

Scientific Note

First record of phoresy by *Parachernes setiger* Mahnert, 1979 (Pseudoscorpiones, Chernetidae) on the fly *Artemita amenides* (Walker, 1849) (Diptera, Stratiomyidae, Pachygastrinae) in the Central Amazon

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Abstract. Pseudoscorpions can attach themselves to various mobile arthropods. This interaction is known as phoresy. We report for the first time the phoretic interaction between pseudoscorpion (Arachnida) and Stratiomyidae (Diptera) in the New World, as well as the first phoretic interaction involving *Parachernes setiger* Mahnert, 1979 (Pseudoscorpiones, Chernetidae), in this case with *Artemita amenides* (Walker, 1849). Three specimens were attached to the fly's mid tibia (1 specimen) and hind tibia (2 specimens on the same side).

Keywords: Arachnid, Behaviour, Commensalism, Host, Phoront.

Phoresy is a relatively common dispersal behavior among pseudoscorpions and is characterized by its dispersal relationships with beetles and flies (Aguar & Bührnheim 1998; Lira & Tizo-Pedroso 2017). They attach themselves to their carrier's legs, abdominal tergites, or antennae (Aguar & Bührnheim 1998; Christophoryová et al. 2018; Bevilaqua et al. 2020). Hypotheses regarding why this behavior evolved and persisted within the group have been proposed in various studies, ranging from males seeking females for mating to the search for environments with better survival conditions (Zeh & Zeh 1992a; 1992b; 1992c). There is also the possibility of a mutualistic relationship, in which phoronts possibly feed on parasitic mites in their hosts (Santos et al. 2005).

Although the record of phoresy of pseudoscorpions by Diptera is somewhat common, it has been recorded in Anthomyiidae, Calliphoridae, Culicidae, Drosophilidae, Heleomyzidae, Lonchaeidae, Muscidae, Neriidae, Pantophthalmidae, Scenopinidae, Sphaeroceridae, Stratiomyidae, Syrphidae, Tabanidae, Tachinidae, Tipulidae, Ulidiidae (as Otitidae) (Poinar et al. 1998), Fanniidae (Lira & Tizo-Pedroso 2017), Limoniidae (Mederos & Zaragoza 2017), Rhinophoridae (Zaragoza & Santiago 2017) Empididae, Hybotidae (Červená et al. 2019), Micropezidae (Martínez et al. 2020), Clusiidae, and Chyromyidae (Hetešová & Christophoryová 2022). The vast majority of these studies are concentrated in countries on the European continent, with South America being an area with few records to date (Poinar et al. 1998; Santos et al. 2005; Lira et al. 2014; Lira & Tizo-Pedroso 2017).

In a review carried out by Poinar et al. (1998), they point out that the pseudoscorpion phoresy behavior in soldier flies (Stratiomyidae) had already been recorded for Europe with *Lamprochernes nodosus* (Schrank, 1803) in the hosts *Hoplites bispinosus* (Wiedemann, 1830), presently *Dicranophora bispinosa*, and *Sargus iridatus* (Scopoli, 1763) (Diptera: Stratiomyidae), the latter being mistakenly classified as Syrphidae. Here we present the first record of the phoretic interaction between pseudoscorpions and Stratiomyidae (Diptera) for Brazil and the first worldwide record of this interaction for the genus *Artemita* (Stratiomyidae).

One adult female stratiomyiid fly was collected in the municipality

of Iranduba, State of Amazonas. The fly specimen was trapped at 21 meters high in a suspended Gressitt & Gressitt interception trap. JRPL identified the fly specimen and ETP identified the pseudoscorpion specimens.

The fly with the pseudoscorpions was dry-mounted and deposited in the Invertebrate Collection of the National Institute for Amazonian Research (INPA). The leg carrying two of the pseudoscorpion specimens was detached, and they were fixed to a carbon adhesive sheet on a stub and metallized for photography using Scanning Electron Microscopy (SEM) at INPA, facilitating the identification process.

We report for the first time the phoretic interaction between pseudoscorpion (Arachnida) and Stratiomyidae (Diptera) in the New World, as well as the first phoretic interaction involving *Parachernes setiger* Mahnert, 1979 (Pseudoscorpiones, Chernetidae), in this case with *Artemita amenides* (Walker, 1849).

Examined material (as in the label). Brasil, AM, Iranduba, Rod. AM-352, Ramal km-50, RDS Rio Negro, 2°55'29"S - 60°51'41"W, 8-22. vii.2024, Gressitt & Gressitt trap, cascata, 21m alt., J.A.Rafael, I.B.Oliveira & F.F.Xavier Fº, INCT BioDossel.

For Brazil, in Diptera, the phoresy behavior of pseudoscorpions was reported in Culicidae, Tabanidae, and Pantophthalmidae in the Amazon Basin (Aguar & Bührnheim 1998; Santos et al. 2005), Tipulidae in the Atlantic Forest (Matthiesen & Hahn 1981), and Fanniidae in the Atlantic Forest and Caatinga (Lira et al. 2014; Lira & Tizo-Pedroso 2017). The vast majority of the records of flies and pseudoscorpions are from the European region.

To date, several records of phoresis behavior have been recorded between pseudoscorpions Chernetidae (Arachnida) and Diptera (Insecta). However, the genus *Parachernes* is quite restricted in its host choice, as existing reports of phoresis in this genus cover only three orders, Coleoptera, Neuroptera and Diptera (Beier 1948; Aguair & Bührnheim 1998). Prior to this record, phoresis had been reported in only two families of flies, Culicidae and Tabanidae (Beier 1948; Aguair & Bührnheim 1998). It is also worth noting that, with the exception of Beier (1948) report of two females, records of *Parachernes* were limited to one individual per fly. Here, we also point to the possibility

of a single host being occupied by more than one.

The pseudoscorpion *Parachernes setiger* Mahnert, 1979 is characterized by short tactile setae on tarsus IV, barely exceeding the width of the tarsus and inserted distally, at the distal outer corner; carapace not tapered at the base; metazone with light lateral spots, large, prominent and dense granulations; males with half-open fingers of the palp and with a chitinous blade on the mobile finger; smooth and shiny hand of the palpus, fingers with serrated setae on the dorsum (Mahnert 1979).

Three pseudoscorpions were attached to the base of the tibiae of the fly (Fig. 1A), one attached to the mid tibia and two specimens to the hind tibia, all adult males. The pseudoscorpion specimens were attached only by one of their pedipalps, at the base of the tibiae, near the femora-tibial articulation (Fig. 1B). The attachment site of pseudoscorpions at the base of the middle and hind tibiae was also observed in Ulidiidae (Christophoryová et al. 2018), as well as at the base of the mid tibia of Tipulidae (Christophoryová & Krasenský 2022). Other studies have shown different positions of the phorons on the

legs of flies, as was shown, for example, at the base of the coxae of Clusiidae and Lonchaeidae (Christophoryová et al. 2021; Hetešová & Christophoryová 2022).

Phoretic association is a crucial attribute that enables pseudoscorpions to explore other habitats, and these records enhance our understanding of their behaviors and the relationships they establish with other arthropod species. According to Lira et al. (2014) the development of the pseudoscorpion specimens is synchronized with the flies' emergence, attaching to the adult fly when the adult emerges.

Taking as a basis that the larvae of the Pachygastrinae inhabit fallen tree trunks (Hauser et al. 2017), which is also an environment frequented by pseudoscorpions, here we corroborate the statement by Poinar et al. (1998) in which they said that the most common form of phoresy is when the host (in this case the larvae and pupae of the Pachygastrinae) and the transported individual (the pseudoscorpions) share the same habitat.

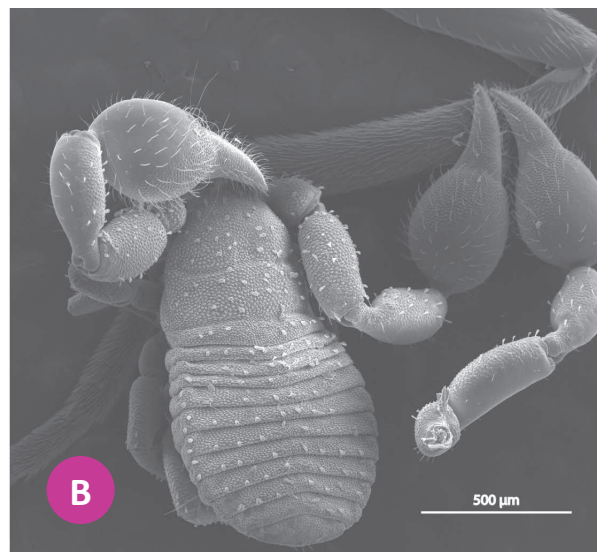
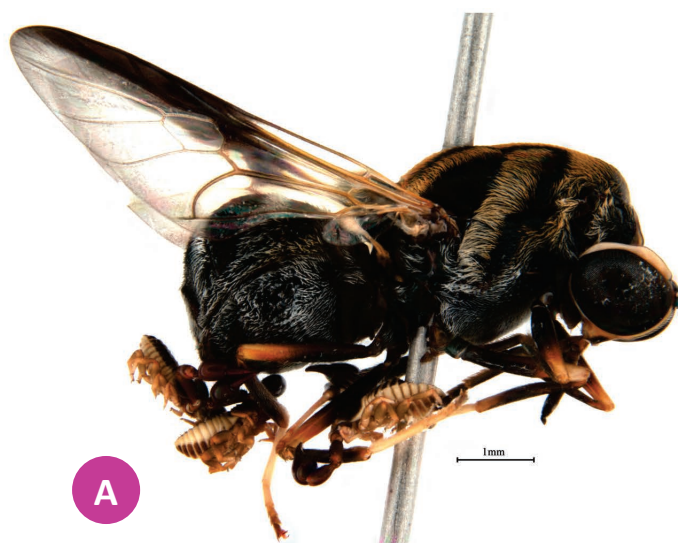


Figure 1. A) female of *Artemita amenides* with pseudoscorpions attached to its legs; B) SEM preparation of the fly hind tibia detached with specimen of *Parachernes setiger* Mahnert, 1979 (Pseudoscorpiones, Chernetidae) attached to its base.

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Authors' Contributions

CRG: Conceptualization, Writing - original draft; JDNS: Writing - review and editing; ETP: Writing - review and editing; JRPL: Writing - review and editing; JAR: Funding acquisition, Validation, Writing - review and editing.

Conflict of Interest Statement

The authors declare no conflict of interest.

References

Aguiar, N. O.; Bührnheim, P. F. (1998) Phoretic pseudoscorpions associated with flying insects in Brazilian Amazônia. *Journal of*

Arachnology, 26(3): 452-459.

Beier, M. (1948) Phoresie und Phagophilie bei Pseudoscorpionen. *Österreichische Zoologische Zeitschrift*, 1: 441-497.

Bevilaqua, M.; Soares, M. M. M.; García, F. (2020) First record of phoretic association between *Cordyllochneres scorioides* (Linnaeus) (Pseudoscorpiones: Chernetidae) and *Hylettus coenobita* (Erichson) (Coleoptera: Cerambycidae) in central Amazon. *Revista Chilena de Entomología*, 46(3): 387-392. doi: [10.35249/rche.46.3.20.05](https://doi.org/10.35249/rche.46.3.20.05)

Červená, M.; Kirchmair, G.; Christophoryová, J. (2019) Phoretic chernetid species newly recorded from Slovakia and Austria (Pseudoscorpiones: Chernetidae). *Arachnologische Mitteilungen: Arachnology Letters*, 57(1): 65-68. doi: [10.30963/aramit5712](https://doi.org/10.30963/aramit5712)

Christophoryová, J.; Červená, M.; Krajčovičová, K. (2021) New records of phoretic associations between pseudoscorpions and their hosts in Slovakia (Pseudoscorpiones: Atemnidae, Chernetidae). *Arachnologische Mitteilungen: Arachnology Letters*, 61(1): 24-26. doi: [10.30963/aramit6104](https://doi.org/10.30963/aramit6104)

Christophoryová, J.; Krásenský, P. (2022) Phoresy association between a pseudoscorpion (Arachnida: Pseudoscorpiones) and a crane fly (Diptera: Tipulidae) in the Czech Republic. *Biharean Biologist*, 16(1): 38-39.

Christophoryová, J.; Vidlička, L.; Krajčovičová, K. (2018) New cases of phoresy of *Lamprochneres nodosus* (Pseudoscorpiones: Chernetidae) on Diptera observed in Slovakia. *Biharean Biologist*, 12(2): 114-115.

Hauser, M.; Woodley, N. E.; Fachin, D. A. (2017) 41. Stratiomyidae (Soldier flies). In: Kirk-Spriggs, A. H.; Sinclair, B. J. (Eds.), *Manual of Afrotropical Diptera. Volume 2. Nematoceros Diptera and*

- lower Brachycera. Suricata* 5. pp. 919–979. South African National Biodiversity Institute, Pretoria.
- Hetešová, E.; Christophoryová, J. (2022) Recent data about pseudoscorpion (pseudoscorpiones) phoresy from Slovakia with new host and phoront records. *Revista Ibérica de Aracnología*, 41: 37–40.
- Lira, A. F. A.; Tizo-Pedroso, E.; Albuquerque, C. M. R. (2014) Phoresy by *Americhernes* aff. *Incertus* (Pseudoscorpiones: Chernetidae) on a tropical fly *Fannia canicularis* (Diptera: Fanniidae) in a fragment of the Atlantic Forest, Brazil. *Entomological News*, 124(1): 24–28. doi: [10.3157/021.124.0103](https://doi.org/10.3157/021.124.0103)
- Lira, A. F. A.; Tizo-Pedroso, E. (2017) Report of *Sphenochernes camponoti* (Beier, 1970) (Pseudoscorpiones, Chernetidae) in phoresy on Fanniidae (Diptera). *Acta Scientiarum. Biological Sciences*, 39(4): 449–454. doi: [10.4025/actasciobiolsci.v39i4.36373](https://doi.org/10.4025/actasciobiolsci.v39i4.36373)
- Mahnert, V. (1979) Pseudoscorpione (Arachnida) aus dem Amazonas-Gebiet (Brasilien). *Revue Suisse de Zoologie*, 86 (3): 719–810. doi: [10.5962/bhl.part.82338](https://doi.org/10.5962/bhl.part.82338)
- Martínez, R. J.; Villegas-Guzmán, G. A.; Quirós, D. I.; Emmen, D. (2020) Phoresy of *Americhernes oblongus* (Say) (Pseudoscorpiones: Chernetidae) in a species of the genus *Scipopus* Enderlein (Diptera: Micropezidae). *Revista Chilena de Entomología*, 46 (2): 179–183. doi: [10.35249/rche.46.2.20.07](https://doi.org/10.35249/rche.46.2.20.07)
- Matthiesen, F. A.; Hahn, N. S. (1981) Forésia em pseudo-escorpiões brasileiros. *Ciência e cultura*, 33: 689–690, 1981.
- Mederos, J.; Zaragoza, J. A. (2017) Nueva cita de *Pselaphochernes scorpoides* (Hermann, 1804) (Pseudoscorpiones: Chernetidae) en asociación forética con *Achyrolimonia decemmaculata* (Loew, 1873) (Diptera: Limoniidae). *Revista Ibérica de Aracnología*, 31: 133–135.
- Poinar, G. O. Jr.; Ćurčić, B. P. M.; Cokendolpher, J. C. (1998) Arthropod phoresy involving pseudoscorpions in the past and present. *Acta Arachnologica*, 47(2): 79–96. doi: [10.2476/asjaa.47.79](https://doi.org/10.2476/asjaa.47.79)
- Santos, J. C.; Tizo-Pedroso, E.; Fernandes, G. W. (2005) A case of phoresy of *Semeiochernes armiger* Balzan, 1892 (Pseudoscorpiones: Chernetidae) on the giant tropical fly *Pantophthalmus tabaninus* Thunberg, 1819 (Diptera: Pantophthalmidae) in an Amazonian rain forest, Pará. *Lundiana: International Journal of Biodiversity*, 6: 11–12. doi: [10.35699/2675-5327.2005.22110](https://doi.org/10.35699/2675-5327.2005.22110)
- Zaragoza, J. A.; Santiago, J. L. R. C. (2017) Primera cita mundial de forésia por Pseudoscorpiones sobre Diptera, Rhinophoridae. *Revista Ibérica de Aracnología*, 31: 147–149.
- Zeh, D. W.; Zeh, J. A. (1992a) Dispersal-generated sexual selection in a beetle-riding pseudoscorpion. *Behavioral Ecology and Sociobiology*, 30: 135–142. doi: [10.1007/BF00173949](https://doi.org/10.1007/BF00173949)
- Zeh, D. W.; Zeh, J. A. (1992b) Failed predation or transportation? Causes and consequences of phoretic behavior in the pseudoscorpion *Dinochernes arizonensis* (Pseudoscorpionida: Chernetidae). *Journal of Insect Behavior*, 5(1): 37–49. doi: [10.1007/BF01049156](https://doi.org/10.1007/BF01049156)
- Zeh, D. W.; Zeh, J. A. (1992c) On the function of harlequin beetle-riding in the pseudoscorpion *Cordyluchernes scorpoides* (Pseudoscorpionida: Chernetidae). *Journal of Arachnology*, 20: 47–51.