An overview of *Neogovea* species (Opiliones: Cyphophthalmi: Neogoveidae) with the description of *Neogovea virginie* n. sp. from French Guiana

MERLIJN JOCQUÉ¹,³ & RUDY JOCQUÉ²

¹BINCO vzw, Rijmenamsesteenweg 189, Haacht, Belgium. E-mail: merlijnjocque@gmail.com
²Royal Museum for Central Africa, Tervuren, Belgium. E-mail: rudy.jocque@africamuseum.be
³Laboratory of general Ecology, Bulgarian Academy of Sciences, Yuri Gagarin Street 2, 1113 Sofia, Bulgaria

Abstract

Cyphophthalmi is a group of small to medium sized opilionids with a circumglobal distribution that have often been overlooked in biodiversity surveys due to their small size, cryptic life style and general resemblance to mites. We present an overview of the described species in the genus *Neogovea* (Neogoveidae), an identification key to the species and the description of a new species based on the material from a biodiversity survey of an inselberg in French Guiana. *Neogovea virginie* n. sp. is morphologically most similar to *N. immsi* Hinton occurring in Brazil, but differentiated by the structure of the “crown” of the spermatopositor.

Key words: Guiana, inselberg, *Neogovea*, identification key, check list

Introduction

Cyphophthalmi is a remarkable group of small opilionids (up to 7 mm) that has often been overlooked due to their small size, cryptic life style and resemblance to mites. They typically live in forest litter but some species appear to occur in caves such as *Neogovea mexasca* Shear, 1977 (Juberthie 1971).

An interesting element of these opilionids is their global distribution. Representatives occur both in temperate and tropical habitats on all continents except Antarctica. Their wide distribution makes the members of this group interesting study organisms for the detection of biogeographical patterns (Juberthie & Massoud 1976; Boyer & Giribet, 2007, Boyer et al. 2007). Yet, their secretive lifestyle and inconspicuousness requires specialized techniques like Winkler extraction to collect them, and this also explains why relatively few species are described at the present day. The current species count is 168 species and subspecies (Pinto da Rocha et al. 2007; Da Silva et al. 2010; http://giribet.oeb.harvard.edu/Cyphophthalmi/) but many more await description, especially in regions such as the Neotropics and Southeast Asia (Clouse & Giribet, 2010).

During a biodiversity survey of the inselberg (=granite outcrop) Savanna Roche la Virginie in French Guiana in 2008, 18 cyphophthalmid specimens were collected. Based on an overview of the described species in the genus *Neogovea* the collected material from French Guiana belonged to a species new to science. The species is described here and an identification key to all described *Neogovea* species is presented. We hope this overview will vitalize the attention for cyphophthalmids.

Material and methods

The material described here was collected during a 10 day fieldtrip in August 2008 to the inselberg Savanna Roche La Virginie in central French Guiana (4° 11’ 24.00”N, 52° 8’ 60.00”W) (Fig. 1). The field trip was organised to study the fauna and flora on this inselberg, as a rapid baseline biodiversity inventory in order to evaluate the impact of expected higher number of visitors to the site after the recent construction of a new road between Regina and St. Georges. Cyphophthalmid specimens were collected on the inselberg from small patches of vegetation, dominated
by Clusia sp. (Clusiaceae). The methods used were pitfall traps, litter sieving and Winkler extraction. Samples were preserved in 70% ethanol and sorted in the laboratory with a Wild M-10 binocular microscope. Specimens were observed and measured with a Leica M10 stereomicroscope. Photographs were taken with a Leica MZ16 using the LAS automontage software. For SEM photos, specimens were sonicated, dried in HMDS, gold-coated and examined and photographed with a JEOL 6480 LV scanning electron microscope. Drawings of the spermatopositor were made using a camera lucida on a Leitz Dialux 22 microscope. All type specimens were stored in 70% ethanol or mounted on stubs. Primary types and paratypes were deposited in the MCZ (Museum for Comparative Zoology, Harvard University).

**FIGURE 1.** Map showing the location of Savanna Roche La Virginie in French Guiana and the known distribution of Neogovea species in the northern part of South America: N. virginie (●), N. kartabo (□), N. kamakusa (▲), N. immsi (△) and three undescribed Neogova species as mentioned in Benavides & Giribet (2007) (●) (Neogovea sp. 1 in French Guiana; Neogovea sp. 6 in Suriname and Neogovea sp. 9 in Guyana).

**Results**

**Taxonomic descriptions**

**Order Opiliones Sundevall, 1833**

**Suborder Cyphophthalmi Simon, 1879**

**Family Neogoveidae Shear, 1980**
**Neogovea Hinton, 1938**

Type species: *Neogovea immsi* Hinton, 1938 (by original designation)

**Diagnosis** (amended from Shear 1977, 1980): In *Neogovea* species the adenostyle ends in a brush of true setae, an appearance duplicated in other cyphophthalmids only in *Metastrio americanus* (Davis, 1933). No adaptation of tergite eight, the anal plate. Tergite nine is fused in corona analis. No anal glands. Coxa I is fused with coxa II and coxa II is fused with coxa III. The shape of the spermatopositor is typical (Figure 6). *Neogovea* species are most closely related to *Metagovea* species, but are easily distinguished by the shape of the spermatopositor with its extended ventral plate lacking apical setae, and the presence of a setose brush at the tip of the adenostyle.

**Key to the species of Neogovea**

This key is corrected and modified from the key presented by Shear (1977). We include *N. mexasca* Shear, 1977 in the key, although it most probably does not belong to this genus (Benavides & Giribet 2007). Illustrations of all species can be found in Benavides & Giribet (2007) and the online catalog (http://giribet.oeb.harvard.edu/Cyphophthalmi/).

1. Troglobitic; legs long and attenuate; color light brown; dorsum of abdomen without conspicuous transverse grooves; claw of leg II smooth, Mexico.......................................................... *N. mexasca* Shear
   - Not troglobitic; legs typically short and stout; color very dark brown to black; dorsum of abdomen with conspicuous transverse grooves; claw of leg II with small teeth ................................................................. 2
2 (1). Adenostyle at base of tarsus or slightly removed from base, positioned before half length of tarsus ............ 3
   - Adenostyle at half length of tarsus ........................................................................................................... 5
3 (2). Adenostyle at base of tarsus, Guyana............................................................................................... *N. kartabo* (Davis)
   - Adenostyle slightly removed from base of tarsus; spermatopositor with distal prongs diverging at an acute angle . ......................................................................................................................................................... 4
4 (3). Spermatopositor as in Fig 6b, Brazil ..................................................................................................... *N. immsi* Hinton
   - Spermatopositor as in Figs 4, 6a, French Guiana.................................................................................. *N. virginie* n. sp.
5 (2). Crown of spermatopositor with two long and sharply pointed spikes (Fig. 6c), Guyana............. *N. kamakusa* Shear
   - Crown of spermatopositor without long and sharply pointed spikes (Fig 6d), Brazil ...... *N. microphaga* (Martens)

**Neogovea virginie** n. sp.

Figures 1–5

**Type material:** Type material: Holotype: 1♂; French Guiana, Savannah Roche La Virginie (4°11’42.4”N 52° 08’57.7”W), 24.VIII.2008, pitfall trap in Clusia vegetation, M. Jocqué & J. Casteels (MCZ 94422). Paratypes: all from same locality as holotype 1♂: 24.VIII.2008 (MCZ 94423); 1♀ 24.VIII.2008 (MCZ 94425); 1♀ 28.VIII.2008 (MCZ 94426); 1♀ 19.VIII.2008 (MCZ 94427), Winkler extraction; 1♀ 22.VIII.2008 (MCZ 94428), Winkler extraction. Other material: All same locality: 1♀ (MCZ DNA 104823); 1 juv. 24.VIII.2008 (MCZ 94424); 1♂ and 1♀ 24. VIII. 2009, kept on stub for SEM in RMCA.

**Etymology:** The species name is a noun in apposition taken from the type locality.

**Diagnosis:** *Neogovea virginie* n. sp. closely resembles *N. immsi*, but it is easily distinguished from this species by the shape of the crown structure at the tip of the spermatopositor. The large size of the species (>4mm) is shared with *N. kamakusa*, of which it is distinguished most easily by the structure of the spermatopositor (Fig. 4), the position of the ozophores, which are located more ventrally in *N. kamakusa* and more laterally in *N. kartabo*. The size of the anterior lobes of the coxae of legs I are in between those of these species.

**Description:** (male holotype): total length: 4.08mm (5.15mm with chelicerae). Openings of ozophores lateral (Fig. 2). Spiracles circular, typical for the family Neogoveidae (Fig. 3e). Sternum small, surrounded by coxae II and III, diamond shaped, elongate, about twice as long as wide (Fig. 5a). Gonostome approximately as wide as
FIGURE 2. Neogovea virginie n. sp. Habitus of male holotype before dissection of the spermatopositor. Dorsal view (a); lateral view (b); ventral view (c). (scale bar = 1 mm).
FIGURE 3. Neogovea virginie n. sp. Male; lateral view of right leg III (a), cuticular structure of chelicerae, ventral view (b), tarsus IV, lateral view (c), tarsal caw IV, lateral view (d), adenostyle, lateral view (e), spiraculum, ventral view (f).
long, anterior and lateral walls formed by lobes of coxae IV, anterior and lateral lobes not distinct, edges of lateral lobes smooth without any projections. Posterior wall formed by extension from first opisthosomal sternite, delimited by a conspicuous groove; extension triangular with blunt tip, posterior corners not touching lobes of coxa IV. Spiracular grooves present. Chelicerae long and thin, movable finger 1/7th the length of the second article. Palp without coxal apophysis, measurements presented in Table 1. Ventral side of palps and basal article of chelicerae with a tuberculate-microgranulate morphology (Fig. 3b) (Murphree 1988). The convex tubercles are smooth above with bluntly conical tubercles surrounding their bases. The microgranulations of the cuticular background are regularly spaced and appear as rounded points. The larger microgranulations measure 14 μm in basal diameter. The smaller microgranulations measure <1 μm.

Spermatopositor with a strongly sclerotized crown-shaped structure at the top (Fig. 4). This structure is characterized by two long, almost perpendicular dorsal projections; slightly bending inwards and with very small indentations visible laterally (Fig. 4a). The remainder of the crown is irregular in shape with denticles from various shapes, all smaller than the two main dorsal projections (Fig. 4ab). Dorsally there is one group of three large setae, and six small setae more distal towards the crown of the spermatopositor (Fig. 4b, d). Laterally there is one group of five large setae on each side (Fig. 4a). Some of these lateral setae are also visible dorsally. The spermatopositor is ventro-laterally strongly deepened (Fig. 4a).

Fourth tarsus as in Figure 3c, no significant swelling present. Adenostyle removed from base but before half length of tarsus, long acuminate, apical portion set off by definite groove; microtrichiae of brush somewhat modified.

Female paratype (MCZ 94425):
Total length 5.67mm (4.4mm without chelicerae). Further as male except for differences of the ventral thoracic complex (Figs. 5a, b) and the length of the diamond shaped sternum which is as long as wide.
TABLE 1. Measurements of leg and palp segments in mm (Tr = trochanter, F = femur, P = patella, Ti = tibia, M = metatarsus, Ta = tarsus).

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FIGURE 5. Neogovea virginie n. sp. Ventral thoracic complex; male (a); female (b).
FIGURE 6. Lateral view of the top of the spermatopositor of *N. virginie* n.sp. (a) and *N. immisi* (b) (after Martens 1969). Frontal view of the top of the spermatopositor of *N. kamakusa* (c) (after Shear 1977) and *N. microphaga* (d) (after Martens 1969).

**Discussion**

Identification of the *Neogovea* species is reliably performed on a combination of male characters, chiefly the adenostyle position and spermatopositor structure. The distance of the adenostyle to the base of the fourth tarsus, appears to be a continuous character with the position varying from near the base to the middle of the tarsus. The most distinctive character is the “crown” of the spermatopositor; the structure of the tip, characterized by spikes and/or dentations.
Neogovea has a neotropical distribution, with most of the species found close to the equator in South America; in the Guyanas and Brazil. One troglobitic species (*N. mexasca*) is known from Mexico and poses an interesting case of niche shift from a forest litter inhabiting ecology to living in caves. However the position of *N. mexasca* in this genus is unclear. In a morphological phylogenetic analysis of the cyphophthalmid genera, it clusters within the clade containing sironids and pettalids, a position that is supported by many morphological characters (Giribet & Boyer 2002), and in their catalog of Neotropical Neogoveidae Benavides & Giribet (2007) exclude *Neogovea mexasca* from the family Neogoveidae. More data are required to understand the ecology and distribution of the species in the genus *Neogovea*. Many species are so far only known from a single locality and based on the ecology and expected low dispersal rates of these species, and accordingly low exchange of individuals between populations, a substantial radiation of the genus in South America appears to exist (see Benavides & Giribet 2007).

The newly described *N. virginie* n. sp. was collected in Clusia forests, vegetation that is characteristic for inselbergs. Focused collections in other habitats should show whether this species is restricted to the typical floral communities of this habitat type. Inselberg habitats are typically very different from the surrounding terrestrial matrix, and are known for their highly adapted fauna and flora worldwide (e.g. Porembski & Barthlott 2000). These habitats occur in all major biomes worldwide and can be found exposed in over 15% of all continental areas (Twidale & Romani 2005). The global distribution, high specialization of occurring organisms, well delineation of populations and communities on these habitats that can be seen as islands currently results in a surge of interest in these habitats as model study systems for ecological and evolutionary research (e.g. Jocqué et al. 2010). The study of cyphophthalmids on inselberg habitats (e.g., *N. virginie* n.sp.) and of their possible strongly different ecology as compared to the species that live in lowland forests, would strongly add to the interesting prospects of this group as study organisms for biogeography.

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References


