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***Ooencyrtus marcelloi* sp. nov. (Hymenoptera: Encyrtidae), an egg parasitoid of Heliconiini (Lepidoptera: Nymphalidae: Heliconiinae) on passion vines (Malpighiales: Passifloraceae) in Central America**

Emilio Guerrieri ^{ab}; Martinus E. Huigens ^c; Catalina Estrada ^d; Jozef B. Woelke ^c; Marjolein de Rijk ^c; Nina E. Fatouros ^c; Annette Aiello ^c; John S. Noyes ^b

^a Institute for Plant Protection, National Research Council of Italy, Via Università, Portici, NA, Italy ^b Department of Entomology, The Natural History Museum, Cromwell Road SW7 5BD, London, United Kingdom ^c Laboratory of Entomology, Wageningen University P.O. Box 8031, Wageningen, the Netherlands ^d Section of Integrative Biology, University of Texas, Austin, TX, USA ^e Smithsonian Tropical Research Institute, P.O. Box 0843-03092, Balboa, Ancon, Republic of Panama

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***Ooencyrtus marcelloi* sp. nov. (Hymenoptera: Encyrtidae), an egg parasitoid of Heliconiini (Lepidoptera: Nymphalidae: Heliconiinae) on passion vines (Malpighiales: Passifloraceae) in Central America**

Emilio Guerrieri^{a,c*}, Martinus E. Huigens^b, Catalina Estrada^c, Jozef B. Woelke^b, Marjolein de Rijk^b, Nina E. Fatouros^b, Annette Aiello^d and John S. Noyes^e

^aInstitute for Plant Protection, National Research Council of Italy, Via Università 133 80055 Portici (NA) Italy; ^bLaboratory of Entomology, Wageningen University P.O. Box 8031, 6700 EH, Wageningen, the Netherlands; ^cSection of Integrative Biology, University of Texas, Austin, TX 78712, USA; ^dSmithsonian Tropical Research Institute, P.O. Box 0843-03092, Balboa, Ancon, Republic of Panama; ^eDepartment of Entomology, The Natural History Museum, Cromwell Road SW7 5BD, London, United Kingdom

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A new species belonging to the genus *Ooencyrtus* Ashmead is described. *Ooencyrtus marcelloi* sp. nov. has been reared from eggs of Heliconiini (Lepidoptera: Nymphalidae, Heliconiinae) collected in Panama on *Passiflora* spp. The new species is compared with its closest *Ooencyrtus* species, i.e. *O. caligo* Noyes, *O. neustriae* Mercet, *O. flavipes* (Timberlake), *O. camerounensis* (Risbec), *O. endymion* Huang and Noyes and *Ooencyrtus* sp. “undet. C.” (from India). This represents the second record of *Ooencyrtus* from Heliconiinae and the first record of this genus from Panama.

Keywords: *Passiflora*; *Ooencyrtus caligo*; *Ooencyrtus papilionis*; Panama

Introduction

Passion-vine or longwing butterflies of the tribe Heliconiini (Lepidoptera: Nymphalidae: Heliconiinae) (Harvey 1991; Penz and Peggie 2003) are a highly diverse group of Neotropical insects the larvae of which feed exclusively on plants of the genus *Passiflora* (Malpighiales: Passifloraceae) (Benson et al. 1976; Brown 1981). These toxic butterflies, particularly those belonging to the genus *Heliconius* Kulk, exhibit remarkable mimetic convergence in wing colour, and are well-known model organisms in biology (Brown 1981; Gilbert 1991; Mavarez et al. 2006). They are also commonly released in butterfly gardens around the world. A few species have been considered pests of passionfruit crops from California (USA) to Argentina (Lordello 1952, 1956). Despite the well-known ecological interactions and evolutionary history of passion-vine butterflies, only a limited number of studies have identified, to species level, their natural enemies (Querino and Zucchi 2002, 2003a,b; Zhang et al. 2005). In the course of a survey of parasitoid wasps of these butterflies in a tropical lowland rainforest in Panama, a new species of encyrtid was collected from heliconiine eggs deposited on several species of *Passiflora* vines. The wasp species, described below,

*Corresponding author. Email: guerrieri@ipp.cnr.it

belongs to the genus *Ooencyrtus* Ashmead and appears to be the first species of this genus to be recorded from Panama.

Species of *Ooencyrtus* are mainly egg parasitoids of Lepidoptera and Hemiptera, and for this reason have been used in biological control programmes in several countries of the world (see Huang and Noyes 1994). However, species of *Ooencyrtus* have been reported from nymphal stages of aphids (Hemiptera: Aphididae), immature predatory Syrphidae and Cecidomyiidae (Diptera) and Coccinellidae (Coleoptera) feeding on aphids, immature Dryinidae (Hymenoptera) attacking planthoppers (Hemiptera: Auchenorrhyncha: Delphacidae), prepupae of Lepidoptera or their braconid primary parasitoids (Hymenoptera: Braconidae), and from pupae of Chloropidae (Diptera), Ascalaphidae and Chrysomelidae (Neuroptera).

At the genus level, *Ooencyrtus* can be recognized by the following combination of characters: individuals squat (rarely elongate), axillae appearing widely separated, mesopleuron posteriorly enlarged and touching the base of the gaster (this is possibly the most distinctive feature of this genus within Encyrtidae) and forewing with marginal vein punctiform or hardly longer than broad. For species discrimination, many keys are available from different regions: Trjapitzin (1989) for the Palaearctic species; Huang and Noyes (1994) for the Oriental species; Prinsloo (1987) for the Afrotropical species; Noyes (1985) for the Neotropical species; Zhang et al. (2005) for the Chinese species; Hayat (2006) for the Indian species.

Abbreviations used in the text: FV, minimum frontovertex width; FWL, maximum forewing length; FWW, maximum forewing width; GL, gonostylus (third valvula) length; HW, maximum head width; MT, mid-tibia length; MV, marginal vein length; OCL, occipital-ocellar line (the shortest distance between posterior ocellus and occipital margin); OD, maximum diameter of posterior ocellus; OL, ovipositor length; OOL, ocular-ocellar line (the shortest distance between posterior ocellus and adjacent eye margin); PMV, postmarginal vein length; SL, scape length (excluding radicle); SMV, submarginal vein length; SV, stigmal (radial) vein length; SW, maximum scape width.

***Ooencyrtus marcelloi* Guerrieri and Noyes sp. nov**
(Figures 1 A–G)

Female

Holotype. Length, 0.9 mm. Body black, head and thorax slightly shiny, gaster with a faint green lustre laterally; scape (Figure 1A) yellow with a narrow brown stripe along dorsal margin, remaining segments brown with pedicel appearing slightly darker; tegula dark brown; setae on dorsum of thorax dark brown; legs largely yellow except mid and hind coxae, a basal ring on mid and hind tibiae, hind femur and apices of all tarsi, brown; wings hyaline, venation brown.

Head on frontovertex with fine, shallow, raised, fairly regular, polygonally reticulate sculpture of mesh size clearly smaller than an eye facet; ocellar angle about 90°; occipital margin sharp but not carinate; frontovertex about 0.6 times head width; antenna (Figure 1A) with scape about four times as long as broad; all funicular segments nearly quadrate and with linear sensilla; clava with sutures parallel and with a

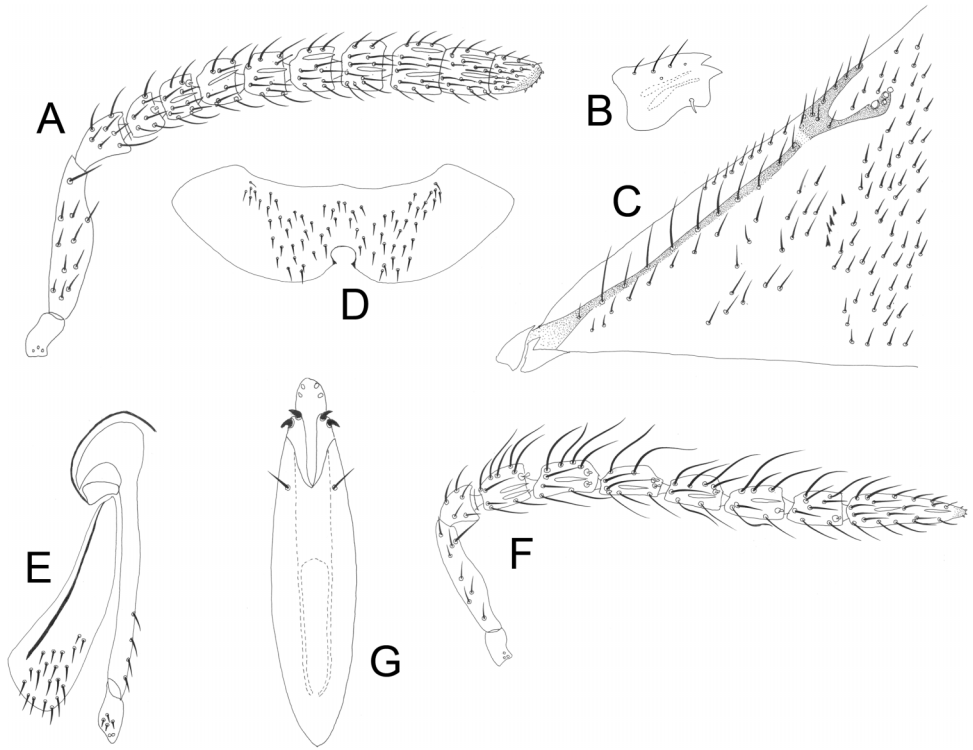


Figure 1. *Ooencyrtus marcelloi* sp. nov. Guerrieri and Noyes. Female: (A) antenna; (B) mandible; (C) base of forewing; (D) hypopygium; (E) ovipositor. Male (F) antenna; (G) genitalia.

sensory area along ventral surface of the last segment, giving it a slightly obliquely truncate appearance; mandible (Figure 1B) with two teeth and a short truncation, appearing almost tridentate; scutellum with sculpture similar to that of mesoscutum but shallower on sides; mesopleuron more or less touching base of gaster; forewing (Figure 1C) about twice as long as broad, with marginal vein about as long as broad, postmarginal vein about as long as stigmal; mid-tibial spur as long as mid-basitarsus; gaster with hypopygium (Figure 1D) transverse and extending not more than 0.6 times the gaster length, its posterior margin with a median invagination; ovipositor hidden or hardly exerted.

Relative measurements: HW 40, FWW 25, POL 7, OOL 2, OCL 1, OD 2, SL 16, SW 4, FWL 78, FWW 39, SMV 33, MV 2, PMV 6, SV 6.

Paratype. Gonostylus (Figure 1E) about 0.6 times as long as mid-tibial spur; second valvifer with four subapical setae; ovipositor about as long as mid-tibia (30 : 32) or about five times as long as gonostylus.

Relative measurements: OL 32, MT 30, GL 6.5.

Male

Length 0.7–0.8 mm: generally similar in appearance to female except for antenna (Figure 1F) and genitalia (Figure 1G); antenna (Figure 1F) with all funicular segments much longer than broad and clothed in setae that are generally much longer than diameter of segments; genitalia (Figure 1G) without parameres and with a single pair of setae at apex; digitus about four times as long as broad and with two apical hooks; aedeagus slender, apically rounded and about half as long as mid tibia.

Variation

Virtually no variation in the material at hand except for the body length which in females varies from 0.8 to 0.9 mm.

Hosts

Reared from eggs of Heliconiini (Lepidoptera: Nymphalidae, Heliconiinae) on *Passiflora biflora* Lamarck, *Passiflora vitifolia* Kunth, *Passiflora coriacea* Juss and *Passiflora auriculata* Kunth.

Distribution

Panama.

Material examined

Holotype female, Panama, Gamboa, 9°10' N, 79°43' W, ex egg Heliconiini (misspelled "Heliconini" on the labels of all material collected) on *Passiflora vitifolia* # 23, 13 February 2008 (J.B. Woelke and M. de Rijk). Holotype in Natural History Museum, London (UK).

Paratypes. One female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 21, 11 February 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 10, 8 February 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 20, 11 February 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 16, 11 February 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 27, 19 February 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora biflora* # 115, 26 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora biflora* # 116, 26 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 60, 3 March 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 58, 3 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 104, 18 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 61, 8 February 2008 (J.B. Woelke and M. de

Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 65, 3 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°08' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 80, 6 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°05' N, 79°40' W, ex egg Heliconiini on *Passiflora vitifolia* # 105, 16 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 121, 24 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora biflora* # 123, 9 April 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 119, 1 April 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°08' N, 79°43' W, ex egg Heliconiini on *Passiflora vitifolia* # 118, 1 April 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°08' N, 79°43' W, ex egg Heliconiini on *Passiflora coriacea* # 85, 12 March 2008 (J.B. Woelke and M. de Rijk); one female, Panama, Gamboa, 9°07' N, 79°43' W, ex egg Heliconiini on *Passiflora biflora* # 120, 3 April 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°09' N, 79°44' W, ex egg Heliconiini on *Passiflora vitifolia* # 95, 11 March 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 16, 11 February 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 34, 21 February 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°10' N, 79°45' W, ex egg Heliconiini on *Passiflora auriculata* # 122, 5 April 2008 (J.B. Woelke and M. de Rijk); one male, Panama, Gamboa, 9°07' N, 79°42' W, ex egg Heliconiini on *Passiflora vitifolia* # 106, 19 March 2008 (J.B. Woelke and M. de Rijk). Paratypes in the Natural History Museum, London and Dipartimento di Entomologia e Zoologia Agraria "Filippo Silvestri", Università degli Studi di Napoli "Federico II" Portici (Italy).

Comments

Of the New World species described so far, *O. marcelloi* is most similar to *O. caligo* Noyes, described from Honduras and Colombia and also parasitic on eggs of Nymphalidae, namely *Caligo iloneus* (Cramer) and *Caligo* sp. (Noyes, 1985). Both species are similar in general body colour (dull dark brown with faint metallic lustre; legs mainly yellow and gaster entirely brown) and forewing venation (see Figure 1C) with the postmarginal vein well developed, about as long as the stigmal.

Females of the two species can be distinguished by the shape of the mandibles and by antennal structure. In *O. caligo* the mandible has one tooth and a broad truncation, and the antenna has the clava distinctly wider than the funicle (about 1.5 times as wide as the last funicular segment), with the outer suture oblique and converging with the inner, and the sensory area extending for nearly half the length of the clava. In *O. marcelloi* the mandible has two teeth and a short truncation, appearing almost tridentate, the clava is about as wide as the last segment of the funicle (1.1 times) (e.g. in *O. caligo* the antenna appears more "clavate") with the outer suture parallel to the inner, and the sensory area extending only along the ventral margin of the apical segment.

Using the available keys to the females of the species of *Ooencyrtus* from other parts of the world (see Introduction for references), *O. marcelloi* runs to Palearctic *O. neustriae* Mercet (1925), Oriental *O. flavipes* (Timberlake, 1920), Afrotropical *O. epulus* Annecke (1965), Chinese *O. endymion* Huang and Noyes (1994) and Indian sp. undet. C. (Hayat, 2006). These species can be separated from *O. marcelloi* as follows: both *O. neustriae* and *O. flavipes* have the postmarginal vein not more than half as long as the stigmal (about as long in *O. marcelloi*), *O. flavipes* also has the fore-coxa and gaster yellow (fore coxa and gaster brown in *O. marcelloi*); *O. camerounensis* has the mandible distinctly tridentate (mandible with two teeth and a short truncation in *O. marcelloi*), *O. endymion* has the head not less than four times the width of the frontovertex (not more than 1.6 times in *O. marcelloi*) and sp. undet. C has the outer suture of the clava oblique (subparallel in *O. marcelloi*) and the fore-coxa and femur and mid-femur brown (yellow in *O. marcelloi*). Other than *O. marcelloi*, the only species of *Ooencyrtus* that has been recorded as a parasitoid of Heliconiini is *O. papilionis* Ashmead reared from eggs of *Heliconius charitonia* (L.) in Thailand (Huang and Noyes, 1994). Females of *O. papilionis* differ from those of *O. marcelloi* in having the mandibles with one tooth and a broad truncation and the postmarginal vein less than half as long as the stigmal vein, while in *O. marcelloi* the mandible has two teeth and a short truncation and the postmarginal vein is about as long as the stigmal vein.

The species is named after the first author's nephew Marcello Mellini.

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