

## Review of the microgastrine braconid wasp genus *Exoryza*, with description of a new species, *E. monocavus*, from Central America

A. A. VALERIO<sup>1,2</sup>, A. R. DEANS<sup>2</sup> & J. B. WHITFIELD<sup>2</sup>

<sup>1</sup> Central American Institute of Biological Research and Conservation (CIBRC). P.O. Box 2398-2050 San Pedro de Montes de Oca, San José, Costa Rica. (AAV) avalerio\_13@hotmail.com.

<sup>2</sup> Department of Entomology, 320 Morrill Hall, University of Illinois at Urbana-Champaign, 505 S. Goodwin Ave, Urbana, IL 61801, U.S.A. (ARD) adeans@life.uiuc.edu, (JBW) jwhitfie@life.uiuc.edu.

### Abstract

A new species of the rarely collected microgastrine braconid wasp genus *Exoryza* Mason, *E. monocavus* n. sp., is described and illustrated. With this finding, the geographical range for the genus is extended to Central America in the New World, from a previous known distribution including only North America (*E. minnesota* Mason) and Asia (*E. schoenobii* (Wilkinson)). The two previously described species are redescribed, and an illustrated key for all three species is presented.

**Key words:** Hymenoptera, Braconidae, *Exoryza*, new species, New World tropics

### Introduction

The braconid wasp subfamily Microgastrinae, with approximately 1500 described species and dozens of species employed in the biological control of lepidopteran pest insects (Whitfield, 1997), constitutes one of the most important groups of parasitoids. Despite its economic and ecological importance, the subfamily still is poorly known in many areas of the world, especially in the New World tropics and Southern Hemisphere temperate zones. New genera are still being described in the group periodically, and other genera are known from only a few identified specimens even though it is clear they contain multiple species. One of the most infrequently collected and poorly known microgastrine genera is the genus *Exoryza* Mason.

Mason (1981) described *Exoryza* to include those species in the tribe Apantelini with broad, heavily sculptured metasomal tergites I and II and a coarsely rugose (although apparently areolate) propodeum. He included in the genus two species: *E. schoenobii*

(Wilkinson), which has been reared from stem-boring pyraloid moths (Lepidoptera) in rice (Poaceae) in the Philippines, and *E. minnesota* Mason (no known host). Mason (1981) considered *Exoryza* to be largely north temperate in distribution with one Asian species (*E. schoenobii*) and one North American species (*E. minnesota*). New material from the Instituto Nacional de Biodiversidad (Costa Rica) expands the range of *Exoryza* into the sub-cloud forest habitats of Central America. The current material suggests that the genus may have a very broad geographical distribution that is very poorly sampled.

### Material and Methods

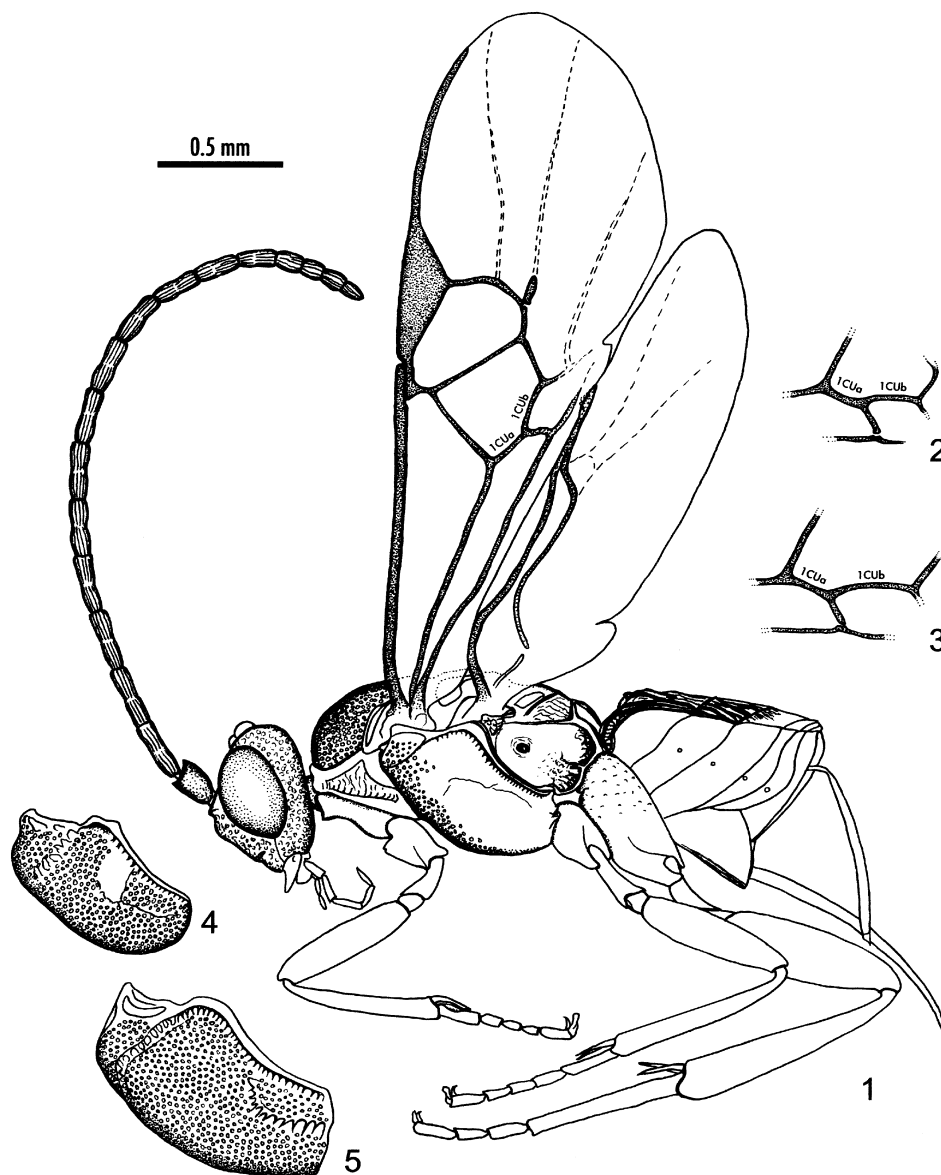
The morphological terminology used in the species descriptions is that of Huber & Sharkey (1993), Schuh (1989) and Mason (1981), except for that of the propodeum morphology which is used *sensu* Townes (1969, Fig. E). The cuticular sculpturing terminology is that of Harris (1979), and wing venation terminology is a variation of the Comstock-Needham system used by Sharkey and Wharton (1997, Fig. 15). All other morphological terminology used in the species description is that of Huber & Sharkey (1993) and Schuh (1989). Collection abbreviations used in the descriptions are as follows: CNC — Canadian National Insect Collection, Agriculture Canada, Ottawa; INBio — Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, and INHS- Illinois Natural History Survey, Champaign.

### Key to the known species of *Exoryza* Mason

- 1) Length of forewing vein 1CUa 0.6 times the length of vein 1Cub (Fig. 3); metapleuron with mostly punctate sculpturing (Fig. 5); first and second metasomal terga with acicularugose sculpturing (Fig. 7) ..... *E. schoenobii* (Wilkinson)
- Forewing 1CUa and 1Cub nearly equal in length (Figs. 1, 2); metapleuron never completely covered by punctate sculpturing; first and second metasomal terga variably sculptured ..... 2
- 2) Metapleuron mostly nitid and with a conspicuously deep central pit; mesopleuron mostly nitid (Fig. 1); first metasomal tergum with areolate-rugulose sculpturing (Fig. 8) ..... *E. monocavus* n. sp. Valerio & Whitfield
- Metapleuron covered by rugulose sculpturing, medial pit present but not conspicuously deep or evident; mesopleuron almost entirely covered by punctate sculpturing (Fig. 4); first metasomal tergum with coarsely rugose sculpturing (Fig. 6) .....  
..... *E. minnesota* Mason

*Exoryza monocavus* Valerio & Whitfield n. sp.  
(Figures 1, 8)

**Female.** Body length = 2.35 mm.



**FIGURES 1–5.** 1: *Exoryza monocavus*, female, lateral habitus; 2,3: Forewing 1-CU of *E. minnesota* and *E. schoenobii*, respectively; 4,5: Mesopleura of *E. minnesota* and *E. schoenobii*, respectively. Scale = 0.5 mm.

**Body color.** Legs pale yellowish brown (except distal tip of hind femur, hind tarsomeres, and distal half of hind tibia), as well as palpus, metasomal pleurites, ovipositor, mandibles (except tips), labrum, ocelli; compound eyes appearing silvery (perhaps not so in

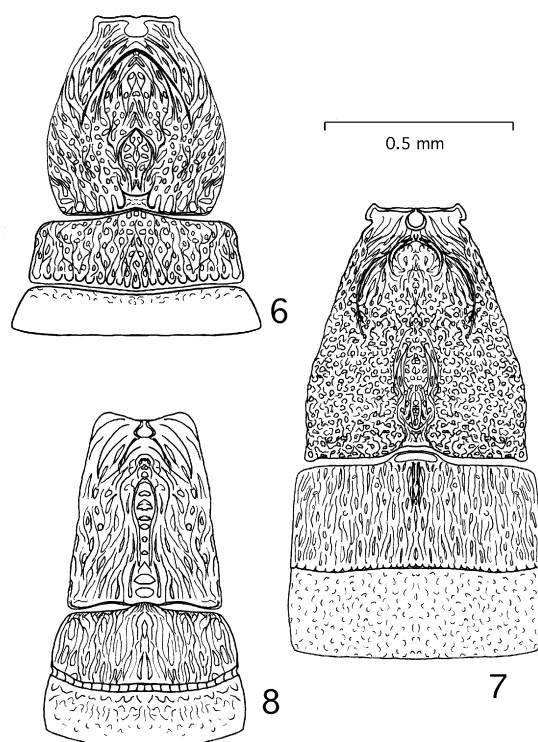
life); antenna same dark brownish yellow as hypopygium area; remainder of body black. Wings hyaline, wing veins brownish.

**Head.** Head height/width = 1.3; compound eye height/width = 1.6; intertentorial pit distance/distance from tentorial pit to compound eye = 3.2; clypeus width/height = 2.3; vertex width/distance between anterior ocellus and edge of torulus = 2.3; length of first flagellomere = 0.24 mm; first flagellomere length/width = 3.8; length of first flagellomere/length second flagellomere = 1.1; length of first flagellomere/length of third flagellomere = 3.6; distal flagellomere length/subdistal flagellomere length = 2.5; distal flagellomere length/width = 1.4; malar space height/basal width of mandible = 1.1; ocell-ocular distance/lateral ocelli distance = 1.4.

Face and clypeus with scattered punctate sculpturing, finer and less evident on clypeus than on frons, face with more confused and denser punctate sculpturing on upper 1/3; frons with scrobal areas nitid, lateral areas and distal area as well as anterior of vertex with punctate sculpturing; gena densely punctate except at ocular ring.

**Mesosoma.** Mesosoma length/width = 1.4. Propleuron with punctate sculpturing throughout; pronotum with dorsal and ventral areas 1/5 of distal edge height; ventral groove with confused and smooth rugulose sculpturing, upper groove with confused and smooth scrobiculate sculpturing, anterior portion with shallow and widely spaced transverse ridges, remainder nitid; mesonotum densely punctate except on area adjacent to scutellar groove as well as on posterolateral corners; scutellar groove with 8 well defined costulae, the medial ones slightly larger than lateral ones; scutellum mostly nitid except for scattered finely punctate sculpturing, lateral areas of scutellum with narrow costulate sculpturing which becomes more elongate and wider distally; axilla through to mesonotum with few narrow transversal ridges at anterior edge of lunulae; lunular edge well defined and semicircular; metanotum with one large and evident single pit on posterior central area from which triangular nitid area extends, distal edge nitid, area below triangular area with confused weak rugulose sculpturing, area inside pit with few smooth confused rugulose sculpturing, remainder of metanotum nitid; pronotum anteriorly with sparse scattered punctate sculpturing mostly next to areolar and transverse carinae, as well as some rugulose sculpturing, remainder of anterior region nitid; spiracular carinae cristate and defined posteriorly but not as well anteriorly, confused with rugulose sculpturing; remainder of spiracular area with smoothly rugulose sculpturing, areola well defined as is longitudinal medial carina, areola anteriorly with confused rugulose sculpturing as well as posterolateral propodeal areas; mesopleuron anteriorly and ventrally punctate, sternaulus appearing as an elongated depression, dorsal and distal edge with well defined scrobiculate sculpturing, distal edge with larger and more widely spaced sculpturing, remainder of mesopleuron nitid; metapleuron with medial pit present at spiracle, dorsal edge with punctate sculpturing along its edge, distal edge with short rugulose sculpturing.

**Legs.** Hind femur length/width = 3.2; hind tibia length/hind femur length = 1.3. Tarsal claws simple.



**FIGURE 6–8.** Metasomal tergites I–III of: 6, *Exoryza minnesota*, 7, *E. schoenobii*, 8, *E. monoca-vus*. Scale = 0.5 mm.

**Wings.** Forewing length = 2.7 mm; 1CUa length/2Cub length = 0.94; length of RS+Ma = 0.4 mm; length M+CU = 1.1 mm; 1M length/ m-cu length = 1.9; pterostigma length/height = 1.7. Hindwing: 1M length = 0.5 mm; 1M length/2M length = 2; 1M length/M+CU length = 1.7; length r-m/length Cua = 0.92; 1RSa length/2r-m = 1.7.

**Metasoma.** First tergum length/distal width = 1.1; second tergum length/distal width = 0.3–0.4; third tergum length/distal width = 0.24; Hypopygium length = 0.48 mm; Metasomal terga I–III (Fig. 9) with dense and well defined areolate-rugulose sculpturing, medial longitudinal area of first metasomal tergum with a longitudinal depressed area surrounded by fine longitudinal carina-bounded depression with transverse smooth rugose sculpturing; second tergum with finer sculpturing than first; third tergum with sculpturing more weakly defined than second tergum on posteromedial half; hypopygium with desclerotized pleats medially; ovipositor sheaths elongate and thin in lateral view, not rectangular at distal tip, and exhibiting long setae throughout its length.

**Material examined.** Holotype: female, “Costa Rica, Puntarenas, San Luis, Monte Verde, Buen Amigo, 1000–1350 m, Nov. 1994, Z. Fuentes, de luz, LN 250850–449250.” Specimen deposited in Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica.

**Comments.** Currently *E. monocavus* is the only known *Exoryza* species to exhibit a single, large mediodistal pit on the posterior area of metapleuron. In other species the mediodistal pit is divided longitudinally and not so evident.

Usually we would hesitate to describe a new species based on only a single specimen, but as this one is a well preserved distinctive specimen of a rare genus not known to occur in the Neotropical Region, it seems useful to advertise this range expansion in the literature in the hope that more material will come to light. Even within temperate areas, collection of *Exoryza* is rare.

**Etymology.** Gender: masculine. The specific epithet refers to the single depression on the metanotum; “monocavus” in Greek means “one hole” or “one cave.”

### *Exoryza schoenobii* (Wilkinson)

(Figs. 3, 5, 7)

*Apanteles schoenobii* Wilkinson, 1932 Stylops 1: 142.

*Exoryza schoenobii* (Wilkinson): Mason, 1981, Mem. Entomol. Soc. Canada 115: 40.

**Female.** Body length = 3.7 mm.

**Body color.** Antenna brownish yellow as are hind coxae, palpus, distal edge of metasomal 3<sup>rd</sup> to 6<sup>th</sup> tergites, ovipositor and lateral areas of metasoma; hind femur distal tip dark brown as are tarsomeres and distal portion of hind tibia; hypopygium yellow as are most of legs; hind tibial spurs whitish yellow; compound eyes silver; ocelli yellow; mandible (except distal tips dark brown) and labrum light brown; palpus yellow as are fore leg telotarsus, distal edge of 3<sup>rd</sup> to 6<sup>th</sup> metasomal terga. Wings hyaline; forewing veins brownish except base of M+CU and basal 1/3 of 1-1A; hind wing veins brownish yellow.

**Head.** Head height/width = 1.2; compound eye height/width = 1.7; intertentorial pit distance/distance from tentorial pit to compound eye = 3.2; width face at dorsal clypeal edge = 0.44 mm; clypeus width/height = 3; vertex width/distance between anterior ocelli and edge of torulus = 2.6; first flagellomere length/width = 1.0; length of first flagellomere/length second flagellomere = 1.0; length of first flagellomere/length of third flagellomere = 1.1; distal flagellomere length/subdistal flagellomere length = 0.14 ; distal flagellomere length/width = 0.25; malar space height/basal width of mandible = 0.46; ocell-ocular distance/lateral ocelli distance = 1.8.

Face and clypeus with dense and fine punctate sculpturing, less evident and less dense on clypeus than on face, remainder of head with same sculpturing; ocell-ocular area with more widely spaced and less evident punctate sculpturing; frons with most of scrobal areas punctate.

**Mesosoma.** Mesosoma length/width = 1.6. Propleuron anteriorly with confused foveate sculpturing, distally with less dense and larger punctations than remainder of propleuron, dorsal area of medial half with confused punctate sculpturing; pronotum anteriorly

with sparse large transverse ridges, lateroventral groove with well-defined but miniature scrobiculate sculpturing, upper groove appearing as a well-defined nitid depression, area between lateral grooves with sparse confused punctate sculpturing; mesonotum with punctate sculpturing which becomes less dense towards scutellar groove; scutellar groove with 10 well defined costulae of approximately same width, medial ones slightly longer than lateral ones; scutellum with tiny shallow punctations, lateral areas of scutellum with narrow transverse costulae distal tip less sculptured than rest of scutellum; axilla through mesonotum with transverse costulate sculpturing on anterior edge of lunulae, remainder nitid; mesopleuron almost totally covered with punctate sculpturing except sternaulus with thick transverse sculpturing, sternaulus appearing as an elongated depression that runs at least 1/3 of mesopleuron length, dorsal edge with well defined and dense sculpturing on medial 1/3, but upper part distally almost completely nitid, anterior 1/3 of dorsal edge with confused and shallow scrobiculate sculpturing; metanotum with anterior 1/3 nitid as on distal edge, remainder with two transverse ridges and conspicuously depressed; metapleuron with anterior 1/3 with punctate sculpturing, medial pit present, distal 2/3 with fine and confused rugulose sculpturing mixed with shallow punctate sculpturing, upper and distal edge with coarsely spaced rugulose sculpturing (distal edge with less sculpturing), remainder of metapleuron nitid; anterolateral area of propodeum with rugose aciculate sculpturing, spiracular carina cristate and well-developed, spiracular area with fine rugulose sculpturing, areola deeper than anterolateral areas (appearing sunken into the propodeum), transverse carinae confused with few shallow punctate sculpturing at areolar area, posterolateral areas with carinate sculpturing mixed with shallow punctate sculpturing.

**Legs.** Hind femur length/width = 3.1; hind tibia length/hind femur length = 1.4. Tarsal claws simple.

**Wings.** Forewing length = 3.5 mm; 1CUa length/2Cub length = 0.62; length RS+Ma = 0.48 mm; length M+CU = 1.3 mm; 1M length/ m-cu length = 1.5; pterostigma length/height = 1.9. Hindwing: 1M length = 0.7 mm; 1M length/2M length = 2.1; 1M length/M+CU length = 2.1; length r-m/length Cua = 1.1; 1RSa length/2r-m = 1.7.

**Metasoma.** First tergum length/distal width = 1; second tergum length/distal width = 2.2; third tergum length/distal width = 0.3; Hypopygium length = 3.2 mm; First and second metasomal terga with rugulose aciculate sculpturing; mediolongitudinal area of first metasomal tergum depressed but not clearly defined; 3<sup>rd</sup> metasomal tergum with shallow punctate sculpturing on anterior edge, becoming less evident towards posterior edge; metasomal terga 4 to 7 mainly nitid; hypopygium with longitudinal desclerotized pleats present medially; ovipositor long and thin throughout its length; ovipositor sheaths squarely truncate distally and slightly wider distally than basally with fine and dense setae throughout its length.

**Material examined.** Female, "Philippines, Pangasinan, San Manuel, 4/ii/1953, H. & M. Townes." Deposited in CNC under the name "*Apanteles schoenobii*."

The holotype is in the Natural History Museum, London and was not examined but our material was compared and matched with the holotype by W. R. M. Mason.

**Comments.** This species is easily recognized by the forewing vein 1CUa which is contrastingly shorter than vein 1Cub (approximately 0.6 X) and the metapleuron being mainly covered in punctate sculpturing. Neither of the two remaining *Exoryza* species exhibits this combination of characters.

The original description of Wilkinson departs from the one presented here and the one presented by Mason (1981) in the dark coloration of the mouthparts as well as of the clypeus, the yellow color of the legs in combination with the brownish tarsomeres; the wings not being distinctly infumate, the presence of more than 6 costulae in the scutellar groove; the absence of minute rugose sculpturing on the anterior edge of the mesopleuron. The remainder of Wilkinson's description agrees with our material in all details.

**Rearing records.** Reared from stem-boring Pyraloidea larvae on rice plants according to Wilkinson's and Mason's accounts.

### *Exoryza minnesota* Mason

(Figs. 2, 4, 6)

*Exoryza minnesota* Mason, 1981, Mem. Entomol. Soc. Can. 115: 40. Holotype in Canadian National Collection, examined.

**Female.** Body length = 3.3 mm.

**Body color.** Hind coxae, hind trochanters yellow as are hind femur (except distal tip), and metasomal anterior two pleura; remainder of tarsomeres light brownish yellow as remainder of metasomal pleura, hypopygium (except longitudinal medial area whitish yellow), mandibular palpus, metasomal terga (except metasomal terga 1 and 2 black), and ovipositor sheaths; hind coxae black at base, then reddish, remainder yellow; metasomal interpleural membrane whitish; antenna brownish yellow including scape and pedicel; maxillar palpus whitish; lunulae and transversal area including area in front of scutellar groove reddish brown; ocelli yellow; compound eyes silver; remainder of body dark brown. Wings hyaline with veins brownish yellow.

**Head.** Head height/width = 0.12; compound eye height/width = 2.7; intertentorial pit distance = 0.18 mm; intertentorial pit distance/distance from tentorial pit to compound eye = 2.3; width of face at dorsal clypeal edge = 0.35 mm; clypeus width/height = 2.7; vertex width/distance between anterior ocellus and edge of torulus = 2.2; length of first flagellomere = 0.2 mm; first flagellomere length/width = 4; length of first flagellomere/length of second flagellomere = 1; length of first flagellomere/length of third flagellomere = 1; distal flagellomere length = 0.15 mm; distal flagellomere length/subdistal flagellomere length = 1.3; distal flagellomere length/width = 1.8; malar space height/basal width of mandible = 0.9; ocell-ocular distance/lateral ocelli distance = 1.2.

Head strongly and conspicuously punctate; less evident and finer on clypeus than on face; scrobal areas of frons with transversal lineate sculpturing on basal 1/3, remainder of scrobal area nitid, lateral areas strongly punctate and distal area with shallower punctate sculpturing as on vertex that is less deeply impressed than lateral sculpturing; ocular ring nitid as on upper area of postgena, remainder of head with dense punctate sculpturing.

**Mesosoma.** Mesosoma length/width = 1.3. Propleuron with dense punctate sculpturing; pronotal lateral area nitid, upper and ventral groove with sparse and widely spaced scrobiculate sculpturing, area between grooves with confused rugulose sculpturing, dorsal and ventral edge 1/6 of distal edge height; mesonotum densely punctate except area next to scutellar groove nitid; scutellar groove with 7 widely spaced costulae, lateral costulae 4 times shorter than medial one; scutellum with confused punctate sculpturing throughout, lateral area with narrow and well defined scrobiculate sculpturing which becomes more elongate and wider distally, lunulae triangular in shape; axilla through mesonotum with sparse transverse and narrow ridges present on anterior 1/3, remainder nitid; metapleuron mediodistal pit divided longitudinally, anterolateral areas nitid above but below with rugulose sculpturing; propodeum with anterolateral areas with dense coarse rugose sculpturing, areola with rugulose sculpturing and appearing sunken into the propodeum relative to posterolateral areas; posterolateral areas anteriorly with rugulose sculpturing and distally and along lateral carinae with sparse weak rugulose sculpturing, medial area nitid; mesopleuron mostly covered by aciculopunctate sculpturing, sternaulus appearing as an elongate and shallow longitudinal depression, dorsal area with well defined and dense scrobiculate sculpturing, distal edge with aciculopunctate sculpturing, medial area distally nitid; metapleuron with medial pit present, anteriorly nitid, remainder with confused dense rugulose sculpturing, dorsal and distal edge with large and widely spaced transverse ridges.

**Legs.** Hind femur length/width = 4.4; hind tibia length/hind femur length = 1.4. Tarsal claws simple.

**Wings.** Forewing length = 2.8 mm; 1CUa length/2Cub length = 0.94; length RS+Ma = 0.35 mm; length M+CU = 1.0 mm; 1M length/ m-cu length = 1.9; pterostigma length/height = 1.9. Hindwing: 1M length = 0.5 mm; 1M length/2M length = 2; 1M length/M+CU length = 1.7; length r-m/length Cua = 1.3; 1RSa length/2r-m = 1.8.

**Metasoma.** First tergum length/distal width = 1.0; second tergum length/distal width = 0.31; third tergum length/distal width = 0.21; hypopygium length = 0.88 mm; First and second metasomal terga with dense coarse rugulose sculpturing; first metasomal terga with longitudinal medial depression shallow and short; third metasomal terga with shallow punctate sculpturing at anterior edge, remainder tergum nitid; remainder of metasomal terga nitid; hypopygium medially with desclerotized pleats present, distal tip of hypopygium slightly divided; ovipositor sheaths wider at distal tip and tip subrectangular in lateral view; ovipositor thin throughout its length.

**Material examined.** Female, "Canada, Ontario, Point Pelee, 28 July 1928, Col. J.M. Cumming." Specimen deposited in INHS.

**Comments.** This species can be separated from the other species of *Exoryza* by the forewing vein ratio of the lengths of 1CUa/1Cub larger than 0.90 and the metapleuron being completely covered by rugulose sculpturing.

**Rearing records.** Host unknown.

## Discussion

*Exoryza* was previously known to be distributed only in North America and in the Oriental region (original specimen collected in the Philippines). The description of the new species *E. monocavus* extends the generic geographical range to Central America. Since this genus appears to be rare everywhere it may be even more widely distributed but poorly sampled.

Now that the characteristics of multiple species are known, it is clear that *Exoryza* shares many morphological features with *Apanteles* and *Dolichogenidea*, as well some features as with *Parapanteles* and *Pholetesor*. Current phylogenetic studies of microgastrine genera using both morphological and molecular data (both in our laboratory and elsewhere) are likely to shed additional light on the generic distinctness of these rare species.

## Acknowledgments

We would like to thank the Instituto Nacional de Biodiversidad (INBio), especially the inventory section personnel, and the Canadian National Collection (M. J. Sharkey, J. Huber) for letting us borrow their specimens for our research as well to Antonia for her famous banana bread!

## References

- Harris, R.A. (1979) A glossary of surface sculpturing. *Occasional Papers of the Bureau of Entomology of the California Department of Agriculture*, 28, 1–32.
- Huber, J. & Sharkey, M.J. (1993) Chapter 3. Structure. In: Goulet, H. & Huber, J.T. (Eds). *Hymenoptera of the World: an Identification Guide to Families*, Research Branch, Agriculture Canada Publication 1984/E, pp. 13–59.
- Mason, W.R.M. (1981) The polyphyletic nature of *Apanteles* Foerster (Hymenoptera: Braconidae): A phylogeny and reclassification of Microgastrinae. *Memoirs of the Entomological Society of Canada*, 115, 1–147.
- Schuh, R.T. (Ed) (1989) *The Torre-Bueno Glossary of Entomology* (revised edition). The New York Entomological Society, New York, 849 pp.
- Sharkey, M.J. and Wharton, R.A. (1997) Morphology and terminology. In: Wharton, R.A., Marsh, P.M. & Sharkey, M.J. (Eds), *Manual of the New World Genera of the Family Braconidae (Hymenoptera)*. *Special Publication of the International Society of Hymenopterists*, 1, 19–37.
- Townes, H. (1969) The genera of Ichneumonidae, Part I. *Memoirs of the American Entomological Institute*, 11, 1–300.

- Wilkinson, D.S. (1932) Four new *Apanteles* (Hym. Brac.) *Stylops*, 1, 139–144.
- Whitfield, J.B. (1997) Subfamily Microgastrinae. *In*: Wharton, R. A., Marsh, P. M. & Sharkey, M.J. (Eds), *Manual of the New World Genera of the Family Braconidae (Hymenoptera)*. *Special Publication of the International Society of Hymenopterists*, 1, 333–364.