

Scientific Note

New record of *Brachycyrtus* Kriechbaumer, 1880 (Hymenoptera: Ichneumonidae) from Venezuela and notes about their association with some chrysopid species

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Abstract. *Brachycyrtus pretiosus* Cushman, 1936 is recorded from Venezuela for the first time. The green-lacewings species *Ceraeochrysa valida* (Banks, 1851) and *Ceraeochrysa fairchildi* (Banks, 1946) are considered as the first known recorded hosts of *Brachycyrtus cosmetus* (Walkley, 1956). Illustrations of the studied *Brachycyrtus* spp.. Adults, final larval instar cephalic structures of *B. cosmetus* and maps with geographical distribution are provided.

Keywords: Brachycyrtinae, *Brachycyrtus cosmetus*, *Brachycyrtus pretiosus*, green lacewing, parasitoids.

Brachycyrtus Kriechbaumer, 1880 (Hymenoptera: Ichneumonidae: Brachycyrtinae) is cosmopolitan with half of the known species found in the Neotropical region where ~ 10 species are known (Gauld & Ward 2000; Onody et al. 2009). However, some species are widely distributed in the New World (e.g. *Brachycyrtus pretiosus* Cushman, 1936) (Gauld & Ward 2000) and in the Holarctic region (e.g. *Brachycyrtus ornatus* Kriechbaumer, 1880) (Cushman 1936; Walkley 1956).

Brachycyrtus species are considered solitary ectoparasitoids of the cocooned prepupae and pupae of Chrysopidae (Neuroptera) (Gauld & Ward 2000). The larva presents features characteristic of this lifestyle, the mandibles with dorsal blade margin denticulated, labral sclerite present, and spiracular closing apparatus separated from the atrium by a section of trachea (Wahl & Gauld 2002). However, Wahl & Gauld commented that they were unable to observe the antennae and the determination of its condition is necessary.

The Venezuelan Brachycyrtinae fauna is practically unknown and only three species: *Brachycyrtus cosmetus* (Walkley, 1956), *Brachycyrtus oculatus* Cushman, 1936, and *Brachycyrtus veriatrix* Gauld & Ward, 2000 have been recorded. Herein, *B. pretiosus* is recorded from Venezuela for the first time. Illustration of both *B. pretiosus* and *B. cosmetus* species and final larval cephalic capsule of *B. cosmetus* are provided.

The samplings were carried out sporadically in a citrus orchard in the “Estación experimental Miguel Luna Lugo” Universidad Centroccidental Lisandro Alvarado, Lara state, Venezuela (10° 01' N - 69° 16' W, 520 m) during the period of July 2007 to July 2011.

Cocoons of chrysopids were collected manually and placed in separate voile-stoppered vials until the emergence of chrysopids or parasitoids. The specimens of *Brachycyrtus* spp. obtained were pinned with corresponding parasitized chrysopids cocoons and posteriorly analyzed; the adults chrysopids were pinned and identified. Both, the parasitoids and chrysopids, were deposited in the Museo Entomológico “José Manuel Osorio” (MJMO), Universidad Centroccidental “Lisandro Alvarado”.

To obtain the cephalic capsule of the parasitoid, the internal debris of the parasitized chrysopids cocoon was carefully removed and macerated in KOH 10% for 45 minutes, washed with distilled water, pigmented with Clorazol Black E®, mounted on the slides and photographed under the microscope. The hymenopteran larvae

nomenclatures followed Howar (1987) and Bennett et al. (2019). The identification of the *Brachycyrtus* species were carried out according to Gauld & Ward (2000), and the species of parasitized chrysopids were identified by comparing the cephalic capsules of exuviate with previously obtained chrysopids species from larvae, or by comparing with the illustrations in Tauber & De Leon (2001).

The photographs of adult parasitoids were obtained with a digital camera attached to a stereomicroscope Leica M205C APO and figures were prepared using Adobe Photoshop software (version 11.0). The distribution map was made using SimpleMappr online software (Shorthouse 2010).

Here, a total of 134 adults of Chrysopidae were obtained and grouped in the genera *Leucochrysa* McLachlan, 1868, *Ceraeochrysa* Adams, 1982 and *Plesiochrysa* Adams, 1982, and also eight parasitoids specimens were obtained, of which six were *Brachycyrtus cosmetus* and two were *B. pretiosus*.

Adults of *B. cosmetus* (Figure 1A-B) were obtained from cocooned pupae of both *Ceraeochrysa fairchildi* (Banks, 1946) and *Ceraeochrysa valida* (Banks, 1895), these being the first host records known to the parasitoid.

The species *B. pretiosus* (Figure 1C-D) is recorded from Venezuela for the first time. We were unable to determine the cocooned chrysopids host genus, however the known previous records associate this species with cocooned prepupae of *Nodita pavidia* (Hagen, 1861) [= *Leucochrysa (Nodita) pavidia*] (Cushman, 1936) and *Chrysopa bimaculata* McCledon, 1901 (= *C. valida*) (Muma 1959). The final larvae instar has been previously studied by Short (1978).

The cephalic capsule of the third instar larva of *B. cosmetus* was found, mounted on a slide and photographed, and all their structures were duly labeled (Figure 2) and compared with Wahl (1993). Similarly, with Wahl's evidence, the antenna was not observed, being the essential structure to help elucidate if the species is ecto- or endoparasitoid. However, another *Brachycyrtus* specimen from Amazon Basin exhibits disc-shaped antenna localized in the upper region of the cephalic capsule, which was observed by Sosa-Duque (unpublished personal observations). This fact will require profound studies, due analysis and comparison of the cephalic structures that are very important to help in the determination of parasitoids after the emergence of adults, as well as to define the parasitoid behavior.

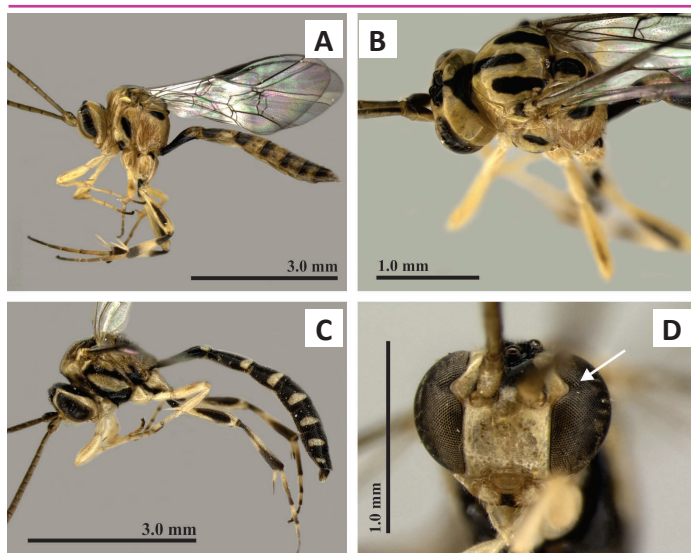


Figure 1. *Brachycyrtus* spp.. A. *Brachycyrtus cosmetus* (male, Cabudare, Lara, Venezuela), lateral; B. *Brachycyrtus cosmetus*, dorsolateral; C. *Brachycyrtus pretiosus* (male, Sanare, Lara, Venezuela), lateral; D. *B. pretiosus*, frontal. Arrow indicates the characteristic eye with a deep impression.

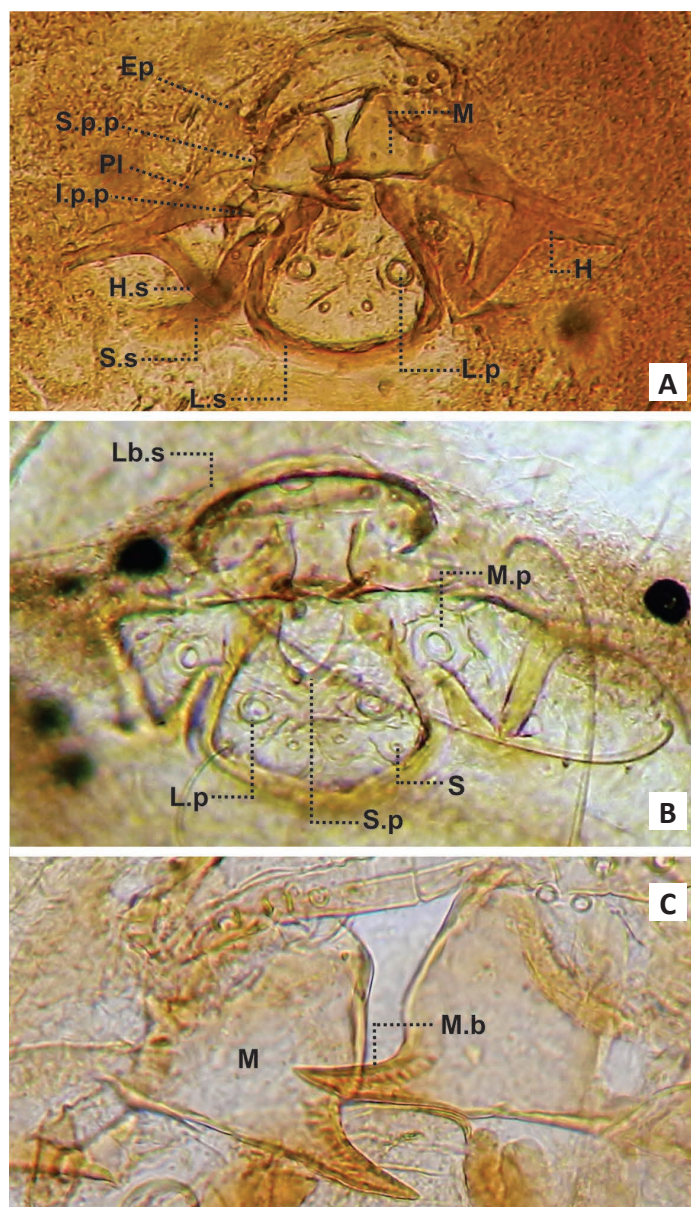


Figure 2. Cephalic structures of the final larval instar of *Brachycyrtus cosmetus*. A. Cephalic structures; B. Details of the palpi and labral structure. Note the inverted U shape of the silk press glandule; C. Details of the mandible shape and denticulated blade. Ep= Epistime; H.s= Hypostomal spurt; H= Hypostome;

L.p.p= Inferior pleurostomal process; L.p= Labial palp; L.s= Labial sclerite; Lb.s= Labral sclerite; M.b= Mandibular blade; M.p= Maxillary palp; M= Mandible; Pl= Pleurostome; S.p.p= superior pleurostomal process; S.p= Silk press; S.s= Stipital sclerite; S= Sensorium

We recommended future studies aimed for knowing the *Brachycyrtus* behavior, opening of some chrysopid cocoons and make external observations and internal dissection of the host to be able to note the presence of the parasitoid. We are aware that this process will lead to the death of the parasitoid, but it could be useful to obtain the larva in the host, and finally observe the cephalic structures attached to the larva in order to observe the presence of antennal disc, which can be lost during the molting process, or slide preparation, because of which the structure has never been documented.

Brachycyrtus cosmetus (Walkley, 1956)

(Fig. 3)

Material examined: Venezuela, Lara, Tarabana, (10°01'N - 69°16' W) 514 m, vi.2007, 1♂, pupa of *C. fairchildi*, A. Yanez (MJMO); viii.2007, 1♂, pupae of *Ceraeochrysa* sp., A. Yanez (MJMO); ii.2008, 1♀, pupa of *Ceraeochrysa* sp., A. Yanez (MJMO); v.2010, 1♀, pupa of *Ceraeochrysa* sp., A. Yanez (MJMO); vi.2010, 1♀, pupa of *C. valida*, A. Yanez (MJMO); iii.2011, 1♀, pupa of *Ceraeochrysa* sp., (MJMO); iv.2011, 1♂, pupa of *Ceraeochrysa* sp., A. Yanez (MJMO).

Current known distribution. Brazil, Costa Rica, Mexico, Panamá, Suriname, Trinidad & Tobago and Venezuela (Gauld & Ward 2000; Onody, et al. 2009; Collantes 2011; González-Moreno & Borda 2011; Yu et al. 2016; Fernandes et al. 2020a; Fernandes et al. 2020b).

New record locality. Venezuela, Lara state.



Figure 3. Map of the geographic distribution of *Brachycyrtus cosmetus*. Red circle = previous records of *Brachycyrtus cosmetus*; blue circle = new records of *Brachycyrtus cosmetus*.

Brachycyrtus pretiosus Cushman, 1936

(Fig. 4)

Material examined: Venezuela, Lara, Tarabana, (10°01' N - 69°16' W) 514 m, vii.2007, 1♂, pupa of Chrysopidae, A. Yanez (MJMO); Sanare, Minas de Arcilla La Rosa, (9°45' N 69°35' W) 1050 m, v.2010, 1♂, pupa of Chrysopidae, E. Arcaya, J. Morales, B. Carrero (MJMO).

Current known distribution. Argentina, Brazil, Costa Rica, Ecuador, Mexico, Peru and USA (Walkley 1956; Gauld & Ward 2000; Onody et al. 2009; Yu et al. 2016; Fernandes et al. 2020a; Fernandes et al. 2020b).

New locality record. Venezuela, Lara state.



Figure 4. Map of the geographic distribution of *Brachycyrtus pretiosus*. Red square = previous records of *Brachycyrtus pretiosus*; blue square = new records of *Brachycyrtus pretiosus*.

Authors' Contributions

AY planned the sampling design and carried out the collection and maintenance of the analyzed material; FD and FJSD identified the *Brachycyrtus* and chrysopids species respectively.

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