

Original Research Article

New Record of a Phoretic Pseudoscorpion Species, *Cheiridium museorum* (Leach, 1817) (Pseudoscorpiones: Cheiridiidae) Associated with Pelage of the Indian Pipistrelle, *Pipistrellus coromandra* (Gray, 1838) (Chiroptera: Vespertilionidae) in Lakhimpur-Kheri, Uttar Pradesh, India

ABSTRACT

Thirty seven pseudoscorpion specimens were collected from abdominal furs of the little Indian bat (*Pipistrellus coromandra*) captured from six different roosts in Lakhimpur-Kheri, Uttar Pradesh, India. Out of 25 captured bats, seven bats (two males and five females) were found to be associated with pseudoscorpions. Collected pseudoscorpion species was identified as *Cheiridium museorum* (Leach, 1817). It was a new record of phoretic association of pseudoscorpion species with pelage of the Indian Pipistrelle, *Pipistrellus coromandra* (Gray, 1838) (Chiroptera: Vespertilionidae). This phoretic association was found as commensalism and for the purpose of food and distribution.

Key Words: Arachnids; Phoretic Association; Mammals; Commensalism.

1. INTRODUCTION

Pseudoscorpions are one of the oldest ancestries of terrestrial arthropods which belong to class Arachnida and order Pseudoscorpiones (Shear, 1991; Shear *et al.*, 1989). They are tiny (2 to 8mm in length), secretive arachnids that live in moist places, crevices of rocks, leaf litter, old books, under tree bark and other sheltered habitats (Jones, 1970; Weygoldt, 1969; Witt & Dill, 1996). They are found in natural and man-made habitats. Some species of pseudoscorpions live in the nests of birds (Bhattacharyya, 1990; Turienzo *et al.*, 2010) and rodents (Rodentia: Muridae) (Beier, 1948; Francke & Villegas-Guzman, 2006; Hoff & Clawson, 1952) whereby they get shelter and food from the nest by feeding on ectoparasites such as larval and adult fleas (Ratnaweera *et al.*, 2010; Thanee *et al.*, 2009). Some pseudoscorpion species are also found to be associated with mammals. They occur mostly reported from Asia, Africa and Australia (Beier, 1948). *Lasocherenes* sp. was recorded in caves related to bat guano and in mammal nests (Beier, 1948, 1963). Three pseudoscorpion species, *Chelifer cancroides* (Linnaeus, 1758), *Dinocheirus panzeri* (C.L. Koch, 1837) and *Allocheres wideri* (C.L. Koch, 1843) were recorded from mammal nest in Slovakia.

Pseudoscorpions are an important group of predators which occupy almost all terrestrial habitats and feed on a variety of small arthropods (moth larvae of clothes, beetle larvae of carpet, booklice, ants, mites and small flies). They have less developed eyes and kill the prey using trichobothria on their pedipalps. Prey are captured with the help of pedipalps and moved to the chelicerae (Weygoldt 1969; Witt & Dill 1996). Verner (1959) published the first record of *Diplotelmus insolitus* (Chamberlin, 1933) (Pseudoscorpiones: Atemnidae) from guano of *Myotis myotis* (Borkhausen, 1797) and *Myotis oxygnathus* (Monticelli, 1885) (Chiroptera: Vespertilionidae). Kovac *et al.*, 2007 reported *Neobisium carcinoides* (Hermann, 1804) (Pseudoscorpiones: Neobisiidae) from guano of bat colony in a cave.

There are only two records of pseudoscorpion species from India. *Megachernes himalayensis* (Ellingsen, 1914) was recorded from the northern regions of Uttarakhand (Ellingsen, 1914) and Jammu and Kashmir (Beier, 1978). Despite of previous records of pseudoscorpions in India, the distribution, abundance and the life history of pseudoscorpions is poorly known. The presence of pseudoscorpions on the pelage of bats and their roosts in India has not been reported previously. This study was conducted to investigate pseudoscorpion species associated with bats in Lakhimpur-Kheri, Uttar Pradesh, India.

2. MATERIALS AND METHODS

The research on the association of pseudoscorpion species with bats was carried out in Lakhimpur-Kheri, Uttar Pradesh, India during the period of 2013 to 2018. Pseudoscorpions were incidentally collected from the abdominal furs of the little Indian bat, *Pipistrellus coromandra*. The specimens were preserved in 70% ethyl alcohol and studied as permanent slide mount (Gardner, 1996). The camera lucida microscope was used for their morphological measurements. All pseudoscorpion specimens were identified using the key of Christophoryová *et al.* (2011). Permanent slides of all pseudoscorpion specimens were deposited to Biodiversity and Wildlife Laboratory, Department of Zoology, University of Lucknow, Uttar Pradesh, India.

3. RESULTS AND DISCUSSION

A total of 37 pseudoscorpion specimens were collected from the dorsal and ventral furs of *Pipistrellus coromandra* captured from six different roosts in Lakhimpur-Kheri, Uttar Pradesh, India in 2017-2018 (Fig. 1). Out of 25 captured bats, seven bats (two males and five females) were found to be associated with pseudoscorpions. Collected pseudoscorpion species was identified as *Cheiridium museorum* (Pseudoscorpiones: Cheiridiidae). The specimens were mostly collected from the abdominal furs of bats. *Cheiridium museorum* is also known as book pseudoscorpion. They were measured 0.89 to 1.36 mm in length. The pedipalps were very long (longer than body), measuring 0.97 to 1.64 mm when extended. The body was teardrop-shaped and colour ranged from yellowish to dark brown however, the pedipalps are typically dark brown. The abdomen had 12 segments, but only 10 of which were easily visible. On dorsal surface, tergite contained pigment granules that were interlaced together. The cephalothorax had one pair of less developed eyes (Fig. 2). They use their pedipalps to capture and seize the prey as well as to grip and hang on the furs of bats. This pseudoscorpion species was found only to be associated with those bats that were heavily infested with ectoparasites. No specimens were recorded on bats that were not infested with ectoparasites.

Cheiridium museorum (Leach, 1817) is a species with a wide geographical distribution. It can be found in several types of habitats: under stones, under bark, mature dunes, dead leaves and mosses in *Abies* forest, under bark of *Populus* trees and holes in *Prunus* trees with nest of *Lasius* sp. (Nassirkhani, 2015). It occurs in synanthropic habitats, such as houses, shops, barns, grain-stores, and stables, as well as in the nests of domestic birds, such as house sparrows, pigeons, barn swallows, and house martins (Christophoryová & Červená 2020).



Fig. 1. The Little Indian Bat (*P. coromandra*)



Fig. 2. *Cheiridium museorum* (Leach, 1817) collected from the pelage of *P. coromandra*
Scale bar: 1 mm.

4. CONCLUSION

Previous studies revealed that pseudoscorpions are not the ectoparasites of bats. They are tiny arachnids that live in a wide range of natural and man-made habitats where sufficient moisture is present. In India, the presence of pseudoscorpions on the bats has not been reported previously. This is a new record of phoretic association of *Cheiridium museorum* with the pelage of the little Indian bat, *Pipistrellus coromandra* in India. Krumpal and Cyprich (1988) reported this association as a regular phenomenon of pseudoscorpions seeking for bird nests as a food source, a refuge and a breeding location. Species of *Megachernes* were found to be obligate commensals with mammals, occurring in their nest and phoretically in their pelage (Beier, 1948; Martens, 1975; Durden, 1991). Shimada *et al.* (2023) reported phoretic behavior of the pseudoscorpion, *Megachernes ryugadensis* on the Japanese wood mouse, *Apodemus speciosus*. On the basis of previous studies, the association of this pseudoscorpion species with bats was analyzed and found that they exhibit a form of commensalism (Phoresis) with bats. They regularly visit the furs of bats for food source and shelter where they feed on larvae and nymphs of bat flies, ticks or mites. This association may be considered as obligate commensalism with bat species.

The current manuscript brings the first concrete data about the presence of this pseudoscorpion species on the pelage of bats in India. The phoresy of *Cheiridium museorum* on the abdominal furs of the Indian pipistrelle, *Pipistrellus coromandra* (Gray, 1838) is recorded for the first time in India and is a valuable contribution from a scientific point of view.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that No generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

- 1.
- 2.
- 3.

REFERENCES

- Beier, M. (1948). Phoresie und Phagophilie bei Pseudoscorpionen. *Osterreichische Zoologische Zeitschrift*, 1, 441-497.
- Beier, M. (1963). Ordnung Pseudoscorpionidea (Afterscorpione). Bestimmungsbucher zur Bodenfauna Europas 1. Akademie-Verlag, Berlin, 313 pp.
- Beier, M. (1978). Pseudoscorpione aus Kashmir und Ladakh (Arachnida). *Senckenberg Biol.*, 58, 415-417.
- Bhattacharyya, S. (1990). A survey of pseudoscorpions in the nests of *Passer domesticus* (Linnaeus) in West Bengal. *Environment and Ecology*, 8, 245-247.
- Christophoryová, J., Červená, M. (2020). *Apocheiridium ferum* (Simon, 1879) (Arachnida, Pseudoscorpiones, Cheiridiidae), a newly recorded genus and species of pseudoscorpion for Hungary. *Check List*, 16 (2), 223-228. <https://doi.org/10.15560/16.2.223>
- Christophoryová, J., Šťáhlavský, F., Fedor, P. (2011). An updated identification key to the pseudoscorpions (Arachnida: Pseudoscorpiones) of the Czech Republic and Slovakia. *Zootaxa*, 2876, 35-48.
- Durden, L. A. (1991). Pseudoscorpions associated with mammals in Papua New Guinea. *Biotropica*, 23, 204-206.
- Ellingsen, E. (1914). On the pseudoscorpions of the Indian Museum, Calcutta. *Records of Indian Museum*, 10, 1-14.
- Francke, O. F., Villegas-Guzman, G. A. (2006). Symbiotic relationships between pseudoscorpions (Arachnida) and packrats (Rodentia). *Journal of Arachnology*, 34, 289-298. <http://dx.doi.org/10.1636/04-36.1>
- Gardner, S. L. (1996). Field parasitology techniques for use with mammals. In Wilson, D. E., Cole, F. R., Nichols, J. D., Rudran, R., Foster, M. S. (Eds.) *Measuring and Monitoring Biological Diversity. Standard Methods for Mammals*. Smithsonian Institution Press, Washington, DC. pp 291-298.
- Hoff, C. C., Clawson, D. L. (1952). Pseudoscorpions from rodent nests. *American Museum Novitates*, 1585, 1-38.
- Jones, P. E. (1970). The occurrence of *Chthonius ischnocheles* (Hermann) (Chelonethi: Chthoniidae) in two types of hazel coppice leaf litter. *Bulletin of the British Arachnological Society*, 1, 72-79.

- Kováč, L., Ľuptáček, P., Višňovská, Z., Mock, A. (2007). Bezstavovce (Evertebrata) Liskovskej jaskyne. *Aragonit*, 12, 47-51.
- Krumpal, M., Cyprich, D. (1988). O výskyte ščuríkov (Pseudoscorpiones) v hniezdach vtakov (Aves) v podmienkach Slovenska. *Zbor. Slov. Nar. Muz., Prir. Vedy*, 34, 41-48.
- Martens, J. (1975). Phoretische Pseudoscorpione auf Kleinsäugetern des Nepal-Himalaya. *Zoologischer Anzeiger*, 194, 84-90.
- Nassirkhani, M. (2015). First records of the pseudoscorpion family Cheiridiidae from Iran. *Arachnology*, 16 (7), 244–251. <https://doi.org/10.13156/arac.2015.16.7.244>
- Ratnaweera, P. B., Wijesinghe, M. R., Udagama-Randeniya, P. V. (2010). Parasitic associations of a threatened Sri Lankan rainforest rodent, *Mus mayori pococki* (Rodentia: Muridae). *Journal of Threatened Taxa*, 2, 901-907. <http://dx.doi.org/10.11609/JoTT.o2194.901-7>
- Shear, W. A. (1991). The early development of terrestrial ecosystems. *Nature*, 351, 283-289. <http://dx.doi.org/10.1038/351283a0>
- Shear, W. A., Schawaller, W., Bonamo, P. M. (1989). Record of Palaeozoic pseudoscorpions. *Nature*, 341, 527-529. <http://dx.doi.org/10.1038/341527a0>
- Shimada, T., Okabe, K., Makino, S. I., Nakamura, S., Fujii, S. (2023). Phoretic behavior of the pseudoscorpion *Megachernes ryugadensis* on the Japanese wood mouse *Apodemus speciosus*. *The Science of Nature*, 110 (6), 51.
- Thanee, N., Kupittayanant, S., Pinmongkhong, S. (2009). Prevalence of ectoparasites and blood parasites in small mammals at Sakaerat Environmental Research Station, Thailand. *Thai Journal of Agricultural Science*, 42, 149-158.
- Turienzo, P., Di Iorio, O., Mahnert, V. (2010). Global checklist of pseudoscorpions (Arachnida) found in birds' nests. *Revue suisse de Zoologie*, 117, 557-598.
- Verner, P. H. (1959). Ein interessanter Fund eines Pseudoscorpions in der Tschechoslowakei (Pseudoscorpionidea). *Acta Faunistica Entomologica Musei Nationalis Pragae*, 5, 61-63.
- Weygoldt, P. (1969) The biology of pseudoscorpions. Harvard University Press, Cambridge, Massachusetts pp. 1-145.
- Witt, D. L., Dill, L. M. (1996). Springtail postmolt vulnerability to pseudoscorpion predation: mechanisms and implications. *Journal of Insect Behavior*, 9, 395-406.