



A new species of *Gonatocerus* (Hymenoptera: Mymaridae) from Argentina, an egg parasitoid of *Tapajosa rubromarginata* (Hemiptera: Cicadellidae)

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Abstract

Specimens of *Gonatocerus virlai* S. Triapitsyn, Logarzo & de León **sp. n.**, which belongs to the *ater* species group of *Gonatocerus* Nees (Mymaridae), were reared in Argentina mostly from wild-collected and sentinel eggs of the sharpshooter *Tapajosa rubromarginata* (Signoret) (Cicadellidae: Cicadellinae: Proconiini) on citrus and corn plants. The distribution and host associations (both natural and laboratory) of *G. virlai* are given. Under quarantine laboratory conditions in the USA, it was successfully reared for many generations on an unnatural host, the glassy-winged sharpshooter, *Homalodisca vitripennis* (Germar).

Key words: Mymaridae, *Gonatocerus*, taxonomy, Cicadellidae, Proconiini, egg parasitoid, Argentina

Introduction

In the New World, many members of the *ater* species group of the common and speciose fairyfly genus *Gonatocerus* Nees (Hymenoptera: Mymaridae) are known to be egg parasitoids of various sharpshooters (Hemiptera: Cicadellidae: Cicadellinae: Proconiini) (Triapitsyn 2002, 2006a).

During surveys for sharpshooter egg parasitoids in Argentina, at least 15 species of *Gonatocerus* were recently reared and identified, mostly from sentinel eggs of *Tapajosa rubromarginata* (Signoret) (Jones 2001; Jones *et al.* 2005; Logarzo *et al.* 2005; Pilkington *et al.* 2005; G.A. Logarzo & S.V. Triapitsyn unpublished data). Among them, a new species was collected in Tucumán Province in December 2000 from eggs of *T. rubromarginata* on citrus plants, and in 1995 it was also reared in Tucumán from eggs of the same leafhopper host on corn plants by E.G. Virla. Since then it has been reared from sentinel eggs of *T. rubromarginata* in other provinces of Argentina, and also re-collected on numerous occasions in Tucumán. This species, described and named here as *Gonatocerus virlai* sp. n., is considered a promising candidate for introduction into California for biological control of the glassy-winged sharpshooter, *Homalodisca vitripennis* (Germar) (Hoddle & Triapitsyn 2005—as *Gonatocerus* sp. 6). A colony of *G. virlai* sp. n. (originating from San Miguel de Tucumán, Tucumán, Argentina) had been successfully maintained on eggs of an unnatural host, *H. vitripennis*, in *Euonymus japonica* leaves at the Department of Entomology, University of California in Riverside (UCR), California, USA quarantine laboratory since 2002 (Hoddle & Triapitsyn 2005) until December 2006,

when it was discontinued due to the lack of host material. Its colony on *H. vitripennis* eggs was also established in 2002 at the USDA, APHIS Mission quarantine laboratory in Edinburg, Texas, USA.

Molecular data showed that this species is genetically related to, but clearly different from, *G. annulicornis* (Ogloblin) and *G. walkerjonesi* S. Triapitsyn (de León *et al.* 2006a,b,c); it was also found to be genetically different from *G. morrilli* (Howard) and *G. sp.* near *morrilli* from Mexico (Hoddle & Stouthamer 2005). Cross-breeding studies performed in UCR quarantine laboratory revealed complete reproductive incompatibility between *G. virlai* sp. n. and *G. walkerjonesi* from California (as *G. "California morrilli"*) (Hoddle & Stouthamer 2005).

The known distribution and host associations of *G. virlai* sp. n. are also reported below.

Materials and methods

Collecting of material

Most of the material examined was collected in various provinces of Argentina using sentinel eggs of *T. rubromarginata* on leaves of potted citrus and corn plants, and sometimes also on Johnson grass. Sentinel eggs of *Molomea consolidata* Schröder on citrus plants were used on one occasion in Tucumán Province. Specimens were also reared from wild-laid egg masses of *T. rubromarginata* on various plants. Other collecting methods were used occasionally as well, such as Malaise traps, yellow pan traps, and sweeping with a net. The specimens earlier collected from several taxonomic collections of Mymaridae were also examined and identified. All non-type alcohol-preserved specimens are stored in freezers at -20°C for future molecular studies.

Taxonomy

Gonatocerus is a well-known genus and its generic and species group diagnoses are available elsewhere (Huber 1988). Terms for morphological features are those of Gibson (1997). Acronyms for depositories of specimens are as follows: CNCI, Canadian National Collection of Insects, Ottawa, Ontario, Canada; IMLA, Fundación e Instituto Miguel Lillo, San Miguel de Tucumán, Tucumán, Argentina; MLPA, Museo de La Plata, La Plata, Buenos Aires, Argentina; UCRC, Entomology Research Museum, University of California, Riverside, California, USA; USNM, National Museum of Natural History, Washington, District of Columbia, USA. An abbreviation used in the text is: F = antennal funicle segment (female) or antennal flagellar segment (male).

Host association studies

Studies on the host associations of *Gonatocerus* species were conducted at PROIMI, San Miguel de Tucumán (no-choice tests using a number of species of Cicadellidae and other families of Hemiptera (E.G. Virla, G.A. Logarzo, unpublished data). Host field range studies in Mendoza and Tucumán Provinces on another species, *G. tuberculifemur* (Ogloblin), also yielded new, apparently unnatural host associations of *G. virlai* sp. n. (E.G. Virla, G.A. Logarzo, unpublished data).

Taxonomy

***Gonatocerus virlai* S. Triapitsyn, Logarzo & de León sp. n.**

(Figs 1–9)

Gonatocerus sp. 6: Hoddle & Stouthamer 2005: 339; Hoddle & Triapitsyn 2005: 341–342; De León *et al.* 2006a: 41–42; De León *et al.* 2006b: 54; De León *et al.* 2006c: 57–58.

Gonatocerus sp.: Jones *et al.* 2005: 243.

Type material

Holotype female on slide [MLPA]: ARGENTINA, Tucumán, Tafí Viejo, 7–11.i.2001, E. Virla, “ex. eggs of *Tapajosa rubromarginata* (Signoret) exposed in citrus fields #F6”. Paratypes: ARGENTINA. CÓRDOBA, Villa de Soto, 30°50'53"S, 65°00'18"W, 540 m, 24.i.2003, G. Logarzo, L. Varone (ex. sentinel eggs of *T. rubromarginata* on citrus left 17.i.2003 by G. Logarzo, L. Varone, E. & M. Virla, W. Jones and S. Triapitsyn, emerged 7.ii.2003 in UCR quarantine, Riverside, California, USA) [1 male on point, UCRC]. CORRIENTES, Yapeyú, xi.2006, G. Logarzo (ex. eggs of *T. rubromarginata*) [1 female, 1 male on points, UCRC]. LA RIOJA: Anillaco, 1–31.iii.2001, P. Fidalgo, J. Torrens, G. Fidalgo [1 female on point, UCRC]. Castro Barros, La Calera, 8.i.2001, P. Fidalgo [1 female on slide, IMLA]. MISIONES, Loreto, 9.xii.1931, A.A. Ogloblin [1 female on slide, MLPA]. SALTA, ca. 14 km N of Rosario de la Frontera, 25°42'45.4"S, 64°56'10.9"W, 780 m, 21.i.2003, S. Triapitsyn, G. Logarzo [1 female on point, UCRC]. TUCUMÁN: El Cadillal ([Ruta Nacional] RN9, km 1311), 23.i.1995, E. Virla (ex. eggs of *T. rubromarginata* on corn) [1 female, 2 males on slides and 1 female, 1 male on cards, CNCI]. San Miguel de Tucumán, soccer field near PROIMI, 26°48'35.6"S, 65°14'24.6"W, 500 m, 2002, E. Virla (ex. eggs of *T. rubromarginata* on Johnson grass) [1 male on slide, UCRC, 2 females on points, IMLA, UCRC, and 12 males on points, IMLA (6), UCRC (3), and USNM (3)]. Tafí Viejo: xii.2000, E. Virla, ex. eggs of *T. rubromarginata* in citrus orchard [1 female, 1 male on points, UCRC]; 11.i.2001, E. Virla, ex. eggs of *T. rubromarginata* in field [2 females on points, UCRC]; 7–11.i.2001, E. Virla, ex. eggs of *T. rubromarginata* in citrus orchard [12 females on points, CNCI (1), IMLA (2), MLPA (2), UCRC (4), USNM (3), 1 male on slide and 1 male on point, UCRC]; 3–10.iii.2002, E. Virla, ex. eggs of *T. rubromarginata* on lemon (colony originators, emerged en route to USDA, APHIS Mission quarantine laboratory, Edinburg, Texas, USA, died 15–20.iii.2002) [1 female on point, 2 males on slides and 3 males on points, UCRC]. USA. CALIFORNIA, Riverside Co., Riverside, laboratory colony at UCR quarantine: emerged 20.iv.2005 from eggs of *H. vitripennis* on *Euonymus japonica* leaves, coll. V. Berezovskiy [1 female, 2 males on points, UCRC]; originally from: Argentina, Tucumán, San Miguel de Tucumán, soccer field near PROIMI, 26°48'35.6"S, 65°14'24.6"W, 500 m, 20.i.2003, G. Logarzo, L. Varone, W. Jones, S. Triapitsyn, E. Virla (emerged 10.ii. 2003 in UCR quarantine from eggs of *T. rubromarginata* on Johnson grass).

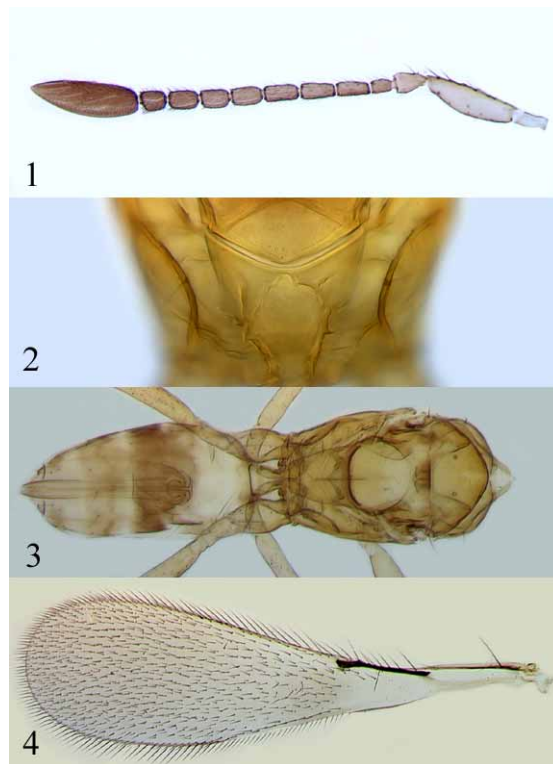
Additional material examined

ARGENTINA. CÓRDOBA, Las Tapias, 16–25.i.xi.2003, M. Virla (ex. egg mass of a proconiine sharpshooter on grape leaf) [1 female in alcohol, USDA, ARS SABCL]. CORRIENTES, San Cosme, 11–13.xi.2003, G. Logarzo, L. Varone (ex. sentinel eggs of *T. rubromarginata* on citrus) [5 females in alcohol, USDA, ARS SABCL]. LA RIOJA, Anillaco, 7.xi.2002, G. Logarzo, L. Varone (ex. sentinel eggs of *T. rubromarginata* on citrus) [16 females, 5 males in alcohol, USDA, ARS SABCL]. ENTRE RÍOS, Concordia, 12–14.xii.2001, G. Logarzo (ex. sentinel eggs of *T. rubromarginata* on citrus) [2 males in alcohol, USDA, ARS SABCL]. MENDOZA: La Consulta, 23–27.x.2002, G. Logarzo, E. Virla (ex. sentinel eggs of *T. rubromarginata* on citrus) [2 females, 1 male in alcohol, USDA, ARS SABCL]. San Carlos, i.2007, G. Logarzo, F. Palotini (ex. wild eggs of *T. rubromarginata* on *Populus* sp. and from sentinel eggs of *T. rubromarginata* on citrus) [numerous females and males in alcohol, USDA, ARS SABCL]. MISIONES, Cerro Azul, 27.x.2000, G. Logarzo (ex. sentinel eggs of *T. rubromarginata* on citrus) [2 females, 2 males in alcohol, USDA, ARS SABCL]. TUCUMÁN: El Manantial, 22–24.i.2005, E. Virla (ex. sentinel eggs of *Molomea consolidata* Schröder on citrus) [3 females in alcohol, USDA, ARS SABCL]. San Miguel de Tucumán, soccer field near PROIMI, 26°48'35.6"S, 65°14'24.6"W, 500 m, 21–22.i.2005, E. Virla (ex. sentinel eggs of *Molomea consolidata* Schröder on citrus) [7 females, 1 male in alcohol, USDA, ARS SABCL]. USA. TEXAS, Hidalgo Co., Edinburg, USDA, APHIS Mission quarantine, from laboratory colony (various dates during 2002) [numerous females and males on points, in gelatin capsules, and in alcohol, UCRC]; originally from: Argentina, Tucumán, Tafí Viejo, 3–10.iii.2002, E. Virla (ex. eggs of *T. rubromarginata* on lemon).

Description

FEMALE (holotype and paratypes). Body length 1.1–1.4 mm. Head, mesosoma, and metasoma (Fig. 3) mostly light brown except trabeculae and vertex (between the ocelli only) dark brown, mesoscutum (posteriorly) and scutellum (anteriorly) with irregular brownish spots, and middle gastral terga brown; scape and pedicel light brown, flagellum brown to dark brown; legs light brown.

Antenna (Fig. 1) with radicle 2.4–2.5 x as long as wide, rest of scape about 3.5 x as long as wide, with strong setae; pedicel longer than F1, with a few strong setae; all funicular segments longer than wide and densely setose (setae short); F2 much longer than F1 and slightly shorter than F3 (F3 and F4 equal in length and the longest funicular segments), F5 a little longer than F6, F7 slightly longer than F6 and notably longer than F8; F1 without longitudinal sensilla, longitudinal sensilla on F2 (0 or 1), F3 (1 or 2), F4 (2), F5 (2), F6 (2), F7 (2), and F8 (2); clava with 8 longitudinal sensilla, 3.2–4.2 x as long as wide.



FIGURES 1–4. *Gonatocerus virilai* (female, holotype). 1. Antenna. 2. Dorsellum and propodeum. 3. Mesosoma and metasoma. 4. Forewing.

Mesosoma as in Fig. 5. Pronotum divided medially, each lobe with 2 strong dorsal and 2 weak lateral setae. Mesoscutum much wider than long, shorter than scutellum; midlobe of mesoscutum with a pair of strong, long setae. Dorsellum of metanotum (Figs 2, 5, 6) with posterior margin widely angulate medially. Propodeum (Figs 2, 5, 6) with curved submedial carinae; these not meeting posteriorly and meeting or almost meeting at anterior margin of propodeum, extending to its anterior margin. Propodeum more or less smooth between submedial carinae but between submedial and lateral carinae with conspicuous transverse wrinkles, and with cellulate sculpture lateral to lateral carinae. Protibia without conical sensilla; metacoxa finely, inconspicuously sculptured.

Forewing (Fig. 4) 3.5–3.7 x as long as wide; marginal setae short, the longest marginal seta 1/5–1/4 greatest wing width. Forewing blade slightly infumate throughout, bare behind submarginal and marginal veins except for a few setae at apex of marginal vein, remainder of the blade densely setose. Submarginal vein with 1 macrochaeta and 2 smaller setae, marginal vein with 4 or 5 setae between proximal and distal macrochaetae. Hind wing 19–23 x as long as wide, the blade slightly infumate and mostly bare except for the usual two com-

plete rows of setae along margins and several scattered setae at apex and an incomplete row of short setae just distal to apex of venation.

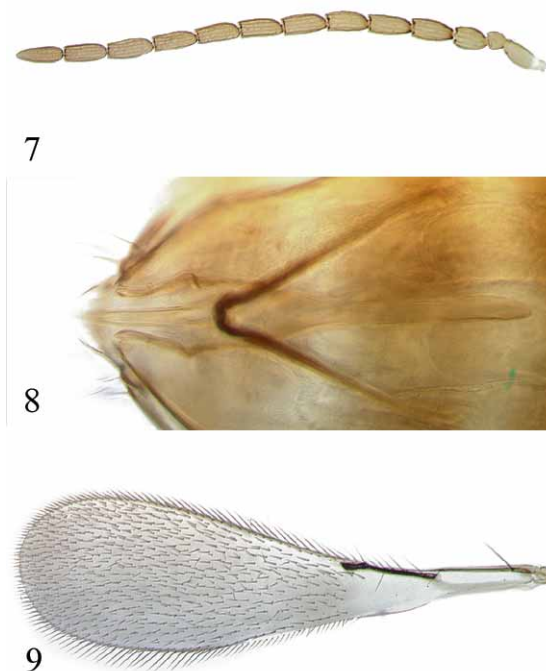


FIGURES 5, 6. *Gonatocerus virilai* (female, scanning electron micrographs). 5. Mesosoma. 6. Dorsellum and propodeum.

Gaster a little longer than mesosoma. Petiole 1.2–1.3 x as wide as long, trapezoidal. Ovipositor 7/10–4/5 length of gaster, not exerted beyond its apex. Ovipositor length: mesotibia length about 1.0. Outer plates of ovipositor each with 1 distal seta.

Measurements of the holotype (in µm, as length or length:width). Mesosoma 529; petiole 58; gaster 584; ovipositor 403. Antenna: radicle 73; rest of scape 212; pedicel 70; F1 45; F2 73; F3 79; F4 79; F5 70; F6 64; F7 67; F8 58; clava 242. Forewing 1341:381; longest marginal seta 91. Hind wing 984:45; longest marginal seta 109.

MALE (paratypes). Body length 1.1–1.4 mm. Body color usually a little (but sometimes notably) darker than in female, particularly of mesonotum and gastral terga (mostly brown, with some light brown); scape and pedicel light brown, flagellum brown to dark brown. Antenna (Fig. 7) with scape and radicle fused, scape (excluding radicle) 2.7–3.4 x as long as wide, pedicel very small, F1 the shortest and widest flagellar segment; all flagellomeres longer than wide and with 10–12 longitudinal sensilla. Forewing (Fig. 9) 3.4–3.5 x as long as wide. Genitalia as in Fig. 8; apex of apodeme of genital sternite more or less rounded.



FIGURES 7–9. *Gonatocerus virlai* (male, paratypes). 7. Antenna. 8. Genitalia. 9. Forewing.

Diagnosis

Member of the *ater* species group of *Gonatocerus*, as defined by Huber (1988), and its *morrilli* subgroup, which is characterized by a usually conspicuously rugose propodeum, particularly posteriorly. The petiole in the species belonging to this subgroup is usually (but not always, as in the case of *G. virlai*) distinctly longer than wide. Among the described species of *Gonatocerus* in the New World, the following ones belong to the *morrilli* subgroup of the *ater* group: *G. annulicornis* (Ogloblin), *G. coxalis* (Ogloblin), *G. grandis* (Ogloblin), *G. helavai* Yoshimoto, *G. morgani* S. Triapitsyn, *G. morrilli* (Howard), *G. quirogai* (Ogloblin), *G. tuberculifemur* (Ogloblin), and *G. walkerjonesi* S. Triapitsyn. Among these, *G. annulicornis*, *G. morgani*, *G. morrilli*, *G. quirogai*, and *G. walkerjonesi* have white or contrastingly lighter funicle segments of the female antenna. *Gonatocerus annulicornis* and *G. walkerjonesi* cluster with *G. virlai* sp. n. molecularly (de León *et al.* 2006a,b,c), thus supporting their inclusion in the same subgroup. The female flagellum is all brown to dark brown, without white or light funicular segments, in *G. coxalis*, *G. virlai*, and *G. tuberculifemur*. *Gonatocerus coxalis* differs from *G. virlai* in having a conspicuous subapical brown spot on the female forewing blade (forewing blade slightly infumate throughout in *G. virlai*). The propodeum of the dark brown-colored *G. tuberculifemur* is not rugose as in *G. virlai* but smooth between the submedial carinae and elsewhere with a faint cellulate sculpture. The male of *G. grandis*, for which females are not known, differs from the male of *G. virlai* by its much larger body size (body length of the slide-mounted specimens 1.8–2.4 mm) and also by a hyaline forewing. The male of *G. helavai*, which is known from the male sex only, has branched antennae and a very long petiole (much longer than wide).

Gonatocerus virlai does not match the descriptions and types of any of the numerous species of *Gonatocerus* from Argentina and elsewhere in South America described by A.A. Ogloblin and others [the senior author examined all of them (except for one lost type of an unrelated species from Ecuador, which belongs to the *membraciphagus* species group) for the forthcoming revision of the described Neotropical species of *Gonatocerus* (Triapitsyn 2006b)].

Comments

Interestingly, A.A. Ogloblin also recognized this as a new species because the female specimen (now a paratype of *G. virlai*) from Loreto, Misiones, is labeled using his manuscript name “*Gonatocerus loretoensis*”.

Etymology

This species is named after our colleague and friend (and co-author of this communication) Eduardo G. Virla, who first reared it from the eggs of *T. rubromarginata* and also studied its biology.

Natural hosts

Cicadellidae (Proconiini): *Tapajosa rubromarginata* (Signoret) as well as *Dechacona missionum* (Berg) and *Molomea consolidata* Schröder (the latter two from the sentinel eggs only). Also Cicadellini: *Ciminius platensis* (Berg) and *Plesiommata mollicella* (Fowler) (from sentinel eggs only).

Laboratory and apparently unnatural hosts

Cicadellidae (Proconiini): *Homalodisca vitripennis* (Germar) as well as *Oncometopia tucumana* (Schröder), *Tapajosa similis* (Melichar), and *Tretogonia notatifrons* Melichar.

Comments

Our laboratory (no-choice) and field host range studies revealed that *G. virlai* readily parasitized eggs of Proconiini, although occasionally it also attacked sentinel eggs of two leafhopper species from the Cicadellini (E.G. Virla unpublished data). Biological traits of this species will be reported elsewhere (E.G. Virla and G.A. Logarzo in preparation).

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