

# Head, Shoulders, Knees and Toes: A Morphological Study of the Schizopterid (Heteroptera: Dipsocoromorpha) Head and Thorax

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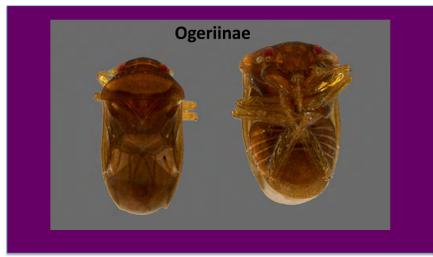
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## Introduction

Dipsocoromorpha, or litter bugs, are possibly the least known infraorder of true bugs. Schizopteridae is the largest family in Dipsocoromorpha and comprises ~48 genera and ~230 species. It showcases stunning morphological diversity and varying degrees of abdominal and genitalic asymmetry. Schizopteridae exhibit a wide range of simple and complex wing venation patterns and some females even possess true elytra. The group is currently divided into three subfamilies: Schizopterinae, Ogeriinae and Hypselosomatinae.

## Objectives

1. Document wing venation and competing venation hypotheses for Schizopteridae
2. Document thoracic structures including:
  - Pretarsal structures
  - Adhesive pad
  - Subgeneric characters of *Schizoptera*



## Materials and Methods:

- 12 Specimens were selected from field collected material from Cameroon, Colombia, Peru, Argentina and Thailand
- Habitat images of specimens were taken on a GT Vision Imaging System
- Wings from 10 specimens, representing 10 genera, were slide mounted and imaged using a Zeiss Axioskop 2 compound microscope
- SEM images were generated at the UCR CFAMM (Central Facility for Advanced Microscopy and Microanalysis) using the XL30 FEG Scanning Electron Microscope

## Background on wing venation hypotheses in the clavus of basal Heteroptera

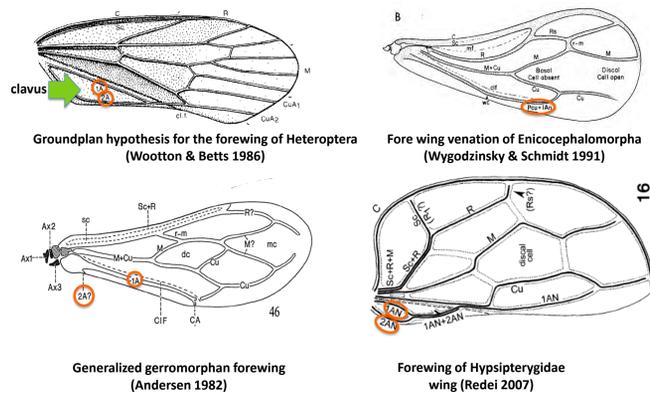
The homology of the two claval veins of Heteroptera is inconsistent in the literature. Some authors label them as **postcubitus (pcu)** and **first anal vein (1AN)**, others as the **first and second anal veins (1AN and 2AN)**. Wootton (1986) rejected the existence of a postcubitus in Heteroptera.

Because of these competing hypotheses that impact interpretation of the more anterior wing veins, wing venation homologies are poorly understood in Dipsocoromorpha.

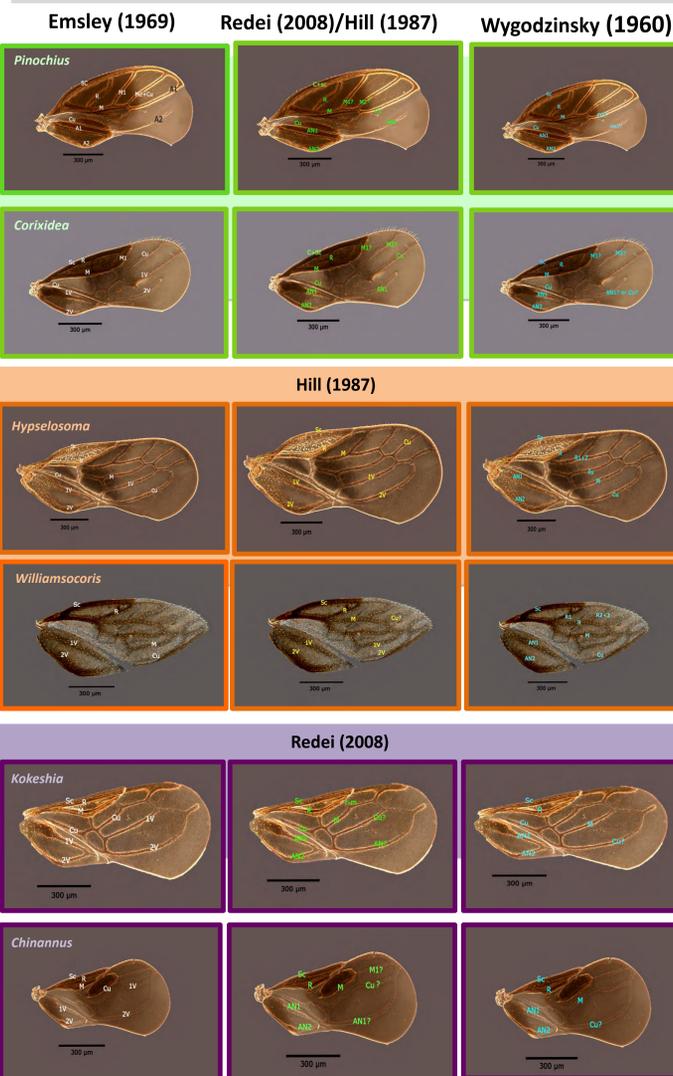
We here review wing vein hypotheses of basal heteropteran groups and previously studied schizopterid and synthesize this information to generate venation hypotheses that are consistent across these groups.

## Results and Discussion

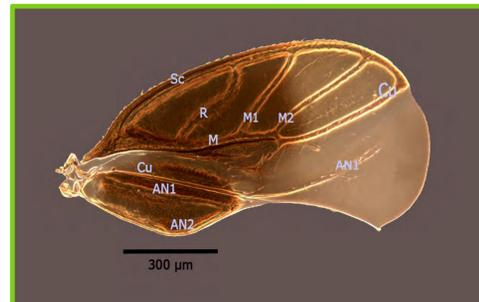
### Wing Venation



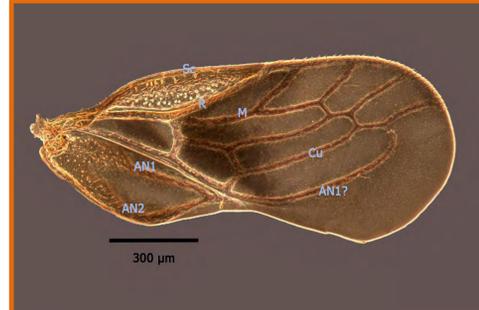
Below: comparison of wing venation hypotheses for 2 taxa of Schizopterinae, Hypselosomatinae, and Ogeriinae according to Emsley (1969), Redei (2008), Hill (1987) and Wygodzinsky (1960)



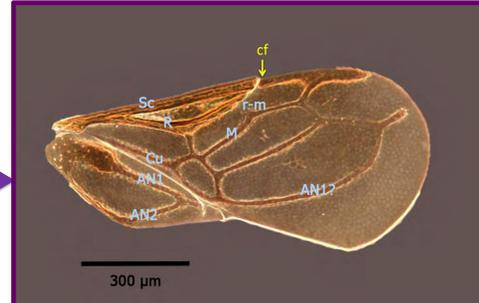
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Wygodzinsky, P., Schmidt, K. 1993. Revision of the New World Enicocephalomorpha (Heteroptera). Bulletin of the American Museum of Natural History 200, 16-18



**Our preferred hypothesis above:** We follow Redei (2008) and disregard the venation hypothesis presented by Emsley (1969) [we only see one anal vein in the wing membrane, as in most Heteroptera]. The position of Cu is along the claval fold, as noted by all authors, but the continuation of Cu through the remigium still remains ambiguous.



**Our preferred hypothesis above:** The venation of Hypselosomatinae is more complex than those in the other two subfamilies. The identity of the cubitus (Cu) is uncertain and whether the An1 crosses from the clavus into the membrane. To remain consistent with Redei (2008), we have adopted a modification of his hypothesis.



**Our preferred hypothesis above:** Ogeriinae possess a costal fracture (cf) on their wings and their wing venation is less complex compared to the venation in the Hypselosomatinae. We have also adopted a modified hypothesis for ogeriines *sensu* Redei (2008)

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## Tarsal and Pretarsal Structures

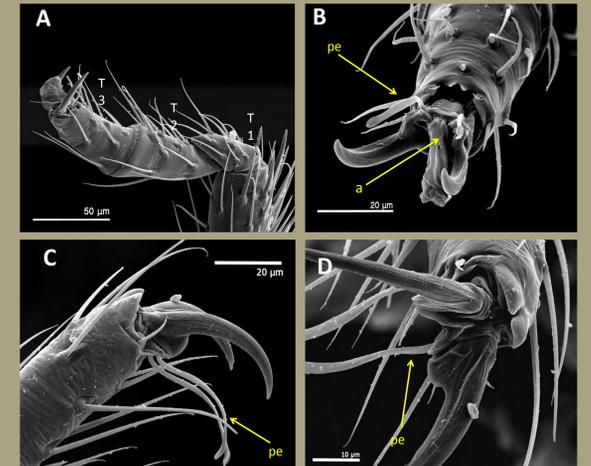


Fig. A: three-segmented prothoracic tarsus of *Haplannanus* sp.  
Fig. B: arolium-like structure (a) and parempodia (pe) of *Haplannanus* sp.  
Fig. C & D: metathoracic pretarsus of *Schizoptera* sp. with pe only

Schizopterid males exhibit an irregular distribution of tarsal segmentation (Emsley 1969). Typically, the pro- and mesothoracic legs possess three tarsomeres and the hind legs possess only two. Not all genera display this pattern of irregularity (e.g. *Ogeria* tarsal formula: 3-3-3; *Kokeshia*: 2-2-3). All legs of schizopterids have parempodia. Arolium-like structures are present in pro- and mesothoracic legs only.

## Coxal Adhesive Pads and Metasternal Spine

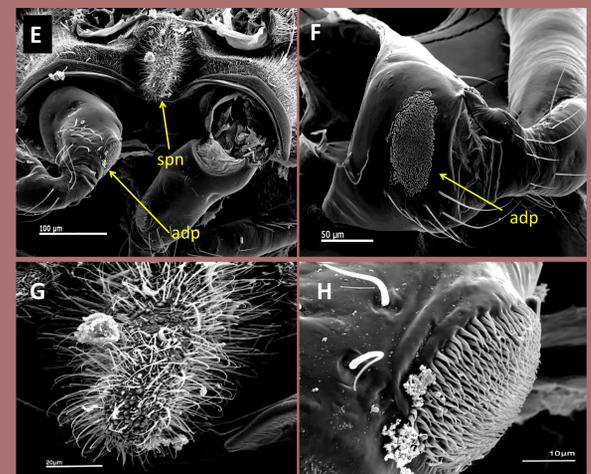
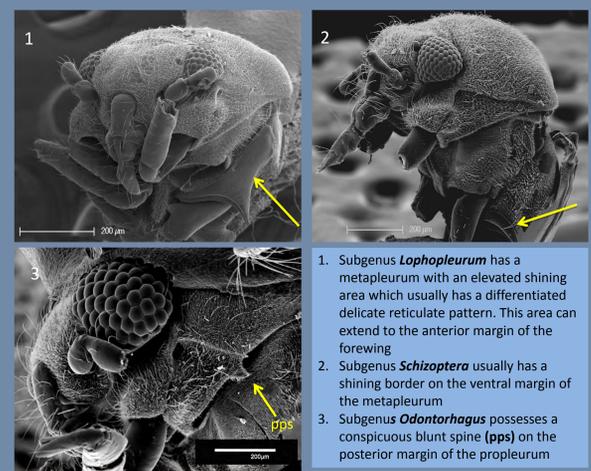


Fig. E: position of metasternal spine (spn) and adhesive pads (adp) on *Haplannanus* sp. thorax  
Fig. F: adhesive pad on metacoxa of *Williamsocoris* sp.  
Fig. G & H: detail of spn and adp of *Haplannanus* sp., respectively

Unique to Schizopteridae are rugose pads, also called adhesive pads, on the inner surface of the metathoracic coxae. These structures have been described, but not imaged before. The literature suggests that in conjunction with the metasternal spine, these pads are used as a jumping device in some genera (*Schizoptera* & *Corixidea*). Upon closer observation it remains unclear how they aid in jumping.

## Thorax: diagnostic features

The genus *Schizoptera* showcases high levels of morphological variability in structures of the thorax. This genus is divided into six subgenera, of which three were examined using SEM.



1. Subgenus *Lophopleurum* has a metapleurum with an elevated shining area which usually has a differentiated delicate reticulate pattern. This area can extend to the anterior margin of the forewing
2. Subgenus *Schizoptera* usually has a shining border on the ventral margin of the metapleurum
3. Subgenus *Odontorhagus* possesses a conspicuous blunt spine (pps) on the posterior margin of the propleurum