

## Scientific Note

# Redescription of *Centronia melanitis* Hübner, 1818 (Lepidoptera: Arctiinae: Arctiini: Ctenuchina) with notes on androconial organs

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**Abstract.** The Neotropical genus *Centronia* Hübner, 1818 is monotypic and represented by the species *Centronia melanitis* Hübner, 1818. Individuals of this species display diurnal habits and are attracted by plant bait of *Heliotropium* sp.. Specimens of *Centronia* are very rare in museum collections. The present study, notes are provided for the male specimens and the first time the female is mentioned in the scientific literature. The presence of androconial organs in *Centronia melanitis* and other species of Ctenuchina is hypothesized to be related to the visits to pyrrolizidine sources and their role in the pheromones production and the sexual attraction for mating.

**Keywords:** Pheromones, *Episcepsis*, *Heliotropium*, Neotropical region.

The Ctenuchina are distributed in the Neotropical region and comprises 92 genera of which 30% are monotypic (Zerny 1912). Phylogenetic studies including a considerable number of representatives of the subtribe are scarce and thus, its evolution history remains largely unknown. Up to date, only four genera were revised: *Ceramidia* Butler, 1876; *Horama* Hübner, [1819]; *Pseudoaethria* Schaus, 1924; *Ptychotrichos* Schaus, 1894. The lack of detailed morphological studies, taxonomic reviews and phylogenetic works has led to a high number of monotypic genera. It is highly probable that some of the non-monotypic genera are polyphyletic and closely related to monotypic genera. In other cases, the description of new taxa has changed the classification of genera previously considered as monotypic. For instance, *Parascepsis* Dognin, 1923 (Grados & Mantilla 2020) and *Epanycles* Butler, 1876, the latter represented by the species *E. imperialis* (Walker, 1854) which would be closely related to *Episcepsis satania* Schaus, 1924, based on morphological characters (Grados & Mantilla, in prep.). Genera as evolutionary units display phylogenetic information related from morphological, ethological, physiological and biochemical characters which in turn present inheritable ancestor-descendant base and the same space-time evolutionary history (Rosen & Bailey 1963; Mayr 1969). A high number of monotypic units is not informative (Michener 1957) and could be the case of Ctenuchina, revealing the need for more studies.

The genus concept of *Episcepsis* Butler, 1877 by Hampson (1898) comprises 13 species, among them the species *Episcepsis melanitis* Hübner, 1818. The species was originally described as *Centronia melanitis*, type-locality Brazil (holotype lost), and recent studies have considered this genus name instead *Episcepsis* when referring to the species (Grados 1999) (ICZN 1999: Art.23.1). In a recent study, Cerda (2017) listed *Centronia* Hübner, 1818 as a monotypic genus but with no further details.

In this study, was redescibe *C. melanitis*, providing photographs and notes on the androconial organ and their function, and the first report of a female specimen. Furthermore, were provide photos of adults, of the genitalia of both sexes, of the structures that make up the androconial organ, drawings of the wing venation, and propose a close association between the presence of the androconial organ with the visit to sources of Pyrrolizidine and its role in mating behavior.

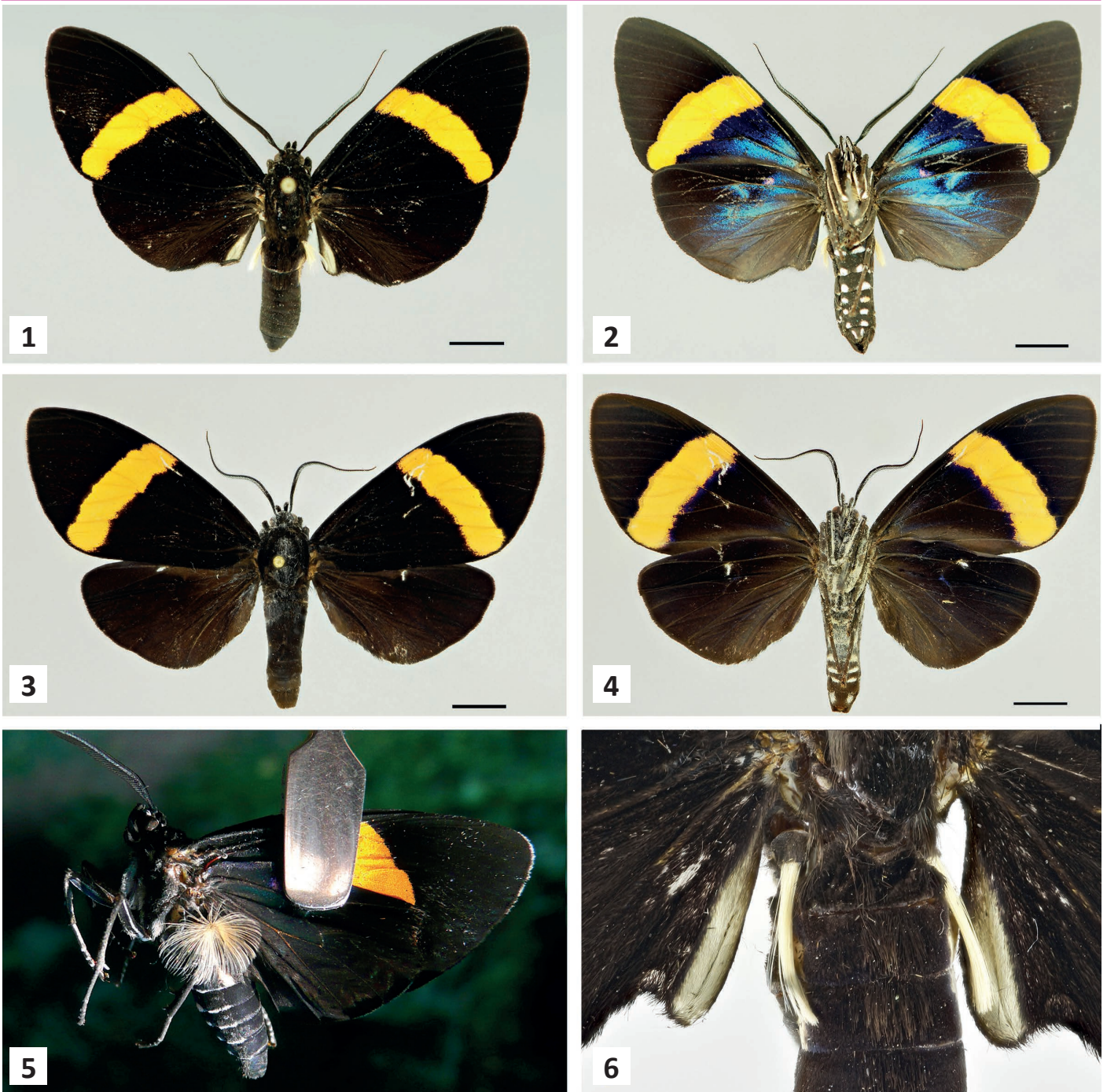
The examination and dissection of the genitalia follow Robinson (1976) with some modifications. The abdomen was immersed in a tube with a solution of KOH 10% in hot water for 15 to 20 min. Scales were removed with the aid of fine brushes and chlorazol black was used as a staining medium to improve the examination of characters (Carayon 1969). Then, specimens were kept in a cryovial with glycerin. Photographs of adult specimens were taken with the digital camera Canon EOS Rebel T6 and Canon lens MP-E 65 mm. The terminology for the alar venation follows Miller (1970) and Common (1990); for genitalia morphology, Klots (1970).

Specimens from the following collections were examined: Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM); National Museum of Natural History, Smithsonian Institution, Washington DC, USA (USNM) and the Zoologisches Museum, Humboldt Universität, Berlin, Germany (ZMHB).

### *Centronia melanitis* Hübner, 1818

#### Redescription

**Male** (Figs. 1-2). **Head.** Blackish brown. Labial palps curved apically towards vertex. First palpomere with white spots on ventral and dorsal surfaces, second on ventral surface and some white scales on dorsal surface. Frontoclypeus with one white spot on the latero-superior surface. Occiput and postgena blackish brown. Scapus with one white spot and pedicel with some white scales on anterior surface. Antenna bipectinate blackish brown with bluish tone. Medial ramis 1.5 times the flagellum axis width. **Thorax.** Blackish brown with bluish tone. Patagias with white scales scarce on lateral surfaces. Tegulas blackish brown and with one small white spot on medial surface. Tymbal organ present on the metakatepisternum. **Legs.** Coxa blackish brown with one white spot on mesal side extending throughout the anterior side. Trochanter blackish brown, with one white spot. Femur blackish brown, with two white spots along mesal and ectal sides. Tibia blackish brown. Epiphysis dark brown. Tarsus brown, with white spots on each tarsal segment up to the distal portion. Second and third pair of legs similar to the first, except for: thigh brown with one white spot on the anterior portion, apical and subapical spines blackish brown with white spots. **Forewing** (Fig. 7). Length: 20-20.3 mm (n = 4). **Dorsal side.** Blackish brown, with blueish tone. Oblique band yellow, extending from the close to



**Figures 1-6.** *Centronia melanitis* Hübner. **1-2.** Male (French Guiana). **1.** Dorsal view. **2.** Ventral view. **3-4.** Female (Picuroyacu, Loreto, Peru). **3.** Dorsal view. **4.** Ventral view. **5-6.** Male specimen. **5.** Brush-hair protracted. **6.** Brush-hair emerging from the counter-tympanal hood on the first abdominal segment. Scales = 5 mm.

the  $R_1$  to the beginning of  $R_{3+4+5}$ , comprising the costal margin, distal part of discal cell, basal portion  $R_5-M_1$ , proximal third of  $M_1-M_2$ ,  $M_2-M_3$ , half base of  $M_3-Cu_1$ , medial portion of  $Cu_1-Cu_2$  to the distal fifth of  $Cu_1-A_{1+2}$ , almost reaching the tornus. Apex border with white scales. **Ventral side.** Blackish brown with iridescent bluish hue, except in  $CuP-A1+A2$  and the anal cell, both greyish browns. Yellow band similar to the dorsal side except for being slightly wider; from both sides of the mesial and ectal borders of the yellow spot, iridescent purple scales. Retinaculum brown with iridescent blue scales. **Hindwing** (Fig. 8). **Dorsal.** Blackish brown with iridescent blue tone; costal cell,  $Sc-R_1$ ,  $R_1-R_2$  greyish brown. Anal area modified, with a lobular projection with modified white scales and an invagination along the central portion. **Ventral.** Dark brown with iridescent blue tone. **Abdomen.** Dark brown with iridescent blue tone. First tergite with white brush-hair on dorsal portion of the counter-tympanal hood. From the first to fourth tergites with setae dorsally phylliform. Presence of a white line on the lateral portion of the first to third tergite. Small white spots on latero-posterior portions of tergites. Two white spots in sublateral position to

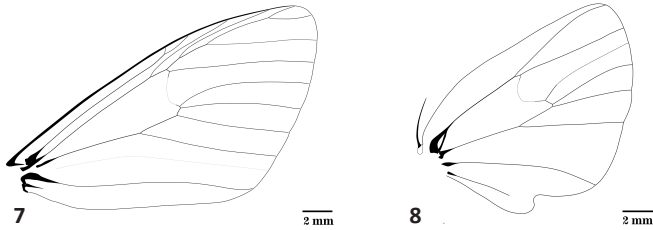
the posterior portion of sternites II to VII; VIII sternite with two white longitudinal spots on centro-posterior portion.

**Genitalia** (Figs. 9-12) (Genitalia # JGA - 1103, MUSM). Tegumen slightly sclerotized, concave in interior view and inverted V-shaped, with a separation between valvae, digitiform; posterior portion emarginated. Saccus well-developed, truncated at the end. Uncus fused to tegumen, sclerotized, broad at the base, elongated and digitiform; setae along both sides and on the ventral side of the medial portion; distal portion thickly sclerotized and point. Juxta sclerotized and oval. Transtilla broad and sclerotized. Valva broad, slightly curved until the mesial axis; basal third wider, with setae on distal half, predominantly on ventral portion; digitiform process on dorso-distal portion from the internal surface, somewhat sclerotized with a constriction on its medial portion; ventral view slightly concave on the medial portion of mesial border, presence of setae on mesial margin and apex slightly curve. Aedeagus enlarged, cylindrical and broad. Vesica smaller than aedeagus with four patches of cornuti: at the proximo-dorsal portion; at the postero-distal portion; at the left side, with small cornuti; at the distal portion, spicules at the

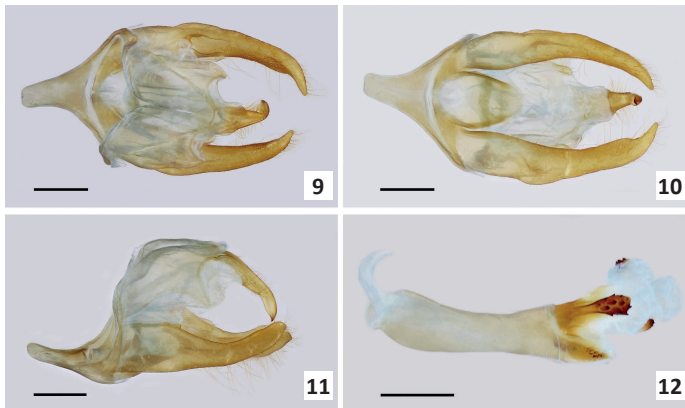


base and small cornutus at the tip; small enlarged and sclerotized areas on the right side. **Tergite 8** (Fig. 13). Rectangular, slightly sclerotized, with sublateral apodemes almost half width of VII tergite, ending in a transversally enlarged structure. **Sternite 8** (Fig. 14). Apodemes sublateral broad, sclerotized and truncated at their tips.

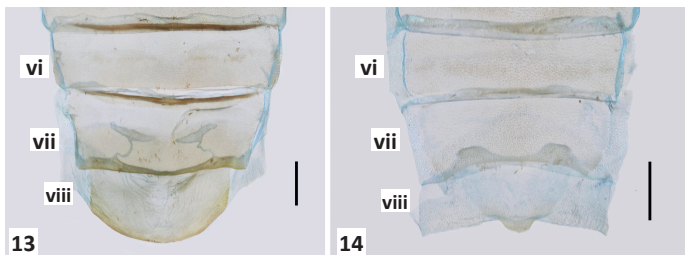
**Androconial organ.** Brush-hair white originating from the counter-tympanal hood, dorsal to the spiracle and reaching the posterior half of third tergite (Fig. 6). Pair of apertures on the exoskeleton, in antero-lateral position of third tergite. In integument, these apertures expand, forming part of a gland (Figs. 15-16). Posterior margin of the hindwing presenting a whitish area. When wings are resting, they cover the brush-hair that remain attached to the abdomen, right above the lateral white line of first three abdominal segments.



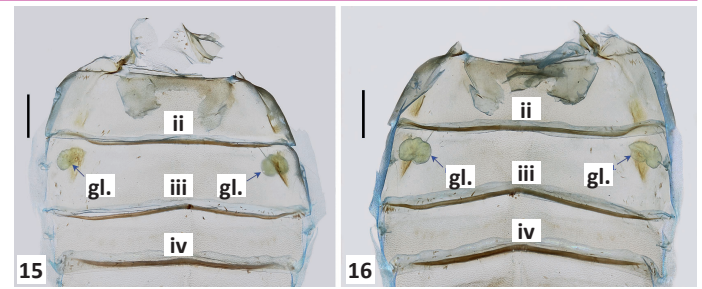
**Figures 7-8.** Wings of *Centronia melanitis* Hübner. **7.** Forewing. **8.** Hindwing. Scale= 2 mm.



**Figures 9-12.** Male genitalia of *Centronia melanitis* Hübner. (Genitalia JGA # 1103-MUSM). **9.** Dorsal view. **10.** Ventral view. **11.** Lateral view. **12.** Aedeagus. Scales= 1 mm.



**Figures 13-14.** Last segments of abdomen. **13.** VI, VII, VIII; sixth, seventh and eighth tergites. **14.** VI, VII, VIII; sixth, seventh and eighth sternites. Scales= 1 mm.



**Figures 15-16.** First segments of abdomen. II, III, IV: second, third and fourth tergite; gl. gland. **15.** Externa view (exoskeleton). **16.** Internal view (integumental). Scales= 1 mm.

**Female** (Figs. 3-4). **Forewing.** Length: 24 mm (n = 1). Similar to male, except for the following: ventral side of wings with no iridescent blue tone, light brown frenulum with two bristles and absence of an androconial organ. **Genitalia** (Figs. 17-18) (Genitalia # JGA - 1115, MUSM). Eighth tergite uniformly sclerotized. Lamella antevaginal membranous and lamella postvaginal sclerotized. Ostium and antrum in position central. Posterior apophysis almost two times longer than the anterior apophyses. Bursae copulatrix with ductus bursae sclerotized, broad and flattened, and corpus bursae with sclerotized spicules on anterodorsal portion; other portions membranous. Ductus seminalis emerging at the right side on proximal portion of corpus bursae. Presence of dorsal and ventral glandular sacs; ventral larger than dorsal ones. Papillae anales short, with some setae on the surface; in lateral view, height 1.5 times its width.

Examined material: **FRENCH GUIANA.** 1 male, "St. Jean, Maroni, F.Guiana", "Collection WmSchaus" (USNM); 1 male, "Maroni River", "Collection WmSchaus" (USNM); 1 male, "Cayena, Montaña de Kaw, Carr. Rarura-Kaw km 37, 19.ix.2017, J. Cerda" (Genitalia # JGA - 1103, MUSM). **PERU. LORETO.** 1 male, Alto Río Contaya, Campamento I, 07°19'S, 74°48'W, 300-400 m, 19.x.2008, J.J. Ramirez; 1 female, Picuroyacu, Río Nanay, 03°39'S, 73°15'W, 110 m, 10.xi.2015, J.J. Ramirez (Genitalia # JGA - 1115, MUSM). **MADRE DE DIOS.** 1 male, Reserva de Tambopata, 12°50'S, 69°17'W, 250 m, 24.ix.1981, G. Lamas & J.B. Pérez (HELIOTROPIUM BAIT-DAY) (Genitalia # JGA - 968, MUSM); 1 male, Tambopata Research Center, 13°08'S, 69°36'W, 300 m, 14.ix.2008, J.Grados (HELIOTROPIUM BAIT-DAY). **PUNO.** 1 male, P.N. Bahuaja-Sonene, 4.5 km NO Qda. Aguajal Río Tambopata, 13°23'31.8"S, 69°29'58.7"W, 335 m, 10.ix.2011, J.Grados & E.Rázuri & E.Guillermo (HELIOTROPIUM BAIT-DAY) (MUSM, ARCT-001099, JGA COLLECTION), (Voucher DNA Barcoding, Arct# 00762, JGA- MUSM); 1 male, idem except, (MUSM, ARCT-001098, JGA COLLECTION), (Voucher DNA Barcoding, Arct# 00761, JGA- MUSM).

Based on the data on the label *C. melanitis* occurs in French Guiana and Peru; after the type locality and some bibliographic references occurs in Brasil (Ferro & Teston 2009) and could be wide geographical distribution in other countries with Amazon rainforest. The species displays diurnal habits and males are attracted by baits of *Heliotropium* sp. Being uncommon in museum collections, probably due to its behavior, frequently not getting into light traps.

A female specimen is here reported for the first time and the other known female is deposited at the ZMHB. Some species of *Ctenuchina*



**Figures 17-18.** Female genitalia of *Centronia melanitis* Hübner. (Genitalia JGA # 1115-MUSM). **17.** Left view. **18.** Right view. Scales= 1 mm.

are very similar to *C. melanitis*, such as *Epidesma ursula* (Stoll, [1781]) and *E. crameri* (Travassos, 1938), as well as of the subfamily Dioptinae (Notodontidae), such as *Getta unicolor* (Hering, 1925), *Polyptychia hermiere* Miller, 2009 and *Phavaraea rejecta* (Geyer, 1832) (Miller 2009), that could be compromised by mimetic rings.

The androconial organs in males of Lepidoptera are found in different parts of the body (Swinton 1908-1909; Varley 1962; Birch et al. 1990; Grados 2004), which is also observed in the Ctenuchinae. According to the morphology of androconial organ in *C. melanitis*, we propose that the glands located on the third tergite store semiochemicals (Kellog 1894; Scoble 1992). Under certain conditions, those substances attached to the lateral scales of first three abdominal segments would be free and then by contact they would pass to the brush-hair that arise from the counter-tympanal hood. In full operation and for better dispersion of semiochemicals, hairs (scent-organs) are protracted (Fig. 5), widening the dispersion area. A similar functioning mechanism is inferred to the androconial organs of the Sphingidae *Deilephila elpenor* (Linnaeus, 1758), as reported by Birch (1983).

Several species of Ctenuchina in the southeastern Amazonia of Peru display diurnal activity and are attracted by plant baits of *Heliotropium* sp. with a well-marked sex ratio to males, similar to *C. melanitis*. All specimens collected with *Heliotropium* sp. were males. *Heliotropium* species have pyrrolizidine alkaloids (Hartmann 2009). The observed sex ratio has been reported for other places of the Neotropical region (Pliske 1975) with similar data to the Peruvian Amazonia, which is the case of *Corematura postflava* (Guérin-Ménéville, 1844) (24 males, 0 females), *Paraethria flavosignata* Rothschild, 1911 (15, 0), *Diptilon proleuca* Druce, 1896 (25, 0), *Herea prittwitzii* (Möschler, 1872) (11, 0), *Agyrta pandemia* Druce, 1893 (5, 0) and *Belemnina eryx* (Fabricius, 1775) (27, 0). Some of those species are very rare in museum collections due to the fact that individuals are not attracted by light traps and the few or only specimens that are known have been collected with entomological nets by specialists in butterflies and other insects. However, using sources of pyrrolizidine (*Heliotropium* sp.) is the best way to collect large series of specimens. This is a clear example of how rarity of some species in collections could be related to catch methodology.

At least, according to available data, most species of Ctenuchinae that are attracted by sources of pyrrolizidine (*Heliotropium* sp.) present some type of androconial organ. Regarding the morphological diversity of androconial organs in Ctenuchina, the brush-hair in counter-tympanal hood were only observed in *C. melanitis* and *Eucreon archias* (Stoll, [1790]); the latter is the type species of *Eucreon* Hübner, [1819]. Morphological data of adult specimens and genitalia suggest that such organs are analogous and would be a clear example of evolutionary convergence.

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## Authors' Contributions

JG carried out the field work and collected specimens. Both authors participated in the taking of photographs and in the writing of manuscript.

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