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The tribe Proscopiini, nov. (Orthoptera, Eumastacoidea, Proscopiidae)

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Abstract

Proscopiini, new tribe (Proscopiidae, Proscopiinae) is here defined. As presently known, it includes six genera and a considerable number of species. A description of the tribe and keys for the recognition of its males and females to genera are given. As is the case with the tribe Tetanorhynchini (Bentos-Pereira 2003a), the species in this new tribe are very homogeneous in their external anatomy, which has been, in the past, the cause of a general confusion in its taxonomy and the making of many synonymies.

Key words

Proscopiidae, genitalia, systematics

Introduction

The subfamily Proscopiinae, according to the definition of Liana (1980) includes the largest group of genera and species within the family Proscopiidae. A detailed study of the male and female genitalia of the species of this subfamily, together with features of their external anatomy and biogeographical characteristics, reveal many and important differences among its members. These differences indicate that the subfamily is an artificial grouping of dissimilar members, this probably being due to the insufficient information at the disposal of its author.

Using the same criteria of a previous work (Bentos-Pereira 2003a), I propose here a new grouping of genera and species of tribal category. The definitive constitution of the subfamilies of Proscopiidae will have to wait until all the tribes have been studied and defined on a rational basis.

The group of genera studied here is extremely homogeneous in their external anatomy, to the point that only one of them, namely *Apioscelis* Brunner von Wattenwyl 1890, can be easily recognized at first sight. This makes necessary a thorough revision of the group's species based upon not only their external anatomy, but also on the male and female internal genitalia. Other sources that will help in the revision of the group are the, unfortunately very scarce, data on their bionomics and geographical distribution.

The fact that the species in this group have a marked sexual dimorphism contributes to make their study most difficult. Species of which only one sex is known may be misidentified and correspond to another species also described from the other sex. Accordingly, every possible effort has been made, to describe the new species on the basis of the two sexes (Bentos-Pereira & Listre 2005; Bentos-Pereira 2006a, 2006b).

Materials and methods

The present work has been done on the basis of the examination of the type specimens belonging in the family Proscopiidae, validated according to the catalogue of Carbonell (1977) and the revision by Jago (1989). Also by the study of unidentified and undescribed specimens found in the collections named below.

The collections examined in the course of this work are the following: **Brazil**—Museu de Zoologia de Sao Paulo, Escola Agricola Luiz de Queiroz, Piracicaba, Museu Nacional de Rio de Janeiro; **Austria**—Naturhistorisches Museum, Wien; **France**—Museum National d'Histoire Naturelle, Paris; **Colombia**—Instituto de Ciencias Naturales; **Panama**—Universidad de Panama, Museo Fairchild, Smithsonian Tropical Research Institute. Other materials were borrowed by the author from: **USA**—Academy of Natural Sciences of Philadelphia; **Argentina**—Facultad de Ciencias Naturales y Museo de La Plata, Museo Nacional de Historia Natural de Buenos Aires. Other materials were borrowed by Dr. C.H.F. Rowell in the Zoologisches Institut of Basel University, Switzerland (and studied there by the author) from the following institutions: **Italy**—Museo Regionale di Scienze Naturali, Torino; **Germany**—Museum für Naturkunde der Humboldt Universitet, Berlin; Staatliches Museum für Naturkunde, Stuttgart; Zoologisches Museum der Universitet Hamburg; **Poland**—Museum and Institute of Zoology of the Polish Academy of Sciences, Warsaw.

The study of the materials of the above collections consisted in: 1) Revision and correction (when necessary) of the measurements given in the original descriptions; 2) Redescription of the characters of the external anatomy; 3) Dissection, description and drawing of the male and female genitalia.

The study of the genitalia was done by dissecting and cleaning with an 8% solution of potassium hydroxide, the female spermathecae and the male phallic complexes. Drawings were made with the help of a camera lucida.

For the distribution maps, the map of the phytogeographic zones of South America proposed by Cabrera and Willink (1973), was used as a basis (Fig.1). Nomenclature for the parts of the phallic complex is that proposed by Jago (1989). Theoretical schemes for the parts of the phallic complex, like that of Jago (*op. cit.*), are also included (Fig. 2).

In the case of new species to be described from materials in museum collections, every effort has been made to find males and females corresponding to the same species. In the case of large series from a single locality, attention has been paid to the shared characters of their external anatomy, such as color pattern and sculpturing of the integument. Identification of both sexes of one

species was in some cases doubtful or impossible. Future revisions on the basis of new and more abundant materials may reveal that, as has happened in the past, males and females of the same species have been described as different species, and, in extreme cases, even as belonging to different genera.

Results and discussion

The following genera are considered to belong in Proscopiini, n. tribe:

Proscopia Klug 1820
Apioscelis Brunner von Wattenwyl 1890
Prosarthria Brunner von Wattenwyl 1890
Pseudoproscopia Bentos-Pereira 2006
Paraproscopia Bentos-Pereira 2006
Carbonellis Bentos-Pereira 2006

The species included in these genera are of medium to large size. Specimens of some of these species may be the largest known Caelifera. Some females of *Proscopia gigantea* Klug and *Proscopia superba* Br. v. Wattenwyl, surpass 14 cm in length. All the species in this group are entirely apterous, without even vestiges of the scales that in some species of other groups represent the much-reduced wings. A study of the muscles, like that of *Orienscopia* made by Zolessi (1968), has not been made for any of these species, so we must ignore whether they still keep the wing muscles as in the above genus.

Sexual dimorphism is defined by a marked difference in size between the sexes which is proportionally greater than that in other acridomorphs, and by important differences in the shape of the head. The fastigium is larger and more conspicuous in the females, often quadrate in section, with a tendency to have apical foliar expansions. In the males it is usually small and conical, with carinae only slightly marked. Females usually have heads of conical shape, much wider in the buccal area. In the males the head is markedly constricted behind the eyes.

Another important sexual difference that can be observed in many species lies in their color-pattern. Males frequently have bright colored spots (yellow, orange, red) on the epistoma and bases of the genae, on the thoracic pleurae, on the end of the abdominal tergae, on the pallium and the subgenital plate. Females are generally less brightly colored, or show reddish-brown to greenish hues when alive, turning to uniformly brown color after death.

Characteristic of the species in this group is a tubular prothorax. Pronotum and prosternum are entirely welded without any marks in between, forming a narrow tubular structure that reminds one of a long neck. In some specimens, however, a tenuous line of suture can be seen, that has in some cases (*Proscopia gigantea*) a line of conspicuous dorsal spines.

Meso- and metathorax often have a fairly regular pattern, showing a wide median band of the integument, with different degrees of sculpturing and, according to the species, one or two lateral zones where the integument is smooth and lighter colored. This type of design is shared by the first abdominal segment, which also shows a certain degree of inflation, that disappears in the rest of the abdomen in most species.

On the line of the pleural suture, there may be carinae with tubercles or spines and, according to the species, areas of darker coloration. Pleurae are usually smooth, except in *Proscopia*, where tuberculate carinae are so remarkable that they are included in the generic diagnosis, even if they may be lacking in some species.

After the first segment, the rest of the abdomen presents a rather homogeneous pattern, usually similar in all the proscopiids. Integument is usually darker than in the head and thorax, opaque and microgranulated. In a very few species the abdominal integument may be rugose or sculptured. In the males of some species, abdominal tergae may be inflated posteriorly. There is often a narrow mid-dorsal line that runs the entire length of the abdomen.

Abdominal terminalia are taxonomically important. Liana (1972) proposes revalidation of *Proscopia inaequalis* Brunner von Wattenwyl 1890 and *Proscopia ingens* Walker 1870, because of remarkable differences in the female subgenital plates. There are two Central American species, *Pseudoproscopia septentrionalis* and *Pseudoproscopia panamensis* which cannot be distinguished, except for differences in the female subgenital plate (Bentos-Pereira & Rowell 1999).

The genital segments of the males are also taxonomically important. Therein lies one of the characters that separate this group of species (Proscopiini) from the rest of the proscopiids. Their subgenital plates are always short, globose, rounded and truncate: they never have an acute ending. Palliums are short and sclerotized in such a way that they contribute to form a true capsule. In some species of *Prosarthria*, the pallium shows a median carina which is related to a median ventral carina; the two of them together generate a small median peak, that gives the abdominal terminalia a slightly acute aspect. The pallium is one of the abdominal structures that may have brightly colored spots.

It is important to mention that we know very little about the habits of oviposition of the species of this group. The presence of a fine denticulation on the edges of the ovipositor valves of some of its species, may point to a tendency for endophytic oviposition. This might not be unusual, considering that most of the species of this tribe live on trees or bushes. Associated with this type of habitat is one of the distinctive biological characteristics of the group. All its species share it, except those of the genus *Prosarthria*, that prefer open spaces such as savannas and plains, where they are found on the ground or on low plants, as happens in those of the vicariant species from the south of the Neotropical region, belonging to the tribe Tetanorhynchini.

The patterns of geographical distribution are also very homogeneous for all the species of proscopiines (Fig.1). They are found from the area of Amazonic influence of the Brazilian state of Mato Grosso to Costa Rica in the north. They inhabit the Amazonian forest, either primarily or secondarily, and also the Andine rainforests of Bolivia, Peru, Ecuador, Colombia, Panama and Costa Rica. And they extend also through North and Central Brazil to the Guianas. Some proscopiine genera are included in the virtual division found in the Amazonian fauna on either side of the Rio Negro (Amedegnato, pers. comm.).

Genitalia.—Females: Spermathecae are extremely variable among the genera in this group. Most of them are complex, with many digitiform prolongations of the duct. Some of these prolongations have certainly undergone a development that has transformed them in supernumerary spermathecae, as in the case of *Proscopia*, which presents a triple structure, similar to that found in the genera *Orienscopia* and *Mariascopia* among the Tetanorhynchini (Bentos-Pereira 2000; 2003a, b). The bursa copulatrix is in most cases less membranous than in other groups of genera, having a certain degree of sclerotization, and in some species well-marked sclerites in the bursa or in the initial part of the spermatic duct.

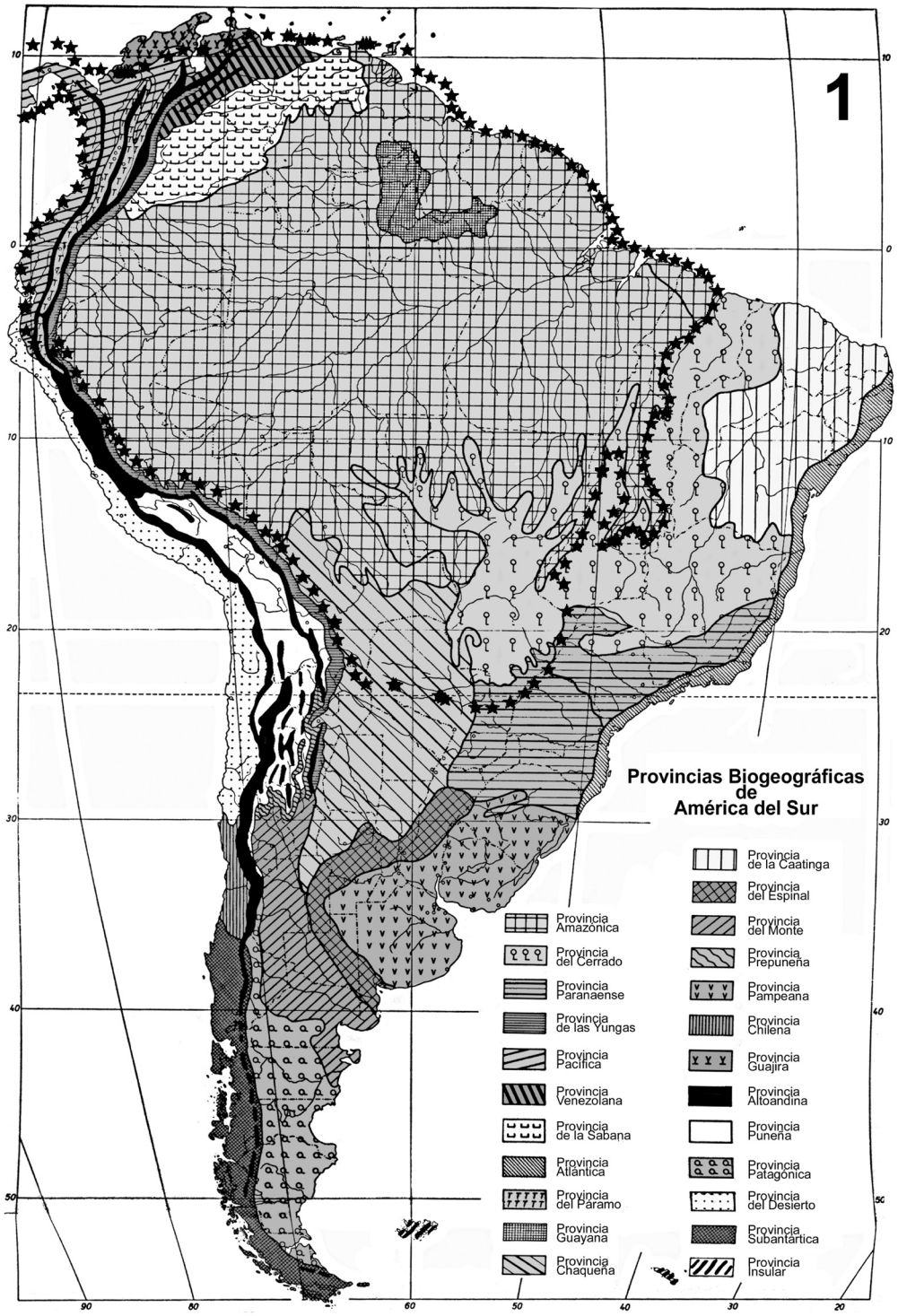
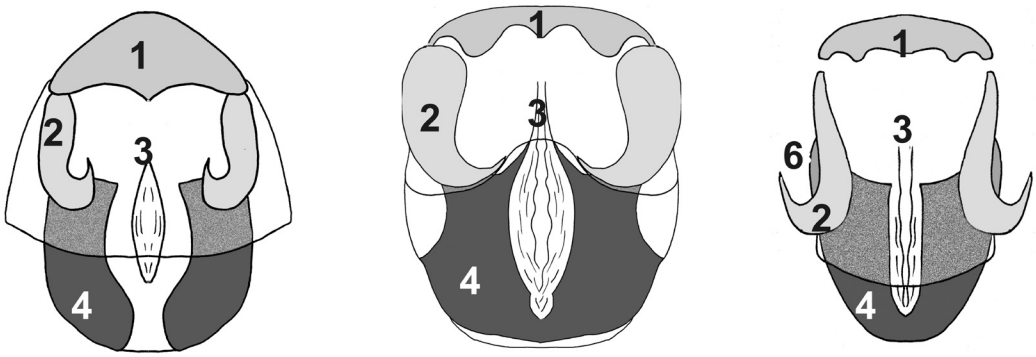


Fig. 1. Probable dispersion of Proscopiini in the Neotropical Region.

Males: Phallic complexes are fairly homogeneous in the species of this group (Fig. 2). Epiphalli are reduced to three plates, a median transverse one and two posterior, symmetrical ones (lophi), which are always present. These three plates (respectively plate 1 and plates 2 according to the nomenclature proposed by Jago, 1989) may be united together or separated, plate 1 being the most variable: from narrow and weakly sclerotized to strong, wide and heavily sclerotized. Plates 2 are rather uniform, usually thick and sclerotized, and always terminated in hook-like structures directed upwards and to the midline, except in the genus *Paraproscopia*, where they tend to be directed towards the outside.

The median cleft (phallotreme and 3 according to Jago 1989) is fairly large. It is the place through which the endophallus is everted. The latter becomes turgid and takes a characteristic form during copulation, by means of a powerful musculature and, in this group, indeed, by the many sclerotizations present (Bentos-Pereira 2006a, b). Here it has on its border, plates 4, in different degrees of development but always conspicuous and sclerotized, and reinforced by thick sclerotized folds placed close to the median cleft. These plates unite behind and below the median cleft with another



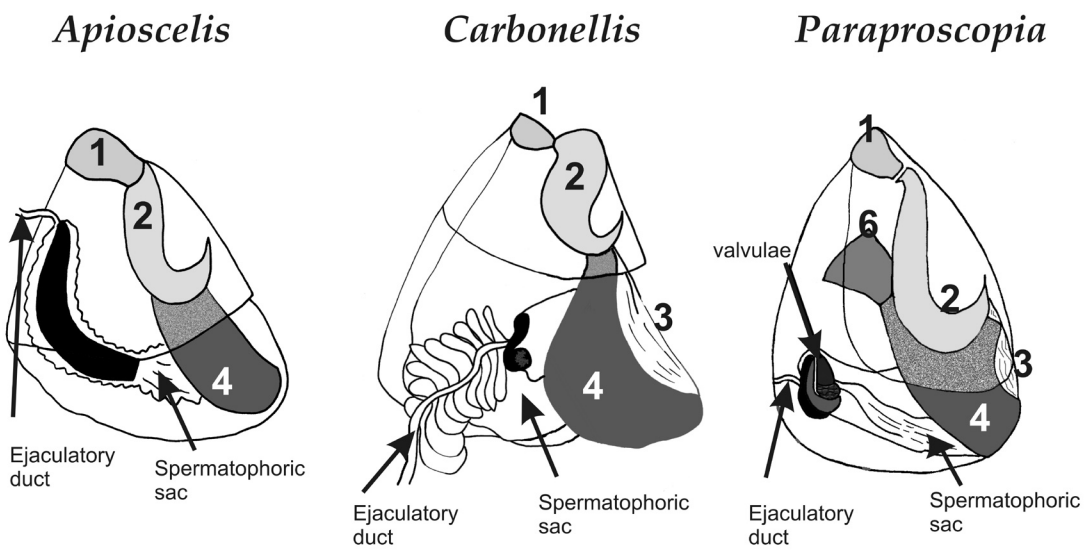


Fig. 2. Theoretical schemes of male genitalia in genera of Proscopiini. Numbers refer to the plates of the epihallic complex following Jago 1989.

single, median plate, plate 4b, which in this tribe, is strongly fused to plates 4 to the point of being impossible to distinguish.

The presence of plates 6 at the sides, and of plates 10 and 9, generally in support of the lophi, is infrequent, being present only in a few of the species, mostly in those belonging to the genera *Paraproscopia* and *Prosarthria*.

The endophallus in this tribe, is characteristic. It always presents large and conspicuous sclerotizations, either in the form of a tube that reinforces part of the ejaculatory duct, or as a valve. The latter may vary from a simple ring-like form, as in *Prosarthria*, to more complex structures as in *Carbonellis*, *Paraproscopia* and *Proscopia*. The ejaculatory ducts may be strongly developed and sclerotized as in *Apioscelis*, or of variable morphology, such as half-tubes, or simple sclerites, long and sometimes straight, or sometimes helicoidal as in *Pseudoproscopia*. But in general, the ejaculatory duct is a simple tube of variable length, except in *Carbonellis* where it has a membranous and extremely folded covering, giving it a brush-like aspect. The ejaculatory sac is generally of a variable size that depends on the size and form of its internal sclerotizations placed near the opening of the ejaculatory duct. We have not found spermatophores.

Keys to the genera of the tribe Proscopiini

Females

1 Femora of hind legs only slightly dilated basally. 2
1′ Femora of hind legs strongly dilated in basal third to basal half, depending on species. . . . . *Apioscelis*
2 Subgenital plate of variable shape 3
2′ Subgenital plate always elongated, with median prolongation of variable shape . . . . . *Pseudoproscopia*
3 Spermatheca with a tube of variable complexity, and a single distal ampulla 4
3′ Always with three complex spermathecae, of different form and characteristics, according to the species . . . . . *Proscopia*
4 Only one spermatheca, its duct with very many digitiform expansions, some of them may be bifurcated . . . . . *Prosarthria*
4′ Only one spermatheca; its duct, when present, has a single digitiform prolongation . . . . . *Carbonellis*
4″ Only one spermatheca; its duct with several digitiform prolongations . . . . . *Paraproscopia*

Males

1 Subgenital plate blunt, globose, its edge obtuse 2
1′ Subgenital plate somewhat longer than in the rest of the genera in this tribe, slightly acute. In some species with a well-marked median keel . . . . . *Prosarthria*
2 Plates 4 completely covering the margins of the median cleft. 3
2′ Plates 4 cover the borders of the median cleft only approximately along its distal half . . . . . *Paraproscopia*
3 Plates 4 smooth 4

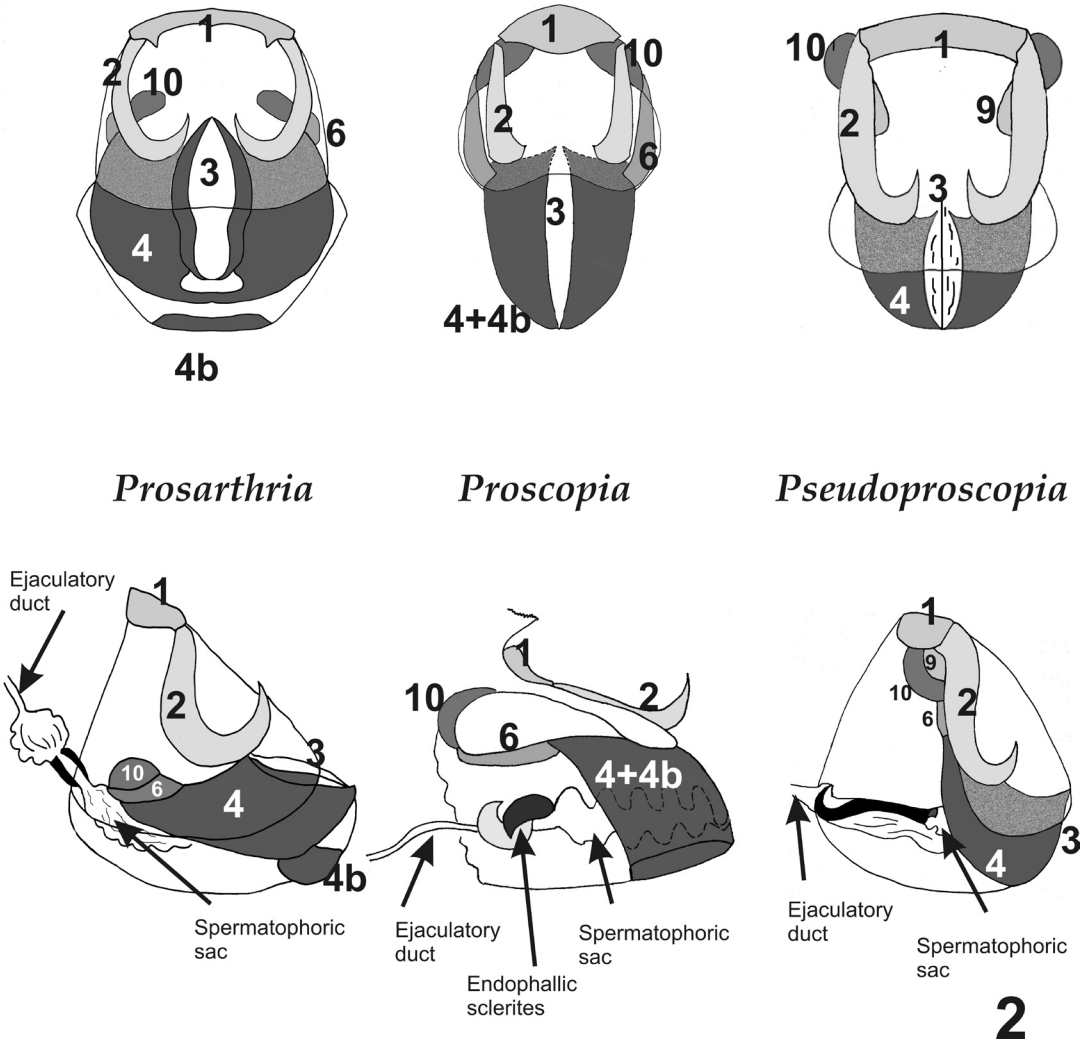


Fig. 2. (contin.)

3' Plates 4 with an inflated edge, forming a labium along the median cleft . . . . . *Prosarthria*
4 Ejaculatory duct with several sclerotizations 5
4' Ejaculatory duct without sclerotizations, covered with a very plicate external membrane . . . . . *Carbonellis*
5 With small sclerotizations in the beginning of the ejaculatory duct . . . . . *Proscopia*
5' With large and conspicuous sclerotizations, some of them shaped as a half-tube or a tube, that are placed throughout the ejaculatory duct and the ejaculatory sac . . . . . *Pseudoproscopia*

Table 1.

Diagnosis of Proscopiini, new tribe.

* Apterous insects, with sexual dimorphism.
* Females large, robust, with conical head, fastigium longer than the maximun length of the eye. Ovipositor strong. Subgenital plate with posterior edge of variable form in different species.
* Males of a size almost half of that of the corresponding female and more slender, with their heads constricted behind and below the eyes. Abdominal terminalia globose. Subgenital plate short and blunt. Pallium sclerotized.
* Spermathecae variable: from simple, with only a terminal ampulla, to multiple and extremely complex ampullae, showing a tendency to have many digitiform prolongations along its duct.
* Phallic complex with plates 1, 2 and 4 always present, large, sclerotized and conspicuous. Plate 4b present but hardly visible. Plates 6, 9 and 10 present or absent. Endophallus always with elaborate and complex sclerotizations.
* Ply (crease/fold) of the ectophallic membrane that partially occupies the median cleft, always present.

Discussion

As shown by the keys and the diagnosis of this group, its genera are clearly differentiated, mostly by characters of the male and female internal genitalia. These characters having not been studied in the past has been the cause of confusion and misidentifications. It is hoped that the present work will allow correct future identification.

However, one of the species included presents some problems. *Pseudoproscopia panamensis* (Bentos-Pereira and Rowell 1999), exhibits some unique characters in the female sex. Its spermatheca is double, with digitiform prolongations in both ducts, and its subgenital plate is simple, its posterior edge entire, without any medial prolongation as called for in the female key (2') for this genus. *Pseudoproscopia panamensis* and *Pseudoproscopia septentrionalis* are found at the northernmost limit of the distribution of the family. Males of the two species have the ejaculatory ducts in the form of a

sclerotized tube, which is typical of the genus *Pseudoproscopia*. But, on the other hand, they have some additional sclerotized plates: the plates 6 and 10, which are not present in other species of the latter genus.

It is hoped that future collections and new data on the present group will allow clarification of the position of these two species that seem to be separated from the rest of the species of the genus.

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