First records of pseudoscorpions (Arachnida: Pseudoscorpiones) from Lithuania

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Krajčovičová, K., Tamutis, V., Ivinskis, P., Machač, O. & Christophoryová, J. 2018: First records of pseudoscorpions (Arachnida: Pseudoscorpiones) from Lithuania. — Entomol. Fennica 29: 49–53.

First records of pseudoscorpions from Lithuania are presented based on specimens preserved in Lithuanian collections and new material collected during the latest ten years. Pseudoscorpions were collected at 25 localities in both deciduous and coniferous forests at altitudes of 5 to 186 m above the sea level. Sifting of litter and moss, pitfall traps and collecting by picking under the bark of deadwood were used as the collecting methods. Altogether 132 specimens belonging to eight species from three families were recorded. The findings of *Neobisium crassifemoratum* (Beier, 1928) represent the northernmost known records of the species.

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Received 12 June 2017, accepted 4 August 2017

1. Introduction

The arachnid order Pseudoscorpiones represents a group of predators that occur in a wide range of terrestrial habitats in most parts of the world including oceanic islands. A majority of the species occurs in tropics and subtropics. On the other hand, many pseudoscorpions live in temperate zones, even extending far to the north, having a circumpolar distribution or occurring only in the northern hemisphere, but they are absent from Antarctica (Weygoldt 1969, Harvey 2013).

Table 1. List of localities where pseudoscorpions were studied in Lithuania.

No.	Locality	Latitude (N)	Longitude (E)	Altitude (m)
1	Alksnynė	21.115071	55.646108	7
2	Ignalina	26.067443	55.448851	186
3	Jonava	24.394463	55.078683	60
4	Jonava	24.405503	55.117371	87
5	Jonava	24.480209	55.128604	90
6	Juodkrantė	21.112603	55.547075	38
7	Kaišiadorys	24.325655	54.808493	87
8	Kaišiadorys	24.354713	54.811464	94
9	Kaunas	23.936996	54.850097	37
10	Kaunas	23.940245	54.851565	55
11	Kaunas	23.495184	54.898504	73
12	Kaunas	23.957847	54.950368	72
13	Kaunas	23.938933	54.853769	51
14	Nagliai Nature Reserve	21.066666	55.433333	5
15	Rokiškis	25.803195	55.789402	115
16	Šakiai	23.442239	55.010153	68
17	Šakiai	23.449156	55.027992	62
18	Šakiai	23.449151	55.028014	62
19	Šakiai	23.442902	55.027327	59
20	Tauragė	22.472472	55.178058	57
21	Ukmergė	24.620951	55.176296	102
22	Utena	25.949318	55.485822	180
23	Varėna	24.389324	54.024891	140
24	Varėna	24.412182	54.028323	143
25	Vilnius	25.261127	54.872136	152

Approximately 3,500 pseudoscorpion species and subspecies are recognized from around the world and about 787 valid species names are applied to the European fauna (Harvey 2013). However, even in Europe the knowledge on the distribution appears rather sporadic and fragmentary. In Northern Europe, there is a lack of studies dedicated to this arachnid order in general. In the Nordic countries, 20 species are known from Sweden, 19 from Denmark, 19 from Norway, 17 from Finland, 2 in Iceland and 1 in The Faroe Islands (Stol 2006, Uddström & Rinne 2014, Henriksen & Hilmo 2015, Fjellberg & Lissner 2016). Recently, Sammet *et al.* (2016) published an annotated checklist for Estonia that includes nine species listed for the Estonian pseudoscorpion fauna for the first time. The number of Estonian pseudoscorpion species is now set at 15 species (Sammet *et al*. 2016). From the neighbouring countries of Lithuania, 12 species have been recorded from Latvia (Tumšs 1934, Jansson & Hultengren 2002, Telnov & Salmane 2015), none has been published from Belorussia, but a considerably high number of species (38) has been recorded in Poland (Harvey 2013) where the Carpathian system interferes and the country is located in a different climatic zone. In Lithuania, no pseudoscorpion research has been carried out until now.

Each faunistic study of a new area improves the knowledge about pseudoscorpion diversity and distribution. The present paper adds new data about distributions of pseudoscorpions in the Northern Europe by summarizing their first records in Lithuania as a checklist.

2. Materials and methods

The litter samples were collected outside of the growing season (October – April) in 2006, 2010, 2013 and 2014. The litter samples comprised moss, leaf or needles litter and humus layer to the depth of 5 cm from the surface of the layer.

The pseudoscorpions were extracted from the litter samples manually using sieves with a mesh size of 5, 3 and 1 mm and collected using an aspirator. The specimens found under the tree bark were collected individually under the bark of unspecified deadwood in 2004 – 2008, 2015 and 2017. In Nagliai Nature Reserve, the collecting was carried out using pitfall traps with two or three weeks sampling intervals during 2012 – 2015.

The pitfall traps were placed in transects through each studied biotope (grey dunes with lichens and mosses, open grey dunes, old *Alnus* forest, white dunes with *Elymus arenarius*, white dunes with free sand). Few specimens from Lithuanian collections obtained from different collectors lacked proper data about biotopes. List of localities is included in Table 1.

For identification, the specimens were mounted as temporary slide mounts without preparation, using lactic acid for clearing. The specimens were photographed using a Leica DM1000 compound microscope with ICC50 Camera Module (LAS EZ application, 1.8.0). Measurements needed for proper identification were taken from photographs using the Axio-

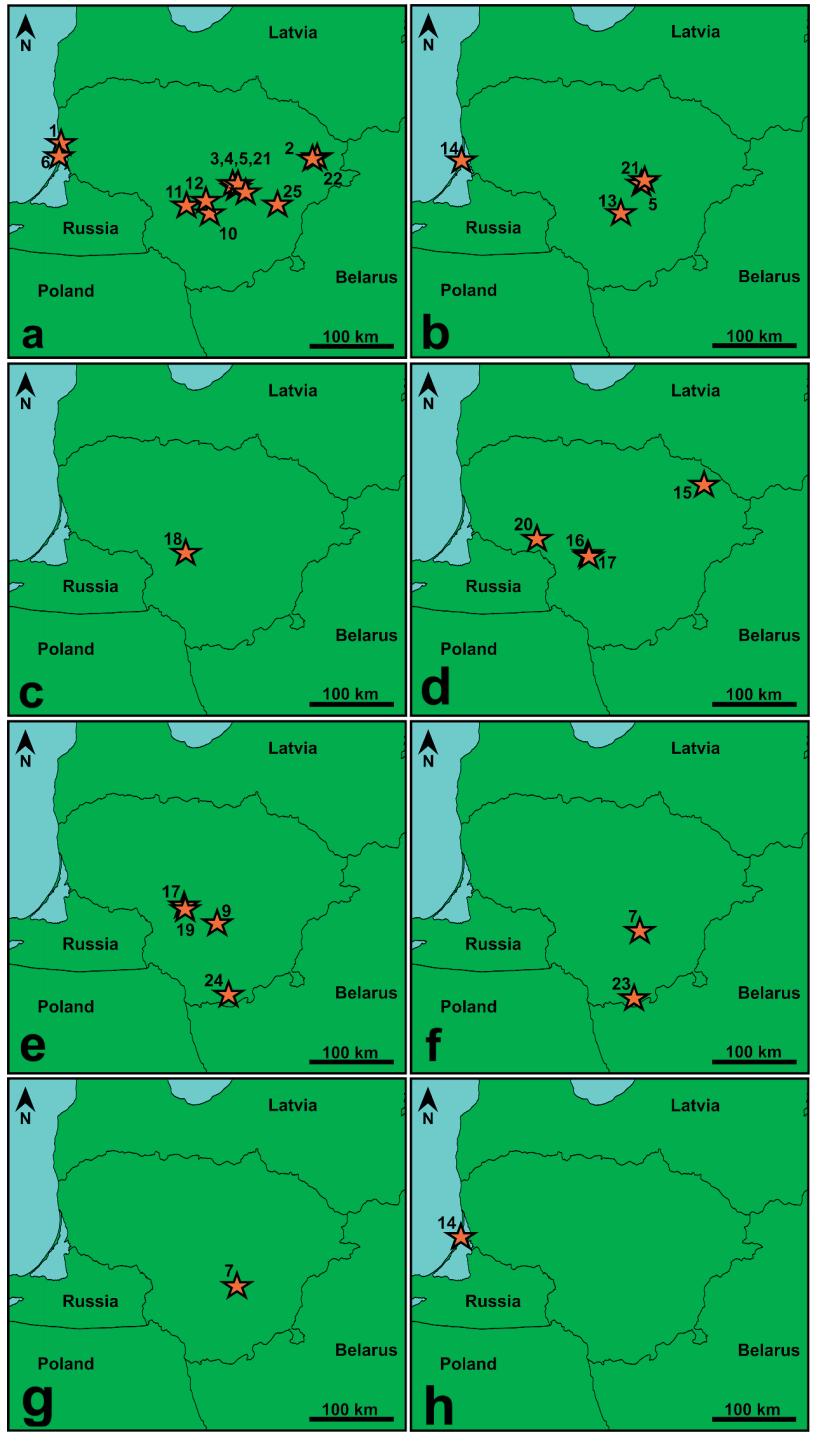

Fig. 1. Distributions of pseudoscorpion records in Lithuania. – a. *Neobisium carcinoides*. – b. *Neobisium crassifemoratum*. – c. *Chelifer cancroides*. – d. *Chernes cimicoides*. – e. *Chernes hahnii*. – f. *Dendrochernes cyrneus*. – g. *Allochernes wideri*. – h. *Pselaphochernes scorpioides*. For locality numbers, see Table 1.

Vision 40LE application (version 4.5). The pseudoscorpions were identified using the key in Christophoryová *et al*. (2011). The nomenclature for all taxa follows Harvey (2013). The material is deposited in the zoological collections of Kaunas T. Ivanauskas Zoological Museum (KZM). All specimens are preserved in 70% ethanol.

3. Results

Altogether 132 specimens belonging to eight species and three families were identified. One damaged specimen remains identified only to family level (Cheliferidae). Both found neobisiid species are considered to be epigeic and were collected by sifting of litter and moss and using pitfall traps. Species from Cheliferidae and Chernetidae were obtained by picking under the bark of deadwood, except *Pselaphochernes scorpioides* (Hermann, 1804) that was found in pitfall traps.

The list of the collected taxa is given below with locality number (see Table 1) in parentheses, biotope and sample type, date and the number of collected individuals of each developmental stage (male: ♂, female: ♀, adult: damaged specimen, tritonymph, deutonymph, protonymph) and collector's name.

3.1. List of Lithuanian pseudoscorpion taxa

3.1.1. Neobisiidae

Neobisium carcinoides (Hermann, 1804) (Fig. 1a) – Alksnynė (1), 21.IX.2010, *Pinus sylvestris* forest, moss sifting, 3♂♂, 1♀, leg. V. Tamutis; Ignalina (2), 3.III.2014, *P. sylvestris* forest, moss sifting, 6♀♀, leg. V. Tamutis; Jonava (3), 10.X.2013, *P. sylvestris* forest, needles litter sifting, 4♂♂, 9♀♀, leg. V. Tamutis; Jonava (4), 10.X.2013, *P. sylvestris* forest, moss sifting, 1♂, 19♀♀, 2 protonymphs, leg. V. Tamutis; Jonava (5), 10.X.2013, *P. sylvestris* forest, moss sifting, 2♂♂, leg. V. Tamutis; Juodkrantė (6), 6.X. 2010, *Pinus mugo* forest, moss sifting, 1♂, 7♀♀, leg. V. Tamutis; Kaunas (10), 22.IX. 2006, found in leaf litter, 1♀, leg. R. Ferenca; Kaunas (11), 11.XI.2010, *P. sylvestris* forest, needles litter sifting, 8♂♂, 8♀♀, leg. V. Tamutis; Kaunas (12), 16.IV. 2007, coniferous forest, moss sifting, 1♀, leg. R. Ferenca; Ukmergė (21), 10.X.2013, *P. sylvestris* forest, moss sifting, 3♂♂, 6♀♀, leg. V. Tamutis; Utena (22), 3.III.2014, *P. sylvestris* forest, moss sifting, 8♀♀, leg. V. Tamutis; Vilnius (25), 27.VI.2010, coniferous forest, found in moss, 1 adult, leg. J. Ušinskytė.

Neobisium crassifemoratum (Beier, 1928) (Fig. 1b) – Jonava (5), 10.X.2013, *P. sylvestris* forest, moss sifting, 4♂♂, 6♀♀, 1 deutonymph, 1 tritonymph, leg. V. Tamutis; Kaunas (13), 24.VI.2006, deciduous forest, litter sifting, 1♂, leg. R. Ferenca; Nagliai NR (14), 2.V.–11.XI.2013, pitfall trap, 2♂♂, 1♀, leg. P. Ivinskis, O. Macháč; Ukmergė (21), 10.X. 2013, *P. sylvestris* forest, moss sifting, 1♂, 2♀♀, 1 protonymph, 1 deutonymph, leg. V. Tamutis.

3.1.2. Cheliferidae

Chelifer cancroides (Linnaeus, 1758) (Fig. 1c) – Šakiai (18), 3.VI.2006, under deadwood bark, 2♂♂, leg. R. Ferenca. In addition, an unidentified damaged cheliferid specimen was found in Kaišiadorys (8) under deadwood bark on 23.VIII.2005, leg. B. Paulavičiūtė.

3.1.3. Chernetidae

Chernes cimicoides (Fabricius, 1793) (Fig. 1d) – Rokiškis (15), 7.V.2004, under deadwood bark, 2♂♂, leg. R. Ferenca; Šakiai (16), 17.VI.2007, under deadwood bark, 1♀, leg. R. Ferenca; Šakiai (17), 24.VI.2008, under deadwood bark, 1♂, leg. R. Ferenca; Tauragė (20), 18.VIII.2006, under deadwood bark, 1♂, leg. R. Ferenca.

Chernes hahnii (C. L. Koch, 1839) (Fig. 1e) – Kaunas (9), 9.V.2006, under deadwood bark, 1♂, leg. R. Ferenca; Šakiai (17), 24.VI.2008, under deadwood bark, 1♂, leg. R. Ferenca; Šakiai (19), 06.05.2017, under bark of *Alnus incana* deadwood, 1♂, leg. R. Ferenca; Varėna (24), 10.IX.2015, under *P. sylvestris* bark, 1♀, leg. R. Ferenca.

Dendrochernes cyrneus (L. Koch, 1873) (Fig. 1f) – Kaišiadorys (7), 26.IV.2007, deciduous forest, under deadwood bark, 1♀, leg. R. Ferenca; Varėna (23), 4.V.2006, under deadwood bark, 1 tritonymph, leg. R. Ferenca.

Allochernes wideri (C. L. Koch, 1843) (Fig. 1g) – Kaišiadorys (7), 18.V.2006, deciduous forest, under deadwood bark, 1♀, leg. R. Ferenca.

Pselaphochernes scorpioides (Hermann, 1804) (Fig. 1h) – Nagliai NR (14), 2.V.–11.XI.

2013, pitfall trap, 5♀♀, leg. P. Ivinskis, O. Macháč.

4. Discussion

The occurrence of *N. carcinoides* in the Nordic countries is well known (Weygoldt 1969, Stol 2006, Sammet *et al*. 2016), and in the current research in Lithuania the species was the most numerous one. However, the occurrence of *N. crassifemoratum* in Lithuania was unexpected. Its previously known range reached from Greece and Turkey in the south to Germany in the north (Drogla & Lippold 2004, Harvey 2013). Its closest occurrence to Lithuania was recorded by Rafalski (1967), who found the species in Bieszczady Mountains, southern Poland. Accordingly, the findings of *N. crassifemoratum* at four localities in Lithuania represent the northernmost known records of the species.

Most species in the samples belonged to Chernetidae family. *Chernes cimicoides*, *C. hahnii* and *A. wideri*, found in the current study under the bark of unspecified deadwood, were considered as the species with the closest association with tree microhabitats in the latest studies in Slovakia (Christophoryová 2010, Krajčovičová & Christophoryová 2014).

The occurrence of *C. cimicoides*, *D. cyrneus*, *A. wideri* and *P. scorpioides* in the Nordic countries has already been recorded (Stol 2006, Sammet *et al*. 2016) and the presence of *C. hahnii* in Latvia, neighbouring Lithuania, was recently recorded by Telnov and Salmane (2015). The current findings of these species in Lithuania further improved the knowledge of their distributions.

Acknowledgements. We are grateful to all collectors for obtained pseudoscorpion material. We would like to express our thanks to Kaarel Sammet and Christoph Hörweg for their help with literature and to our colleague Daniel Jablonski for technical assistance with the maps. We also thank two anonymous reviewers for their suggestions for improving the manuscript. The study was financially supported by the Grants No VP1-3.1-ŠMM-08-K-01-025 and VEGA 1/0191/15.

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