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TWO NEW SPECIES OF BRACONID WASPS (HYMENOPTERA: BRACONIDAE: MIRACINAE: *MIRAX* AND ROGADINAE: *CHOREBOROGAS*) FROM MEXICO

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ABSTRACT

Two new species of braconid wasps (Hymenoptera: Braconidae) collected in the Mexican Yucatan Peninsula are described. *Mirax avena* **sp. nov.** is the first species described of this genus for Mexico, *Choreborogas odontofemoralis* **sp. nov.** is the second species of the genus described in the country. The new species are compared with other species in its respective genus and a key is provided for correct determination. Diagnosis and morphological character illustrations are provided.

Key Words: Neotropical, parasitic wasps, Hymenoptera, Braconidae, Miracinae, Rogadinae

RESUMEN

Se describen dos especies nuevas de avispas bracónidas (Hymenoptera: Braconidae) colectadas en la Península Mexicana de Yucatán. *Mirax avena* **sp. nov.** es la primera especie del género que se describe para México, *Choreborogas odontofemoralis* **sp. nov.** es la segunda especie del género que se describe para el país. Las nuevas especies son comparadas con otras especies del mismo género y se provee de una clave para la correcta determinación específica. Se proporciona la diagnosis e ilustraciones de caracteres morfológicos distintivos.

Palabras Clave: Neotropical, avispas, parasitoides, Hymenoptera, Braconidae, Miracinae, Rogadinae

Braconid wasps (Hymenoptera: Braconidae) represent an important insect group in biodiversity and conservation studies. Braconids are systematically speciose with 19,434 described species, but perhaps close to 40,000 total species (Campos & Sharkey 2006; Yu et al. 2012). They are worldwide in distribution (Wahl & Sharkey 1993) and play an ecological role as regulators of other insect groups, finally they are used in the biological control of agricultural and forest pests (Coronado et al. 2004).

Mexico is considered a megadiverse country, with many endemic species of plants and animals, due to its complex biogeographical ecosystems (Morrone et al. 2002) and the mixture of Neotropical with Nearctic mountain and desert elements (Wharton & Mercado 2000; Morrone & Márquez 2008). The diversity of Braconidae in Mexico has been explored superficially; 584 species has been described or reported to the country (Yu et al. 2012), which represent 10 % of the potentially distributed species (Wharton & Mercado 2000).

Mirax Haliday is a small genus with a worldwide distribution and 20 described species (Yu et al. 2012) reported as parasitoids of lepidopteran leafminers (Whitfield & Wagner 1991; Gates et al. 2002). Some species attack pests of economic im-

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portance, for example, *M. insularis* Muesebeck, is a parasitoid of the coffee leafminer, *Leucoptera coffeella* Guér. (Muesebeck 1937).

Species of this genus have been described from North America (Ashmead 1893; Rohwer 1914; Walley 1941; Muesebeck 1922; Papp 1989) and South America (Brues 1912; Marsh 1979; Papp 1993). In Mexico, *Mirax* Haliday has been reported only at the genus level in several states (Sánchez & López 2000; Wharton & Mercado 2000; Delfín & León 1997), but no species has been described or reported at this time.

When the genus *Choreborogas* was described (Whitfield 1990), 2 Neotropical species were included. Later, Achterberg (1995) described 6 species from Panama. Host records for this genus include only leafminers of the families Lyonetiidae (Whitfield & Wagner 1991) and Gracillariidae (Penteado-Dias & Ramiro 2009). Until now, *Choeborogas birostratus* Whitfield is the only species reported in Mexico (Colima, Guerrero, Michoacan, Morelos, Oaxaca, Tamaulipas and Yucatán) (Whitfield 1990; López-Martínez et al. 2009).

In current studies on biodiversity and conservation of parasitoid wasps in the Yucatan Peninsula of Mexico (Cauich-Kumul et al. 2012), specimens of *Mirax* and *Choreborogas* representing new species were collected. This material represents the first species described of *Mirax* and the second of *Choreborogas* in Mexico.

Materials and Methods

The keys of Achterberg (1990) and Wharton et al. (1997) were used for the identification of the braconid species to subfamily level; keys and descriptions by Achterberg (1995) and Whitfield (1990) were used for *Choreborogas,* and descriptions by Ashmead (1893), Brues (1912), Rohwer (1914), Muesebeck (1922), Walley (1941) Marsh (1979) and Papp (1989, 1993) were used for determining *Mirax* species.

Description of the new species is based on all the material examined. Terminology for descriptions follows Sharkey & Wharton (1997), and for measurements, Achterberg (1988). Figures were prepared by a camera DXM 1200 C Nikon, a stereomicroscope SMZ 1500 Nikon, and the software CombineZM ver 5.3. Measurements were taken with a micrometer attached to a stereomicroscope (Olympus SZ 11) and are given in millimeters.

Specimens are deposited in the Canadian National Collection of Insects (CNC); Colección Entomológica Regional, Universidad Autónoma de Yucatan (CER-UADY); Coleccion Entomológica de la Escuela Superior de Ciencias Agropecuarias (CEESCA-UACH); and Hymenoptera Institute, Department of Entomology, University of Kentucky (HIC).

Mirax avena, **sp. nov.**
Cauich, López & Delfín
(Figs. 1-4)

Female

Body length 1.20-1.42 mm.

Color. Body brown to dark brown, shiny, except for the following: terguites and sternites I, II and III, yellowish; antenna dark brown, scape and pedicel yellowish; legs yellowish, tarsi brown; labial and maxillar palps yellowish; margin of mandible yellow, tip dark brown.

Head. Antenna with 12 flagellomeres densely covered with small setae. Terminal flagellomere acute. Third flagellomere 1.6-3 times longer than wide; fourth flagellomere 1.5-2.6 times longer than wide; penultimate flagellomere 1.6-2 times longer than wide; surface of the face smooth; clypeus transversal and convex (Fig. 1), smooth, scarcely covered with setae; malar space 1.2-2 times the mandible base width; vertex and frons smooth.

Mesosoma. Notauli indistinct, metanotum smooth, propodeum smooth with a longitudinal carina diverging distally, pronotum with longi-

Fig. 1. Frontal view of head, *Mirax avena* **sp. nov.**

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tudinal carina, mesopleuron and metapleuron smooth and shiny.

Wings. Fore wing: (RS+M)a vein absent; stigma 2.5-6.2 times longer than wide, 1CUb vein 1.6-2.6 times longer than 1CUa vein; r-m vein absent; 1M vein straight; 2-1A vein incomplete; 2CUa vein absent, therefore the first subdiscal cell is open (Fig. 2). Hind wing: 4.3-5.1 times longer than wide; subbasal cell closed, not reaching the wing margin (Fig. 3).

Legs. Hind femur 2.7-3.1 times longer than wide; tibia 8.2-11.3 times longer than wide; hind basitarsus 3.6-5.3 times longer than wide; hind tibial spurs 0.2-0.4 times the length of the hind basitarsus.

Metasoma. Petiole weakly sclerotized posteriorly, with a large drop shape, rest of the surface membranous but with oblique striae; terguite II weakly sclerotized, with an inverted "E" shape in the sclerotized area, the middle projection is wider posteriorly, reaching terguite I, rest of terguite surface membranous with longitudinal striae. Terguite III with an anterior rounded sclerotized area, rest of terguite and metasoma sclerotized and pigmented (Fig. 4).

Male.

Body length 1.24 mm. Similar in structure and body color, except for their genital structures.

Material Examined

HOLOTYPE. Female. MEXICO, Yucatan, El Cuyo, Cementerio, 30/05/-16/06/08, sand dune thicket, Malaise trap, Col. R. Cauich, 107. Deposited in Canadian National Collection of Insects, Ottawa. PARATYPES, all specimens from Yucatan. 1♂ and 1♀ same data as holotype; 1♀ same data but 18/03/08, Malaise 6; 1♀ same data but 19/05/-03/06/08; 1♀ same data but 28/07/-12/08/08; 4♀ same data but 15/04/09, Savanna, Malaise trap; 1♀ same data but 13/05/09, Savanna, Malaise trap; 1♀ same data but 08/07/09, Savanna, Malaise trap; 1♀ same data but 23/12/09, Savanna, Malaise trap; 1♀ Ria Lagartos, 18/02/-04/03/09, Savanna, Malaise trap; 1♀ Sacboh, 16/06/-30/06/08, tropical forest, Malaise trap. One specimen deposited en HIC, rest of them in CER-UADY.

Etymology

From Latin "a" absent, and "vena" vein, refers the absence of (RS+M)a vein in the fore wing.

Host

Unknown. According to Papp (1989), Whitfield & Wagner (1991), and Beyarslan (2009) the species of *Mirax* are solitary endoparasitoids of lepidopteran larvae of Coleophoridae, Graciillaridae, Heliozelidae, Nepticulidae and Tischeriidae on many host plants. Possibly *Mirax avena* **sp. nov.** is a parasitoid of a lepidopteran leafminer in Yucatan, Mexico.

There is no species key to identify the New World *Mirax*, however, *M. avena* **sp. nov.** can easily be identified by the absence of the fore

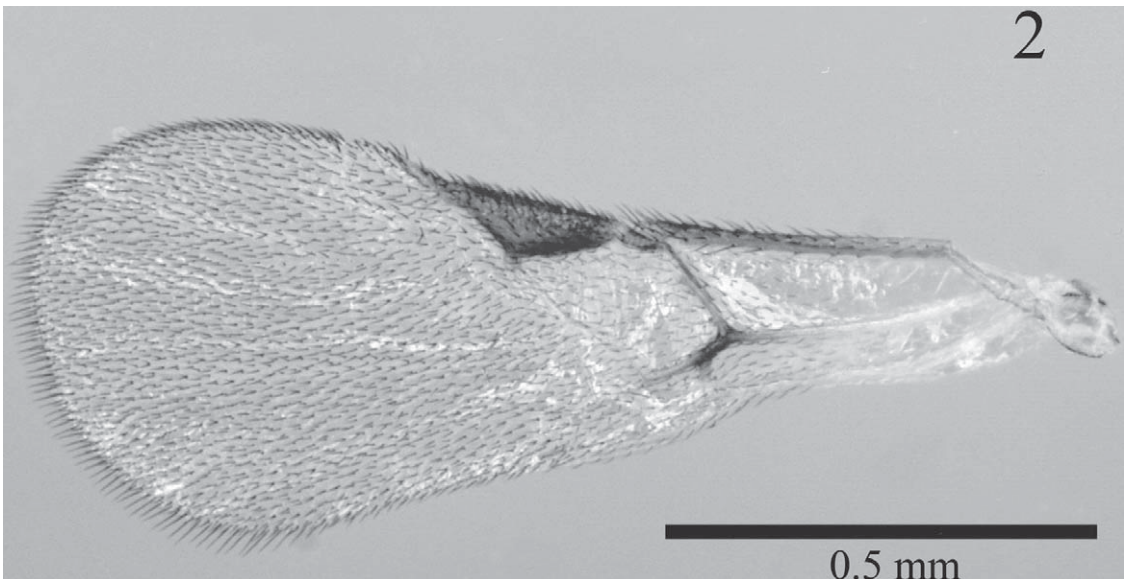

Fig. 2. Fore wing, *Mirax avena* **sp. nov.**

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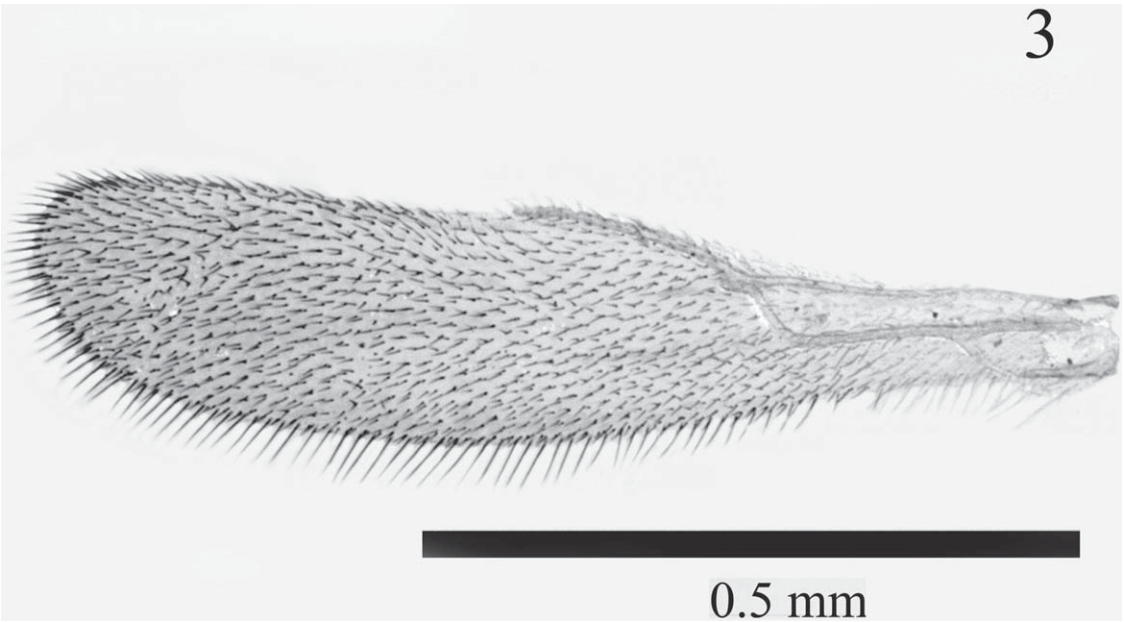

Fig. 3. Hind wing, *Mirax avena* **sp. nov.**

wing (RS+M)a vein, which separates it from the other species of the genus.

Fig. 4. Dorsal view of torax and metasoma, *Mirax avena* **sp. nov.**

CHOREBOROGAS ODONTOFEMORALIS LÓPEZ, DELFÍN & GARCÍA, **SP. NOV.**

Female

Body length. 1.34-1.75 mm.

Color. Dark brown, except for the following: labial and maxillar palps yellow; antennal scape, pedicel and flagellomeres I and II yellow, the remaining flagellomeres dark brown; terguite I, anterior and middle terguite II, yellowish brown; terguite III brown; fore and middle legs yellowish; hind femur yellow proximally, distally brown, femoral tooth yellow; hind tibia yellow, except distal 1/3, brown.

Head. Antenna with 14 flagellomeres; length of the third, fourth and penultimate flagellomere 3.3-6, 3.3-5.75 and 2.66-4.5 times longer than width; pedicel long, 1.09-1.5 times scape length; eye dorsal length 1.71-2.08 times longer than the temple; malar suture conspicuous (Fig. 5). Vertex finely granular, gena and temple smooth, face slightly punctated and flattened. Malar space length 1.0 times mandible basal width.

Mesosoma. Mesoescutum and scutellum with granular surface. Notaulus not evident. Scutellar sulcus smooth, without carinae. Pronotum smooth; mesopleuron granular in upper area, smooth on the rest. Metapleuron granular. Propodeum with a pentagonal propodeal areola, with two short projections at the upper corners; propodeal carina larger than the length of the propodeal areola, with carinae open laterally on the sides of the propodeal areola. Propodeum almost smooth surface with small rugose lines.

Wings. Fore wing (Fig. 6): Stigma whitish; 4-5.1 times longer than wide; wings hyaline

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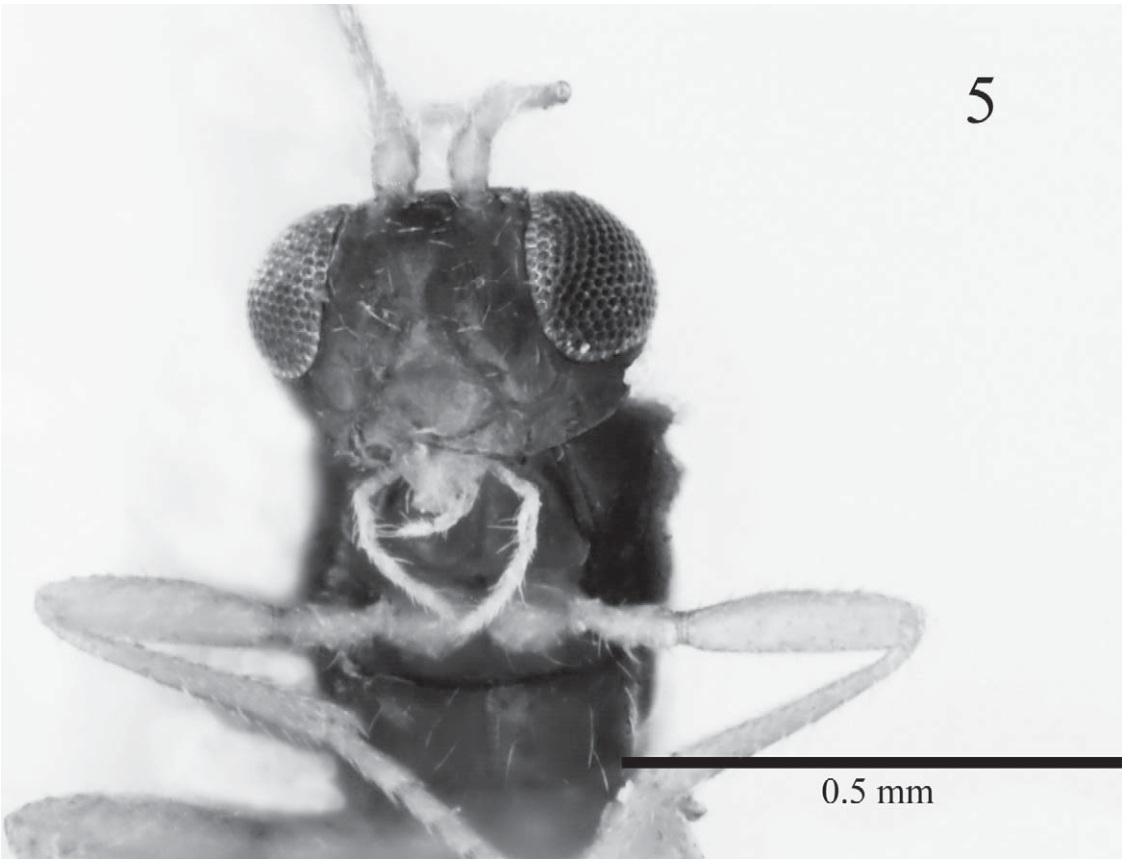

Fig. 5. Frontal view of head, *Choreborogas odontofemoralis* **sp. nov.**

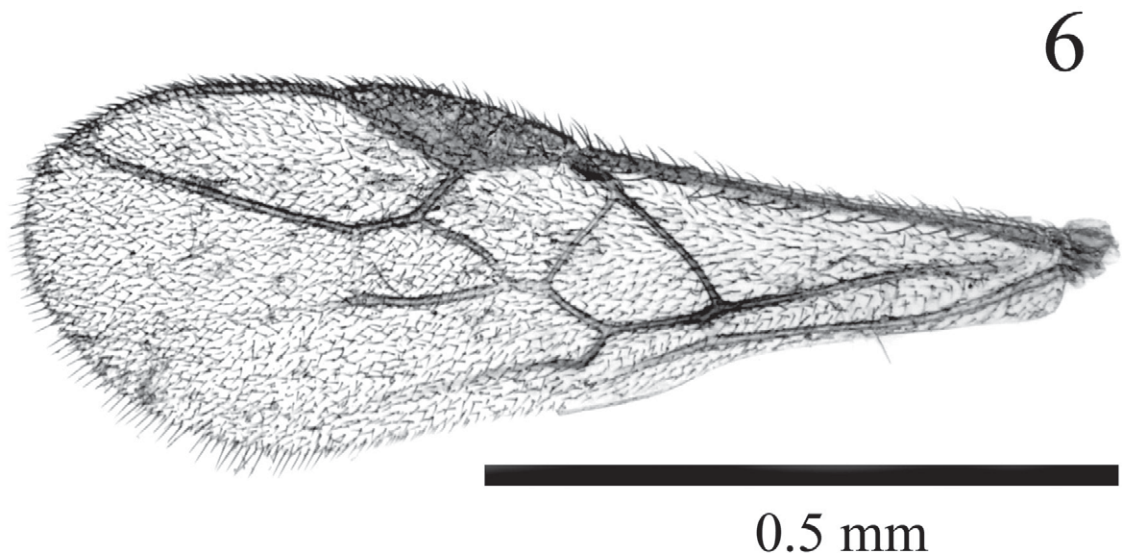

Fig. 6. Frontal wing, *Choreborogas odontofemoralis* **sp. nov.**

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except for a dark band that runs through the 1st discal cell, first submarginal cell and anteriorly to second discal and marginal cells. Vein r emerges at basal 0.3-0.32 of stigma; vein 1CUa short, 6.66 times longer than 1CUb; vein 2cu-a absent, 1st subdiscal cell open (Fig. 8). Hind wing: vein 1-M 1.27 times longer than M+CU (Fig. 7).

Legs. Hind femur posterior thick, 2.61-4 times longer than wider, with obtuse and conspicuous tooth on the ventral surface (Fig. 9). Hind tibia 6.66-7.4 times longer than wider. Basitarsus 3-3.83 times longer than wider. Tibial spurs shorter, 0.27-046 times the length of basitarsus.

Metasoma. Deeply granulate; terguite I with median carina behind subbasal ring of dorsal carinae, terguite I length I 1.5-1.71 its apical width. Terguites II and III without longitudinal carina. Length of terguite II 0.86-0.97 its basal width (Fig. 6). Ovipositor sheaths and ovipositor barely visible.

Male

Body length: 1.59 mm. Body color brown, terguite I and II dark brown. Similar to the female in body structure, except for their genital structures.

Material Examined

HOLOTYPE: Female. MEXICO, Yucatan, Merida County, Yaxnic, 9/II/01, Col. D. Chay and L. Hernandez colls., malaise trap in cucumber crop (3203001006). Deposited in CNC. PARATYPES. 3♀, Mexico, Campeche, El Tormento, 26/I-2/II/2010, malaise trap, labeled as 10-DABCAMP-00017, 10-DABCAMP-00018 and 10-DABCAMP-00033; 1♀ same data but 10-18/III/2010 (10-DABCAMP-00103); 1♂ Mexico, Yucatan, Sudzal Chico, 7/IV/1999, Col. L. Hernandez coll., tropical forest; 1♀ same data as holotype but 7/II/01, tropical forest (3203001009); 1♀ same data as holotype but 24/I/01 (3203001008). Paratypes from Campeche are deposited in CE-ESCA-UACH, material from Yucatan in CER-UADY.

Etymology

From Greek "odonto" tooth and "femoralis" femur, refers to the presence of an obtuse tooth on the ventral surface of the hind femur.

Host

Unknown. All Rogadinae sensu stricto are koinobiont endoparasitoids, which mummify the larva host (Quicke & Shaw 2005). Known species of the genus *Choreborogas* are endoparasitoids of Lyonetiidae and Gracillariidae (Whitfield & Wagner 1991; Penteado-Dias & Ramiro 2009). Possibly *C. odontofemoralisis* **sp. nov.** is a koinobiont endoparasitoid of these microlepidopteran of the Yucatan Peninsula.

Choreborogas odontofemoralis **sp. nov.** runs to couplet 3 in the key of Achterberg (1995) for *Choreborogas* of the New World, and can be identified in the following modified key:

3. Lower half of face of ♀ without depression 3a

—. Lower half of face of ♀ with depression, with pair of minute flattened projections dorsally ..... *C. birostratus* Whitfield 1990

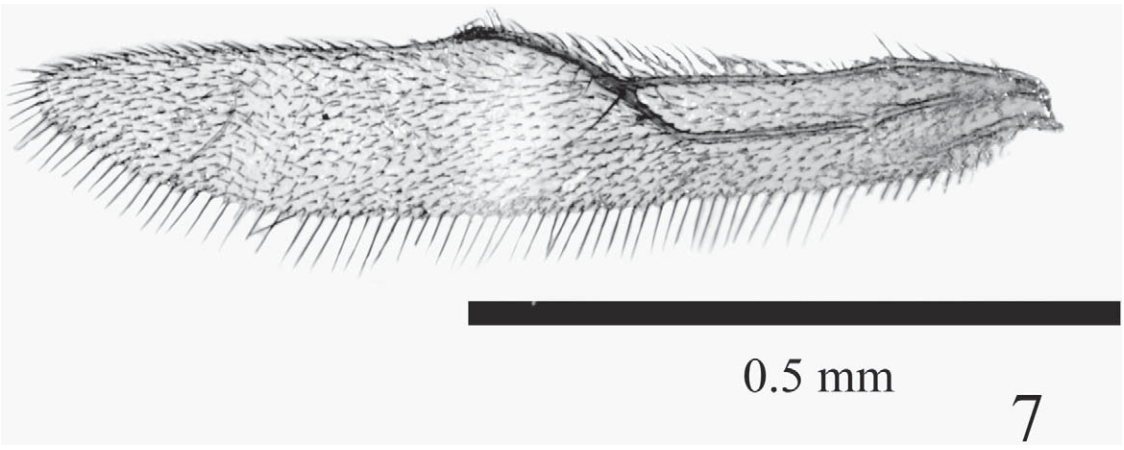

Fig. 7. Hind wing, *Choreborogas odontofemoralis* **sp. nov.**

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Fig. 8. Hind femur, *Choreborogas odontofemoralis* **sp. nov.**

3a. Hind femur with an obtuse tooth ..... *C. odontofemoralis* **sp. nov.**

—. Hind femur without an obtuse tooth ..... *C. minutus* Achterberg 1995

Discussion

The placement of the genus *Mirax* in the subfamily Miracinae is widely accepted (Valerio 2007), mainly in the Americas. Others authors considered *Centistidea* as a valid genus (Chen et al. 1997; Beyarslan 2009) in the subfamily. A longitudinal carina in the propodeum has been used to separate *Centistidea* (with carina) and *Mirax* (without carina) (Chen et al. 1997) as 2 valid genera; but apparently it is not a synapomorphic character to support the monophyly of both groups (Walley 1941; Marsh 1979; Belokobylskij 1989; Papp 1989, 1993). The lack of a systematic world study of the subfamily makes it difficult to define the appropriate use of both genera, and the recognition of other possible genera. Our concept of the genus *Mirax* is based on the criteria used by Valerio (2007). In *Mirax* species, the (RS+M)a vein in the fore wing can be present only at the base of the wing or may be a complete vein (Wharton et al. 1997), *Mirax avena* **sp. nov.** is the first species described with the (RS+M)a vein totally absent.

Choreborogas and the genera *Polystenidea* and *Stiropius* are included in the monophyletic tribe Stiropiini and are considered as truly Rogadinae (Zaldívar-Riverón et al. 2008); is a medium-sized genus with at least eight species described from the Neotropical region. Prior to this study in Mexico the genus was represented by *C. birostratus* collected from northern to southeastern states (Whitfield 1990; López-Martínez et al. 2009).

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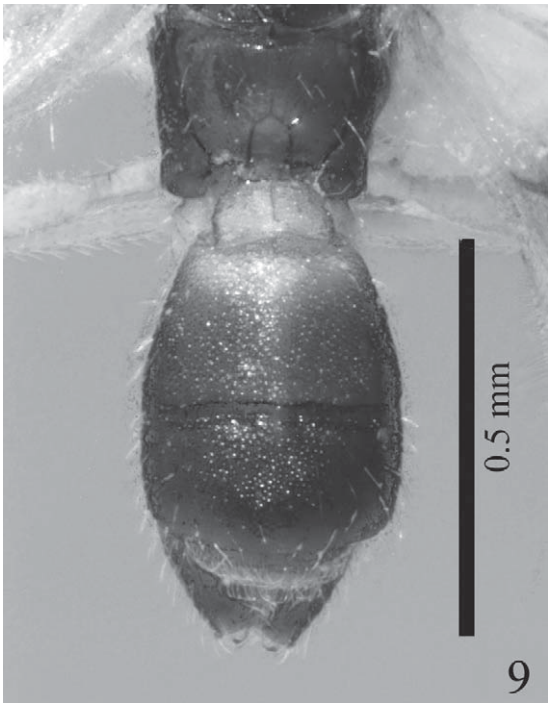

Fig. 9. Dorsal view of propodeum and metasoma, *Choreborogas odontofemoralis* **sp. nov.**

Only a small fraction of the Mexican Braconidae is known (Figueroa-De la Rosa et al. 2004), but the number increases with numerous studies presently conducted by many braconologists.

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