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# *Tucanogovea schusteri* n. gen. n. sp., a new cyphophthalmid (Opiliones, Cyphophthalmi, Neogoveidae) from Amazonia

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**Summary**. A new cyphopthalmid genus and species, *Tucanogovea schusteri* n. gen. n. sp., is described from Amazonas State, Brazil. The new genus clearly differs from other Neotropical neogoveids by the presence of a dorsal lobe on the spermatopositor, a so far unknown structure. The new genus is closely related to the genus *Huitaca* Shear, 1979. Genus *Metasiro* is proposed to be excluded - and the genus *Shearogovea* is proposed to be included into the family Neogoveidae. Characters from the spermatopositor structure arise as essential for neogoveid generic designations. A tendency of shifting of the male gonostome anteriorly toward the posterior line of coxal lobes III is sugested as a synapomorphic character of the family Neogoveidae.

**Key words:** Brazil, morpho-anatomy, Neotropic, new genus, spermatopositor structure, *Tucanogovea*.

## INTRODUCTION

Prof. Dr. Reinhart Schuster from Graz kindly lent me a few flacons with cyphophthalmid specimens from Amazonas State collected in 1973 in the course of one of his expeditions. In the material, besides the known species–*Brasiliogovea microphaga* Martens, 1969 and *Metagovea oviformis* Martens, 1969, there were also a couple of specimens of an apparently new species that differed from all known species in the family by a series of unusual characters. Based on the unique spermatopositor structure in combination with other morphological characteristics, a new genus needs to be established for the species. Despite intensified explorations on Cyphophthalmi in this particularly interesting area (Benavides and Giribet 2007; Da Silva et al. 2010; Benavides and Giribet 2013*)* it is necessary to point out that insufficient attention has been given to important morphological details. More attention needs to be dedicated to the details of the spermatopositor structure, which is an extremely important and indicative character. Unusual for Cyphophthalmi, the spermatopositor structure within Neogoveidae shows considerable variation, providing more opportunities for phyletic studies.

## MATERIALS AND METHODS

Dissection of the specimens and slide mounting were done as in Karaman (2009). The separated body parts were prepared by dehydration through graded alcohol and acetone and cleaned in a sonicator. Dried samples mounted on stubs were prepared in a Baltec SCD005 sputter coater. Scanning electron microscopy (SEM) photographs were recorded with a JEOL-JSM-64601v SEM microscope under high vacuum.

Microscopic photographies were done on Zeiss Axio Imager A1. Drawings were made in Adobe Illustrator CS2 on a Wacom Intuos 2 graphics tablet.

## RESULTS

### *Tucanogovea* n. gen.

**Typus generis**

### *Tucanogovea schusteri* n. gen. n. sp.

(Figs 1-6)

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## Derivatio nominis

The generic name is dedicated to the Tucano peoples, tribes of the northwestern Amazon where the new species was found in combination with the ending "–ogovea", which is the name of the nomynotype genus of the family Ogoveidae.

## Diagnosis

A genus of medium-sized Cyphophthalmi of the family Neogoveidae, characterised by the presence of a dorsal lobe on the spermatopositor, as a new structure, between setae dorsales. Spermatopositor terminal lobe with anterior scales and two pairs of fimbriate movable fingers (digiti mobiles), fringed by slender small spine like processes. Second lobe of prosomal complex as long as wide. Male basitarsus IV dorso-distally protruded. Adenostyle placed on the base of telotarsus. A pair of exocrine gland openings on male second opistosomal sternite. Ozophores dorso-laterally oriented (type 2). Receptacles sigmoid.

## Material examined

1 ♂ (holotype); 1 ♀ (paratype).

## Type locality

Brazil, Amazonas State, Upper course of the Rio Negro near Uaupés, May 1973, Leg H. Schubart.

## Deposition

Holotype and paratype (Inv. No. 1450/1; 1450/2) are deposited in the zoological collection (ZZDBE) at the Department of Biology and Ecology, University of Novi Sad (Serbia).

## Etymology

The species is dedicated to Professor Reinhart Schuster, a renowned acarologist from Graz, Austria, who kindly provided these interesting samples.

## Description

**Male** holotype body length 1.71 mm. Body uniformly brown in color. Dorsum elongated, oval (Fig. 1A); anterior margin of prosoma dorsally and laterally protruded; posterior margin of opisthosoma rounded. Ozophores wider at their bases than long, dorso-laterally orientated (type 2).

Anal plate without modifications (Fig. 1F), pores of anal glands absent.

Chelicerae slightly elongated, of attenuate type (Fig. 2A): basal article 0.84 mm, second article 0.77 mm long. Basal article with pronounced backward oriented dorsal crest and massive ventral process, densely ornamented towards its proximal half. Digit mobile as long as one fourth of the second article length.

Pedipalps (Fig. 2B) of normal proportions, 1.23 mm long (without coxa and apotele); Trochanter as long as patella, somewhat more than a half of the femur length; dorso distally with bulbous swelling covered with tubercles.

Legs slightly elongated, all telotarsi without ornamentation. Telotarsus I (Fig. 2C) elongated (L/W ratio: 2.43), with distinct soleae. Claws I smooth. Claws II with ventral row of 5 teeth (Fig. 3C). Claws III and IV with two mediolateral teeth (as on Fig. 3D).

Telotarsus IV narrow (L/W ratio: 2.65) with adenostyle on its base, (Fig. 2D); adenostyle of tubular lancet form (Fig. 2E). Basitarsus IV dorso-distally protruded, above adenostyle base.

Measurements of legs (without coxae and claws, in mm): I -2.5; II -1.87; III -1.75; IV -2.23.

Ventral prosomal complex (Fig. 1C): coxal lobes II somewhat longer than wide at their narrower part; posteriorly (on the half of their length) abruptly narrowing; coxal lobes III short, not meeting each other in the middle; conical processes on lateral margins of gonostome.

Spermatopositor (Figs 4-5) elongated (2.5 x as long as wide) – distal margin of terminal lobe wide with triangular protrusions. Distal part of terminal lobe scale like sclerotized. Setae terminales (6) long, almost of the same length; Setae dorsales arranged in two rows, three basal setae on each side and two median pairs separated by a wide dorsal lobe. The bases of the median dorsal setae are fused. An unpaired seta ventralis standing on the basal half of the spermatopositor. Movable fingers well developed, straight, terminally fimbriate. Both pairs of movable fingers are only slightly sclerotized and hardly noticeable. Lateral movable fingers (digiti mobiles laterales) elongated (half of the spermatopositor length), remarkably longer than median movable fingers. Aside of the genital opening a pair of sensory papillae and a pair of cone-like structures, here termed inner papillae.

**Female** body length 1.75 mm. Dorsum as in male, elongated- oval (Fig. 1B); ventral prosomal complex (Fig. 1D)–coxal lobes II as in male; coxal lobes III longer than in male, not meeting each other in the middle. Ovipositor apical lobes (Fig. 6) with sigmoidal receptacles. Openings of receptacles situated on the half of the apical lobes length. Each apical lobe bearing one terminal, one multi-branched and 13 simple setae.

## Remarks

The characters of chelicera and pedipalp structure as well as dorsum shape indicate close relations of *Tucanogovea schusteri* n. gen. n. sp. with the species *Gen.? enigmaticus* Martens, 1969. However, they differ significantly in the de-

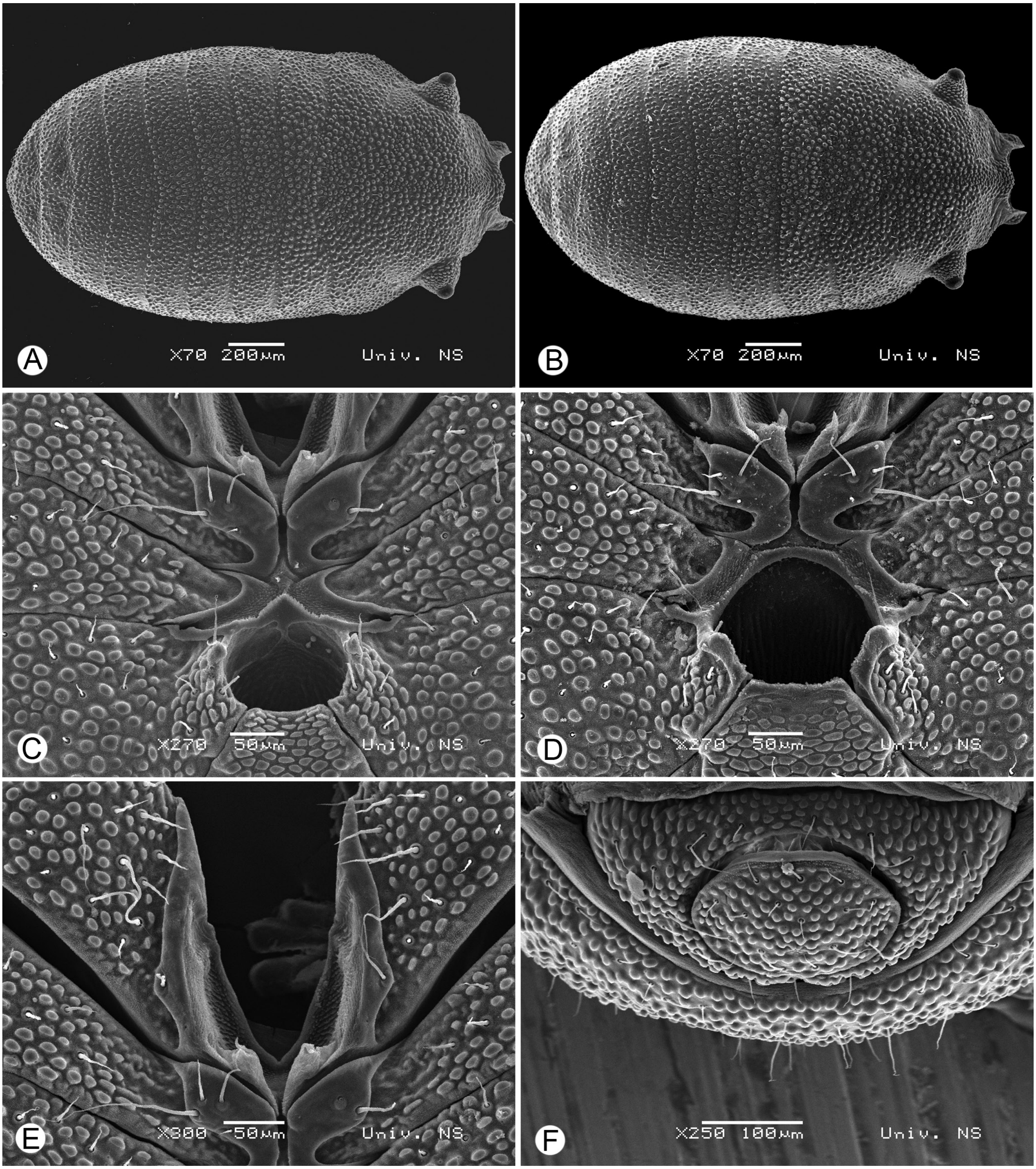

**Figure 1.** *Tucanogovea schusteri* n. gen. n. sp. (A, C, E-F – holotype male, B, D–female paratype). **A**, male dorsum; **B**, female dorsum; **C**, male ventral prosomal complex; **D**, female ventral prosomal complex; **E**, stomotheca, arrow indicate divided endite of coxa I; **F**, anal region.

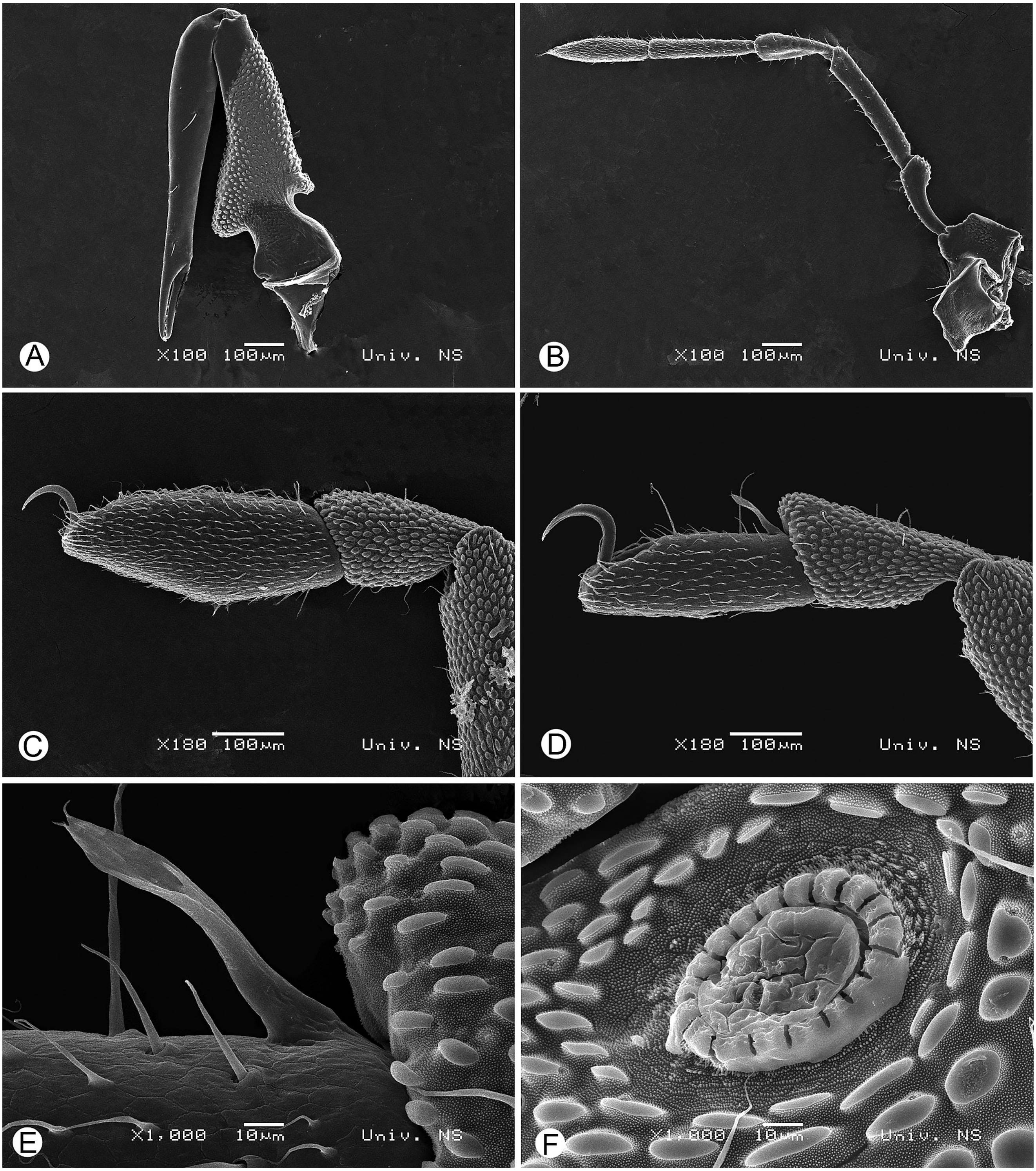

**Figure 2.** *Tucanogovea schusteri* n. gen. n. sp. (holotype male)**.** **A**, chelicerae, medial view; **B**, pedipalp, medial view; **C**, basitarsus and telotarsus of the left leg I; **D**, basitarsus and telotarsus of the left leg IV; **E**, adenostyle; **F**, spiracle.

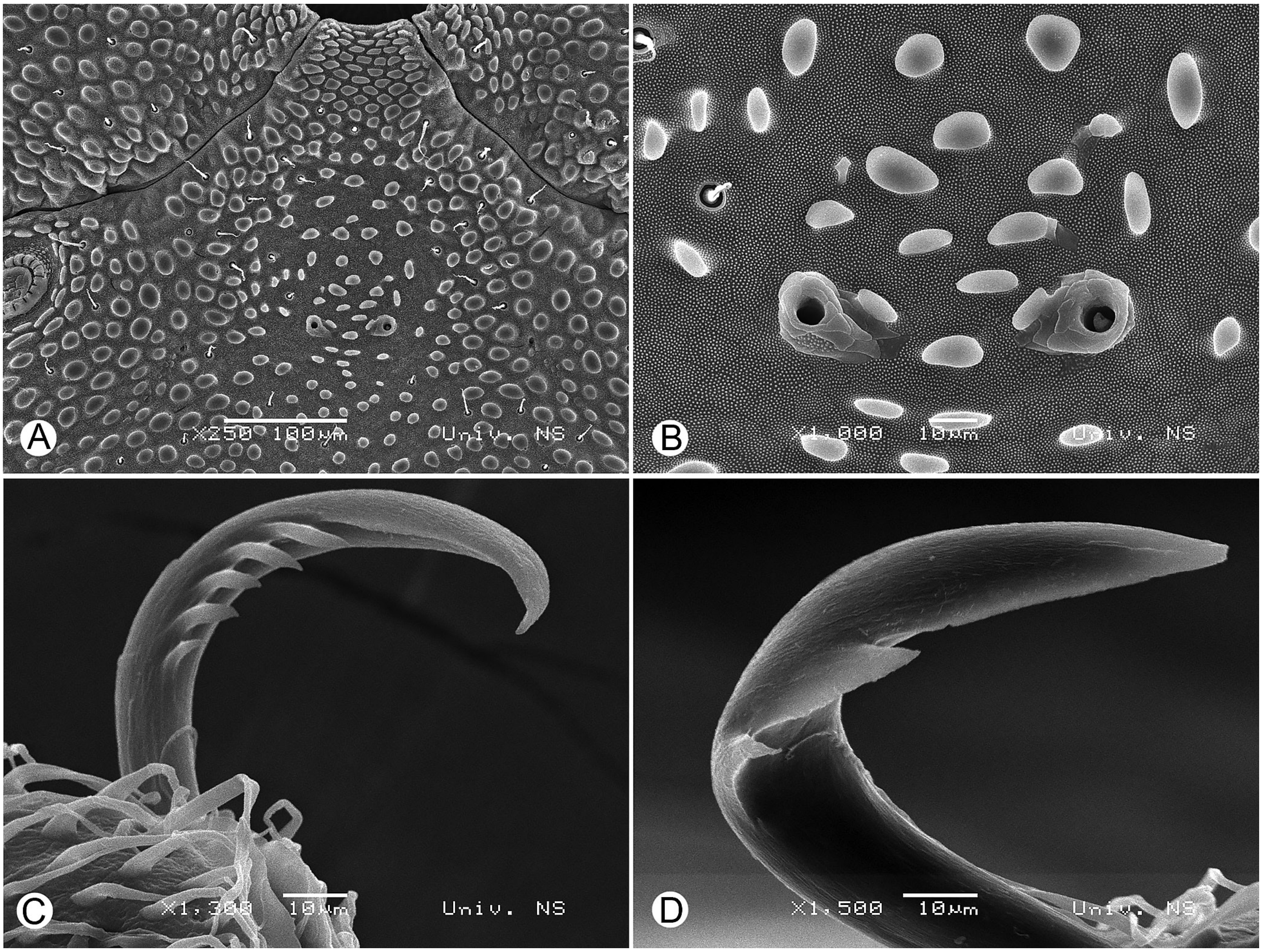

**Figure 3.** *Tucanogovea schusteri* n. gen. n. sp. (A-C–holotype male, D–female paratype). **A**, depressed area arround the openings of ventral exocrine glands; **B**, openings of ventral exocrine glands; **C**, claw of the left leg II, medial view); **D**, claw of the right leg IV.

tails of the structure of terminal leg articles as well as in the setation of ovipositor terminal lobi. There remains a possibility that these two species are congeneric. Their collection sites are within the same larger region of the northwestern Amazon, another argument for such an assumption. *A*t this moment, because males of *Gen.? enigmaticus* are unknown and without knowledge of the most relevant details of male structure, it is impossible to make a definitive conclusion.

## DISCUSSION

Members of the suborder Cyphophthalmi are classified into six families, established by Shear (1980, 1993). These families have since been reorganized, and partly redefined (Giribet and Prieto 2003; Giribet 2007), but are still mostly based on characters which are neither useful for taxon discrimination nor to explain phylogenetic relations. Furthermore, there are still no strictly defined characters that clearly separate the families Ogoveidae, Neogoveidae and Troglosironidae (a monophyletic group constituting the infraorder Sternophthalmi (Giribet et al. 2012)). Although characters of spermatopositor structure could support the monophyly of some families, it is questionable whether these are sufficient to solely define a family. In terms of morphological diagnoses, I conclude that Cyphophthalmi families currently may not be considered to be stable.

Few moments shed new light onto relationships and positions of a particular genera. In the group of neogoveid genera, a tendency of shifting the male gonostome anteriorly towards the posterior line of coxal lobes III (the position of the female gonostome) is evident. As a direct consequence, the coxal lobes IV are reduced. In direct connection with this, as a cause or consequence, an elongation of the spermatopositor is evident. These character states are present in the genera *Neogovea, Metagovea, Huitaca, Brasilogovea, Shearogovea* and *Tucanogovea* n. gen. and to a lesser extent in *Canga* and *Paragovia,* but can neither be observed in the genus *Metasiro* nor in the genera *Ogovea (*family Ogoveidae) *and Troglosiro* (family Troglosironidae). These changes are quite complex and have the weight to be treated as syn-

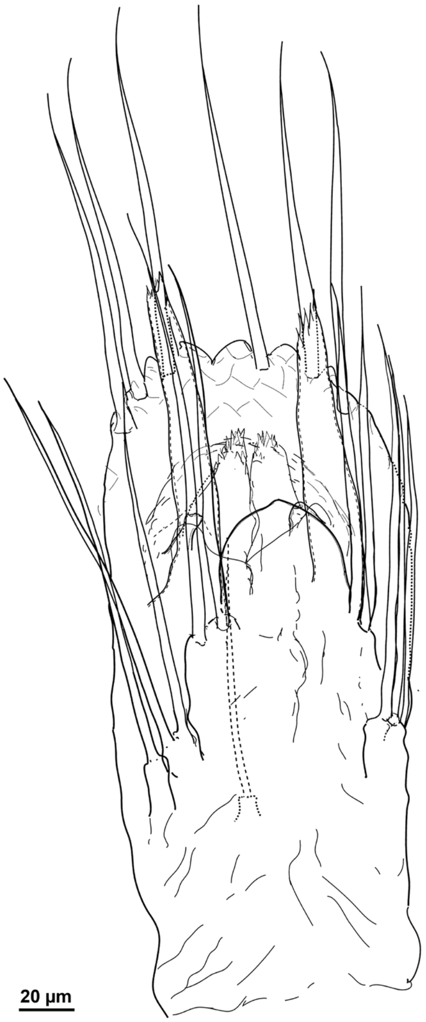

**Figure 4.** *Tucanogovea schusteri* n. gen. n. sp. (holotype male). Spermatopositor.

apomorphic character to unambiguously define the family Neogoveidae.

Characters of the genus *Metasiro*, such as the position of the male gonostome, having simple spermatopositor structure and possession of anal instead of sternal glands in males, represent a plesiomorphic state and indicate its basic position among Sternophthalmi. Fused bases of the spermatopositor median dorsal setae are the only shared characters which could support *Metasiro* to be the sister genus to all neogoveids, as suggested in Giribet et al. (2012). On this basis, *Metasiro* might rather be placed *incertae sedis* within Sternophthalmi.

The situation regarding the monotypic genus *Shearogovea* is different. *Shearogovea mexasca* (Shear 1977) was originally described within the genus *Neogovea* and its placement within the family Neogoveidae was logical (Shear 1980). Establishing a separate genus for *mexasca* (Giribet 2011) is reasonable, but excluding it from the family Neogoveidae is not. Exclusion of *Shearogovea* by Giribet (2011) from Neogoveidae was based on two lost characters, namely the lack of the toothed claw of leg II and opisthosomal exocrine glands. Reduction of opisthosomal exocrine glands also occured among some other Cyphophthalmi independently, and could not be treated as important for phyletic studies (*Parasiro* among Sironidae, *Karripurcellia* among Petalidae and most of Stylocellidae). Shear (1980) already assumes that the loss of clawed teeth in *S. mexasca* is a troglobitic adaptation. That is obvious as elongated and enlarged claws are the most distinctive adaptation for life in wide open subterranean spaces. Such claws are important for climbing and hanging on to rock surfaces, the most common mode of travel among these troglobites, instead of crawling through substrate crevices like their epigean relatives. Teeth on such claws could complicate such movements, and thus may have been reduced under this specific selective pressure. This situation is well illustrated by the fact that in the type population of *mexasca* the reduced teeth on the legs III and IV are still present (Figs 19, 20 in Shear 1977), while they are totally reduced in the population from a different cave (Shear 1980).

As defined previously, the spermatopositor structure of *Shearogovea mexasca* does clearly indicate its position within neogoveids. It shows the close relation of *S. mexasca* with the genera *Brasilogovea* and *Neogovea. Shearogovea, Brasilogovea* and *Neogovea* share some similarities in the immobile sclerotized structures of the spermatopositor–terminal plate or crown-shaped structures and central structure which could be derived from or functionally replace inner and outer digiti mobiles. These unique structures could be treated as synapomorphies of this group of genera.

Genital morphology in neogoveids, with considerable variation within the group, is an essential character in generic designations and allows consideration of phyletic relathionships.

Spermatopositor structure suggests the position of *Tucanogovea schusteri* n. gen. n. sp. close to the genus *Huitaca.* A dorsal lobe of the spermatopositor, the most striking character of *T. schusteri* n. gen. n. sp., occurs in a modified form in the genus *Huitaca* as well. In this genus there is a structure between setae dorsales, as shown for *H. caldas* and *H. ventralis** in Benavides and Giribet (2013), which carries a strong spinelike structure. In all other details of spermatopositor structure, differences between these two genera are striking and clear. In contrast to *Tucanogovea* n. gen., the spermatopositor of *Huitaca* is narrow and elongated, with narrow and elongated terminal lobe and short terminal setae.

Based on the spermatopositor structure presented in Legg (1990), *Paragovia pabsgarnoni* Legg, 1990, represents its own genus which is even not closely related to the genus

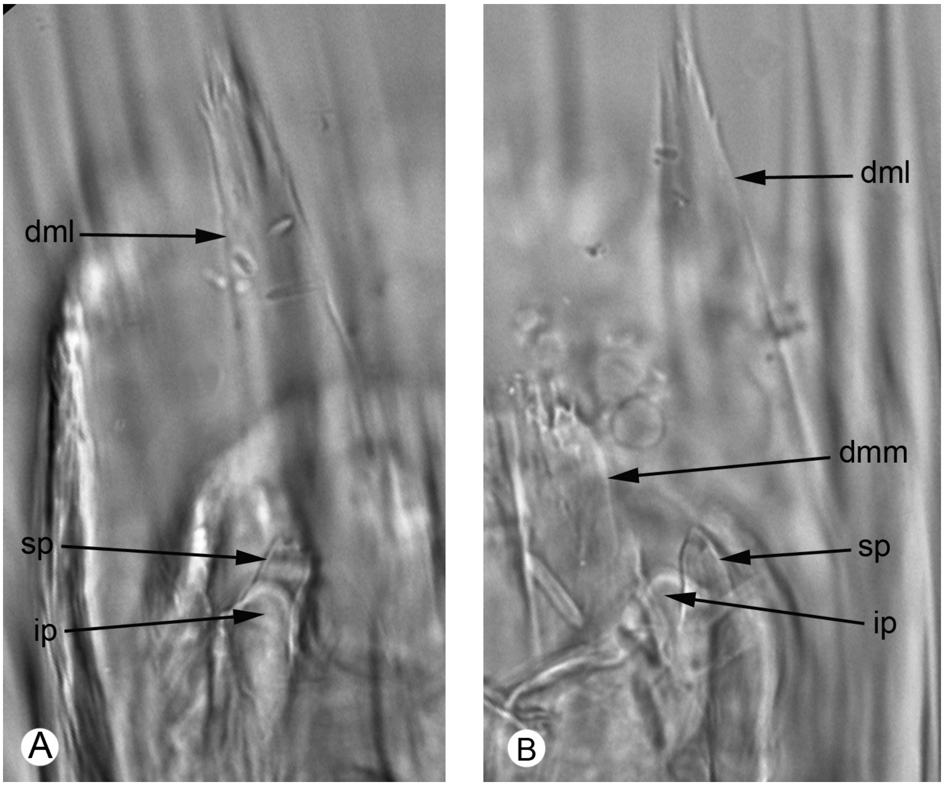

**Figure 5.** *Tucanogovea schusteri* n. gen. n. sp. (holotype male). Central portion of spermatopositor. **A**, left half; **B**, right half: **dml**, lateral movable fingers (digiti mobiles laterales); **dmm**, medial movable fingers (digiti mobiles medialis); **ip**, inner papilae; **sp**, sensory papilae.

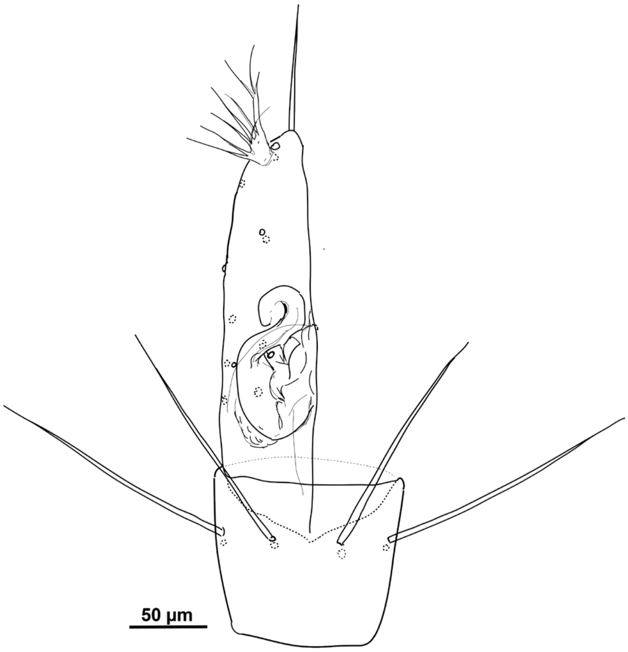

**Figure 6.** *Tucanogovea schusteri* n. gen. n. sp. (female paratype)**.** Distal portion of ovipositor (left terminal lobe excluded), ventral view.

*Paragovia*. Its relation seems closer to Neotropical than Afrotropical neogoveids.

In his basic study on neogoveids Martens (1969) clearly attributed considerable variation and importance to the male genital morphology in the taxonomy of Neotropical Cyphophthalmi. After his publication, analysis of male genital morphology should have reasonably become a standard in all taxonomical studies of this group. The absence of such analysis in some recent literature resulted in confusion in the generic designations of studied species. Thus *Huitaca* sp. 4, *Huitaca* sp. 7, *Neogovea* sp. 2, *Neogovea* sp. 3, *Neogovea* sp. 4, as designated in Benavides and Giribet (2007), were assigned as *Brasilogovea chiribiqueta*, „*Brasilogovea*" sp., *Metagovea* sp. Hila, *Metagovea* sp. Nambi, *Metagovea* sp. Pasto respectively in Benavides and Giribet (2013). Furthermore, *Neogovea* n. sp. DNA 101409 and *Neogovea* n.sp. DNA 101408 from Boyer et al. (2007) were assigned as *Metagovea* sp. Nambi and *Metagovea* sp. Leticia respectively in Benavides and Giribet (2013).

In order to avoid such situations, detailed spermatopositor analysis is clearly mandatory in taxonomical studies of Cyphophthalmi.

*Spermatopositors in Figures 29H and 29D in Benavides and Giribet (2013) presenting *H. caldas* and *H. ventralis* respectively, are nearly identical, at least indicating a very close phylogenetic position. But both figures do not refer to the species *H. ventralis.* Illustration of the spermatopositor structure in Shear's (1979) original description of *H. ventralis*, which may not be the most accurate, differs in many details from that of *H. ventralis* presented in Figure 29D in Benavides and Giribet (2013). It shows greater similarity with the spermatopositor of *H. tama* Benavides and Giribet, 2013 in Figure 29G. It is possible that *H. tama* is a synonym of *H. ventralis* and that the species whose spermatopositor is presented as of *H. ventralis* in Benavides and Giribet (2013) could represent a new, as yet undescribed species close to *H. caldas*. Type localities of *H. ventralis* and *H. tama* are from the same small area in the southern part of North Santander Department in Colombia.

## ACKNOWLEDGMENTS

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