2024. Journal of Arachnology 52:139–142

SHORT COMMUNICATION

Riding on ants: A new report of this interesting behavior in *Attacobius* spiders (Araneae: Corinnidae)

G. Pompozzi[1] and F. Fernández Campón[1,2]: [1]Laboratorio de Entomología, IADIZA (CCT CONICET-Mendoza), Mendoza, Argentina; E-mail: gpompozzi@mendoza-conicet.gob.ar; Orcid Number: 0000-0001-8083-2103; [2]Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Cuyo, Mendoza, Argentina.

Abstract. Ants are among the most ecologically dominant animals in several terrestrial ecosystems. Some myrmecophile species use ants to transport themselves, a behavior known as phoresy or phoresis. Although phoresis is commonly reported in arachnids such as pseudoscorpions or acari, it is very unusual among spiders. Phoresis on ants has only been reported in one genus of spiders, the sac-spider *Attacobius* Mello-Leitão, 1925 and for only two Brazilian species. In this report, we describe this amazing behavior in *Attacobius nigripes* (Mello-Leitão, 1942) for the first time in association with a new host, the leaf-cutting ant *Acromyrmex lobicornis* Emery, 1888. This record extends the geographic distribution of this spider species to the southwest of Argentina, from the Chaco into the Monte Desert region. We briefly describe the riding behavior of spiders and discuss the myrmecophile association between this species and *A. lobicornis*. More studies are needed to understand the evolutionary context of this association.

Keywords: hitch-hiking, *Attacobius nigripes*, leaf-cutting ants, *Acromyrmex lobicornis*, myrmecophily
https://doi.org/10.1636/JoA-S-24-003

Ants are among the most ecologically dominant animals, and they play a significant role in several terrestrial ecosystems. Although they are not the most diversified group within arthropods; their biomass constitutes more than 30% of the entire insect biomass (Hölldobler & Kwapich 2022). This makes ants a good resource to be exploited by other organisms and some of the most common are the myrmecophiles, considered as guests of ants (Jackson & Nelson 2012). Currently, more than 10,000 myrmecophile species are known, including beetles (Coleoptera), butterflies (Lepidoptera), wasps (Hymenoptera), flies (Diptera), true bugs (Hemiptera), crickets (Orthoptera), cockroaches (Blattodea) and silverfishes (Zygentoma) among the insects, and also arachnids, like mites (Acari), whip scorpions (Uropygi) and spiders (Araneae) (Cushing 1997, 2012; Hölldobler & Kwapich 2022).

Some of these myrmecophile species not only live in close association with ants, living inside their nests and feeding on them, but some also use ants as transportation. This type of animal-mediated dispersal is known as phoresy or phoresis, in which an organism (the phoront) disperses from one location to another by attaching itself to another organism (the dispersal host). Phoronts are in general passive "hitchhikers" that have little negative effects on their hosts (Bartlow & Agosta 2021). Phoresis behavior using ants as dispersal hosts has been reported in different taxa, being most common in some beetles (Histeridae and Dermestidae families), roaches (Blattodea) and mites (Acari). For example, the roaches of *Attaphila* Wheeler, 1900 genus were reported as phoretic on leaf cutting ants, *Atta* Fabricius, 1805 and *Acromyrmex* Mayr, 1865, using winged ants to migrate (Philips et al. 2017). Although many species of different taxa use ants to disperse, either on reproductive alates to migrate long distances or on workers to move within or near the ant-nests, this type of phoresis has been reported in only one genus of spiders, the sac-spider *Attacobius* Mello-Leitão, 1925 (Corinnidae) (Bonaldo & Brescovit 2005). In addition, another spider genus, the myrmecophile spider *Sicariomorpha maschwitzi* (Wunderlich, 1995) (Oonopidae), was reported often climbing onto the top of its host ants, but it is still not clear if they ride them while in motion (Witte et al. 1999; von Beeren et al. 2012).

Attacobius spiders are known as myrmecophiles, and associations between these spiders with different ant species were reported in Brazil (Platnick & Baptista 1995). This genus, endemic to South America, belongs to the Corinnidae family and has 16 described species (Pereira-Filho et al. 2018). Until now only three species are known to be myrmecophiles, *Attacobius attarun* (Roewer, 1935) and *A. luederwaldti* (Mello-Leitão, 1923), which were reported in close association with leaf-cutting ants of the genus *Atta,* and *Attacobius lavape* Bonaldo, Pesquero & Brescovit, 2018 associated with *Solenopsis* ants. The first report of a spider riding on ants was on *A. attarum* (Roewer 1935). The author remarked that spiders used ants as riding animals, and they were always found clinging on the dorsum of the thorax and sometimes on the head of *Atta* ants. This behavior was later reported again in the studies of Erthal & Tonhasca (2001), Ichinose et al. (2004) and Camargo et al. (2015) for two Brazilian species, *A. attarum* and *A. luederwaldti*. Currently, why spiders perform this behavior is open to discussion and there is a scarcity of information about its function. Spiders living inside ant nests are very difficult to find, and there are very few records of their natural history. Their diet is still poorly known, and it is presumed that even though they can attack prey other than ants, they can also consume larvae and eggs of their host ants, as was reported for *A. attarum* and *A. lavape* (Erthal & Tonhasca 2001; Mendonça et al. 2019).

Attacobius nigripes (Mello-Leitão, 1942) is the only species of the genus found in Argentina and data about its natural history is unknown. This species was previously found at two localities in Chaco and Córdoba provinces, Argentina, with only one individual collected at each. Furthermore, the two specimens were females; males have not been described yet. Here, we report the presence of *A. nigripes* associated with a different ant species from those already reported. We found spiders riding on worker ants, which adds one more spider species showing this interesting behavior. In addition, these observations constitute a new distributional record of the species.

During field work looking for nocturnal myrmecophagous spiders of the Zodariidae associated with leaf-cutting ants we made an

Figure 1.—Screenshots taken from video S1 (available online at https://doi.org/10.1636/JoA-S-24-003.s1) in which it is possible to observe an *Attacobius nigripes* female riding on a worker ant of *Acromyrmex lobicornis*.

unexpected discovery. We found a spider riding a worker ant close to the ant nest entrance (Fig 1). (See Supplemental File S1, video of spider riding on ants, online at https://doi.org/10.1636/JoA-S-24-003.s1). During the encounter we focused on this interaction and on this spider species that had not been recorded at this location. During two consecutive nights (November of 2022, spring), we found specimens of *Attacobius nigripes* riding on workers of *Acromyrmex lobicornis* Emery, 1888 at nest entrances and in an ant trail. The observations took place at the "Ñacuñán" Natural Reserve located in the center of Mendoza province, Argentina (34° 03′ S; 67° 58′ W), within the Monte Desert biome. The site is dominated by "Jarilla" shrubs (*Larrea* spp. Cav.) and "Algarrobo" trees (*Neltuma flexuosa* (D.C.) Hughes & Lewis). The climate is semiarid with mean annual rainfall of 200–300 mm. This record is the southernmost of the species and the genus, and it is located approximately 400 km from previously known localities of *A. nigripes* (Fig. 2). This is the first report on the association between *Attacobius nigripes* and the ant *Acromyrmex lobicornis*. The leaf-cutting ant *A. lobicornis* is the species within the genus with the most extensive distribution in Argentina, and it is found from the northern part of the country at approximately 21° 40¨S in Jujuy province to 44°S in southern Patagonia, inhabiting more than 2000 km of diverse habitats (Farji-Brener & Ruggiero 1994). These ants build their nests in mountainous and/or flat areas that can be arid, semi-arid or mesic (Quirán & Pilati 1998). Moreover, this is the first report for the genus *Attacobius* in Mendoza province, which extends its current known distribution to the southwest, from the Chaco into the Monte Desert region in Argentina.

In February 2023, we came back for two nights to the site to look for more specimens and take more data on spider natural history. Unfortunately, severe rainfall both nights made it impossible to find active spiders and ants. However, during the morning, we dug eight ant nests of *A. lobicornis*. We did not complete the entire nest excavation, but we reached some brood chambers. In only one nest, we found a female of *A. nigripes* riding on an ant coming out from inside the nest while we were digging. In total, we found no spiders within the nests but found a total of six individuals (five females and one immature male), all of them riding on ants. We identified spiders using female genitalia following Platnick & Baptista (1995), and ants following Kusnezov (1978). All specimens (spiders and host ants) were deposited in the Arachnological Collection of the IADIZA (CAI-IADIZA, G. Pompozzi curator). Despite having few specimens, an interesting observation to highlight is that almost all the individuals found were females (5 of 6). Skewed sex ratios may be because males do not stay in ant colonies for a long time (being more exposed to predation or desiccation) or might represent a bias in the relative number of females and males that emerge from eggsacs. These variations in the sex ratio have been reported in other myrmecophile species (Hölldobler & Kwapich 2022) including other species of *Attacobius* (Camargo et al. 2015). However, it is necessary to find more specimens to corroborate any of these ideas. Unfortunately, after collecting, the spiders died the next morning before we could arrive to the laboratory. We suspect that *Attacobius nigripes* are very susceptible to outside conditions. We think that they probably live inside ant nests with more stable and suitable conditions. In *A. nigripes*, we observed that when an ant moved far from the nest, the spider would get down and immediately look for another ant to climb on. The ants seemed not to notice the presence of the spider, even when the spider touched the ant with its legs as if it were assessing its size. The differences in size between ants and spiders were not as large as with the other *Attacobius* species that ride on *Atta* ants, where differences in size are notable (Ichinose et al. 2004). Nevertheless, the spiders are significantly smaller than the host ants (spider median size: 2.5 mm, ant median size: 5.3 mm; Wilcoxon test = 57, $P = 0.002$; $n = 6$).

All of the spiders were found riding on worker ants, and when we intentionally removed the spider from the ant using forceps ($n =$ 5 observations), spiders quickly attempted to find another ant to ride on. When the spider was on the ground, it moved on the substrate quickly and without a problem. Every time an ant passed by the spider touched it with its front legs (legs I and II), and if the ant was too small, the spider let it go (see supplemental File S2, video of spider touching ants, online at https://doi.org/10.1636/JoA-S-24-003.s2). Spiders touched several ants until finally one of the ants was big enough to ride on, and quickly grabbed it from behind and climbed up the

Figure 2.—Map showing the location of the new record (red star, Ñacuñán Natural Reserve, Mendoza Province, Argentina) and the previous records (yellow stars) of *Attacobius nigripes*. Map created in SimpleMappr (online at https://www.simplemappr.net/).

ant, holding on to the ant's head with the legs I, and the legs II hanging on the thorax ($n = 5$). Spider's legs III and IV were positioned backwards above the ant's hind legs and accompanied their movement, and even in one of the videos we observed how the spider actively supported its legs IV on the ground, appearing to help the ant walk. Although the ant did not make any movement to free itself from the spider, when comparing the walking of this ant with an ant without a spider, an erratic movement was observed, so a spider on top could be modifying the normal movement of an ant walking. More studies on the walking behavior and speed of ants with and without spiders are necessary to corroborate this idea.

Attacobius riding behavior has been discussed always from a dispersal perspective (Erthal & Tonhasca 2001; Ichinose et al. 2004; Camargo et al. 2015), with the focus on spider phoresis on winged ants. For example, Erthal & Tonhasca (2001) mention that the riding behavior was observed mainly on winged ants resulting in a long-distance dispersal function of the behavior. In our observations, we only found spiders riding on worker ants; we did not find winged ants in the nest to corroborate if *A. nigripes* disperses with winged ants during nuptial flights. We think that spiders use worker ants to move inside nests as it might be easier for spiders to look invisible to other ants if they are on top of an ant. We also observed that spiders can move quickly by their own volition and that ants did not seem to notice them. Unfortunately, we did not get enough data to discuss this interesting behavior in more detail.

In 2005, Bonaldo & Brescovit performed a cladistic analysis of the genus and found that a small monophyletic clade formed by *A. attarum*, *A. luederwaldti* and *A. nigripes*, all probably shared the riding behavior on ants, suggesting that *A. nigripes* should also show this interesting behavior. Here, we can support their previous ideas and confirm that the third species in this clade also performs the riding behavior just as they suggested. In addition, it will be interesting to know how this behavior came to be established in the interaction between these two species, and what are the implications in a functional level for both spiders and ants.

With our data we cannot confirm that these spiders live inside nests, but we suspect this could be the case. Spiders died very quickly when we removed them from ant nests, also when we detached spiders from the ant body, spiders quickly looked for another ant to ride on, indicating a very high dependence on them. However, we must be cautious with the statements we make. As an example, the recently described species, *Myrmecicultor chihuahuensis* Ramírez, Grismado & Ubick, 2019 (Myrmecicultoridae) was reported first as myrmecophile species living in close association with *Novomessor* Emery, 1915 and *Pogonomyrmex* Mayr, 1868 ants (Ramírez et al. 2019). However, a study later showed that these spiders feed on workers of these ants and probably live outside the nest, in close proximity, as do other myrmecophagous spiders (Cushing et al. 2022). Therefore, more data are needed to make more accurate statements on *A. nigripes* natural history.

ACKNOWLEDGMENTS

Thanks to two anonymous reviewers and the editor for their valuable comments on the manuscript. Also, thanks to Daniela

Sadovsky, Sofía Copperi and Agustina Peralta for their help during field samplings. G.P and F.F.C. are researchers of CONICET. Thanks also due to the *Dirección de Recursos Naturales Renovables de Mendoza* for the collection permits (RS: 2022-7040250-DRNR-POMPOZZI). This study was partially funded by the grant "PIBAA N°28720210100535CO" provided by CONICET to G.P. The authors confirm that the data supporting the findings of this study are available from the corresponding author (GP), upon reasonable request.

SUPPLEMENTAL FILES

Supplemental File S1.—Video of *Attacobius nigripes* riding behavior reported on November 9th of 2022 at night in Ñacuñán Natural Reserve in Mendoza Province, Argentina, online at https://doi.org/10.1636/JoA-S-24-003.s1

Supplemental File S2.—Video of *Attacobius nigripes* spider looking for a new ant to ride on November 9th of 2022 at night in Ñacuñán Natural Reserve in Mendoza Province, Argentina, online at https://doi.org/10.1636/JoA-S-24-003.s2

LITERATURE CITED

Bartlow AW, Agosta SJ. 2021. Phoresy in animals: review and synthesis of a common but understudied mode of dispersal. *Biological Reviews* 96:223–246.

Bonaldo AB, Brescovit A. 2005. On new species of the Neotropical spider genus *Attacobius* Mello-Leitao, 1923 (Araneae, Corinnidae, Corinninae), with a cladistics analysis of the tribe Attacobiini. *Insect Systematics & Evolution* 36:35–56.

Camargo RDS, Forti LC, de Matos CAO, Brescovit AD. 2015. Phoretic behaviour of *Attacobius attarum* (Roewer, 1935)(Araneae: Corinnidae: Corinninae) dispersion not associated with predation?. *Journal of Natural History* 49:1653–1658.

Cushing PE. 1997. Myrmecomorphy and myrmecophily in spiders: a review. *Florida Entomologist* 80:165–193.

Cushing PE. 2012. Spider-ant associations: an updated review of myrmecomorphy, myrmecophily, and myrmecophagy in spiders. *Psyche: A Journal of Entomology* 2012, Article ID 151189.

Cushing PE, Brückner A, Rogers JW, Horner NV. 2022. Trophic specialization of a newly described spider ant symbiont, *Myrmecicultor chihuahuensis* (Araneae: Myrmecicultoridae). *Journal of Arachnology* 50:250–255.

Erthal M, Tonhasca A. 2001. *Attacobius attarum* spiders (Corinnidae): Myrmecophilous predators of immature forms of the leaf-cutting ant *Atta sexdens* (Formicidae). *Biotropica* 33:374–376.

Farji-Brener AG, Ruggiero A. 1994. Leaf-cutting ants (*Atta* and *Acromyrmex*) inhabiting Argentina: patterns in species richness and geographical range sizes. *Journal of Biogeography* 21:391–399.

Hölldobler B, Kwapich CL. 2022. The Guests of Ants: How Myrmecophiles Interact with Their Hosts. Harvard University Press.

Ichinose K, Rinaldi I, Forti LC. 2004. Winged leaf-cutting ants on nuptial flights used as transport by *Attacobius* spiders for dispersal. *Ecological Entomology* 29:628–631.

Jackson RR, Nelson XJ. 2012. Specialized exploitation of ants (Hymenoptera: Formicidae) by spiders (Araneae). *Myrmecological News* 17:33–49.

Kusnezov N. 1978. Hormigas Argentinas. Clave para su identificación. *Miscelanea-Fundacion Miguel Lillo (Argentina)* 61:1–28.

Mendonça CAF, Pesquero MA, Carvalho RDSD, de Arruda FV. 2019. Myrmecophily and myrmecophagy of *Attacobius lavape* (Araneae: Corinnidae) on *Solenopsis saevissima* (Hymenoptera: Myrmicinae). *Sociobiology* 66:545–550.

Pereira-Filho JMB, Saturnino R, Bonaldo AB. 2018. Five new species and novel descriptions of opposed sexes of four species of the spider genus *Attacobius* (Araneae: Corinnidae). *Zootaxa* 4462:211–228.

Phillips ZI, Zhang MM, Mueller UG. 2017. Dispersal of *Attaphila fungicola*, a symbiotic cockroach of leaf-cutter ants. *Insectes Sociaux* 64:277–284.

Platnick NI, Baptista RL. 1995. On the spider genus *Attacobius* (Araneae, Dionycha). *American Museum Novitates* 3120:1–9.

Quirán E, Pilati A. 1998. Estructura de los hormigueros de *Acromyrmex lobicornis* (Hymenoptera: Formicidae) en un sitio natural semiárido de La Pampa, Argentina. *Revista de la Sociedad Entomológica Argentina* 57:1–4.

Ramírez MJ, Grismado CJ, Ubick D, Ovtsharenko V, Cushing PE, Platnick NI, et al. 2019. Myrmecicultoridae, a new family of myrmecophilic spiders from the Chihuahuan Desert (Araneae: Entelegynae). *American Museum Novitates* 3930:1–24.

Roewer CF. 1935. Zwei myrmecophile Spinnen-Arten Brasiliens. Veroff. Deutschen Kolon. *Uebersee-Mus.* 1:193–197.

von Beeren C, Hashim R, Witte V. 2012. The social integration of a myrmecophilous spider does not depend exclusively on chemical mimicry. *Journal of Chemical Ecology* 38:262–271.

Witte V, Hänel H, Weissflog A, Rosli H, Maschwitz U. 1999. Social integration of the myrmecophilic spider *Gamasomorpha maschwitzi* (Araneae: Oonopidae) in colonies of the South East Asian army ant, *Leptogenys distinguenda* (Formicidae: Ponerinae). *Sociobiology* 34:145–149.

Manuscript received 16 February 2024, revised 22 April 2024, accepted 26 April 2024.