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Source: Arachnologische Mitteilungen: Arachnology Letters, 68(1) : 21-28

Published By: Arachnologische Gesellschaft e.V.

URL: https://doi.org/10.30963/aramit6806

A note on alien spider species from Kosovo (Arachnida: Araneae)

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doi: 10.30963/aramit6806

Abstract. Kosovo is a small landlocked country on the Western Balkans and the youngest country in Europe. In this paper, we report three alien spider species from Kosovo for the first time: *Ostearius melanopygius*, *Parasteatoda tepidariorum* and *Spermophora senoculata*. In addition, we report new records for *Pholcus phalangioides* for the region. Our investigation is one of the first contributions to the knowledge about the distribution patterns of alien spider species on the Balkan Peninsula.

Keywords: Balkans, distribution, invasive species, Linyphiidae, Pholcidae, Theridiidae

Zusammenfassung. Eine Bemerkung zu nichtheimischen Spinnenarten in Kosovo (Arachnida: Araneae). Kosovo ist ein kleiner Binnenstaat im westlichen Balkan und das jüngste Land in Europa. Diese Arbeitet berichtet zum ersten Mal über drei nichtheimische Spinnenarten aus Kosovo: *Ostearius melanopygius, Parasteatoda tepidariorum* and *Spermophora senoculata.* Zusätzlich werden neue Nachweise von *Pholcus phalangioides* für die Region präsentiert. Unsere Untersuchung ist eine der ersten Beiträge zu Verbreitungsmustern von nichtheimischen Spinnenarten auf dem Balkan.

Kosovo is a small landlocked country on the Western Balkan Peninsula next to Albania and North Macedonia to the South, Serbia to the north and Montenegro to the west. Although Kosovo only has a total area of 10,908 km^2, the varied relief of the country exhibits an altitude range from 265 to 2,656 m. This, together with a mostly continental climate, explains the rich biodiversity of the country despite its small size (Damo et al. 2012).

The knowledge about alien species in Kosovo increased significantly over the past years (Gashi et al. 2015, Maxhuni & Ibrahimi 2016, Kulijer & Ibrahimi 2017, Ibrahimi et al. 2022, Geci & Ibrahimi 2018, Geci et al. 2020). However, most of the reported species belong to fish and insects, and currently, only one alien spider species, *Pholcus phalangioides* (Fuesslin, 1775) has been reported from Kosovo (Geci & Naumova 2021b). The overall knowledge about the distribution of alien spider species in the Balkans is poor, with only a few species recorded, without any details about the invasion trends, possible impact on autochthonous species and ecological patterns. Most spiders introduced to Europe are thermophilous and prefer artificially heated habitats such as greenhouses (Kielhorn 2008, 2009, Kielhorn & Rödel 2011, Hänggi & Sandrine 2016, Hänggi et al. 2022).

In this article, we provide records of some alien spider species registered in recent years in Kosovo.

Material and methods

Spiders were collected between 2018 and 2021 at 17 locations belonging to eight different municipalities in Kosovo (Tab. 1, Fig. 1). All 17 examined sites are inhabited areas (Fig. 2). Specimens were preserved in 70% alcohol and identified to species level using the taxonomic keys in Nentwig et al. (2024) under an Olympus Stereomicroscope and photographed with a GXCAPTURE camera at the Laboratory of Zoology, University of Prishtina. Specimens were deposited at the University of Prishtina, Department of Biology. The number of specimens, date and location representing species where they were found are presented in Tab. 2. Maps were created using QGIS (v. 3.26, the Open-Source Geospatial Foundation, USA).

Tab. 1: Sampling sites

Sites	Longitude °N	Latitude °E	Name	Municipality
S1a	42.7522	20.5525	Veriq	Istog
S1b	42.7531	20.5518	Veriq	Istog
S2	42.6255	20.5808	Klinë	Klinë
S3	42.6975	20.8612	Shtuticë	Drenas
S4	42.6127	20.8529	Damank	Drenas
S5	42.6332	21.1021	Fushë Kosovë	Fushë Kosovë
S6	42.6607	21.1710	Taslixhe	Prishtinë
S7	42.6540	21.1741	Kodra e Diellit	Prishtinë
S8	42.3593	20.9881	Jezerc	Ferizaj
S9	42.3707	21.0783	Nerodime e Epërme	Ferizaj
S10	42.3774	21.1023	Balaj	Ferizaj
S11	42.3296	21.1516	Greme	Ferizaj
S12	42.3012	21.1091	Burrnik	Ferizaj
S13	42.2971	21.1529	Gaçkë	Ferizaj
S14	42.3628	20.7395	Samadraxhë	Suharek
S15	42.5724	21.2476	Janjevë	Lipjan
S16	42.5393	21.1383	Konjuh	Lipjan
S17	42.3549	20.9241	Budakovë	Suharekë

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Academic editor: Tobias Bauer

received 12.7.2023, accepted 15.11.2024, online 30.11.2024

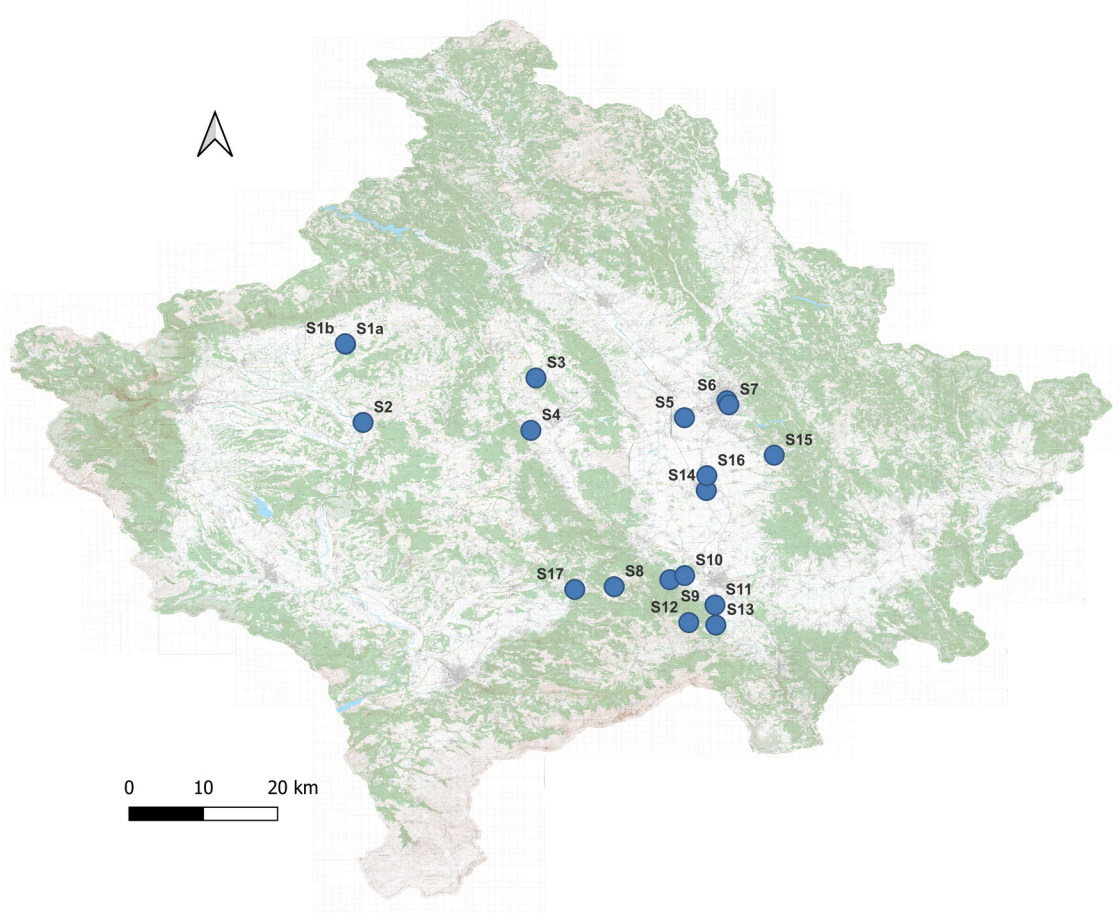

Fig. 1: The sampling sites in Kosovo

Results

We report three species new for Kosovo, all of them being associated with human settlements. In houses, we found 55 specimens (12 ♂♂, 43 ♀♀) of *Parasteatoda tepidariorum* (C. L. Koch, 1841) at 14 sites and a single male of *Spermophora senoculata* (Dugès, 1836). At one site near a house, we found three females of *Ostearius melanopygius* (O. Pickard-Cambridge, 1880). In addition, we provide new locations for *Pholcus phalangioides* for which 22 specimens (7 ♂♂, 15 ♀♀) were found at seven new sites.

Tab. 2: Species, specimens, sex, sites, habitat and collection dates

Species	♂/♀	Site	Habitat	Date
Ostearius melanopygius	0/3	S1a	near house	5. Apr. 2018
Parasteatoda epidariorum	1/1	S11	house	5. Sep. 2021
	1/0	S12	house	29. May 2021
	1/0	S12	house	26. May 2021
	1/2	S15	house	5. Jul. 2021
	0/1	S13	house	10. Aug. 2021
	0/6	S17	house	1. Jul. 2021
	0/1	S10	house	3. Jul. 2021
	1/3	S10	house	12. Sep. 2021
	1/8	S8	house	1. Oct. 2021
	1/2	S9	house	18. Sep. 2021
	1/5	S9	house	13. Oct. 2021
	1/1	S6	house	24. Apr. 2021
	0/1	S6	house	10. Sep. 2021
	1/3	S1a	house	10. Aug. 2021
	1/2	S1b	house	10. Aug. 2021
	0/2	S2	house	2. Sep. 2020
	0/1	S5	house	1. Nov. 2021
	0/1	S1a	house	1. Aug. 2020
	1/3	S3	house	20. Aug. 2021
Total sites	**12**			
Total specimens	**55**			
Pholcus phalangioides	1/1	S15	house	30. Aug. 2021
	1/2	S4	house	3. Aug. 2020
	1/3	S1a	house	1. Aug. 2020
	2/1	S7	house	10. Aug. 2020
	2/3	S14	house	15. Oct. 2020
	0/4	S16	house	13. Sep. 2020
	0/1	S1b	house	15. Nov. 2020
Total sites	**7**			
Total specimens	**22**			
Spermophora senoculata	1/0	S7	house	23. Mar. 2022

Ostearius melanopygius (O. Pickard-Cambridge, 1880)

European distribution. First reported in Europe from England in 1906 (O. Pickard-Cambridge 1908, sub *Tmeticus nigricauda*), then spread to other countries: Czechia (Růžička 1995, Růžička & Řezáč 2024), Slovakia (Růžička 1995), Iceland (Agnarsson 1996), Ireland (Cawley 2001, Laver 2019), Sweden (Kronestedt 2001), Bulgaria (Deltshev & Blagoev 2001), Norway (Aakra & Hauge 2003), Greece (Bosmans et al. 2013), Hungary (Pfliegler 2014), Slovenia (Kostanjšek & Kuntner 2015), Finland (Koponen et al. 2016), Malta (Pfliegler et al. 2017), Latvia (Cera 2018), Cyprus (Bosmans et al.

Fig. 2: Habitats at some of the sampling sites. **a.** S1a; **b.** S2; **c.** S5; **d.** S6; **e.** S7; **f.** S11; **g.** S13; **h.** S15

2019), Italy (Pantini & Isaia 2019), Luxembourg (Kreuels et al. 2019), Northern Ireland (Lavery 2019), Portugal (Branco et al. 2019), Spain (Branco et al. 2019), Türkiye (Europe) (Danışman et al. 2024), Ukraine (Polchaninova & Prokopenko 2019) and recently from Serbia (Grbić & Hänggi 2023). In Europe, it is found in various habitats such as grasslands, under stones, herbs along rivers, and inside buildings.
Kosovo distribution (Fig. 3). We found it only at site S1a, Istog municipality under garbage.

Parasteatoda tepidariorum (C. L. Koch, 1841) (Fig. 4)
European distribution. This is a species of Asian origin and was found in Europe for the first time in greenhouses in Germany (Koch 1841) and then reported from other parts of Europe such as Italy (Kritscher 1969), Iceland (Agnarsson 1996), Hungary (Samu & Szinetár 1999), Sweden (Kronestedt 2001), Bulgaria (Deltshev & Blagoev 2001), Norway (Aakra & Hauge 2003), Belarus (Ivanov 2013), Slovenia (Kostanjšek & Kuntner 2015), Finland (Koponen et al. 2016), Malta (Pfliegler et al. 2017), Latvia (Cera 2018), Luxembourg (Kreuels et al. 2019), Portugal (Branco et al. 2019), Spain (Branco et al. 2019), Ukraine (Polchaninova & Prokopenko 2019), Georgia (Otto 2020) and later in Türkiye (Europe) (Danışman et al. 2024). This species can be found on buildings and in greenhouses across almost all of Europe, but occasionally enters natural habitats far from anthropogenic structures. It can be confused with the very similar native species *P. simulans* (Thorell, 1875) and also with *P. tabulata* (Levi, 1980), another expansive species of Asian origin (Knoflach 1991).

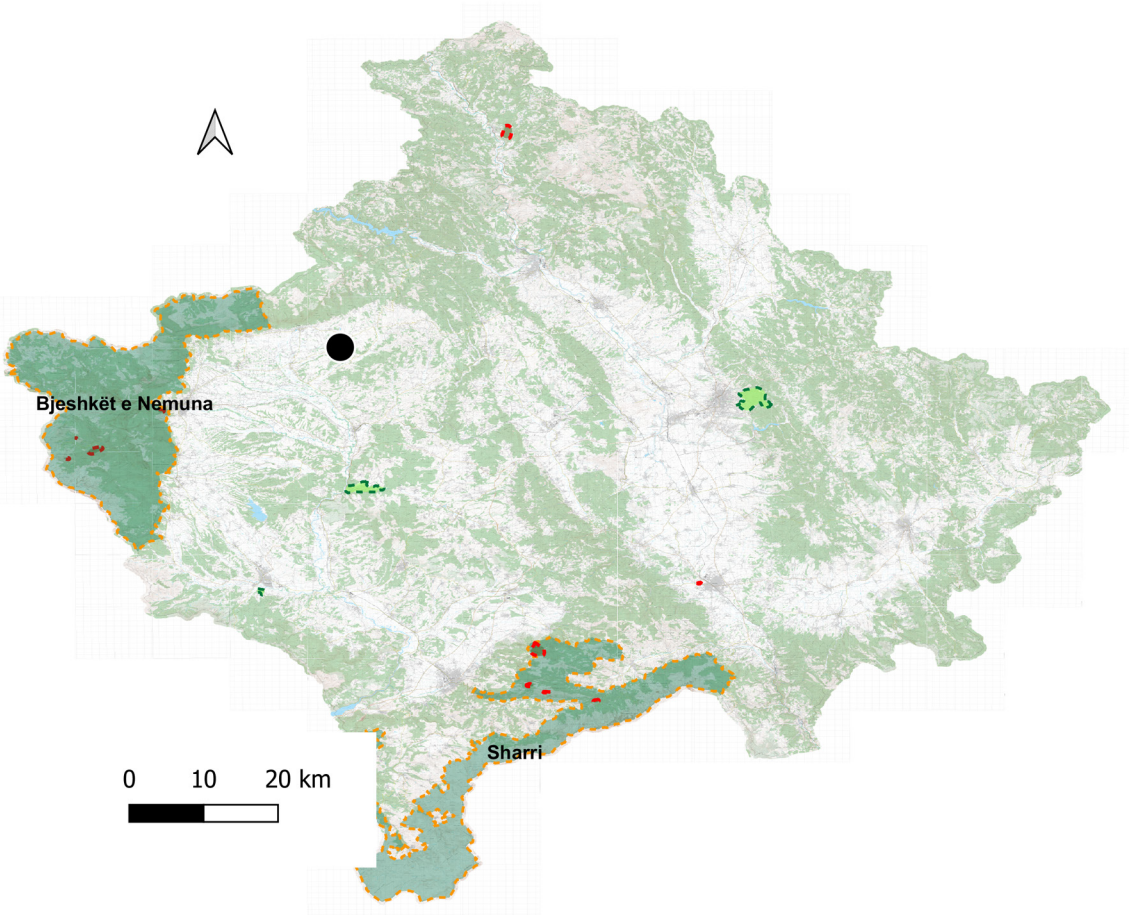

Fig. 3: Known distribution of *Ostearius melanopygius* in Kosovo

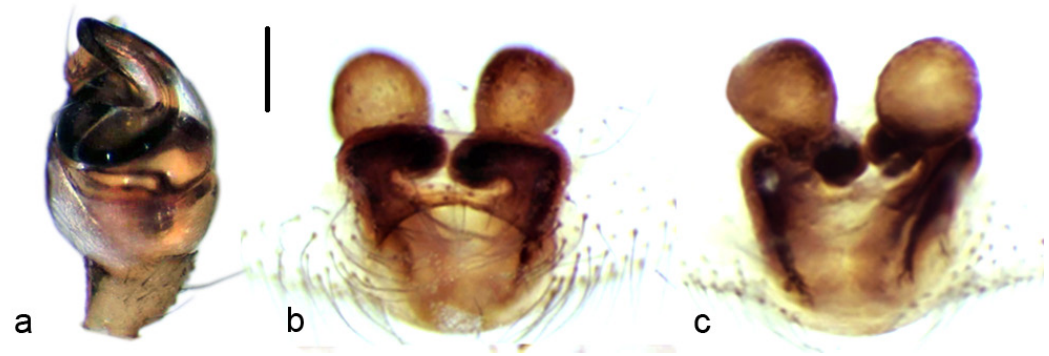

Fig. 4: *Parasteatoda tepidariorum*. **a.** palp ventral; **b.** epigyne/vulva ventral; **c.** vulva dorsal view. Scale: 0.3 mm

Kosovo distribution (Fig. 5)**.** The species was found at 14 sites belonging to eight municipalities.

Pholcus phalangioides (Fuesslin, 1775)

European distribution. The species was first reported in Europe from Switzerland by Fuesslin (1775) and was subsequently reported in the rest of Europe as Hungary (Samu & Szinetár 1999), Sweden (Kronestedt 2001), Bulgaria (Deltshev & Blagoev 2001), Belarus (Ivanov 2013), Slovenia (Kostanjšek & Kuntner 2015), Finland (Koponen et al. 2016), Malta (Pfliegler et al. 2017), Latvia (Cera 2018), Italy (Pantini & Isaia 2019), Luxembourg (Kreuels et al. 2019), Norway (Farlund 2019), Portugal (Branco et al. 2019), Spain (Branco et al. 2019), and recently from Kosovo (Geci & Naumova 2021b) and Türkiye (Europe) by Danışman et al. (2024). *Pholcus phalangioides* can be found in habitats such as buildings, but also occurs in caves, and is defined as a troglophile (Mammola et al. 2018)

Kosovo distribution (Fig. 6)**.** The species was reported for the first time by Geci & Naumova (2021b) from three locations belonging to three municipalities: Mitrovica, Istog, and Lipjan (Fig. 6). Here we report the species from six more sites (blue circles in Fig. 6), one from Drenas municipality, one from the municipality of Prishtina, one from Suhareka municipality, two more from Lipjan and two more from Istog, both far from the where they were first reported.

Spermophora senoculata (Dugès, 1836)

European distribution. In Europe, it is known from Bulgaria (Deltshev & Blagoev 2001), Hungary (Kovács et al. 2008), Romania (Moscaliuc 2012), Slovenia (Kostanjšek & Kuntner 2015), Cyprus (Bosmans et al. 2019), Italy (Schifani et

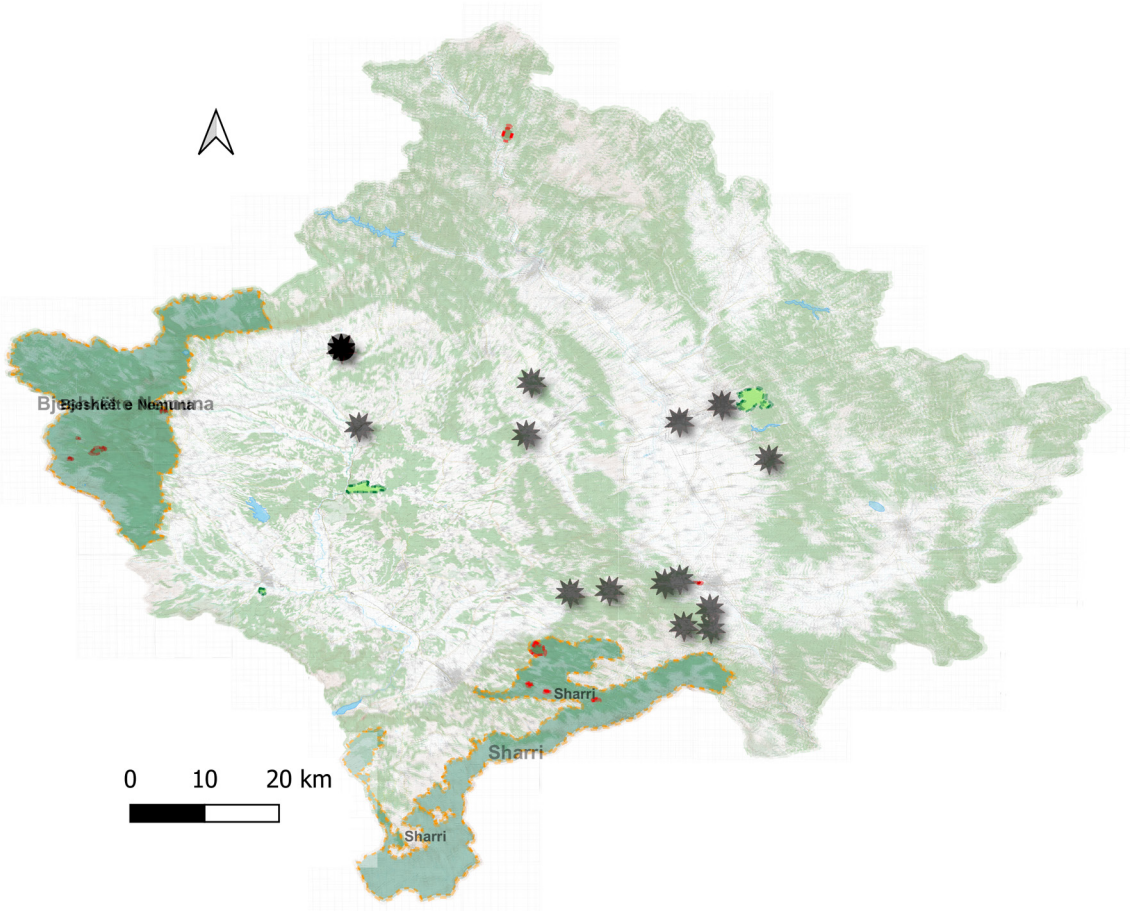

Fig. 5: Distribution of *Parasteatoda tepidariorum* in Kosovo

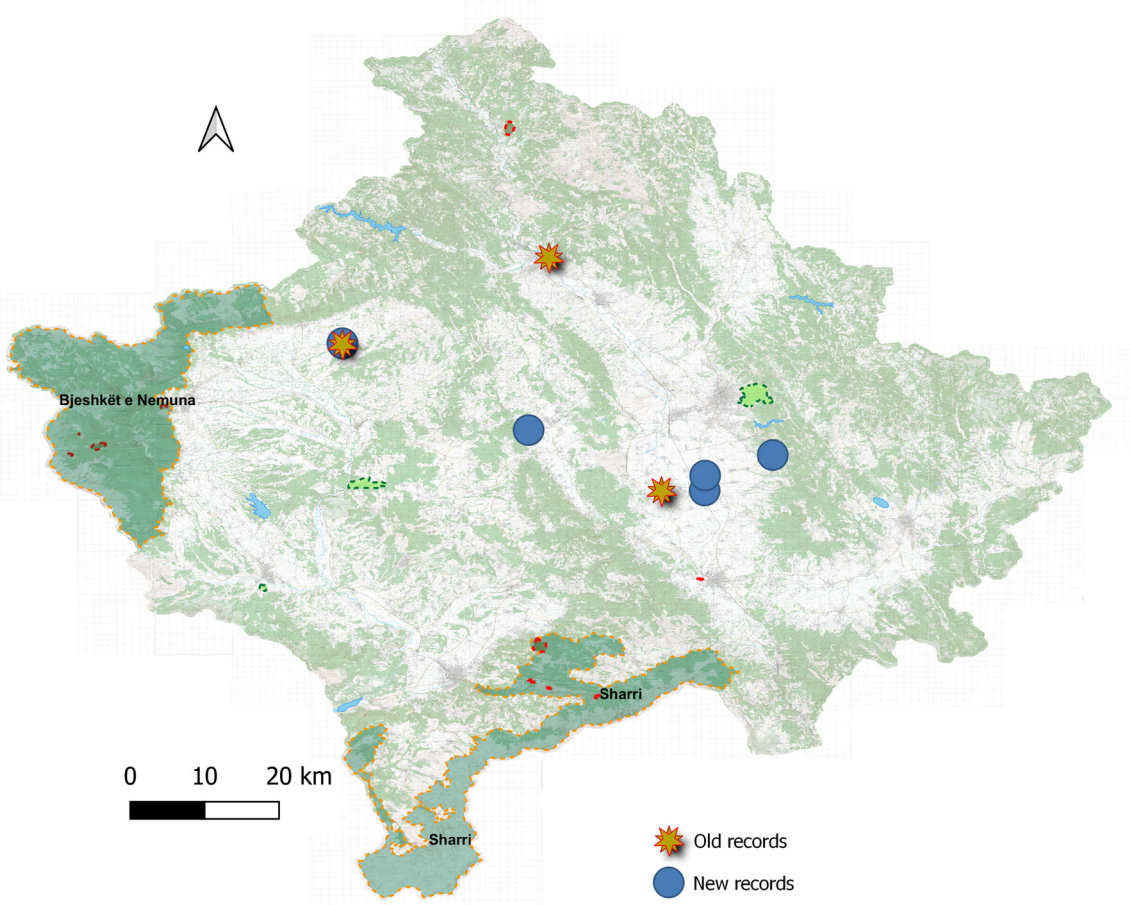

Fig. 6: Distribution of *Pholcus phalangioides* in Kosovo

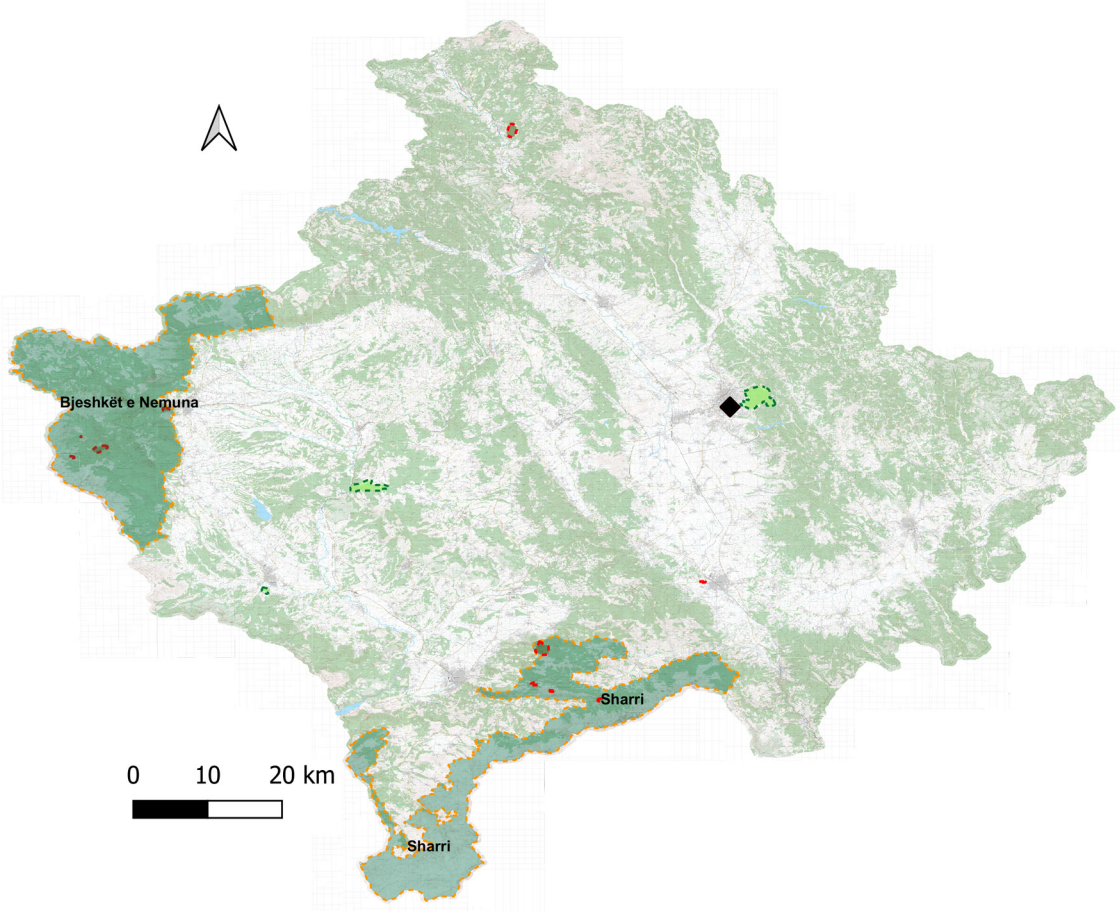

Fig. 7: Distribution of *Spermophora senoculata* in Kosovo

al. 2019, Pantini & Isaia 2019), Portugal (Branco et al. 2019), Spain (Branco et al. 2019) and Türkiye (Europe) (Danışman et al. 2024). In Europe, it is found in habitats such as under stones, stonewalls, and caves in Mediterranean regions, while in temperate regions, it is found only in buildings (Mammola et al. 2018).

Kosovo distribution (Fig. 7)**.** In Kosovo, we found only one male specimen inside a house near site S7, Prishtinë municipality.

Discussion

The knowledge of alien spider species in Kosovo is very limited, but this is true for the entire Balkan region. Even in the relatively well-studied Bulgaria, the number of known alien spiders comprises only six, in Serbia five and in Albania, Montenegro and North Macedonia three species (Nentwig et al. 2024).

The increasing number of alien species in Europe has become a major concern due to the potential negative impacts on native biodiversity and economy. Several thousand alien species have been identified in Europe (DAISIE 2009) among the various taxonomic groups, with spiders being particularly notable as they are represented by over 150 alien taxa (Nentwig 2015, Nentwig et al. 2024), many of which have been introduced from the Americas (North, Central and South America) (Nentwig 2015). The expansion of global transport and trade has facilitated the spread of alien species, leading to a continuing increase in the number of alien spider species in Europe. Alien species have the potential to be invasive, causing significant ecological and economic impacts, including displacement of native species, changes in ecosystem structure and function, and negative effects on human health and well-being (Kenis 2005, Luque et al. 2014, Meyerson & Mooney 2007, Pyšek et al. 2020). However, the particular effect of alien spider species on biodiversity, health and economy in Europe is still insufficiently known (Nentwig 2015). For this reason, studying alien species is an urgent task for biodiversity conservation and management, but for countries such as Kosovo, which have a weak tradition of arachnology, this is a complex task, considering that for such countries arachnological knowledge is still sparse and research structures just have begun to emerge (Geci & Naumova 2021a, 2021b, Grapci-Kotori et al. 2022, Geci et al. 2023, Ibrahimi et al. 2024).

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