

First known host records for the egg parasitoid *Gonatocerus californicus* (Hymenoptera Mymaridae)

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Abstract

Two leafhopper (Hemiptera Cicadellidae) hosts are reported for *Gonatocerus* (*Gonatocerus*) *californicus* Girault (Hymenoptera Mymaridae): *Exitianus obscurinervis* (Stal) and *Spangbergiella vulnerata lacerdae* Signoret. At El Manantial site in Tucumán Province, Argentina, *G. californicus* emerged from 7.1% and 90.5% of the parasitized sentinel eggs of the respective host on maize plants. Notes on the biological traits of *G. (G.) californicus* are provided.

Key words: *Exitianus obscurinervis*, *Spangbergiella vulnerata lacerdae*, *Gonatocerus* (*Gonatocerus*) *californicus*, egg parasitoid, Argentina.

Introduction

Several species of Aphelinidae, Eulophidae, Mymaridae, and Trichogrammatidae (Hymenoptera) were obtained during a study of egg parasitoids associated with leafhoppers (Hemiptera Cicadellidae) found in maize crops in Argentina (Luft Albarracin, 2009). One of these, *Gonatocerus* (*Gonatocerus*) *californicus* Girault is associated with two leafhopper species that lay their eggs in the leaf sheaths of maize plants. Here we report on its hosts and biology.

Gonatocerus is a common and speciose genus found in all terrestrial environments (Huber, 1988); some of its species have been used in classical biological control programs against agricultural pests (Triapitsyn, 2002). In Argentina, 50 described and several undescribed species of *Gonatocerus* are known (Luft Albarracin *et al.*, 2009; Triapitsyn *et al.*, 2010). The main hosts of *Gonatocerus* species are various leafhoppers (Cicadellidae). Some Aetalionidae and Membracidae (Hemiptera) have also been reported as hosts (Triapitsyn, 2002; Triapitsyn *et al.*, 2010). In the New World, species of *G. (Cosmocomoidea* Howard) mainly parasitize Proconiini (Cicadellinae). In the Americas, there are few confirmed host records for the species of the subgenus *G. (Gonatocerus)*: the known ones are from eggs of the leafhopper genus *Draeculacephala* Ball (Cicadellinae Cicadellini). *Gonatocerus* (*Gonatocerus*) *mexicanus* Perkins attacks eggs of three species, *Draeculacephala minerva* Ball, *Draeculacephala mollipes* (Say), and *Draeculacephala producta* (Walker), *G. (Gonatocerus) koebelei* Perkins was registered on *D. mollipes* and *D. producta*, and *G. (Gonatocerus) rivalis* Girault was reported to parasitize eggs of *Draeculacephala antica* (Walker) (Huber, 1988). Hosts of the widely distributed *G. californicus* [Nearctic-Mexico, USA, Neotropical-Argentina, Colombia and southern Mexico, and Oceania (Hawaiian Islands)] (Huber, 1988; Triapitsyn *et al.*, 2010) are unknown.

Exitianus obscurinervis (Stal) (Cicadellidae Deltocephalinae Euscelini) is found in several provinces of

Argentina and is associated with a great variety of cereal crops as well as surrounding weeds (Tesón *et al.*, 1986; Remes Lenicov *et al.*, 2004). It is related to *Exitianus exitiosus* (Uhler), an important pest in Central America and vector of Corn Stunt Spiroplasma (CSS), which causes considerable losses to farmers in that region (Nault, 1980). Recently *E. obscurinervis* was registered as new experimental vector of *Spiroplasma kunkei* (Carlóni *et al.*, 2011). Virla (1990; 1994) provided information on the biology of *E. obscurinervis* under laboratory conditions as well as on its field behaviour. Three parasitoid species have been previously reported attacking *E. obscurinervis* eggs in Argentina: *Oligosita desantisi* Viggiani, *Paracentrobia subflava* (Girault) (both Trichogrammatidae), and an unidentified species of Polynematini (Mymaridae) (Virla, 2000).

Spangbergiella vulnerata lacerdae Signoret (Cicadellidae Deltocephalinae Hecalini) is a widely distributed species in South America, and especially in Argentina where it is found on maize plants and surrounding weeds (Tesón *et al.*, 1986; Luft Albarracin *et al.*, 2008). It has had no recorded egg parasitoids.

Methods

Samples were taken during 2 growing seasons (2004-2005 and 2005-2006) from December to April, in an experimental corn field at El Manantial (26°49'50.2"S, 65°16'59.4"W, 495 m a.s.l.) in Tucumán Province. The cornfield (free of pesticide applications) employed for exposure was 1 hectare, and always exposures carried out during the vegetative stage of the crop (cotyledon to V10).

To obtain host eggs, five leafhopper females each of *E. obscurinervis* and *S. vulnerata lacerdae* were placed in separate plastic cages on maize leaves for oviposition in the laboratory. Each cage (35 cm high × 12 cm diameter) contained leaves of potted maize plants in the vegetative stage. After 48 h, the adult females of both leafhoppers were removed, and the eggs oviposited on

each maize leaf were counted. The pots that contained these sentinel host eggs (less than 48 hours old) were then exposed to parasitism in cornfield for 3 or 4 days. The sentinels were placed in the maize field 3 m from the border and 10 m from each other. This was repeated 29 times in *E. obscurinervis* and 8 times to *S. vulnerata lacerdae*, at different sampling dates. A potted plant with eggs was considered a single replicate. The replicates were maintained in a rearing room at 25 ± 2 °C.

After exposure, the pots were taken back to the laboratory and 8 days later the leaves with the exposed eggs were cut from the plant and transferred to Petri dishes containing wet tissue paper at the bottom. The dishes were then covered with a clear plastic food wrap to avoid dehydration of the eggs and leaves, and to prevent parasitoids from escaping. Parasitized eggs were checked daily to ensure leaf quality until emergence of all adult parasitoids.

Specimens were preserved in 70% ethanol and later some were point-mounted or slide-mounted in Canada balsam. Voucher specimens of *G. californicus* were deposited in the entomological collection of the Fundación e Instituto Miguel Lillo, San Miguel de Tucumán, Tucumán, Argentina (IMLA), and the Entomology Research Museum, University of California, Riverside, California, USA (UCRC).

Results

Females of both leafhopper host species deposit egg masses parallel to one another in the leaf sheaths of maize plants, and the eggs are completely covered by plant tissue. These are the only two species of Cicadellidae associated with maize that lay their egg masses in the leaf sheaths of maize. The average number of eggs laid by *E. obscurinervis* was 7.4 ± 3.2 (range: 4-16) and more than 70% of the egg masses examined contained 4-7 eggs. *S. vulnerata lacerdae* laid a higher average number of eggs: 12.5 ± 3.2 (range: 10-22).

Of the 1,031 sentinel eggs of *E. obscurinervis* exposed in the maize field, 65.9% were parasitized. Among the nine parasitoid species that were obtained, *G. californicus* represented 7.1% of the specimens. This parasitoid was obtained in only 3 out of 29 times from the eggs exposed in the field.

Of the 264 sentinel eggs of *S. vulnerata lacerdae* eggs exposed, 67.4% were parasitized. Among the three parasitoid species that emerged, *G. californicus* was the most abundant with 90.5% of the specimens collected. This parasitoid was obtained in only 2 out of 8 times from the eggs exposed in the field.

The eggs parasitized by *G. californicus* turned dark eight days after field exposure.

G. californicus is a solitary parasitoid producing only one adult per host egg, similar to that reported for other species of *Gonatocerus* on maize plants in Tucumán Province (Virla *et al.*, 2005; 2008). A single wasp emerges through a circular hole made close to the apical extremity of its host egg. In both hosts, developmental time (from oviposition to adult emergence) of *G. californicus* in the field study varied from 13 to 15 days.

The sex ratio was markedly female biased (females to males): 4.7:1.

Material examined - (*G. californicus*): ARGENTINA. Tucumán, El Manantial, E. Luft Albarracin: from eggs of *E. obscurinervis*: 3-6.i.2005 [9 females, 2 males, IMLA], 10-17.i.2005 [2 females, 1 male, UCRC], 26-29.xii.2005 [3 females, 2 males, IMLA]; from eggs of *S. vulnerata lacerdae*: 23-30.i.2006 [30 females, 8 males, IMLA; 3 females, 1 male, UCRC], 26.i-2.ii.2006 [8 females, 3 males, IMLA].

This is the first study that reports on Deltocephalinae species as hosts of *Gonatocerus* in Argentina. *G. californicus* might be a useful agent for biological control of *E. obscurinervis*, a potential pest of corn. Future studies in the laboratory may provide more biological data of this parasitoid.

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References

- CARLONI E., VIRLA E., PARADELL S., CARPANE P., NOME C., LAGUNA I., GIMÉNEZ PECCI M. P., 2011.- *Exitianus obscurinervis* (Hemiptera: Cicadellidae), a new experimental vector of *Spiroplasma kunkelii*.- *Journal of Economic Entomology*, 104 (6): 1793-1799.
- HUBER J. T., 1988.- The species groups of *Gonatocerus* Nees in North America with a revision of the *sulphuripes* and *ater* groups (Hymenoptera: Mymaridae).- *Memoirs of the Entomological Society of Canada*, 141: 1-109.
- LUFT ALBARRACIN E. B., 2009.- Estudios biológicos y taxonómicos sobre parasitoides oófilos de Cicadellidae (Hemiptera: Clypeorrhyncha) presentes en el cultivo de maíz en el Noroeste argentino. 258 pp. *Tesis doctoral*, Universidad Nacional de Tucumán, Argentina.
- LUFT ALBARRACIN E., PARADELL S., VIRLA E., 2008.- Cicadellidae (Hemiptera: Auchenorrhyncha) associated to maize crops in northwestern Argentina; influence of the sowing date and phenology on the abundance and diversity.- *Maydica*, 53: 289-296.
- LUFT ALBARRACIN E., TRIAPITSYN S. V., VIRLA E. G., 2009.- Annotated key to the genera of Mymaridae (Hymenoptera: Chalcidoidea) in Argentina.- *Zootaxa*, 2129: 1-28.
- NAULT L. R., 1980.- Maize bushy stunt and corn stunt: a comparison of disease symptoms, pathogen host ranges, and vectors.- *The American Phytopathology Society*, 70: 659-662.
- REMES LENICOV A. M. MARINO DE, PARADELL S., VIRLA E., 2004.- Homoptera: Cicadellidae, pp. 331-342. In: *Catálogo de Insectos Fitófagos de la Argentina y sus plantas asociadas* (CORDO H. A., LOGARZO G., BRAUN K., DI IORIO O., Eds).- Sociedad Entomológica Argentina ediciones, Buenos Aires, Argentina.
- TESÓN A., REMES LENICOV A. M. MARINO DE, DAGOBERTO E. L., PARADELL S. L., 1986.- Fluctuaciones poblacionales de los cicadélidos que viven sobre maíz y maleza circundante en la zona de Sampacho, Córdoba, Argentina (Homoptera, Cicadellidae). - *Revista de la Sociedad Entomológica Argentina*, 44 (1): 77-84.

- TRIAPITSYN S. V., 2002.- Species-level taxonomy of Mymaridae (Hymenoptera): current status and implications for biological control of leafhoppers of economic importance, pp. 89-94. In: *Parasitic wasps: Evolution, systematics, biodiversity and biological control* (MELIKA G., THURÓCZY C., Eds).- Agroinform, Kiado és Nyomda Kft., Budapest, Hungary.
- TRIAPITSYN S. V., HUBER J. T., LOGARZO G. A., BEREZOVSKIY V. V., AQUINO D. A., 2010.- Review of *Gonatocerus* (Hymenoptera: Mymaridae) in the Neotropical region, with description of eleven new species.- *Zootaxa*, 2456: 1-243.
- VIRLA E., 1990.- Biología de los homópteros argentinos: I. Datos bionómicos preliminares sobre *Exitianus obscurinervis* (Stål, 1859) (Insecta - Cicadellidae).- *Revista de la Asociación de Ciencias Naturales del Litoral*, 21 (2): 25-33.
- VIRLA E., 1994.- Biología de los homópteros argentinos: II. Fluctuación poblacional de *Exitianus obscurinervis* (Stål, 1859) (Insecta - Cicadellidae).- *Revista de la Facultad de Agronomía (La Plata)*, 70: 37-49.
- VIRLA E. G., 2000.- Aportes al conocimiento del complejo de enemigos naturales de *Exitianus obscurinervis* (Insecta - Cicadellidae).- *Boletín de Sanidad Vegetal, Plagas*, 26 (3): 365-375.
- VIRLA E. G., LOGARZO G. A., JONES W. A., TRIAPITSYN S., 2005.- Biology of *Gonatocerus tuberculifemur* (Hymenoptera: Mymaridae), an egg parasitoid of the sharpshooter, *Tapajosa rubromarginata* (Hemiptera: Cicadellidae).- *Florida Entomologist*, 88 (1): 67-71.
- VIRLA E. G., LOGARZO G. A., PARADELL S. L., TRIAPITSYN S. V., 2008.- Bionomics of *Oncometopia tucumana* (Hemiptera: Cicadellidae), a sharpshooter from Argentina, with notes on its distribution, host plants, and egg parasitoids.- *Florida Entomologist*, 91 (1): 55-62.

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