

Scientific Note

New records of associations between species of Reduviidae (Hemiptera: Heteroptera) and plants in Argentina

Nuevos registros de asociaciones entre especies de Reduviidae (Hemiptera: Heteroptera) y plantas en Argentina

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Abstract. Almost all reduviids are predators; however, recent observations have shown that certain reduviids, particularly members of tribe Harpactorini (Harpactorinae) may be associated with specific plants as a strategy of predation and complementary nectarivory. These observations on the occurrence of the use of nectar as food source by various species of Reduviidae, mostly Harpactorini, in Argentina (Misiones), are recorded here. Additional records of oviposition and preying by Harpactorini and Bactrodinae species on certain plants are also provided.

Key words: Apiomerini; Apocynaceae; Asteraceae; *Heniartes*; nectaries; Phymatinae.

Resumen. Casi todos los reduvidos son depredadores; sin embargo, varias observaciones han demostrado que algunas especies, en particular los miembros de la tribu Harpactorini (Harpactorinae), pueden estar asociados con plantas específicas como estrategia de predación y complementariamente la nectarivoría. Aquí se registran observaciones recientes del uso del néctar como fuente alimentaria por varias especies de Reduviidae, en su mayoría Harpactorini, en Argentina (Misiones). También se proporcionan registros adicionales de oviposición y depredación por especies de Harpactorini y Bactrodinae en ciertas plantas.

Palabras clave: Apiomerini; Apocynaceae; Asteraceae; *Heniartes*; nectarios; Phymatinae.

Reduviidae (Hemiptera: Heteroptera) - the assassin bugs - is the largest family of predaceous terrestrial Heteroptera, while its subfamily Harpactorinae contains the greatest number of genera and species in the Neotropical region and worldwide (Schuh and Weirauch 2020). In the New World, Harpactorinae contains two tribes: Apiomerini and Harpactorini (Gil-Santana *et al.* 2015). Almost all reduviids are predators of insects or other arthropods. However, several studies have shown that certain reduviids, particularly members of the tribe Harpactorini may be associated with some plants. These generalist predators frequently live on a particular plant species, not only as adults but sometimes also as immature instars. Besides seeking prey, these species apparently are adapted to visiting these plants species exclusively. In addition to hosting the arthropod

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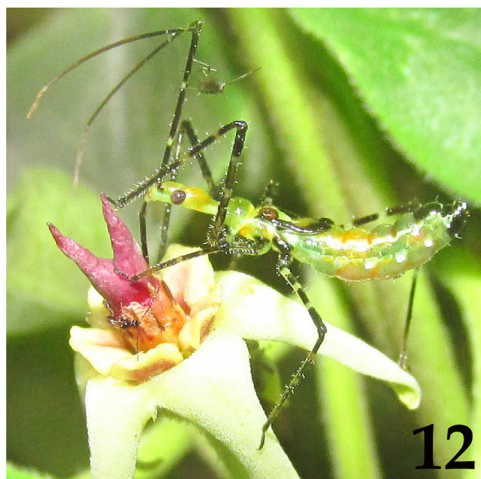
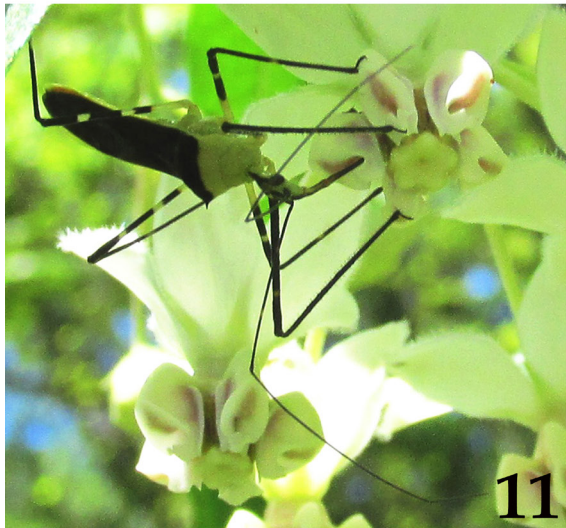
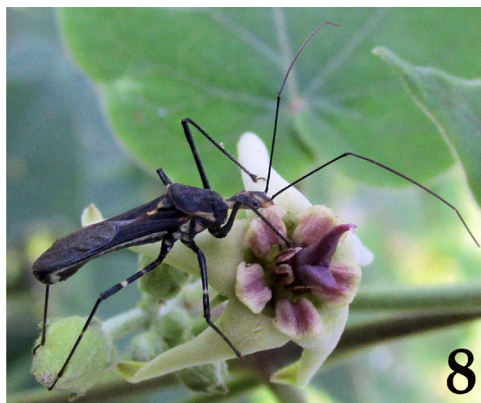
prey species the assassin bugs feed on, these plants provide additional resources such as sugary or proteinaceous secretions produced in extrafloral nectaries or other structures (e.g., Bérenger and Pluot-Sigwalt 1997; Gil-Santana and Alves 2011; Alvarez *et al.* 2019). In addition, members of tribe Apiomerini, such as species of *Apiomerus* Hahn, 1831 collect plant resins with their forelegs that may facilitate prey capture in immature and adults. In females, this resin is particularly important during oviposition (Forero *et al.* 2011). Weirauch *et al.* (2021) suggested that species of *Bactrodes* Stål, 1860 (Bactrodinae) are exclusively associated with plant species with glandular trichomes. It is noteworthy that several evidence suggest a close systematic relationship between Bactrodinae and Harpactorinae (Schuh and Weirauch 2020; Weirauch *et al.* 2021).

In the context of the revision of several genera of the subfamily Asclepiadoideae (Apocynaceae) for the Argentine flora (Keller 2020, 2021; Keller and Goyder 2021; Keller and Liede-Schumann 2021; Liede-Schumann and Keller 2021; Liede-Schumann *et al.* 2021; Rapini and Keller 2021), the second author had the opportunity to record several observations of various Reduviidae species associated with plants in Argentina. Additionally, some observations were done of species of Asteraceae, identified by Leonardo Paz Deble (Universidade Federal de Santa Maria, Rio Grande do Sul, Brazil). The records were collected in Misiones, Departamentos Eldorado, San Ignacio, Cainguás y Candelaria, by direct observation of live specimens on the vegetation during the period from September to March of 2014 to 2020. Most of the photographs (Figs. 1-12, 14-17) were taken by the second author with a Sony DSC-HX400V camera. The photograph of *Phymata* cf. *fortificata* (Herrich-Schäffer, 1848) (Fig. 13) was taken by Christian Zanotti (Instituto de Botánica Darwinion - IBODA, Argentina), and the SEM image of abaxial surface of a leave of *Macroscepis elliptica* (Fig. 18) was done by Ana María Gonzales (Instituto de Botánica del Nordeste-Herbáριο CTES, Argentina). The identification of the species was done by the first author following the keys and literature summarized by Gil-Santana *et al.* (2015) and specifically following respectively: Carvalho and Costa (1993) for *Notocyrtus dorsalis* (Gray, 1832); Coscarón and Melo (2003) for *Bactrodes femoratus* (Fabricius, 1803); Cobben and Wygodzinsky (1975) and Melo and Coscarón (2004) for *Cosmoclopius nigroannulatus* (Stål, 1860); Kormilev (1962) for *Phymata* cf. *fortificata* (Herrich-Schäffer, 1848); Martin-Park *et al.* (2012) for *Repipta flavicans* (Amyot & Serville, 1843); Wygodzinsky (1947a) for *Heniarthes erythromerus* Spinola, 1840; Wygodzinsky (1947b) for *Harpactor angulosus* (Lepeletier & Serville, 1825); and Zhang *et al.* (2016) for *Zelus* spp.

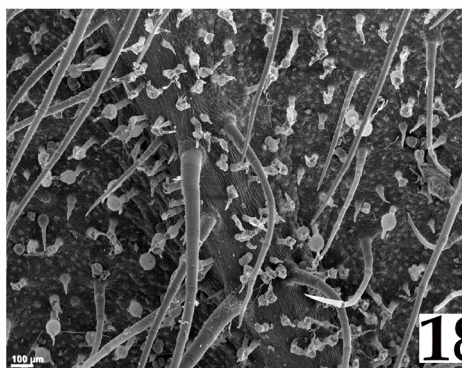
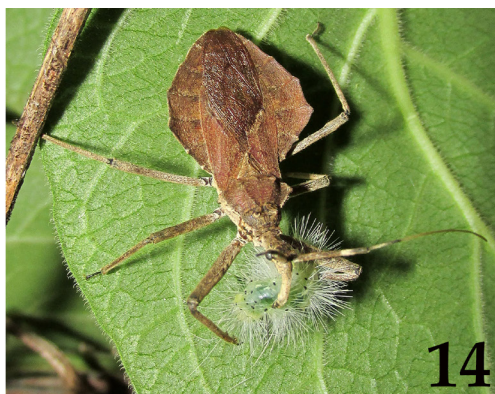
As a result, observations of associations involving several reduviids belonging to subfamilies Bactrodinae, Harpactorinae and Phymatinae with plants (Figs. 1-17), including the use of nectar as a food source, were recorded, most of them for the first time (Table 1; Figs. 1-13). A total of 15 species of plants (13 Apocynaceae and 2 Asteraceae) were recorded as being visited by 16 species of reduviids, most of the which visited flowers, alternating the capture of preys with nectarivory (Table 1; Figs. 1-13). Most of the observations of nectarivory corresponded to flower visitors of the family Apocynaceae (Asclepiadoideae), which attract floral visitors using colors and aroma of the flowers, as well as a reward of nectar (Ollerton *et al.* 2019). Among the reduviids, species belonging to tribe Harpactorini (Harpactorinae) were more numerous, but species of the subfamily Phymatinae and the tribe Apiomerini (Harpactorinae) were recorded too (Table 1). The nectarivory was mostly recorded in adults (Figs. 1-11, 13), but in the case of *Zelus versicolor* (Herrich-Schäffer, 1848) (Harpactorini), nymphs were also observed using nectar as a food source (Fig. 12). It is noteworthy that *Notocyrtus dorsalis* (Gray, 1832) (Harpactorini) (Fig. 3) was observed feeding only on nectar, without any observation of predatory events by this species.



Figures 1-6. Species of Reduviidae recorded sucking nectar from flowers and their respective plant species. 1. *Heniartes erythromerus* on *Senecio grisebachii*. 2. *Cosmoclopius nigroannulatus* on *Oxypetalum pannosum*. 3. *Notocyrtus dorsalis* on *Oxypetalum balansae*. 4. *Repipta flavicans* on *Orthosia virgata*. 5. *Zelus armillatus* on *Gonolobus parviflorus*. 6. *Zelus* cf. *couturieri* on *O. balansae*. / **Especies de Reduviidae registradas chupando néctar de flores y las especies respectivas de plantas.** 1. *Heniartes erythromerus* en *Senecio grisebachii*. 2. *Cosmoclopius nigroannulatus* en *Oxypetalum pannosum*. 3. *Notocyrtus dorsalis* en *Oxypetalum balansae*. 4. *Repipta flavicans* en *Orthosia virgata*. 5. *Zelus armillatus* en *Gonolobus parviflorus*. 6. *Zelus* cf. *couturieri* en *O. balansae*



Figures 7-12. Species of Reduviidae recorded sucking nectar from flowers and the respective plant species. 7-8. *Zelus laticornis* 7. On *Ditassa burchelli*. 8. On *Oxypetalum balansae*. 9. *Zelus* sp. 1. 10. *Zelus* sp. 2. 9-10. On *O. balansae*. 11-12. *Zelus versicolor*. 11. Adult female on *Gomphocarpus physocarpus*. 12. Nymph on *O. balansae*. / Especies de Reduviidae registradas chupando néctar de flores y las especies respectivas de plantas. 7-8. *Zelus laticornis* 7. En *Ditassa burchelli*. 8. En *Oxypetalum balansae*. 9. *Zelus* sp. 1. 10. *Zelus* sp. 2. 9-10. En *O. balansae*. 11-12. *Zelus versicolor*. 11. Hembra adulta en *Gomphocarpus physocarpus*. 12. Ninfa en *O. balansae*.



Figures 13-18. 13. *Phymata* cf. *fortificata* sucking nectar from a flower of *Oxypetalum arnottianum*. 14. *Harpactor angulosus* preying on a caterpillar on a leaf of *Oxypetalum erianthum*. 15-17. *Bactrodes femoratus* on leaves of *Macroscelis elliptica*. 15. An adult preying upon on unidentified winged insect. 16. Female with its egg batch. 17. A nymph. 18. SEM image of abaxial surface of a leaf of *Macroscelis elliptica*. / 13. *Phymata* cf. *fortificata* chupando néctar de una flor de *Oxypetalum arnottianum*. 14. *Harpactor angulosus* depredando una oruga en una hoja de *Oxypetalum erianthum*. 15-17. *Bactrodes femoratus* en hojas de *Macroscelis elliptica*. 15. Un adulto alimentándose de un insecto alado no identificado. 16. Hembra con su lote de huevos. 17. Una ninfa. 18. imagen MEB de la superficie abaxial de una hoja de *Macroscelis elliptica*.

Flower visiting by assassin bugs has not often been recorded. Gil-Santana and Alves (2011) recorded that it was common to see adults of *Zelus versicolor* on the flowers of *Bidens rubifolia* Kunth (Asteraceae) where they preyed upon insects attracted to them. The Pollinators of Apocynaceae Database (Ollerton *et al.* 2019) contains only one other record of a species of Reduviidae feeding on nectar: *Apiomerus longispinis* Champion, 1899 on flowers of *Asclepias subverticillata* (Gray) Vail (Mark Fishbein, unpublished). However more recently, Behrstock (2021) recorded three species of reduviids on flowers of *Asclepias angustifolia* Schweigger. None of the assassin bugs observed on flowers of Apocynaceae act as pollinators so their ecological role may be purely as nectar thieves or as herbivore-preying mutualists of the plants.

Besides the observations of nectarivory outlined above, oviposition by females and the predation of caterpillars on leaves of *Oxypetalum erianthum* Decne. (Apocynaceae) by *Harpactor angulosus* (Lepeletier & Serville, 1825) (Harpactorini) were recorded (Fig. 14). Likewise, predation activity, oviposition, and the occurrence of both adults as well as nymphs of *Bactrodes femoratus* (Fabricius, 1803) (Bactrodinae) (Figs. 15-17) were recorded on leaves of *Macroscelis elliptica* N.E.Br. (Apocynaceae). There was no previous record of the association of a species of *Bactrodes* with *M. elliptica* (Weirauch *et al.* 2021). Like almost all species of the Gonolobinae subtribe, this plant has viscid and fetid leaves, covered with very long multicellular glandular trichomes and shorter capitate glandular trichomes (Fig. 18), which, according to a recent study, are stinging (Medina *et al.* 2021).

The present observations suggest that the associations between Reduviidae and plants is probably more common than has been recognized and must be recorded and more thoroughly studied.

Table 1. Species of Reduviidae recorded sucking nectar from flowers and the respective plant species. / Especies de Reduviidae registradas chupando néctar de flores y las respectivas especies de plantas.

Reduviidae	Plant species
Harpactorinae: Apiomerini	Apocynaceae
<i>Apiomerus</i> sp. 1	<i>Oxypetalum pannosum</i> Decne.
	<i>Oxypetalum sylvestre</i> (Hook. & Arn.) Goyder & Rapini
<i>Apiomerus</i> sp. 2	<i>Oxypetalum macrolepis</i> (Hook. & Arn.) Decne
	Asteraceae
<i>Heniartes erythromerus</i> Spinola, 1840 (Fig. 1)	<i>Senecio grisebachii</i> Baker
	<i>Calea</i> sp.
Harpactorinae: Harpactorini	Apocynaceae
<i>Cosmoclopius nigroannulatus</i> (Stål, 1860) (Fig. 2)	<i>Funastrum flavum</i> (Decne.) Schltr.
	<i>Oxypetalum balansae</i> Malme
	<i>Oxypetalum pannosum</i> Decne.
<i>Notocyrtus dorsalis</i> (Gray, 1832) (Fig. 3)	<i>Oxypetalum balansae</i> Malme
<i>Repipta flavicans</i> (Amyot & Serville, 1843) (Fig. 4)	<i>Ditassa burchelli</i> Hook. & Arn.
	<i>Orthosia virgata</i> (Poir.) E. Fourn.
	<i>Oxypetalum appendiculatum</i> Mart.
	<i>Oxypetalum balansae</i> Malme

Table 1 (continuation). Species of Reduviidae recorded sucking nectar from flowers and the respective plant species. / Especies de Reduviidae registradas chupando néctar de flores y las respectivas especies de plantas.

Reduviidae	Plant species
Harpactorinae: Harpactorini	
<i>Zelus armillatus</i> (Lepeletier & Serville, 1825) (Fig. 5)	<i>Asclepias curassavica</i> L. (Apocynaceae)
	<i>Ditassa burchelli</i> Hook. & Arn. (Apocynaceae)
	<i>Gomphocarpus physocarpus</i> (E. Fourn.) Schltr. (Apocynaceae)
	<i>Gonolobus parviflorus</i> Michx. (Apocynaceae)
	<i>Calea</i> sp. (Asteraceae)
<i>Zelus</i> cf. <i>couturieri</i> (Bérenger, 2003) (Fig. 6)	<i>Oxypetalum balansae</i> Malme (Apocynaceae)
<i>Zelus</i> cf. <i>illotus</i> Berg, 1879	<i>Ditassa burchelli</i> Hook. & Arn. (Apocynaceae)
<i>Zelus laticornis</i> (Herrich-Schäffer, 1853) (Figs. 7-8)	<i>Ditassa burchelli</i> Hook. & Arn. (Apocynaceae)
	<i>Oxypetalum balansae</i> Malme (Apocynaceae)
<i>Zelus</i> sp.1 (Fig. 9)	<i>Oxypetalum balansae</i> Malme (Apocynaceae)
<i>Zelus</i> sp. 2 (Fig. 10)	<i>Orthosia congesta</i> Decne. (Apocynaceae)
	<i>Oxypetalum balansae</i> Malme (Apocynaceae)
<i>Zelus versicolor</i> (Herrich-Schäffer, 1848) (Figs. 11-12)	<i>Gomphocarpus physocarpus</i> (E. Fourn.) Schltr. (Apocynaceae)
	<i>Oxypetalum balansae</i> Malme (Apocynaceae)
	<i>Oxypetalum sylvestre</i> (Hook. & Arn.) Goyder & Rapini (Apocynaceae)
Phymatinae	
<i>Phymata</i> cf. <i>fortificata</i> Herrich-Schäffer, 1848 (Fig. 13)	<i>Oxypetalum arnottianum</i> H. Buek ex E. Fourn. (Apocynaceae)

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