Afrotropical–North American Disjunct Distribution of *Minanga* (Hymenoptera: Braconidae) with the Description of a New Species and First Record for the New World

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ABSTRACT Previously known only from seven Afrotropical species, this article describes a new species of *Minanga* from northern Mexico. Speculations are made on the biogeographic history of the genus. Specialized glands on the vertex of the head and modified setae on the hind tibia are illustrated with high magnification scanning electron micrographs.

THE SUBFAMILY SIGALPHINAE SEEMS to be a basal lineage of the Braconidae (Quicke et al. 1999), and there is evidence that it is the sister-group of Agathidinae + *Pselaphanus*, although Sharkey (1997) considered *Pselaphanus* as a member of the Sigalphinae. Achterberg and Austin (1992) revised the genera of the Sigalphinae, but later *Afrosigalphus* was removed from the subfamily and placed in the Helconinae (Quicke et al. 2002). Six genera are currently included in the subfamily but only 25 species, including *Pselaphanus trogoides* Szépligeti, which is sometimes placed in its own subfamily, and the species described here, are known. The few members with known biologies are koinobiont endoparasitoids of lepidopteran larvae (Achterberg and Austin 1992, Sharkey and Janzen 1995). Members are distributed worldwide but are rare everywhere. Because the fossil record is poor, it is difficult to determine whether the Sigalphinae represent a relict group or one that has always been species-poor.

While sorting specimens in the Berkeley insect collection in 1997, I came across a specimen representing a new species of *Minanga* with a locality label indicating that it was from Mexico. I delayed publishing the discovery for several years because I was suspicious that it may have been mislabeled since all previously recorded species of *Minanga* are from sub-Saharan Africa. Recently, while visiting the insect collection at Universidad Nacional Autónoma de México in Victoria, Tamaulipas I discovered three more specimens that convinced me of the validity of the Mexican locality data.

I have placed the new species, *Minanga achterbergi*, in the genus *Minanga* based on obvious generic synapomorphies, i.e., a sharp horn located behind each lateral ocellus (Fig. 1A); the metasomal carapace completely fused, without an articulation between segments 1 and 2 (Figs. 1E and 1F); and CUa of the hind wing curved.

Materials and Methods

Several body parts of a male paratype were investigated using high-magnification scanning electron microscopy. Comparisons with Afrotropical species were made on the basis of determined specimens in various collections as well as the original descriptions and redescriptions in the following publications: Enderlein (1905a, b), Cameron (1906, 1910, 1911), Brues (1926), Granger (1946), and Saeger (1948).

Results

Minanga achterbergi sp. n

Holotype [♀]

Diagnosis. Distinct morphologically from other species of *Minanga* based on characters such as absence of the occipital carina (Fig. 1B); last tergum of the carapace rather sharply tapered posteriorly (Fig. 1F, compare with *M. seyrigi* Granger, Fig. 4B); longitudinal carinae of first metasomal tergum weakly converging posteriorly (Fig. 1E, compare with sharply converging carinae of *M. seyrigi*, Fig. 4B); no flange at the apex of the carapace (Figs. 1E and 1F, compare with *M. seyrigi*, Fig. 4A and C); and hind basitarsomere laterally flattened.

Length. 5.2 mm.

Color. Mostly reddish orange and melanic with some yellow. Yellow as follows: foretarsus and parts of foretibia, mid- and hind tarsi, anterior border of metapleuron, venter of metasoma; reddish orange as follows: metanotum, propodeum, metapleuron, and metasoma (black mottling is present on the metasoma but this seems to be a stain originating from the digestive system.); remainder of body melanic; wings infuscate (Fig. 3).

Head (Fig. 1A and B). Antenna with 33 flagellomeres; horn, measured from dorsal border of lateral

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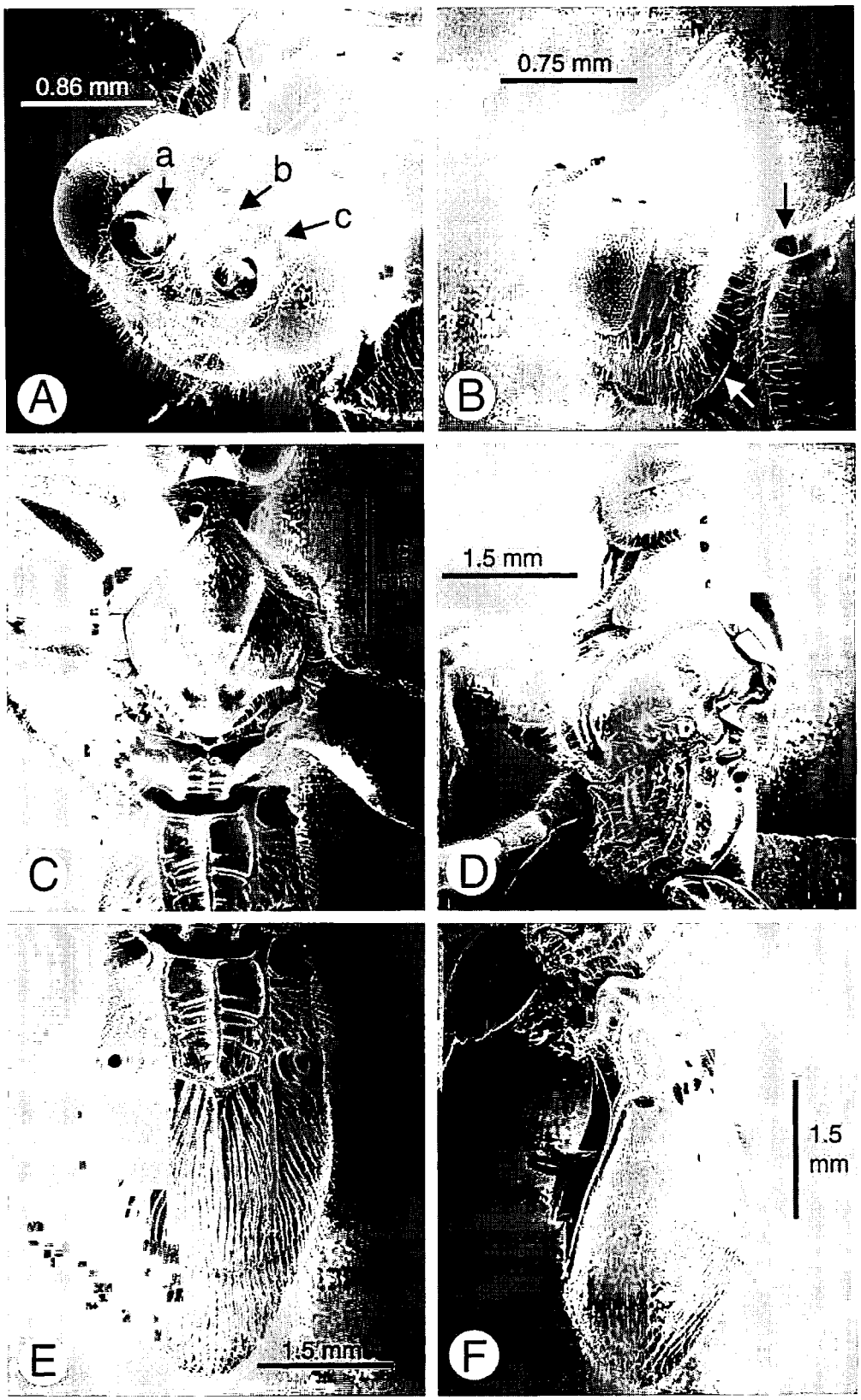

Fig. 1. *M. achterbergi* n. sp. (A) Dorsolateral view of head; a, posterior carinae of antennal insertion; b, medial carina of frons; c, lateral carina of frons. (B) Lateral view of head; black arrow indicates subpronope; white arrow indicates genal flange. (C) Dorsal view of mesosoma. (D) Lateral view of mesosoma. (E) Dorsal view of metasoma. (F) Lateral view of metasoma.

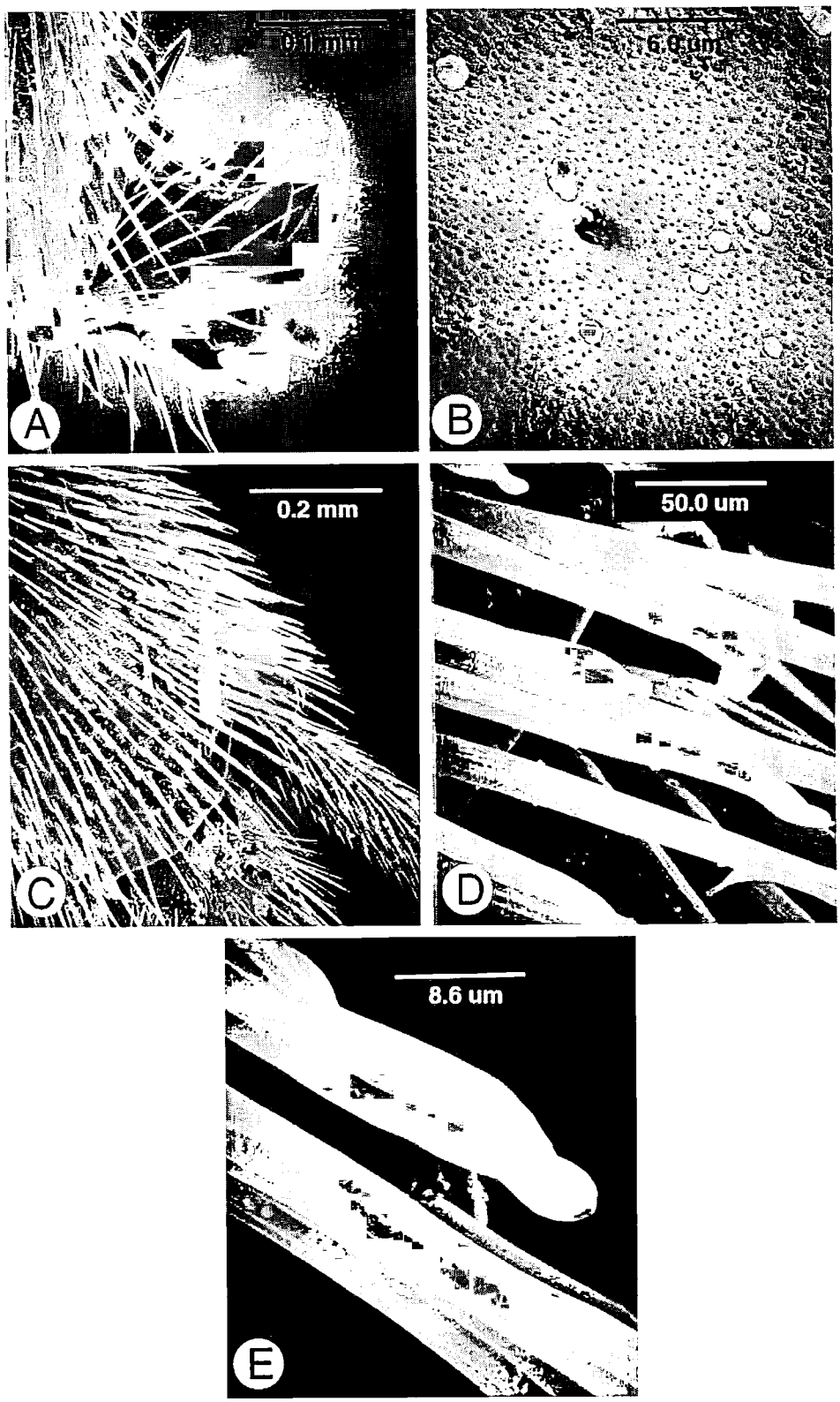

Fig. 2. *M. achterbergi* n. sp. (A) Hind tarsal claw. (B) Detail of surface of horn on vertex of head, showing micropores. The micropores are the numerous small pores. The white structures are hypothesized to be exudates from the micropores. (C) Apex of hind tibia. (D) Magnified setae of hind tibia. (E) Apex of one seta of hind tibia.

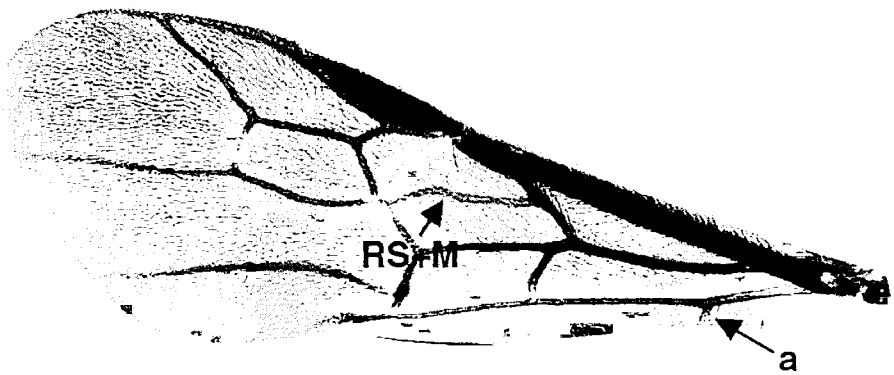

Fig. 3. *M. achterbergi* n. sp. Forewing: costal margin is folded over the wing making the basal cell seem small. RS+M, fused radial sector and medial veins. a, anal crossvein.

ocellus, 2.4× as long as maximum diameter of lateral ocellus; occipital carina absent; sculpture absent except for transverse rugae anteriad antennal insertions and area of frons near antennal insertions bordered posteriorly, laterally, and medially with carinae; gena expanded into a flange posteroventrally.

Mesosoma (Figs. 1C, 1D, 2A, and 3). Epicnemial carinae well defined with carinate posterior border; sternaulus smooth with pronounced ventral border that reaches epicnemial carina; posterior border of mesopleuron with large crenulae; midcoxa bordered anteriorly with large transverse ridge; metapleuron with large smooth longitudinal ridges; pronotum with distinct, round pronope (Fig. 1C) and large triangular subpronope bordered ventrally by distinct, longitudinal ridge (Fig. 1B); scutum smooth; notauli well defined, smooth, nearly extending to trans-scutal articulation; trans-scutal articulation indicated as a weak line; scutellar sulcus divided medially by high ridge forming two depressions in the sulcus; each depression further divided longitudinally by weak shallow ridge; posterior scutellar depression transverse, composed of small areolae; metanotum composed of large areolae, median areolae large, triangular and well excavated; propodeum with one medial and two lateral longitudinal carinae; area between lateral longitudinal carinae with irregular transverse carinae; lateral area of propodeum smooth, bisected by one transverse carina; all tarsal claws with acute basal lobe (Fig. 2A); basitarsomere of hind coxa laterally flattened; terminal abscissa of RS of forewing weakly decurved; vein RS+M sinuate (Fig. 3); crossvein "a" of forewing present; vein CUb of hind wing long and tubular.

Metasoma (Fig. 1E and F). Unarticulated carapace composed of three segments; tergum 1 about as wide as long, longer medially than laterally, with three complete longitudinal carinae; transverse carinae run between the two lateral and medial longitudinal carinae; lateral area of tergum 1 weakly rugose with another longitudinal carina near the point at which the tergum curves ventrally (Fig. 1F); tergum 2 with distinct depressions anteriorly; tergum 2 about as wide as long, longer medially than laterally with three longitudinal carinae; medial surface of tergum 2 covered with weaker longitudinal carinae that become obsolete laterally; lateral areas of terga 2 and 3 mostly smooth; terga 2 and 3 lacking border laterally; tergum 3 tapering to blunt apical point, mostly striate dorsally and rugose apically; apex of carapace lacking flange (Fig. 1F, compare with *M. seyrigi*, Fig. 4C); foramen of carapace not nearly extending to apex of metasoma and margined with sharp ridge; ovipositor short, barely exerted from ventral foramen of carapace.

Male Paratypes. As in female, except for sexual characters and as follows: length: 5.4–5.7 mm, color reddish orange and black except some palpi, foretarsus, and venter of metasoma yellow; propodeum and metasoma reddish orange in both males, metapleuron reddish orange in one male; antenna with 32–33 flagellomeres.

Material Examined

Holotype [♀]. MEXICO: Chiapas, Santo Domingo, 15 miles southeast of Simojovel, 8-15-VII-1958. J. A. Chemsak. Deposition: Essig Museum of Entomology, Berkeley, CA.

Paratypes. [♂], MEXICO, Tamulipas, Gomez Farias, 300–900 m, 7-16-I-1999, S. Hernández, deposition: Canadian National Collection of Insects, Ottawa, Ontario, Canada. 2♂♂, Tamulipas, Gomez Farias, 300 m, 16-26-XIII-1998, S. Hernández. Specimen is dissected and coated in gold. Deposition: American Entomological Institute, Gainesville, FL.

Etymology. Named in honor of Cornelius (Kees) van Achterberg in recognition of his many contributions to the study of the Sigalphinae and the Braconidae in general.

Morphological Notes. High-magnification scanning electron micrographs of the horns on the head (Fig. 2B) revealed densely packed micropores. Some of these are larger than others and these are plugged with what seem to be coagulated secretions. Similar pores are found over the entire surface of the vertex where they are much more dispersed. Originally, I assumed the horns to be defensive, functioning as a deterrent

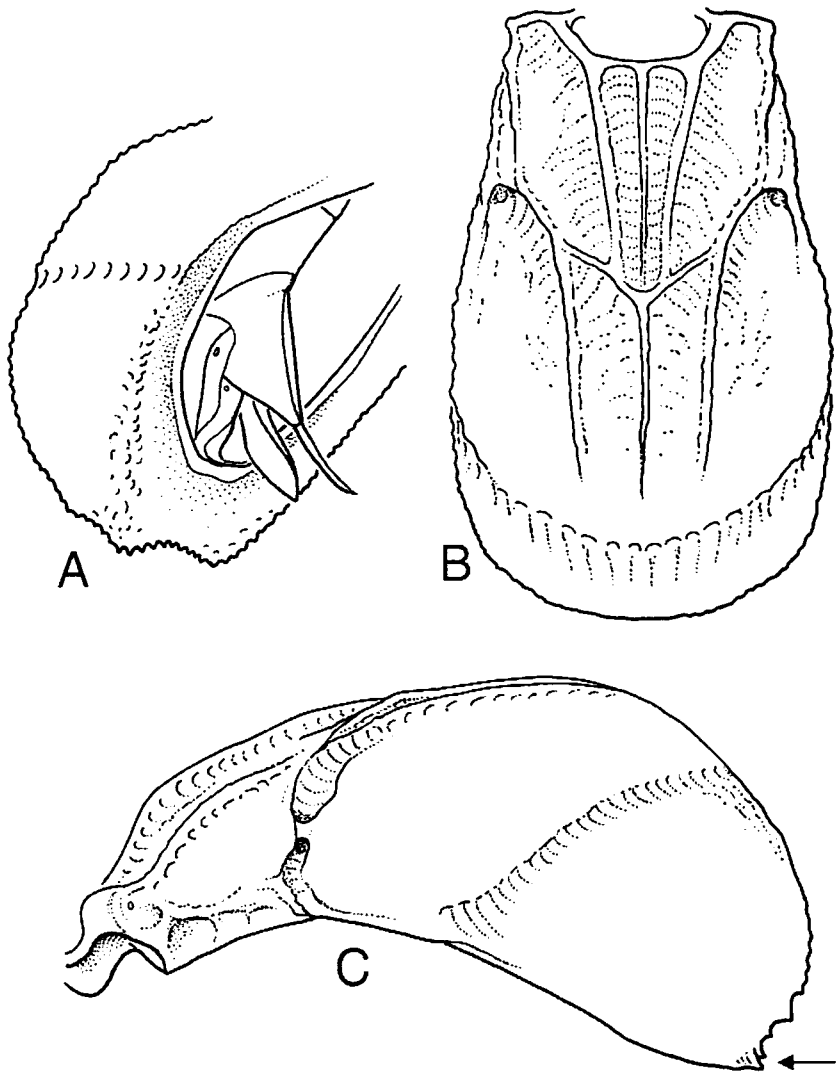

Fig. 4. *M. seyrigi* Granger. (A) Ventrolateral view of apex of metasoma. (B) Dorsal view of metasoma. (C) Lateral view of metasoma, arrow indicates posterior flange.

to predators, although this was somewhat doubtful because the horns are not sharp. In light of the discovery of the micropores the function may be partly, or entirely, to provide greater surface area for the secretion of chemicals.

High magnification of the setae of the hind tibia (Fig. 2C-E) shows longitudinal ridges and flattened, spoon-like tips. The ridged setae provide increased surface area which may facilitate grooming of the metasoma. I illustrate these setae in part because of their potential utility in uncovering phylogenetic relationships among the Sigalphinae.

Scanning electron microscopy was conducted only on a male paratype, so it is not known whether the females have dense micropores on the horns or whether they have modified setae on the hind tibia.

Discussion

Specimens of the seven African species of *Minanga* are recorded from the following countries: Democratic Republic of the Congo (Zaire), South Africa, Kenya, and Madagascar. The discovery of *M. achterbergi* has resulted in a very rare distribution pattern, with species restricted to the Nearctic and Afrotropical realms. There are many cases of taxa recorded in both the Afrotropical and Nearctic realms, but all of those that I have found also contain taxa in South America or the Caribbean. Undoubtedly, there are other taxa with distributions restricted to the Afrotropical and Nearctic realms but the point is that the pattern is exceedingly rare. One possible reason for the disjunction is that *Minanga* originally had a pan-

tropical distribution in Gondwana before South America split from Africa in the late Cretaceous. *M. achterbergi*, or its ancestor, then dispersed to North America via land bridges with South America in the Cenozoic (Graham 1992) and became extinct in South America. Another explanation is consistent with the Boreotropics hypothesis (Wolfe 1975, Lavin and Luckow 1993). Under this scenario, species of *Minanga* were widespread in Pangaea, including areas presently in the northern hemisphere, but became extinct in the Palearctic. Due to the paucity of known distributional data, both of these seem to be equally, albeit weakly, supported.

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