

First record of parasitoidism of Reduviidae (Insecta: Hemiptera: Heteroptera) by *Xanthomelanodes* Townsend, 1893 (Insecta: Diptera: Tachinidae) in the Neotropical region

Primer registro de parasitoidismo de Reduviidae (Insecta: Hemiptera: Heteroptera) por *Xanthomelanodes* Townsend, 1893 (Insecta: Diptera: Tachinidae) en la región neotropical

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Abstract. The parasitoidism of an adult female of *Heniartes jaakkoi* Wygodzinsky, 1947 (Hemiptera: Heteroptera: Reduviidae: Harpactorinae: Apiomerini) by a female of *Xanthomelanodes* cf. *brasiliensis* Townsend, 1929 (Diptera: Tachinidae: Phasiinae: Gymnosomatini), from Nova Friburgo, Brazil, is recorded. Previous observations of Phasiinae eggs on three species of Harpactorinae had been made, but without record of the parasitoid species. This is the first record of parasitoidism in Reduviidae, including both the host and the parasitoid in the Neotropical region.

Key words: Assassin bugs; *Apiomerus mutabilis*; *Xanthomelanodes arcuata*; *Zelus versicolor*.

Resumen. Se registra el parasitismo de una hembra adulta de *Heniartes jaakkoi* Wygodzinsky, 1947 (Hemiptera: Heteroptera: Reduviidae: Harpactorinae: Apiomerini) por una hembra de *Xanthomelanodes* cf. *brasiliensis* Townsend, 1929 (Diptera: Tachinidae: Phasiinae: Gymnosomatini), en Nova Friburgo, Brasil. Se realizaron observaciones previas de huevos de Phasiinae en tres especies de Harpactorinae, pero sin registro de la especie del parasitoide. Este es el primer registro de parasitoidismo en Reduviidae, incluyendo tanto al huésped como al parasitoide en la región neotropical.

Palabras clave: *Apiomerus mutabilis*; chinches asesinas; *Xanthomelanodes arcuata*; *Zelus versicolor*.

Reduviidae, a large group of predatory insects, is one of the three most speciose families of true bugs (Hemiptera: Heteroptera), containing more than 7,000 described species (Gil-Santana *et al.* 2015). About 24 subfamilies are recognized, among which, Harpactorinae has the greatest number of genera and species of Reduviidae in the Neotropical region and worldwide. The harpactorines are diurnal and found over plants where they catch their prey, being polyphagous in general. Only two of the seven recognized tribes of the subfamily, Apiomerini and Harpactorini, occur in the New World (Gil-Santana *et al.* 2015).

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Flies of the family Tachinidae are endoparasitoids of other arthropods, including hosts from at least 15 different orders (Stireman *et al.* 2019). Their hosts are predominantly other insects, and the vast majority of approximately 8500 described species of Tachinidae are lepidopteran parasitoids (Stireman *et al.* 2006; Wood and Zumbado 2010; O'Hara *et al.* 2020). Because of this behavior, many tachinid species have importance as biological control agents for forests and crop pests (Stireman *et al.* 2006; Nihei and Pavarini 2011). One of the four Tachinidae subfamilies, namely Phasiinae, are known for being almost exclusively parasitoids of different families of true bugs, with some exceptions in Strongygastrini, which has besides Heteroptera, records of Hymenoptera and Coleoptera members as hosts as well (Dupuis 1963; Blaschke *et al.* 2018; Dios and Nihei 2023, in prep.). In South America, only phytophagous species in the families Coreidae, Largidae, Lygaeidae, Pentatomidae, Pyrrhocoridae, and Scutelleridae have been recorded as hosts of Phasiinae (Guimarães 1977; Liljesthröm and Avalos 2015). In the Nearctic region, there were three records of Reduviidae as hosts of *Xanthomelanodes arcuata* (Say, 1829) (Phasiinae) in the United States of America: *Pselliopus cinctus* (Fabricius, 1776) (Yonke and Medler 1970), *Sinea spinipes* (Herrich-Schäffer, 1846) (Swadener and Yonke 1973), and *Pselliopus barberi* Davis, 1912 (Harpactorinae: Harpactorini) (Swadener and Yonke 1975). In all records the emergence of a single larva from each host was observed, and in the two former species, the larvae emerged from the 5th instar nymph, while in the latter species it emerged from an adult male. There are also a few records of other Phasiinae parasitizing Heteroptera from the Palearctic region, but most of these seem to be of more generalist parasitoid species, as each phasiine species uses as hosts a wide range of Heteroptera families, except for the single record of host from *Phasia* sp. (as *Alophorophasia* sp.) (Tschorsnig 2017).

From the Neotropical region there are no records of Reduviidae parasitoidism by Tachinidae. The first author (HRG-S), however, recorded Phasiinae eggs on external portions of the body of a male *Apiomerus mutabilis* Costa Lima, Seabra & Hathaway, 1951, on several individuals of *Heniarthes jaakkoi* Wygodzinsky, 1947 (Harpactorinae: Apiomerini) (Gil-Santana and Forero 2010), and on a female of *Zelus versicolor* (Herrich-Schäffer, 1848) (Harpactorinae: Harpactorini) (Fig. 1), in Nova Friburgo, Rio de Janeiro State, Brazil. While the male of *A. mutabilis* had four eggs over its body, specimens of *H. jaakkoi* were covered by several eggs, including a male with 11 eggs (Gil-Santana and Forero 2010). Several of these specimens were kept alive in individual containers and observed until their death. After the death of the *A. mutabilis* specimen and one of the *H. jaakkoi* specimens, a fly puparium was observed in each glass container; they were kept under observation. However, no adult fly emerged from these puparia, while from all other containers with individuals of *H. jaakkoi* not a single larvae emerged. In the case of the male of *H. jaakkoi* with the greater number of eggs attached (11), three days after its death, a ventral incision was made to examine both the thoracic and abdominal cavities, but no larva was found (Gil-Santana and Forero 2010). However, at the time, a thorough search for any signs of cephalopharyngeal skeleton was not done, so it is not possible to exclude the possibility of parasitoidism. All these records occurred in Nova Friburgo, Rio de Janeiro State, Brazil, more than a decade ago (Gil-Santana and Forero 2010; this work, Fig. 1). All the observed eggs were likely from flies of the Gymnosomatini tribe, but the second author (RVPD) could not examine those specimens as they were destroyed on the 2nd of September 2018, during the fire that destroyed most of the zoological collections of the National Museum of the Federal University of Rio de Janeiro (MNRI), including the entire Heteroptera collection (Escobar 2018). Among phasiines, Gymnosomatini, some Strongygastrini and Hermyini produce large eggs, as well as the Eutherini (Dexiinae), and the eggs of each group have subtle morphological differences (Dios and Nihei 2023,

in prep.). However, that inference is possible as Gymnosomatini are the most abundant group in the Neotropical Region, the single species of Hermyini occur only in U.S.A., Mexico and Costa Rica, the single Eutherini species in South America is relatively rare and the tribe has no record for Reduviidae host use, and the Neotropical Strongygastrini are smaller flies with very subtle eggs, not easily visible on the host (Guimarães 1977; O'Hara *et al.* 2020; Dios and Nihei 2023, in prep.).

On the 31st of January 2022, over the low vegetation of a country road in a woodland border (Fig. 2), in Nova Friburgo, Rio de Janeiro State, Brazil (22°16' S / 42°29' W; 1000 m.a.s.l.), a female of *H. jaakkoi* (Fig. 3) was collected. A Phasiinae egg was observed over the lateral portion of the hind lobe of the pronotum (Fig. 4). The reduviid was kept alive in an individual container; on the 16th of February, it was found dead beside a larva which pupated in a short time. On 7th of March, a female of *Xanthomelanodes cf. brasiliensis* Townsend, 1929 (Diptera: Tachinidae: Phasiinae: Gymnosomatini) (Figs. 5-6) emerged from the puparium.

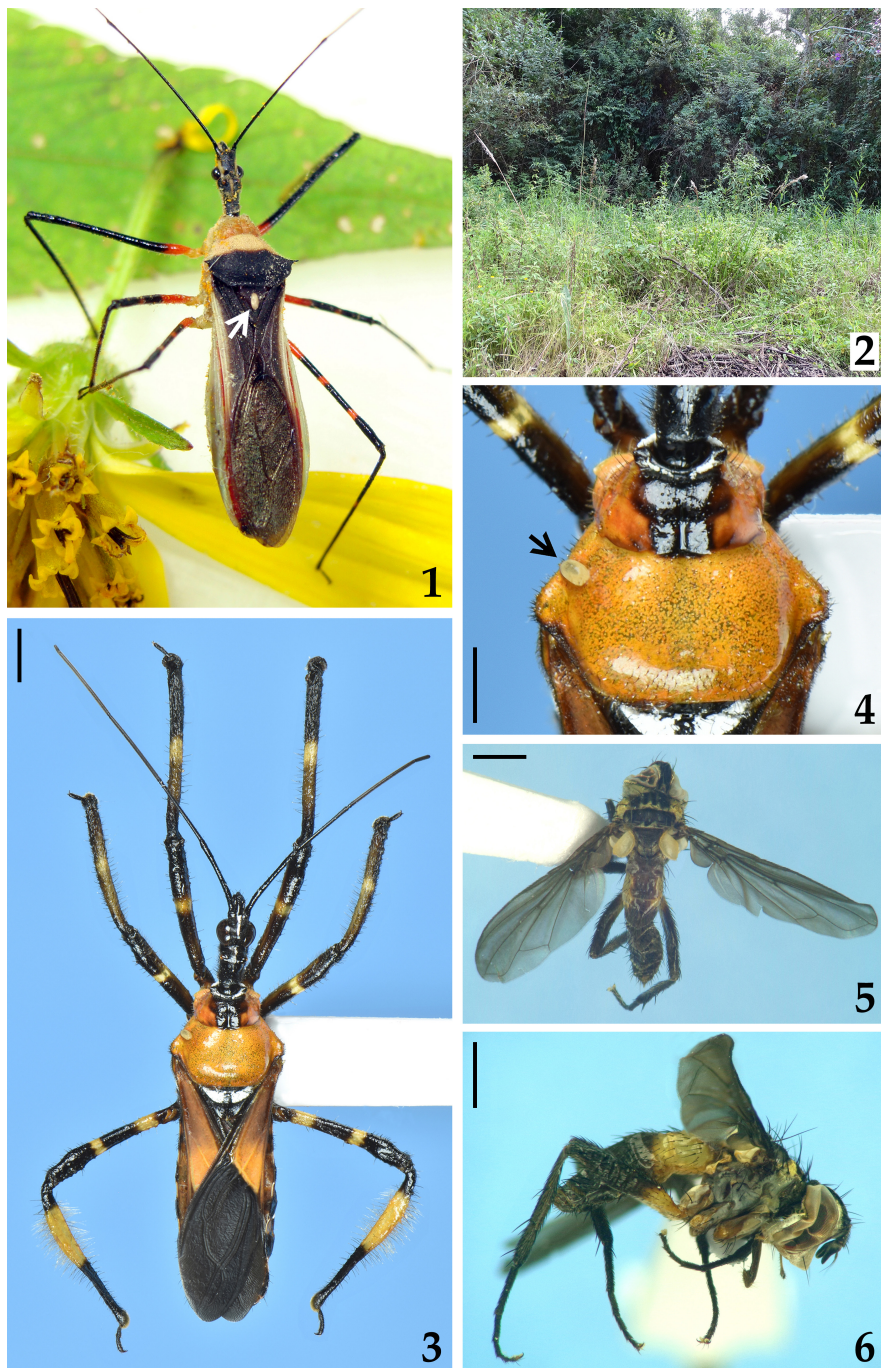
Heniartes jaakkoi (Figs. 3-4) was identified based on Wygodzinsky (1947) and Gil-Santana and Forero (2010).

The identification of *Xanthomelanodes cf. brasiliensis* (Figs. 5-6) followed Sabrosky (1950), Toma (2003), and Wood and Zumbado (2010).

The specimens studied here are deposited at the "Coleção de Triatomíneos do Instituto Oswaldo Cruz" (CTIOC) of the "Laboratório Nacional e Internacional de Referência em Taxonomia de Triatomíneos" (LNIRTT) in Oswaldo Cruz Institute, Rio de Janeiro, Brazil, under the following numbers: *H. jaakkoi*: CTIOC 13350, and *X. cf. brasiliensis*: CTIOC 13351.

All *Xanthomelanodes* Townsend, 1893 host records (*X. arcuata*) in the Nearctic region (Yonke and Medler 1970; Swadener and Yonke 1973; Swadener and Yonke 1975) are from Harpactorinae species. All the observed hosts or potential hosts herein observed for the Neotropical Region are also of Harpactorinae species. It is curious to note this host transition, as usually phasiines choose phytophagous heteropterans as hosts, and such change may have come with some predation risks, as the fly could resemble a few of the host's preys, even though there are no records in the literature about the oviposition behavior of this genus, or other Reduviidae parasitoid, even though there are detailed records for the oviposition in different phytophagous heteropterans (Dupuis 1963). However, in a record observed in Russia (Aksenenko and Gaponov 2012), the Gymnosomatini *Ectophasia crassipennis* (Fabricius, 1794) was reared from an attached egg on the ventral part of the abdomen of *Rhynocoris annulatus* (Linnaeus, 1758) (Harpactorinae: Harpactorini), differently from the egg observed in the thorax here. Future studies that explore these biological questions are necessary, and are only possible when these biological relationships are known.

Due to the problematic and challenging taxonomic history of tachinids in the Neotropical region (O'Hara 2013), it is not possible to confirm the *Xanthomelanodes cf. brasiliensis* species at this moment. There are 11 *Xanthomelanodes* species recorded from the Neotropical Region, and a single species (*X. brasiliensis* Townsend, 1929) is recorded from Brazil (Guimarães 1971; Nihei *et al.* 2023), however a taxonomic revision of the genus in the Region is needed, as the range of some Central American species need to be expanded, and possible new species need to be described. There are also problems with male/female association, and the *X. brasiliensis* type material examined was a male. Nonetheless, because of the lack of information on Tachinidae parasitizing Reduviidae in Neotropical region, the current first proven observation is worth of record, although limited to the information of the genus of the fly.



Figures 1-6. 1. *Zelus versicolor*, live female with a Gymnosomatini egg on its scutellum (pointed by an arrow). 2. Vegetation in which the parasitized female of *Heniartes jaakkoi* was found. 3-4. *Heniartes jaakkoi*, female parasitized by *Xanthomelanodes* cf. *brasiliensis*, dorsal view. 3. Scale: 2.0 mm. 4. Pronotum, the arrow points to the egg of the fly. Scale: 1.0 mm. 5-6. *Xanthomelanodes* cf. *brasiliensis*, female in dorsal and lateral views. Scales: 1.0 mm. / 1-6. 1. *Zelus versicolor*, hembra viva con un huevo de Gymnosomatini en su escutelo (señalado por una flecha). 2. Vegetación en la que se encontró la hembra parasitada de *Heniartes jaakkoi*. 3-4. *Heniartes jaakkoi*, hembra parasitada por *Xanthomelanodes* cf. *brasiliensis*, vista dorsal. 3. Escala: 2,0 mm. 4. Pronoto, la flecha apunta al huevo de la mosca. Escala: 1,0 mm. 5-6. *Xanthomelanodes* cf. *brasiliensis*, hembra en vistas dorsal y lateral. Escalas: 1,0 mm.

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