a;b). CHRISTOFOLETTI et al. (2004), based on scanning electron microscopy and histological analyses, noticed the presence of three patterns of structures with different morphology,

diameter and size in the same area in *Gryllus assimilis* species. Two of them are similar in structure to typical trichoidea sensilla

Once sound production in *Gryllus* is species-specific, and considering the high number of cryptic species in that genus, we believe that *pars stridens* analysis under the scanning electron microscope reveals a set of useful characters for taxonomic information mainly if it is associated with morphometric data.

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