



The study of proventricular micromorphological characterization of ten Grylloidea species (Orthoptera: Grylloidea) from China

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Abstract

The present study compares the proventricular morphology, analyzed under optic microscope and scanning electron microscopy (SEM), among ten Grylloidea species. The result showed that the size of proventriculus was of critical value. Internally, the main differences were the number of sclerotized appendix (sa), middle denticles (md) and lateral denticles (ld), and the structure of lateral teeth (lt). In addition, we analyzed the crickets' feeding habits and note that the proventriculus possesses highly sclerotized projections which act in the selection of victuals. The morphology of proventriculus is closely related to feeding habits. A clustering analysis of seven features of the proventriculus was constructed. It revealed that the proventriculus had significance for taxonomy and species relationships. Observations on morphological characterization of proventricular morphology will be useful in future studies of the feeding habits and phylogeny of crickets.

Key words: Crickets, insect anatomy, proventriculus, SEM

Introduction

In Orthoptera, the foregut is commonly differentiated into the pharynx, esophagus, crop and proventriculus. The proventriculus is often the most highly specialized part of the foregut and variously modified in different insects, serving for storage, grinding and transport of food during digestion (Chapman 1998).

The proventriculus is a transition area between the foregut and midgut. As early as 1948, Judd had made a comparative studies on the foregut among 115 species of Orthoptera. He established a practical phylogenetic tree based on internal and external features of proventriculus and the number and shape of gastric caeca (Judd 1948). Recently, J.E. Serrão reported a comparative study of the proventricular structure in corbiculate Apinae (Hymenoptera, Apidae). The results confirm that internal morphology can be used in studies of the phylogeny in those insects (Serrão 2001). The results showed that proventriculus characteristics had a high degree of species specificity that it can be a major factor in the taxonomy of Apoidea and demonstrated the phylogenetic utility of proventricular studies in bees (Serrão 2005; Serrão 2007). The results of a parallel experiment had been reported in Panorpidae and Bittacidae (Mecoptera) provided more evidence revealing the relationships of Mecoptera with other orders among Antliophora by the structure of proventriculus (Liu & Hua 2009). There was also a report in tsetse fly (Diptera: Glossinidae), which claimed that the proventriculus even played a crucial role in immunity among these species (Hao *et al.* 2003).

The inner structures of alimentary canal of 4 species of Tettigoniidae in the subfamily Phaneropterinae and 6 species of the subfamily Conocephalinae were described and compared. The results of this survey indicate that the internal structure of the foregut is different among genera and can be a useful taxonomic character (Li & Zheng 2004, 2005).