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A new *Meteorus* Haliday species from Colombia and Ecuador (Hymenoptera: Braconidae)

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Abstract

A new species of parasitoid wasp, *Meteorus gigas* Aguirre, Shaw and Jones (Hymenoptera: Braconidae), is described from Huila and Santander Provinces in Colombia and from Napo Province, in Ecuador. The new species is diagnosed and is compared to other species in the genus. Inferences about the possible biology of this species are discussed in consideration of the collecting methods used. The new species was most frequently found from Malaise trap samples but to a lesser extent from yellow pans and maxi-net sampling. Despite extensive sampling of caterpillars at this locality, the host of this new species remains unknown.

Resumen

Una nueva especie, *Meteorus gigas* Aguirre, Shaw, and Jones (Hymenoptera: Braconidae) es descrita para Huila y Santander Provincias en Colombia y de Napo Provincia, Ecuador. La especie es analizada y comparada con otras especies del género. Inferencias sobre la posible biología de esta especie es discutida teniendo en mente los métodos de colecta utilizados.

Key words: Braconidae, *Meteorus*, Neotropical, parasitoid, Malaise traps, yellow pan traps

Introduction

Meteorus Haliday is a diverse and widespread genus of Braconidae comprising more than 250 described species worldwide. These have been described or cataloged by Muesebeck (1923, 1939), Nixon (1943), Huddleston (1980, 1983), Shaw (1995, 1997), Maetô (1990), Chen and Wu (2000), Zitani and Shaw (2002), Zitani (2003), Shaw and Nishida (2005), Yu *et al.* (2005) and Stigenberg (2008). All *Meteorus* species, where biology is known, are koinobiont endoparasitoids (Shaw & Huddleston 1991). Most attack young exposed-feeding Lepidoptera caterpillars, although some parasitize Coleoptera larvae (Maetô, 1990; Shaw & Huddleston 1991; Shaw 1995, 1997). *Meteorus* species are also noted for their diverse silk-spinning and cocoon-forming behaviors (Zitani & Shaw 2002, Zitani 2003). While most are solitary parasitoids of small caterpillars, such as Geometridae, Noctuidae and Pyralidae, several tropical *Meteorus* species are known to be gregarious parasitoids of larger caterpillars including some Sphingidae and Limacodidae (Muesebeck 1939, 1958; Nixon 1943; Zitani *et al.* 1997, 1998; Zitani 2003; Shaw & Nishida 2005). Neotropical *Meteorus* species have been the focus of recent taxonomic studies (Zitani *et al.* 1997, 1998; Shaw & Nishida 2005; Shaw & Jones 2009) but many Neotropical species still remain undescribed. The purpose of this paper is to describe a distinctive new *Meteorus* species from Colombia and Ecuador, commonly collected by Malaise and yellow pan traps.

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Materials and Methods

Specimens for this study were sampled by Malaise traps and yellow pans in Colombian and Ecuadorian cloud forests. Ecuadorian specimens of *M. gigas* were collected during the *Caterpillars and Parasitoids of the Eastern Andes of Ecuador* (CAPEA) project (NSF-BSI-03-46729; NSF-BSI-07-17458; Dyer *et al.* 2008). At the Ecuador study site, extensive rearing of potential host caterpillars was also conducted, as described in Shaw and Jones (2009). The Colombian specimens were collected at several cloud forest localities. All Ecuadorian specimens were collected at one locality, the Yanayacu Biological Station and Center for Creative Studies, at 2163 m, 00º35.9'S 77º53.4'W, which is situated on the northeastern slope of the Andes in Napo Province, Ecuador. The Yanayacu reserve comprises both primary and secondary growth montane forests (Greeney 2007). The Holdridge life zone is tropical montane moist forest (Holdridge 1967).

All previously named Neotropical species of *Meteorus* have been examined during previous studies (Shaw 1985; Zitani *et al*. 1997, 1998; Shaw & Nishida 2005; Shaw & Jones 2009) and this new species was determined by SRS to be distinct from any known species. Specimens of *M. gigas* were also compared directly to holotype specimens of 17 previously described Ecuadorian and Costa Rican *Meteorus* species.

Type specimens are deposited in the entomological collections of the Universidad Nacional de Colombia, Instituto de Ciencias Naturales (ICN) in Bogota, the University of Wyoming Insect Museum (UWIM) in Laramie and the Museo Ecuatoriano de Ciencias Naturales (MECN) in Quito, Ecuador.

Morphological terminology and the character-set used in the description follow Wharton *et al.* (1997), Zitani *et al*. (1997, 1998), Shaw & Nishida (2005), and Shaw & Jones (2009). Microsculpture terminology follows Harris (1979). The specimens were measured using a Motic SMZ-168 advanced stereomicroscope with magnification zoom range 7.5 x to 50 x and eyepiece of 10 x with microrule attached to a JVC digital camera. Images were captured using Auto-Montage software Combine Z5.3 program. Scanning electron microscopy was done at the University of Wyoming Microscopy Core Facility using a Hitachi tabletop scanning electron microscope, model TM-1000. Specimens were examined uncoated at an operating voltage of 15 kV.

Meteorus gigas Aguirre, Shaw and Jones, sp.nov.

(Figs 1–9)

Description. Holotype female. Body length 8.3 mm. Mostly black, except antenna brown with white annulus comprising F11–F21; mandibles yellow basally, testaceous medially; palpi yellow; fore coxa testaceous posterodorsally; fore tibia dark brown; wing membrane slightly infused; wing venation, pterostigma dark brown; first tergite yellow basally, apically; second tergite yellow near spiracle; ovipositor, sheath dark brown.

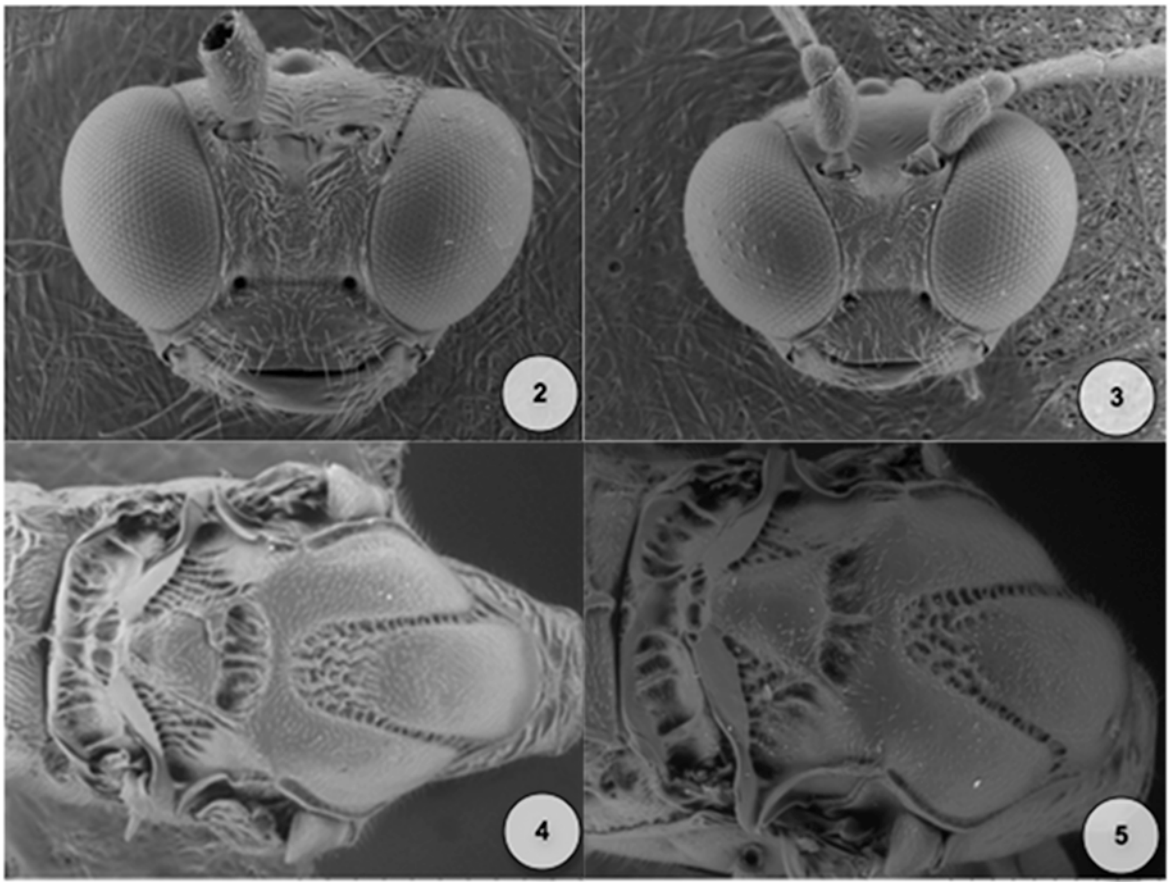
Head. Antenna with 33 flagellomeres; flagellar length/width ratios as follows: F1 = 5.37, F2 = 5.25, F3 = 3.78, F21 = 1.67, F22 = 1.56, F23 = 1.65, F24 = 1.65, F25 = 1.65, F33 (apical flagellomere) = 2.62; head 1.25 x wider than height; eye large and protuberant, nearly parallel in anterior view; head height 1.44 x eye height; temples length 0.46 x eye length in dorsal view; maximum face width 1.31 x minimum face width; minimum face width 0.57 x clypeus width; malar space length 0.22 x mandible width basally; ocelli small, ocello-ocular distance 1.96 x ocellar diameter; mandibles not twisted; clypeus punctate; face rugulose; frons with shallow strigate depressions behind the scape; vertex smooth; occipital carina complete.

Mesosoma. Notauli distinct, foveate converging in rugose area, mesonotal lobes well defined; scutellar furrow with three distinct carinae; pronotum foveate-rugose; propleuron puncticulate; mesopleuron smooth, polished; sternaulus foveate; metapleuron rugose; propodeum carinate-rugose, distinct median, transverse carinae creating very large, defined areolae; median depression absent. Legs: hind coxa rugulose-punctate; tarsal claw simple.

Wings. Forewing length 6.41 mm.; vein m-cu antefurcal; second submarginal cell of forewing strongly narrowed anteriorly; vein r 0.81 x length of 3RSa; 3RSa length 0.82 x r-m length; 1M length 1.29 x cu-a length of hindwing; 1M length 0.81 x 1r-m length.

Metasoma. First metasomal tergite without dorsopes; ventral borders of first tergite separated basally, joined apically; first tergite dorsally smooth; ovipositor long, thick at base, 3.33 x longer than first tergite.

FIGURE 1. Lateral habitus of *Meteorus gigas* **sp.nov.**



FIGURES 2–5. Figure 2. Head of *Meteorus gigas* **sp.nov.**, female, anterior view, 120 x. **Figure 3**. Head of *Meteorus megalops* Zitani, female, anterior view, 120 x. **Figure 4**. Anterior mesosoma of *Meteorus gigas* **sp.nov.**, female, dorsal view, 100 x. **Figure 5**. Anterior mesosoma of *Meteorus megalops* Zitani, female, dorsal view, 150 x.

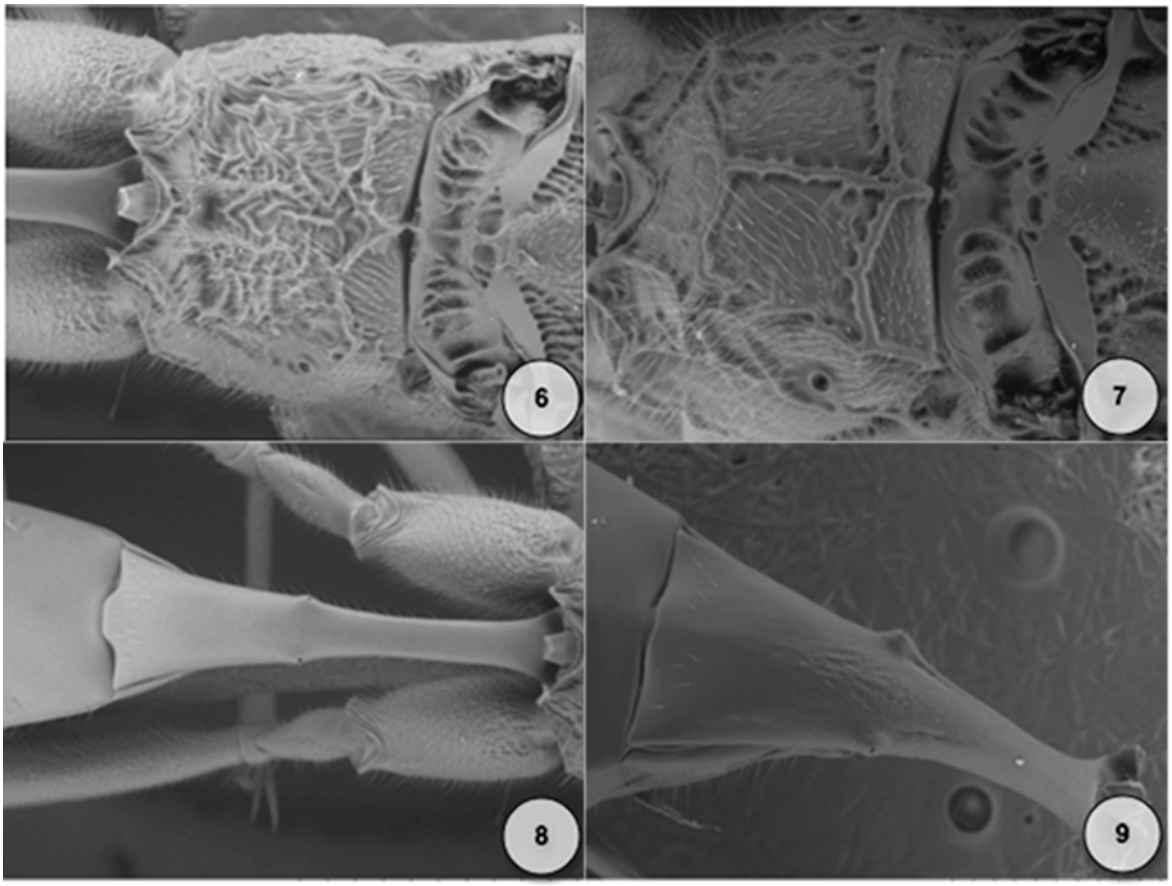
Variation, female paratypes. Body length 8.0–9.76 mm.; antenna with 30–34 flagellomeres; white annulus sometimes comprising F11–F20; F21 color varying from white to brownish-white to brown; head 1.21–1.3 x wider than height; head height 1.37–1.45 x eye height; temple length 0.46–0.53 x eye length in dorsal view; maximum face width 1.27–1.37 x minimum face width; minimum face width 0.53–0.61 x clypeus width; malar space length 0.21–0.31 x mandible width basally; ocello-ocular distance 1.96–2.5 x ocellar diameter. Forewing length 6.42–7.36 mm; vein r 0.7–1.12 x length of 3RSa; 3RSa length 0.57–0.83 x r-m length; 1M length 1.17–1.53 x cu-a length of hindwing; 1M length 0.82–0.9 x 1r-m length; ovipositor 2.61–3.81 x longer than first tergite.

Variation, male paratypes. Body length 6.43–7.0 mm.; antenna black, without pale annulus; antenna with 30–36 flagellomeres; head 1.17–1.19 x wider than height; head height 1.63–1.72 x eye height; temples length 0.74–0.82 x eye length in dorsal view; maximum face width 1.07–1.12 x minimum face width; minimum face width 0.82–0.86 x clypeus width; malar space length 0.44–0.62 x mandible width basally; ocello-ocular distance 2.33–2.86 x ocellar diameter. Trochanter, along with fore and middle coxae, yellow. Forewing length 5.9–6.25 mm.; vein r 0.97–1.33 x length of 3RSa; 3RSa length 0.43–0.77 x r-m length; 1M length 1.21–1.57 x cu-a length of hindwing; 1M length 0.8–1.02 x 1r-m length. Metasomal tergum 1 yellowish-brown; T2 and T3 basally varying from yellowish brown to black.

Holotype data. Female (point mounted), **COLOMBIA, Huila**, Cueva de los Guacharos National Park, Cabaña Cedros, 1°37´N 76°6´W, 2100 m., Malaise trap, 4–18.ii.2002, C. Cortés leg, deposited in Instituto de Ciencias Naturales (ICN) Entomological Collection, Universidad Nacional de Colombia.

Paratype data. 13 females and 19 males. **COLOMBIA, Huila,** same data as holotype except collected on the following elevations and dates: 2 females, 1950 m., 28.xi–2.xii.2001, D. Campos leg; 2 females, 2100 m.,

6–27.iv.2002,. J. Fonseca leg; 1 male, 2100 m., 4–18.ii.2002; 2 females, 1 male, 2100 m., 27.iv–5.v.2002, J. Fonseca leg; 1 male, 2100 m., 27.xi–2.xii.2001, D. Campos leg; 1 male, 2100 m., 18.ii–7.iii.2002; 1 male, 2100 m., 20.iii–6.iv.2002, J. Fonseca leg; same date except collected by red traps on the following elevations and dates: 1 female, 1950 m., 30.xi.2001, D. Campos leg. **COLOMBIA, Santander,** 1 female, Tamá National Park, Municipio Toledo, Vda. La Camacha, Pozo Negro, 7º21'N 72º28'W, 2213 m., Malaise trap, 23.x–2.xi.2003, C. Leal leg, deposited in ICN. **ECUADOR, Napo**, 1 male, Yanayacu Biological Station, S 00°35.9' W 77°53.4', 2163 m, 1–8.ii.2008, J. Simbaña Macucoloma trail, Malaise trap, NSF-BSI-07–17458; same data except collected on the following dates: 1 female, 1–8.vi.2007; 2 females, 1–8.viii.2007; 1 male, 5–12.xi.2007; 1 male, 3–10.xii.2007; 4 males, 1–10.ii.2008; 1 male, 2–9.iv.2008; 1 female, 2 males, 1–10.vi.2008; same date except collected by yellow pans on the following dates: 2 males, 1–10.vii.2007; 1 female, 1–8.i.2008; 1 male, same data except collected by maxi net, 31.vii.2006, Andrew Townsend. Ecuador paratypes deposited in UWIM and MECN.



FIGURES 6–9. Figure 6. Propodeum of *Meteorus gigas* **sp.nov.**, female, dorsal view, 120 x. **Figure 7.** Propodeum of *Meteorus megalops* Zitani, female, dorsal view, 180 x. **Figure 8.** First metasomal tergum of *Meteorus gigas* **sp.nov.**, female, dorsal view, 100 x. **Figure 9.** First metasomal tergum of *Meteorus megalops* Zitani, female, dorsal view, 150 x.

Etymology. The specific epithet is from the Latin *gigas*, meaning "giant" or "large," in reference to the very large body size of this *Meteorus* species.

Comments. In the key to Costa Rican *Meteorus* species by Zitani *et al.* (1998) *M. gigas* keys to couplet 17 (near *M. megalops* Zitani). This new species is most similar to *M. megalops*, sharing the following: mandibles not twisted, eyes large and protuberant (Fig. 2–3), ocelli small, flagellum with white annulus medially (Fig. 1), occipital carina complete, ventral borders of first tergite joined medially, separated basally and apically, and ovipositor long (2.61–3.81 x longer than first tergite) and thick at base (Fig. 1). *M. gigas* differs in being

strikingly larger (8.0 to 9.76 mm vs. 5.4 mm or less), having more flagellomeres (30–36 vs. 24–25), female eyes less convergent ventrally than *M. megalops*, in which these are strongly convergent in anterior view (Figs 2–3). The notauli of *M. gigas* are strongly foveate (Fig. 4) while in *M. megalops* the notauli are more finely foveolate (Fig. 5). The propodeal sculpture is carinate-rugose in *M. gigas* (Fig. 6) while carinate in *M. megalops* (Fig. 7). The mesopleuron is more rugose in *M. gigas* (Fig. 1) while smoother in *M. megalops*. The first metasomal tergite is dorsally smooth in *M. gigas* (Fig. 8) while finely longitudinally costate in *M. megalops* (Fig. 9). Additionally there are some obvious color differences: *M. gigas* body color is mostly black (Fig. 1) while the *M. megalops* body color is dark brown. The fore and middle coxae of *M. gigas* are mostly black (Fig. 1) while the fore and middle coxae of *M. megalops* are entirely yellow.

It is interesting to note that while more than 30,000 individual caterpillars have been reared so far in the Ecuador CAPEA project, including numerous examples of Geometridae and Noctuidae (known hosts for other *Meteorus* species), *M. gigas* has not yet been reared from a host caterpillar. On the other hand, sampling by Malaise traps (both in Ecuador and Colombia) has shown *M. gigas* to be a species that is active as flying adults during all months except August and September. The species has also been collected using yellow pans and by maxi-net, but not yet collected at black lights. This gap between sampling methods shows the importance of using diverse sampling methods for assessing biodiversity of Braconidae in an area, and provides clues about possible hosts. Since the common and apparent caterpillars of the low vegetation at Yanayacu have now been well-sampled, the absence of *M. gigas* reared from these hosts suggests that the species may selectively parasitize either very cryptic caterpillars, nocturnal caterpillars, caterpillars that feed high in the forest canopy, or the species may parasitize beetle hosts that are not yet being sampled in the Ecuador CAPEA project.

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