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First record of *Megaphragma* (Hymenoptera, Trichogrammatidae) in Columbia, and third animal species known to have anucleate neurons

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Abstract

Megaphragma is recorded for the first time in Columbia where it is represented by *M. caribea* that emerged from leaves of *Terminalia catappa* infested by the thrips (*Heliothrips haemorrhoidalis* and *Selenothrips rubrocinctus*). *M. caribea* has anucleate neurons, the third species of *Megaphragma* shown to have this feature.

Keywords

Megaphragma caribea, anucleate neurons, Columbia

Introduction

Megaphragma includes some of the smallest insects. The genus contains 15 described species, distributed mainly in tropical and subtropical regions; only five of them have been recorded in the Western Hemisphere (Pinto 2006, Viggiani et al. 2009). A unique feature has been described in two of the species: the cell bodies and nuclei undergo lysis during a later pupal stage in over 95% of the neurons. As a result, the central nervous system of the adult is represented mostly by anucleate neurons (Polilov 2012). *M. caribea* Delvare, 1993, known only from the type series collected in Guadeloupe, is the smallest species of *Megaphragma* with a body length reported as 0.17 mm (Delvare 1993) and one of the smallest flying insects (Huber and Noyes 2013). Further information on the biology and distribution of *M. caribea* is reported here.

Methods

Adults of *M. caribea* (27 specimens) were collected as they emerged from leaves of *Terminalia catappa* Linneaus, 1767 colonized by the thrips *Heliothrips haemorrhoidalis* (Bouché, 1833) and *Selenothrips rubrocinctus* (Giard, 1901). The leaves were gathered in Cartagena, Columbia, on 22 January 2015 (coordinates 10.422, -75.553).

Specimens were fixed in FAE (formaldehyde—acetic acid—ethanol), preserved in 70% ethanol, critical point dried (Hitachi HCP-2), sputter coated with gold (Giko IB-3) and examined under a Jeol JSM-6380 scanning electron microscope (SEM) where body length was measured. For studying internal morphology, fixed material was dehydrated and embedded in Araldite M. The resulting blocks were cut into complete series of cross sections or longitudinal sections 0.5 μm thick using a Leica RM2255 microtome. The sections were stained with DAPI and studied under an Olympus BX43 microscope with a fluorescent module and a Tucsen TCC-6.1ICE camera.

Results and discussion

The record of *M. caribea* in Columbia considerably expands the known range of this species known previously only from 11 specimens collected from leaves of *Psidium guajava*

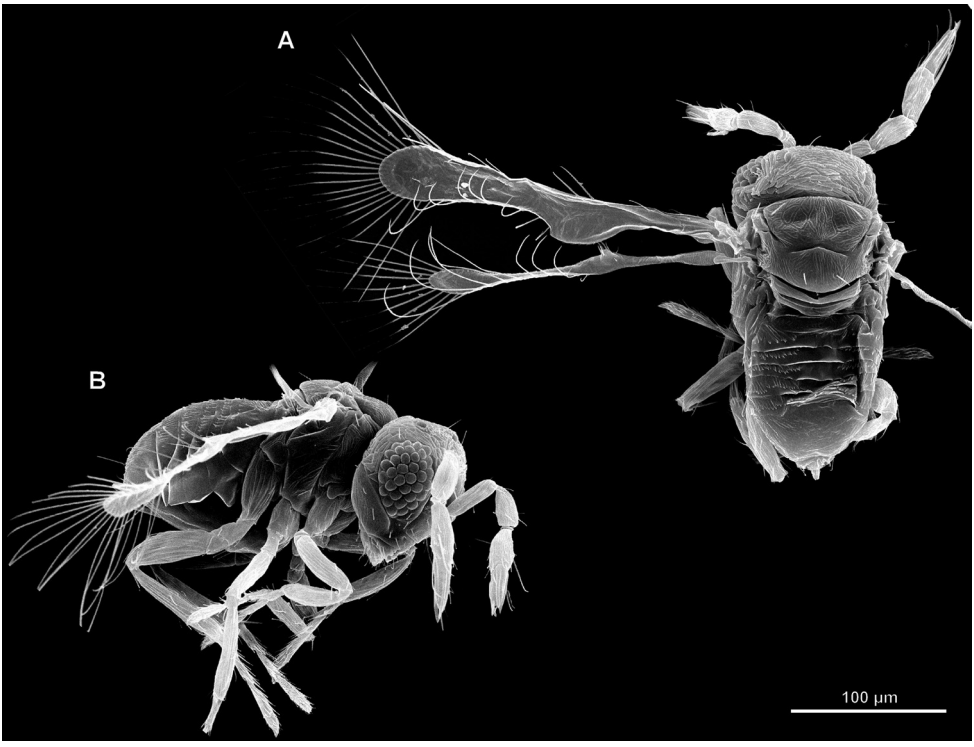

Figure 1. Habitus of *Megaphragma caribea*, SEM: **A** dorsal view **B** lateral view.

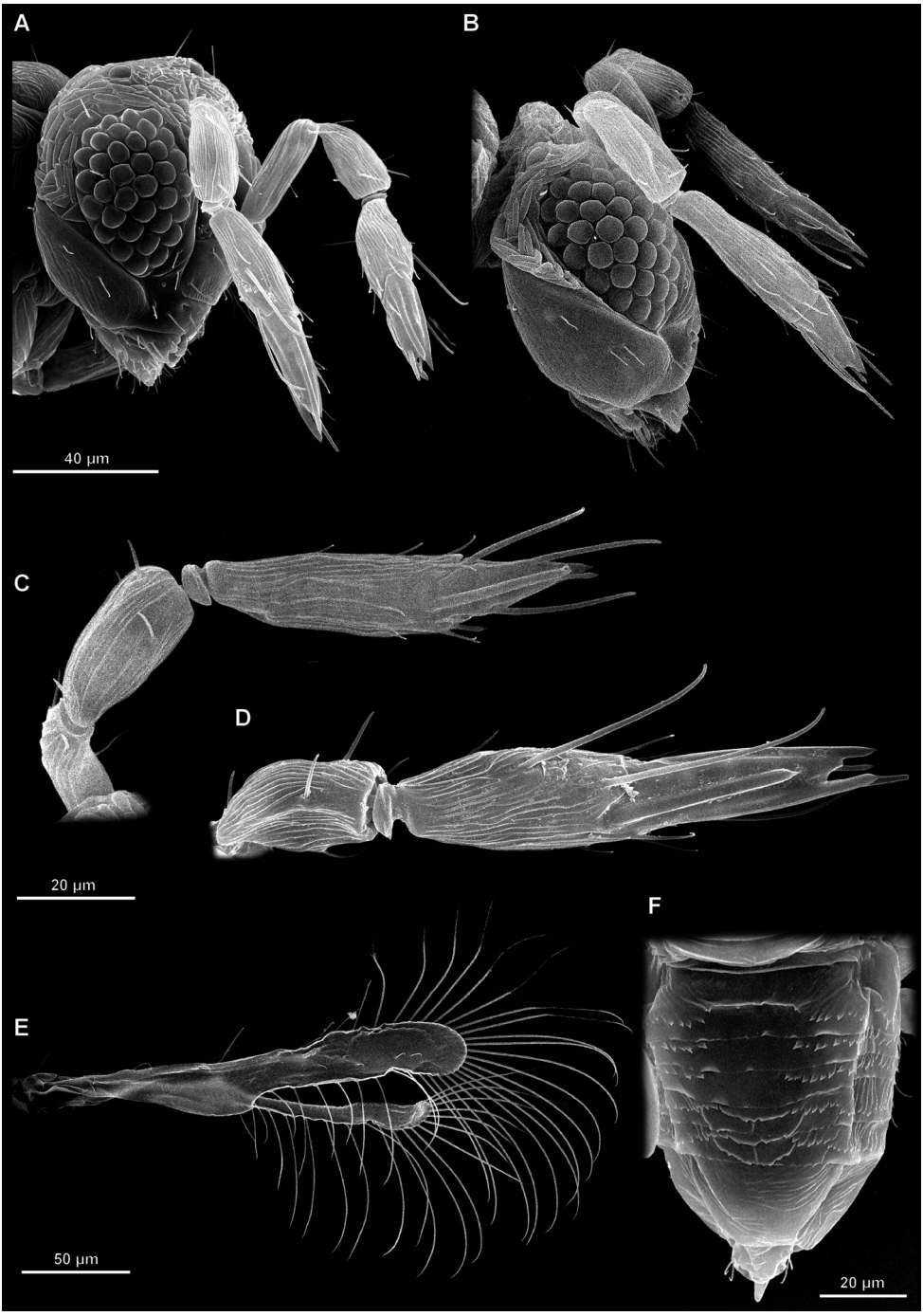

Figure 2. Diagnostic characters of *Megaphragma caribea*, SEM: **A** head of female **B** head of male **C** antennal club, male **D** antennal club, female **E** wings **F** terga of metasoma.

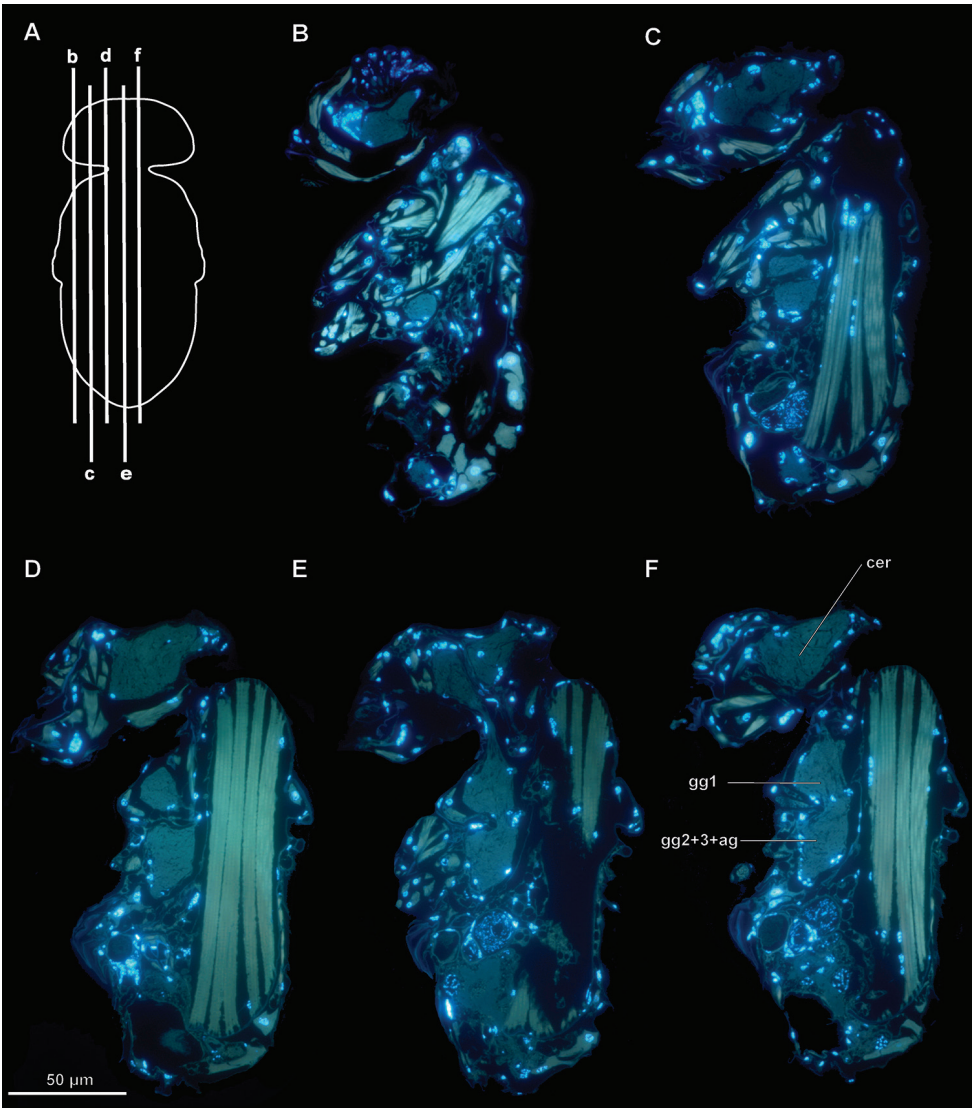

Figure 3. Internal morphology of *Megaphragma caribea*: **A** scheme of sections, dorsal view **B–F** sagittal sections, DAPI and autofluorescence; ag – abdominal ganglion, cer – cerebrum, gg1,2,3 – pro-, meso-, and metathoracic ganglion.

infested by *Selenothrips rubrocinctus* in Vieux Habitans (Guadeloupe) by J. Etienne on 17 November 1988 (Delvare 1993). The host plant and host insect(s) recorded here increase the range of plants and possibly host Thysanoptera in which *M. caribea* can develop.

M. caribea differs from the other species of the genus in its smaller body size, antenna without funicle, two-segmented antennal club, and wing chaetotaxy (Figs 1, 2). The body length of *M. caribea* measures was 181–224 µm (M = 199, n = 12), which is slightly greater than the measurement (170 µm) provided by Delvare (1993). Similar

imprecision of measurements was recently shown also for the smallest known free-living insect, the beetle (Polilov 2015).

Analysis of the anatomy of *M. caribea* has shown that the central nervous system of this species has only a few nuclei (Fig. 3) instead of the cortical layer typical of other insects. The central nervous system of *M. caribea* contains about 600 nuclei, 390 of them in the cerebrum. Organization of the neuropil is otherwise no different from that of other hymenopterans. Taking into account the relative volume and structure of the neuropil and the number of nuclei, which is similar to other species of *Megaphragma* examined earlier but fundamentally different from that of other minute insects. I suggest that *M. caribea* also displays the unique phenomenon of lysis of cell bodies and nuclei in neurons prior to the emergence of the adult from the pupa, as described earlier in *M. mymaripenne* (Polilov 2012) and *M. amalphitanum* (Polilov 2017). Thus, all species of *Megaphragma* whose anatomy has been studied have unique anucleate neurons. Interestingly, the nervous system of *M. caribea* contains almost twice as many nuclei as in the larger representatives of the genus.

Acknowledgements

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