

PSEUDOSCORPIONS (ARACHNIDA: PSEUDOSCORPIONES) FOUND IN BIRD NESTS AND IN BAT GUANO IN SLOVAKIA AND GERMANY

**Katarína Krajčovičová*, Jana Christophoryová*
and Terézia Lučeničová**

* Department of Zoology, Faculty of Natural Sciences, Comenius University, Mlynská dolina B-1, SK-842 15 Bratislava, SLOVAKIA. E-mails: krajcovic.katarina@gmail.com; christophoryova@gmail.com; t.lucenicova@gmail.com

[Krajčovičová, K., Christophoryová, J. & Lučeničová, T. 2015. Pseudoscorpions (Arachnida: Pseudoscorpiones) found in bird nests and in bat guano in Slovakia and Germany. Munis Entomology & Zoology, 10 (2): 428-434]

ABSTRACT: First data about pseudoscorpions found in open nests of *Turdus merula* Linnaeus, 1778 for Germany are presented. The species *Neobisium* sp., *Chernes hahnii* (C.L. Koch, 1839), *Chernes vicinus* (Beier, 1932) and *Lamprochernes nodosus* (Schränk, 1803) were identified in examined nests. In Slovakia, the species *Dactylochelifer latreillii* (Leach, 1817), *C. hahnii* and *Allochernes wideri* (C.L. Koch, 1843) were found in open nests of *T. merula* and *Turdus philomelos* Brehm, 1831. New data on pseudoscorpions living in bat guano from Slovakia are reported. Altogether three pseudoscorpion species were found in guano collected from bat boxes and from tree hollows – *C. hahnii*, *Dinocheirus panzeri* (C.L. Koch, 1837) and *A. wideri*. None of the recorded species showed specific relationship to the host; the built type of nests and their certain location in the environment influenced pseudoscorpion occurrence in the nest.

KEY WORDS: Pseudoscorpions, *Turdus*, Chiroptera, guano, nest, tree hollow, Central Europe.

Pseudoscorpions are an important group of predators, which occupies virtually every terrestrial habitat, including nests of birds and mammals. The pseudoscorpion fauna of Slovakia includes 55 species, which belong to eight families (Christophoryová et al., 2011a,c; Christophoryová et al., 2012a,b). The German fauna is presently known by 50 species from eight families (Blick et al., 2004; Harvey, 2013).

The first recorded pseudoscorpion species from the nests of *Turdus merula* Linnaeus, 1758 in Slovakia was identified as *Chelifer cancroides* (Linnaeus, 1758) (Nosek & Lichard, 1962). Christophoryová (2010) and Christophoryová et al. (2011b) later reported the presence of *Dactylochelifer latreillii* (Leach, 1817) and *Chernes hahnii* (C.L. Koch, 1839) in *T. merula* nests. In the nests of *Turdus philomelos* Brehm, 1831 pseudoscorpions *Neobisium sylvaticum* (C.L. Koch, 1835), *D. latreillii* and *C. hahnii* were recorded (Christophoryová, 2010; Christophoryová et al., 2011b). The species *C. hahnii* was also found in nests of *Turdus pilaris* Linnaeus, 1758 (Christophoryová et al., 2011b).

Only a few records about pseudoscorpions from bat guano are known from Slovakia. Verner (1959) published the first record of *Diplotemnus insolitus* Chamberlin, 1933 from guano of *Myotis myotis* Borkhausen, 1797 and *Myotis oxygnathus* Monticelli, 1885. Until then, *D. insolitus* have been recorded only from Africa and Asia, from where it was introduced probably by bats to Slovakia. On the same locality, the species *C. cancroides* was collected from bat guano (Verner, 1959; Christophoryová et al., 2014). Both of the species were found in a church loft. Kováč et al. (2007) found pseudoscorpion *Neobisium carcinoides* (Hermann, 1804) in guano of bat colony in a cave.

In Germany, species *Cheiridium museorum* (Leach, 1817), *C. cancroides*, *Dinocheirus panzeri* (C.L. Koch, 1837), *Allochernes powelli* (Kew, 1916), *Allochernes wideri* (C.L. Koch, 1843) and *Pselaphochernes scorpioides* (Hermann, 1804) have been recorded from bird nests (Helversen, 1966; Jost, 1982; Droglá & Lippold, 2004). No records about pseudoscorpions from *Turdus* nests were published.

Turienzo et al. (2010) published a global checklist of pseudoscorpions living in bird nests. The species *Chthonius fuscimanus* Simon, 1900, *C. ischnocheles* (Hermann, 1804), *N. sylvaticum*, *C. cancroides*, *D. latreillii* and *D. panzeri* were found in common blackbird nests in Europe (Turienzo et al., 2010; Christophoryová et al., 2011b). From song thrush nests, the species *N. sylvaticum*, *D. latreillii* and *C. hahnii* were collected in Europe (Turienzo et al., 2010; Christophoryová et al., 2011b).

The present paper provides original data about pseudoscorpions found in bat guano for Slovakia. The paper also provides new data about pseudoscorpions inhabiting *Turdus* nests in Slovakia. Pseudoscorpions occurrence in *Turdus* nests is documented from Germany for the first time.

MATERIALS AND METHODS

The research about pseudoscorpions from bird nests was carried out in 2011 in Slovakia and in 2012 in Germany (leg. Terézia Lučeničová, Zlatica Országhová). Altogether, 13 open nests of *T. merula* (Fig. 1) and one open nest of *T. philomelos* were collected immediately after the fledging of chicks in Slovakia. In Germany, four open nests of *T. merula* were examined; one of them was collected about two weeks after the fledging of chicks.

The guano was collected from bat boxes, in which the bats *Nyctalus noctula* (Schreber, 1774) and *Pipistrellus pipistrellus* (Schreber, 1774) were determined; and from tree hollows with guano of bats *Myotis daubentoni* (Kuhl, 1817) and *N. noctula* (Fig. 1). Bat boxes were installed on trees in a high about 2–3 meters above the ground. The studied locality with occurrence of bats was the City Park in Nitra, Slovakia (leg. Jana Christophoryová, Peter Fend'a, Katarína Krajčovičová, Martin Ševčík).

The bird nests and guano were heat extracted in Tullgren funnels. The material was studied as permanent slide mounts using Leica DM1000 microscope. All specimens were identified using the key Christophoryová et al. (2011d) (det. Christophoryová, Krajčovičová). The pseudoscorpions on Figure 2 were photographed using a Leica ICC50 camera connected to a Leica DM1000 microscope, using Leica LAS EZ 1.8.0 software. Digital images were montaged using the "CombineZP" image stacking software. Nomenclature for all taxa follows Harvey (2013). The whole material is deposited in the zoological collection of the Comenius University, Bratislava.

List of collecting sites:

Slovakia

T. merula: Bratislava – Chorvátske rameno: [1] 20.4.2011, 48°06'32.78", 17°06'46.86", 132 m a.s.l.; [2] 2.6.2011, 48°06'10.66", 17°06'14.65", 133 m a.s.l.; Bratislava – Sad Janka Kráľa: [3] 21.6.2011, 48°08'09.36", 17°06'44.40", 138 m a.s.l.; [4] 5.7.2011, 48°08'10.20", 17°06'40.02", 139 m a.s.l.; Bratislava – Malý Draždiak: [5] 13.5.2011, 48°07'29.46", 17°07'23.22", 133 m a.s.l.; [6] 16.5.2011, 48°07'29.46", 17°07'23.22", 133 m a.s.l.; [7] 10.6.2011, 48°06'37.68", 17°07'06.60", 134 m a.s.l.; [8] 8.7.2011, 48°06'36.66", 17°07'00.96", 137 m a.s.l.;

Bratislava – Botanical garden: [9] 11.5.2011, 48°08'44.97", 17°04'28.23", 147 m a.s.l.; [10] 25.5.2011, 48°08'46.98", 17°04'28.08", 147 m a.s.l.; Stupava – Borník (Fig. 1): [11] 25.4.2011, 48°16'28.68", 17°02'24.60", 210 m a.s.l.; [12] 23.5.2011, 48°16'28.32", 17°02'27.12", 211 m a.s.l.; Stupava: [13] 25.4.2011, 48°16'33.72", 17°01'58.98", 183 m a.s.l.

T. philomelos: Stupava: [14] 8.7.2011, 48°15'32.10", 17°02'28.20", 170 m a.s.l.

Guano: Nitra – New City Park (Fig. 1): [15] 28.9.2012, 48°19'01", 18°04'52", 143 m a.s.l.; Nitra – Old City Park: [16] 28.9.2012, 48°19'14", 18°05'03", 142 m a.s.l.

Germany

T. merula: Leipzig – Centre: [17] 19.7.2012, 51°20'34.86", 12°22'49.68", 113 m a.s.l.; [18] 24.7.2012, 51°20'35.88", 12°22'15.77", 111 m a.s.l.; Leipzig – Park: [19] 25.5.2012, 51°19'33.36", 12°21'15.18", 119 m a.s.l.; [20] July 2012, 51°19'37.15", 12°21'07.36", 121 m a.s.l.

RESULTS AND DISCUSSION

Altogether, six pseudoscorpion species from three families were identified from 18 *Turdus* nests. In Slovakia, the species *D. latreillii*, *C. hahnii* and *A. wideri* were found in examined nests. In Germany, the species *Neobisium* sp., *C. hahnii*, *Chernes vicinus* (Beier, 1932) and *Lamprochernes nodosus* (Schrank, 1803) were collected from *Turdus* nests. The most abundant family was the Chernetidae in both of the studied countries. The species *C. hahnii*, *D. panzeri* (C.L. Koch, 1837) and *A. wideri* were recorded in bat guano in Slovakia.

Neobisiidae Chamberlin, 1930

Neobisium sp.

Germany: *T. merula*: [19] open nest on the ground, 1 protonymph.

Neobisiidae species are typical inhabitants of forest leaf litter and soil (Beier, 1963).

The finding of one protonymph in the nest on the ground corresponds to known family preferences; *Neobisium* sp. occurred in nest probably accidentally.

Cheliferidae Risso, 1827

Dactylochelifer latreillii (Leach, 1817)

Slovakia: *T. merula*: [1] open nest 2 m above the ground, 1♂, 1 deutonymph; [2] open nest 1.4 m above the ground, 1♂, 1 tritonymph; [3] open nest 1.4 m above the ground, 1♂; [5] open nest 1.4 m above the ground, 1♂; [6] open nest 1.7 m above the ground, 1 deutonymph; [8] open nest 1 m above the ground, 1 tritonymph; [10] open nest 2.2 m above the ground, 1♂; [13] open nest 1.2 m above the ground, 1 tritonymph. *T. philomelos*: [14] open nest 1 m above the ground, 1 tritonymph.

The species *D. latreillii* is distributed in Europe, Africa and Asia (Harvey, 2013). It was recorded abundantly from bird nests, in mould of tree hollows and under the tree bark (Krumpál & Cyprich, 1988; Droglá & Lippold, 2004; Christophoryová, 2010; Krajčovičová & Christophoryová, 2014). Christophoryová et al. (2011b) characterised *D. latreillii* as species frequently occurring in all types of bird nests, except the ones situated in burrows. *D. latreillii* was less commonly found in forest litter and compost heaps; it was found as well in Malaise trap and wood decay fungi (Droglá, 1988; Droglá & Lippold, 2004; Krajčovičová & Christophoryová, 2014).

During the present study, this pseudoscorpion occurred in *Turdus* nests in Slovakia.

Chernetidae Menge, 1855***Chernes hahnii* (C.L. Koch, 1839)**

Slovakia: *T. merula*: [4] open nest 1 m above the ground, 1♀; [9] open nest 1.5 m above the ground, 4♀♀, 2♂♂, 3 tritonymphs, 4 deutonymphs, 2 protonymphs; [11] open nest 2.3 m above the ground, 1♂; [12] open nest 2.3 m above the ground, 1♀. Guano: [15] bat boxes with *N. noctula*, 1♀, 1♂, 2 tritonymphs; [16] old guano and wasp sheets from bat boxes without bats, 2♀♀, 1♂, 2 tritonymphs, 1 deutonymph. Germany: *T. merula*: [17] open nest 2 m above the ground 1♂, 1 deutonymph; [18] open nest 2.2 m above the ground 1♀.

Pseudoscorpion *C. hahnii* (Fig. 2) is distributed in Europe and Asia (Harvey, 2013). The species prefers the microhabitats under the tree bark, mould of tree hollows and bird nests (Helvesen, 1966; Krumpál & Cyprich, 1988; Droglá & Lippold, 2004; Christophoryová, 2010; Krajčovičová & Christophoryová, 2014). Christophoryová et al. (2011b) characterised *C. hahnii* as species found in all bird nest types, except the ones in synanthropic habitats and burrows. *C. hahnii* was also recorded in tree trunk and ground photoelectors, in wood decay fungi and Malaise traps (Blick et al., 2003; Krajčovičová & Christophoryová, 2014).

During the present study, it was found in *T. merula* nests; moreover this is the first record of *C. hahnii* in bird nests for Germany. The findings in guano represent its first records in this microhabitat type in Slovakia.

***Chernes vicinus* (Beier, 1932)**

Germany: *T. merula*: [18] open nest 2.2 m above the ground, 1♀.

Pseudoscorpion *C. vicinus* is recorded only from Austria, Belgium, Czech Republic, Germany, Slovakia and Sweden (Harvey, 2013). The species was found in anthills (Helvesen, 1966; Droglá & Lippold, 2004). Krumpál & Cyprich (1988) recorded *C. vicinus* in bird boxes and Beier (1963) from leaf litter.

During the present study, *C. vicinus* occurred in *T. merula* nest situated on the ground.

***Dinocheirus panzeri* (C.L. Koch, 1837)**

Slovakia: Guano: [15] old guano of *M. daubentoni* and *N. noctula* and mould from tree hollow, 1♀.

Pseudoscorpion *D. panzeri* was mostly recorded from tree hollows (Helvesen, 1966; Jost, 1982; Šťáhlavský, 2001; Droglá & Lippold, 2004; Christophoryová, 2010; Krajčovičová & Christophoryová, 2014). It was also found in bird nests situated in tree hollows and bird boxes (Helvesen, 1966; Krištofik et al., 2002; Christophoryová, 2010).

During the present study, *D. panzeri* occurred in guano collected from tree hollow that responds to the known microhabitat preference of the species.

***Allochernes wideri* (C.L. Koch, 1843)**

Slovakia: *T. merula*: [7] open nest in open-fronted bird box 1.1 m above the ground, 1♀. Guano: [15] old guano of *N. noctula* and mould from tree hollow, 2♂♂, 1 tritonymph, 1 deutonymph; [16] old guano and wasp sheets from bat boxes without bats, 1♀; [16] guano from bat boxes with *P. pipistrellus*, 1♀.

The species *A. wideri* (Fig. 2) prefers microhabitats of tree hollows and it was occasionally found under the tree bark (Šťáhlavský, 2001; Droglá & Lippold, 2004; Christophoryová, 2010; Krajčovičová & Christophoryová, 2014). There are known records from anthills and Malaise traps (Droglá & Lippold, 2004;

Krajčovičová & Christophoryová, 2014) and also from bird nests (Helversen, 1966; Christophoryová, 2010). According to Christophoryová et al. (2011b) and Krumpál & Cyprich (1988) *A. wideri* occurs frequently in nests situated in burrows, tree hollows and boxes; it occurs only accidentally in open nests.

During the present study, one *A. wideri* female was collected from *T. merula* nest and from bat guano. Observed results correspond to known microhabitat preferences of the species.

***Lamprochernes nodosus* (Schrank, 1803)**

Germany: *T. merula*: [20] open nest on the ground, 1♂, 1 tritonymph, 9 deutonymphs, 1 protonymph.

The species *L. nodosus* was numerous found in compost heaps (Drogla & Lippold, 2004; Christophoryová et al., 2014). The phoresy of *L. nodosus* was recorded in Europe (for example: Ressler & Beier, 1958; Helversen, 1966; Drogla & Lippold, 2004). This pseudoscorpion was less commonly found in buildings, bird nests, under the tree bark and in wood decay fungi (Drogla & Lippold, 2004; Christophoryová, 2010; Krajčovičová & Christophoryová, 2014).

During the present study, *L. nodosus* was recorded for the first time in bird nests in Germany.

Many authors have discussed whether pseudoscorpions arrive accidentally to the nests or are regular visitors (for example: Krumpál & Cyprich, 1988; Christophoryová, 2010; Turienzo et al., 2010; Christophoryová et al., 2011b). We incline to the view that the pseudoscorpion presence in nests is caused by suitable microclimatic conditions, which also offer potential prey. Therefore a lot of species were regularly collected from nests and even were represented by all nymphal stages. The most dominant regular visitors are certainly species from the Chernetidae family (Christophoryová et al., 2011b). The latest detailed studies have found out that the built type of nests and their certain location in the environment influenced the presence of one or another pseudoscorpion species (Krumpál & Cyprich, 1988; Christophoryová, 2010; Turienzo et al., 2010; Christophoryová et al., 2011b). The obtained results of the present study confirmed the aforementioned assumptions.

ACKNOWLEDGEMENTS

We are grateful to all collectors of pseudoscorpion material used in this paper and Alica Christophoryová for technical assistance with figures. The study was financially supported by the project VEGA 2/0035/13 and VEGA 1/0191/15.

LITERATURE CITED

- Beier, M. 1963. Ordnung Pseudoscorpionidea (Afterskorpione). Bestimmungsbücher zur Bodenfauna Europas. Verlag, Berlin, 313 pp.
- Blick, T., Muster, C. & Ducháč, V. 2004. Checkliste der Pseudoskorpione Mitteleuropas. Checklist of the pseudoscorpions of Central Europe (Arachnida: Pseudoscorpiones). Version 1. Oktober 2004. Available from: http://arages.de/wp-content/uploads/2013/05/checklist2004_pseudoscorpiones.pdf (02 February 2015).
- Blick, T., Weiss, I. & Burger, F. 2003. Spinnentiere einer neu angelegten Pappel-Kurzumtriebsfläche (Energiewald) und eines Ackers bei Schwarzenau (Lkr. Kitzingen, Unterfranken, Bayern). Arachnologische Mitteilungen, 25: 1-16.
- Christophoryová, J. 2010. Štúriky (Pseudoscorpiones) pod kôrou stromov, v dutinách a hniezdach na Slovensku. Folia faunistica Slovaca, 15 (1): 1-12.
- Christophoryová, J., Gardini, G. & Enékesová, E. 2012a. *Withius hispanus* new to the fauna of Slovakia (Pseudoscorpiones: Withiidae). Arachnologische Mitteilungen, 44: 10-13.

- Christophoryová, J., Gardini, G. & Korenko, S.** 2011a. *Allochernes powelli* new to the fauna of Slovakia (Pseudoscorpiones: Chernetidae). *Folia faunistica Slovaca*, 16 (2): 67-70.
- Christophoryová, J., Krumpálová, Z., Křištofik, J. & Országhová, Z.** 2011b. Association of pseudoscorpions with different type of bird nests. *Biologia*, 66 (4): 669-677.
- Christophoryová, J., Mock, A. & Luptáčik, P.** 2011c. *Chthonius (Chthonius) carinthiacus* and *Chthonius (Ephippiochthonius) tuberculatus* new to the fauna of Slovakia (Pseudoscorpiones: Chthoniidae). *Arachnologische Mitteilungen*, 42: 23-28.
- Christophoryová, J., Štáhlavský, F. & Fedor, P.** 2011d. An updated identification key to the pseudoscorpions (Arachnida: Pseudoscorpiones) of the Czech Republic and Slovakia. *Zootaxa*, 2876: 35-48.
- Christophoryová, J., Štáhlavský, F. & Krajčovičová, K.** 2014. Štúriky (Pseudoscorpiones) Pohoria Burda (NPR Kováčovské kopce). *Folia faunistica Slovaca*, 19 (2): 161-167.
- Christophoryová, J., Štáhlavský, F., Krumpál, M. & Fedor, P.** 2012b. Pseudoscorpiones of Czech Republic and Slovakia: An annotated and revised checklist (Arachnida: Pseudoscorpiones). *North-Western Journal of Zoology*, 8 (1): 1-21.
- Drogla, R.** 1988. Pseudoskorpione aus dem Naturschutzgebiet „Ostufer de Münitz“ – Aberrationen und eine für die DDR neue Art (Arachnida, Pseudoscorpiones). *Zoologischer Rundbrief Bez. Neubrandenburg*, 5: 10-15.
- Drogla, R. & Lippold, K.** 2004. Zur Kenntnis der pseudoskorpion-fauna von Ostdeutschland (Arachnida, Pseudoscorpiones). *Arachnologische Mitteilungen*, 27/28: 1-54.
- Harvey, M. S.** 2013. Pseudoscorpions of the World. Version 3.0. Western Australian Museum, Perth. Available from: <http://museum.wa.gov.au/catalogues-beta/pseudoscorpions>. (02 February 2015).
- Helversen, O.** 1966. Pseudoskorpione aus dem Rhein-Main-Gebiet. *Senckenbergiana biologica*, 47: 131-150.
- Jost, G.** 1982. Zum Vorkommen und zur Verbreitung von Pseudoskorpionen (Arachnida, Pseudoscorpionidea) im Naturpark Hoher Vogelsberg. *Bericht der Naturwissenschaftlicher Verein Darmstadt*, 6: 2-12.
- Kováč, L., Luptáčik, P., Višňovská, Z. & Mock, A.** 2007. Beztavovce (Evertebrata) Liskovskej jaskyne. *Aragonit*, 12: 47-51.
- Krajčovičová, K. & Christophoryová, J.** 2014. Faunistic survey of pseudoscorpions (Arachnida: Pseudoscorpiones) collected from trees and using Malaise traps in Slovakia and the Czech Republic. *Klapalekiana*, 50: 167-180.
- Křištofik, J., Šustek, Z. & Mašán, P.** 2002. Arthropods (Pseudoscorpionida, Acari, Coleoptera, Siphonaptera) in the nests of red-backed shrike (*Lanius collurio*) and lesser grey shrike (*Lanius minor*). *Biologia*, 57 (5): 603-613.
- Krumpál, M. & Cyprich, D.** 1988. O výskytu štúrikov (Pseudoscorpiones) v hniezdach vtákov (Aves) v podmienkach Slovenska. *Zborník Slovenského národného múzea, Prírodné vedy*, 34: 41-48.
- Nosek, J. & Lichard, M.** 1962. Beitrag zur Kenntnis der Vogelnebstfauna. *Entomologische Probleme II*, 8 (6): 29-51.
- Ressl, F. & Beier, M.** 1958. Zur Ökologie, Biologie und Phänologie der heimischen Pseudoskorpione. *Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere* 86: 1-26.
- Štáhlavský, F.** 2001. Štúri (Arachnida: Pseudoscorpiones) Prahy. *Klapalekiana*, 37: 73-121.
- Turienzo, P., Di Iorio, O. & Mahnert, V.** 2010. Global checklist of pseudoscorpions (Arachnida) found in birds' nests. *Revue Suisse de Zoologie*, 117 (4): 557-598.
- Verner, P. H.** 1959. Ein interessanter Fund eines Pseudoscorpions in der Tschechoslowakei (Pseudoscorpionidea). *Acta Faunistica Entomologica Musei Nationalis Pragae*, 5: 61-63.



Figure 1. Collecting sites and microhabitat types with pseudoscorpion occurrence. A. Stupava – Borník. B. Nest of *Turdus merula*. C. City Park in Nitra. D. Bat boxes. Photos: Jana Christophoryová, Peter Fenda, Terézia Lučeničová.



Figure 2. Recorded pseudoscorpions from Slovakia. A. *Chernes hahnii*. B. *Allochernes wideri*. Scale: 1 mm. Photos: Jana Christophoryová.