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Arachnids from the greenhouses of the Botanical Garden of the PJ Šafárik University in Košice, Slovakia (Arachnida: Araneae, Opiliones, Palpigradi, Pseudoscorpiones)

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Abstract. This is the first detailed contribution on the arachnid fauna from heated greenhouses in the Botanical Garden of the P.J. Šafárik University in Košice (Slovakia). Over ten years 62 spider taxa in 21 families were found. Two spiders, *Mermessus trilobatus* (Emerton, 1882) and *Hasarius adansoni* (Audouin, 1826), were recorded in Slovakia for the first time. Another interesting record was the cellar spider *Hoplopholcus* sp. and a new locality for the exotic spiders *Coleosoma floridanum* Banks, 1900 and *Triaeris stenaspis* Simon, 1891 was discovered. Additionally, a short survey of other arachnids (except Acari) was done. A single specimen of a provisionally identifiable palpigrade species (cf. *Eukoenenia florenciae*), one harvestmen species, *Opilio canestrinii* (Thorell, 1876), and four pseudoscorpion species were recorded. The rare pseudoscorpion species *Chthonius ressli* Beier, 1956 was collected for the second time in Slovakia.

Keywords: alien species, artificial ecosystems, faunistics, introduced species, new record

Zusammenfassung. Spinnentiere aus Warmhäusern des Botanischen Gartens der PJ Šafárik Universität in Košice, Slowakei (Arachnida: Araneae, Opiliones, Palpigradi, Pseudoscorpiones). Hiermit wird der erste umfangreiche Beitrag zur Spinnentierfauna des Botanischen Gartens der P.J. Šafárik Universität in Košice (Slowakei) präsentiert. Während zehn Jahren wurden 62 Spinnentaxa aus 21 Familien nachgewiesen. Zwei Spinnenarten, *Mermessus trilobatus* (Emerton, 1882) und *Hasarius adansoni* (Audouin, 1826), werden erstmals für die Slowakei gemeldet. Weiterer bemerkenswerte Nachweise sind die Kellerspinne *Hoplopholcus* sp. und ein neuer Fundort der exotischen Spinnenarten *Coleosoma floridanum* Banks, 1900 und *Triaeris stenaspis* Simon, 1891. Weiterhin wurden die übrigen Spinnentiere (ohne Milben) erfasst. Ein Einzelexemplar einer nicht sicher bestimmbaren Palpigradenart (cf. *Eukoenenia florenciae*), eine Weberknechtart, *Opilio canestrinii* (Thorell, 1876) sowie vier Pseudoskorpionarten wurden gefangen. Die seltene Pseudoskorpionart *Chthonius ressli* Beier, 1956 wird das zweite Mal für die Slowakei gemeldet.

Greenhouses, with relatively stable temperature and humidity conditions, represent a suitable environment for a variety of different invertebrates. Depending on the cultivated plants, size of the heated space, type of management and other factors, more or less complex artificial ecosystems may be formed. Common synanthropic species can be found as well as some outdoor species occasionally entering the greenhouse, and some exotic tropical and subtropical species introduced with plants and substrates from remote sources (Kielhorn 2008).

Only a little information has been published about arachnids in greenhouses in Slovakia so far. Within a concise survey of invertebrates from Bratislava greenhouses Krumpál et al. (1997) summarized six different spider taxa on the basis of older samples from the years 1972 and 1976: *Pholcus opilionoides* (Schrank, 1781), *Parasteatoda tepidariorum* (C. L. Koch, 1841), *Agelena* sp., *Amaurobius ferox* (Walckenaer, 1830), *Berlandina cinerea* (Menge, 1872) and *Pseudicius encarpatus* (Walckenaer, 1802). One pseudoscorpion species, *Lamprochernes chyzeri* (Tömösváry, 1882) was found by Krumpál et al. (1997) in greenhouses as well. Recently the research on artificial ecosystems intensified, providing new information about alien species living in Slovakia. Individual records of spider species new to the Slovak arachnofauna were published: *Coleosoma floridanum* Banks, 1900 and *Scytodes fusca* Walckenaer, 1837 from greenhouses in Bratislava (Šestáková et al. 2013, 2014) and *Uloborus plumipes* Lucas, 1846 from Košice (Suvák 2013). New for the fauna of Slovakia were also the palpigrade *Eukoenenia florenciae* (Rucker, 1903) and the schizomid *Stenochrus portoricensis* Chamberlin, 1922 from greenhouses in Bratislava (Christian & Christophoryová 2013, Christophoryová et al. 2013). No harvestmen records have been published from any botanical garden in Slovakia so far.

The aim of this paper is to present data from collections during a ten-year research project in heated greenhouses of the Botanical Garden of P.J. Šafárik University in Košice. The research focused mainly on spiders as potential predators of pests in the greenhouses. Additionally, a short survey of other arachnids (except Acari) was done. The presented data includes four arachnid orders, two first and three second records for Slovakia.

Material and methods

The greenhouses of the Botanical Garden of the Pavol Jozef Šafárik University in Košice (herein BG PJŠU, 48.735°N, 21.238°E, Fig. 1) were built in 1958. Taking into account only heated rooms, it is a system of interconnected greenhouses (C1–3, G1–7, L) and separated ones (S1–4). Their total area is 2800 m^2. Heights of individual greenhouses range from 3 to 12 m and the total volume of these greenhouses is 13350 m^3. Temperature and humidity values were measured using 11 sensors in three main greenhouses from October 2014 to January 2015. Average humidity was about 64 % (min. 23 %, max. 94 %). Average temperature was about 20 °C (min. 12 °C, max. 34 °C). Occasionally some extremes outside these ranges could take place (seasonally and/or in greenhouses without sensors). Temperature is usually regulated separately in each greenhouse according to vegetation requirements (e.g. highest temperatures were measured in greenhouses with tropical plants during the whole year and the lowest values in greenhouses with citrus plants, especially in winter).

Several collecting methods were used to obtain data on the arachnofauna in greenhouses of the BG PJŠU in Košice:

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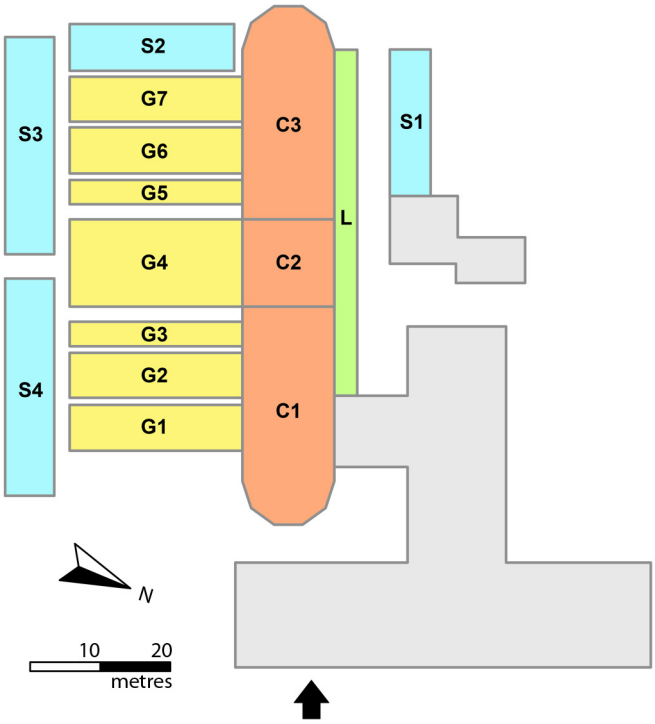

Fig. 1: Plan of the greenhouses of the Botanical garden of the PJ Šafárik University in Košice. The arrow points to the entrance. C1 – 1st connecting greenhouse; C2 – 2nd connecting greenhouse; C3 – 3rd connecting greenhouse; G1 – anthurium greenhouse; G2 – orchid greenhouse; G3 – cold greenhouse; G4 – Victoria greenhouse; G5 – reproduction greenhouse; G6 – citrus greenhouse; G7 – greenhouse with succulents; L – complex of lateral small greenhouses; S1 – separate greenhouse with orchids; S2 – separate greenhouse with succulents; S3 – western separate greenhouse with succulents; S4 – eastern separate greenhouse with various potted plants.

1. Photo-monitoring of spiders during the study of biological control (2005–2016). Photos of live specimens were taken by M. Suvák with a digital camera (Canon 20D) and macro lens (Canon MP–E65). Species with uncertain identification were omitted from the results. Some specimens were collected for proper identification.
2. Ethanol pitfall traps exposed for short periods (1–2 weeks) in winter or early spring season in selected greenhouses in the years 2007, 2012–2016 (leg. M. Suvák).
3. Collecting by hand. The samples were collected in 2011, 2013–2015 (leg. M. Suvák).
4. Extraction from soil samples or samples of dead wood using Tullgren funnels (leg. P. Fenďa, K. Krajčovičová, A. Mock).

Spiders and harvestmen were stored in 70 % alcohol and deposited in the Western Slovakia Museum, Trnava. The majority of examined pseudoscorpion specimens were mounted as permanent slide mounts using Liquido de Swann mounting medium. Two specimens of *Chthonius tetrachelatus* are deposited in 70 % ethanol. The pseudoscorpion material is deposited in the zoological collections of the Comenius University, Bratislava.

Microphotos were made using the EOS Utility software and a digital camera (Canon EOS 100D and 1000D) connected to a stereomicroscope (Intraco Micro STM 823 5410 and Zeiss Stemi 2000-C). Measurements were taken from photographs using the AxioVision 40LE application (v. 4.6). These photographs were made using a Leica ICC50 camera connected to a Leica DM1000 stereomicroscope using LAS EZ 1.8.0 software. Figures were drawn using a Leica drawing tube.

Identification was made according to Nentwig et al. (2016), Gruber (1984) and Christophoryová et al. (2011). Nomenclature follows the World Spider Catalog (2016), Gruber (1984) and Harvey (2013).

Results and discussion

Qualitatively, most of the species recorded in the greenhouses are native for the Slovakian fauna. Synanthropic and alien species were the most abundant, especially among the spiders.

Spiders (Araneae)

During the research 62 different taxa from 21 families were recorded in total. Of these, 47 taxa from 19 families (>590 ex.) were photographed as living individuals, 45 taxa from 18 families (188 ex.) were collected individually and 7 taxa from 6 families (34 ex.) were collected using pitfall traps (Tab. 1). Two species, *Mermessus trilobatus* and *Hasarius adansoni*, are new to the fauna of Slovakia. The spiders *Coleosoma floridanum* and *Triaeris stenaspis* represent the second Slovakian records. The finding of a male of *Uloborus plumipes* confirmed sexual activity for this species. The dominant species, *Parasteatoda tepidariorum*, was abundantly observed in almost every room of the botanical garden. Other very common spiders were *Pholcus phalangioides*, *Steatoda triangulosa*, *Parasteatoda tabulata*, *Sitticus pubescens*, *Tegenaria* cf. *domestica*, *Uloborus plumipes*, *Agelena labyrinthica* and *Hasarius adansoni*. The goblin spider *Triaeris stenaspis* was dominant in pitfall traps. The first records of two introduced species and several interesting species are discussed in detail.

Linyphiidae

Mermessus trilobatus (Emerton, 1882)

Material examined. 1♀ – under a log, G1, 2.6.2014; 1♂ – under a sheet behind a radiator, S4, 13.2.2015.

This small inconspicuous linyphiid can be easily identified by its genitalia (Figs 2, 3). For a detailed description of the species see Millidge (1987). The epigyne of the collected

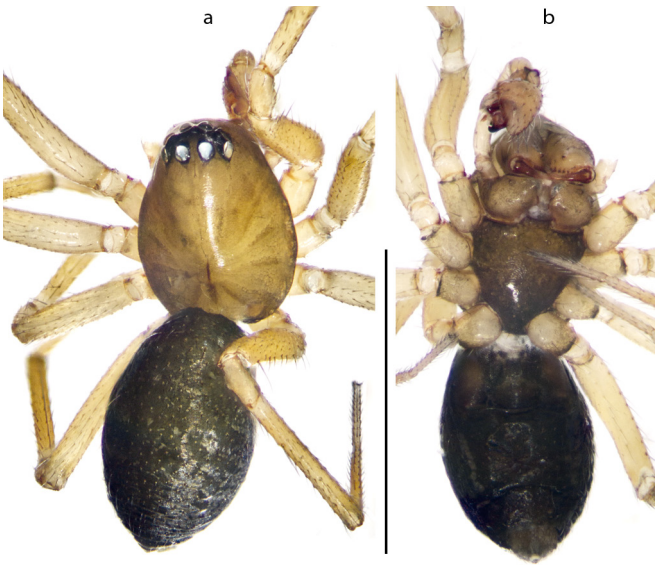

Fig. 2: Habitus of male *Mermessus trilobatus* from Slovakia; **a.** dorsal view; **b.** ventral view; scale: 1 mm

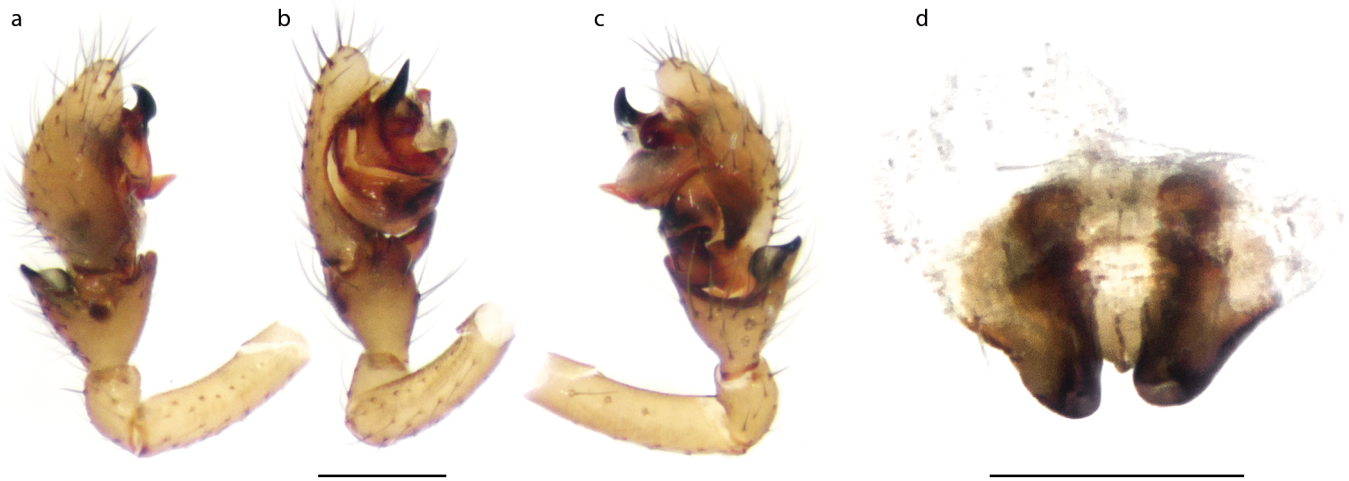

Fig. 3: Genitalia of *Mermessus trilobatus* from Slovakia; **a–c.** male left palp: **a.** retrolateral view; **b.** ventral view; **c.** prolateral view. **d.** epigyne; scales: 0.2 mm

female was covered by a huge globular plug, which pointed to sexual activity. The plug gives the epigyne a different appearance, thus its removal is essential for proper identification. *Mermessus trilobatus* is a Nearctic species found throughout North America, and is also recorded in the Panamanian region in Veracruz and Chiapas in Mexico (Millidge 1987, Ibarra-Núñez 2011). The first record from Europe came from Germany in 1982 (Dumpert & Platen 1985). Nowadays *M. trilobatus* has become established in natural habitats and is expanding its range. High colonization ability may be related to ballooning (Blander 2009). The species is usually collected in open habitats (Nentwig & Kobelt 2010). Thus its finding inside a greenhouse is untypical, and it should also be present in the garden outside the greenhouses.

Salticidae

Hasarius adansoni (Audouin, 1826)

Material examined. 1♂ – on the wall, G6, 5.6.2014; 1♂ – on the wall, C2, 12.2.2015; 1♀ – pitfall trap, G4, 19.2. – 5.3.2015; 1 subad. ♀ – pitfall trap, C2, 9. – 16.3.2016.

Males (Fig. 4) are easily distinguished by the dark brown coloration contrasting with orange hairs around the eyes and white markings on the palps, carapace and abdomen. Females (Fig. 5) are less distinct without a specific pattern, only a slightly paler broad band on the head region is visible. Both sexes can be easily identified by their genitalia (Figs 6, 7). Adanson's House Jumper is an attractive cosmopolitan jumping spider probably originating from Africa, introduced into many countries around the world especially into greenhouses (Metzner 2015). Males were observed quite regularly on the walls inside the greenhouses and also in the building. Only one adult female was caught using pitfall traps. In 2016 several females and juveniles were observed, which points to a stable population here in the BG PJŠU. *Hasarius adansoni* probably could not survive outside heated buildings. Howe-

Fig. 5: Habitus of female *Hasarius adansoni* from Slovakia; **a.** dorsal view; **b.** ventral view; scale: 5 mm

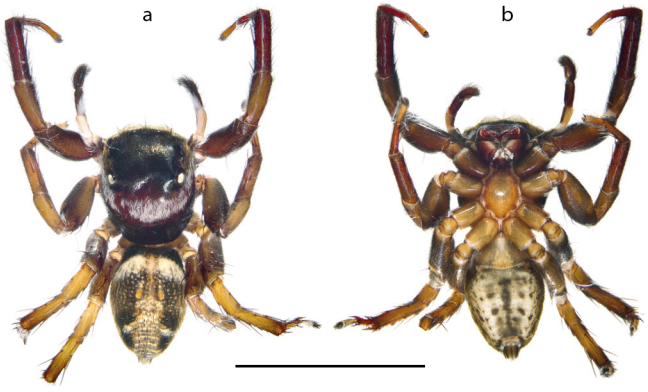

Fig. 4: Habitus of male *Hasarius adansoni* from Slovakia; **a.** dorsal view; **b.** ventral view; scale: 5 mm

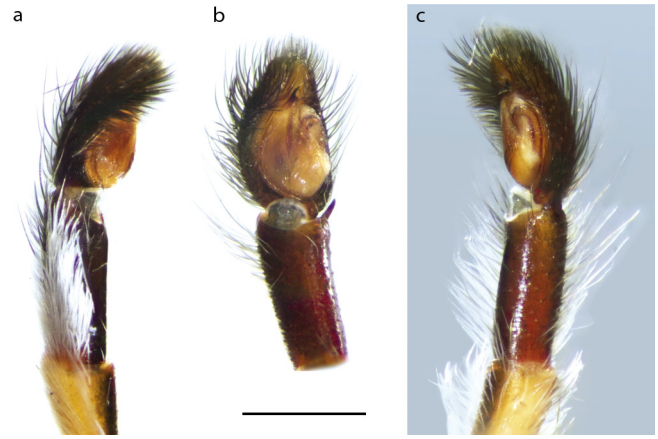

Fig. 6: Male left palp of *Hasarius adansoni* from Slovakia; **a.** retrolateral view; **b.** ventral view; **c.** prolateral view; scale: 0.5 mm

Fig. 7: Cleared epigyne of *Hasarius adansoni* from Slovakia; scale: 0.5mm

ver, it has a potential to become a synanthropic spider distributed via plants in Slovakia.

Pholcidae

Hoplopholcus sp.

Material examined. 1 subad. ♂ – on the wall behind a radiator, S4, 13.2.2014.

In Slovakia only one species of this genus was recorded, *H. forskali* (Thorell, 1871), which looks very similar to the collected specimen (Fig. 8). The cavernicolous species *H. forskali* is typical for the Balkan fauna and Eastern Europe, and was also recorded in Asia and Turkmenistan. The expansion to the north should be restricted by temperature (Kenyeres & Szinetár 2003). In Slovakia it is known from a single record in Tekovské Lužany (Dudich 1933). The type specimen originated from Hungary (Thorell 1871), but it seems not to be native there, because of its preference for synanthropic habitats such as cellars, basements and toilets (Loksa 1969, Szinetar et al. 1999, Korsós et al. 2006). Although a subadult male collected in the botanical garden strongly resembles *H. forskali* (Thorell, 1871), it could be any species introduced to the garden via plants or soil (Huber pers. comm.). Unfortunately, no more specimens were found up to the present.

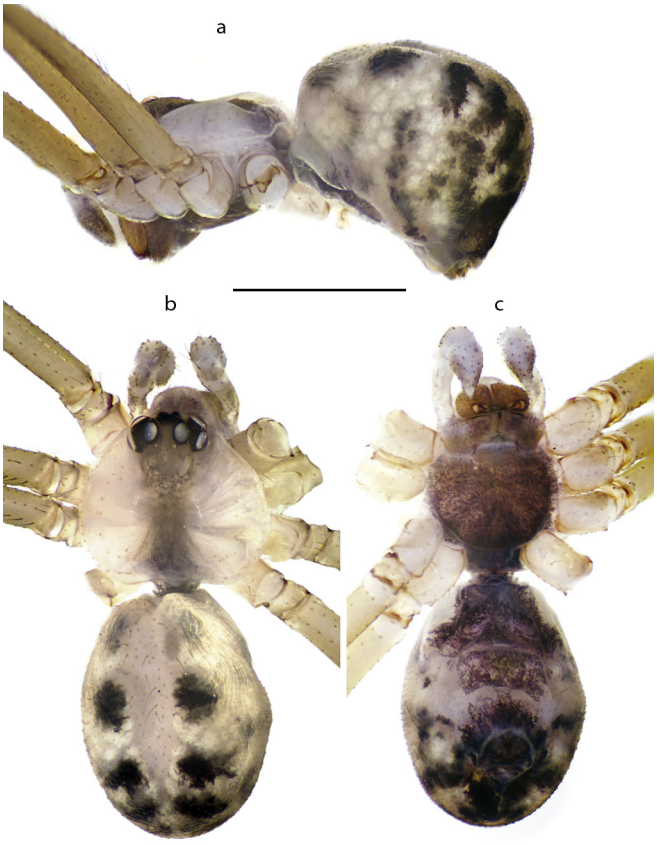

Fig. 8: Habitus of subadult male *Hoplopholcus* sp. from Slovakia; **a.** lateral view; **b.** dorsal view; **c.** ventral view; scale 1 mm

Oonopidae

Triaeris stenaspis Simon, 1891

Material examined. 2♀♀, 1 juv. – pitfall trap, G1, 2. – 5.3.2007; 2 juv. – pitfall trap, G4, 20. – 27.3.2012; 1 juv. – pitfall trap, C1, 20. – 27.3.2012; 2 juv. – pitfall trap, G1, 20. – 27.3.2012; 6♀♀, 3 juv. – pitfall trap, G4, 10.1. – 1.2.2013; 1♀ – under the piece of wood, G4, 30.10.2013; 1♀ – under the piece of wood, C1, 8.8.2014; 2♀♀ – pitfall trap, G4, 19.2. – 5.3.2015; 1 subad. ♀ – pitfall trap, C1, 9. – 16.3.2016; 1 subad. ♀ – pitfall trap, G4, 9. – 16.3.2016.

This pantropical orange goblin spider is a typical epigeic species in greenhouses. Due to its small size (<2 mm) and parthenogenetic reproduction, it has been introduced with great success via soil to botanical gardens all over Europe (Korenko et al. 2009). Its origin is questionable. According to morphologically similar species *T. stenaspis* should be native also to Western Africa, although it was described from specimens collected in the Caribbean (Platnick et al. 2012). The male of this species is still undiscovered (World Spider Catalog 2016). The first record from Slovakia is known from the greenhouse of the botanical garden in Bratislava (Miller & Žitňanská 1976) and from that time on it became well-established there (Šestáková, pers. observation). In the BG PJŠU it has a stable population, thus the second locality in Slovakia for this species was confirmed.

Uloboridae

Uloborus plumipes Lucas, 1846

Material examined. 1♀ – on the wall, C3, 26.5.2014; 1 ♀, 1 juv. – on the wall, L, 5.6.2014; 1 ♀ – on the wall, G6, 5.6.2014; 2 ♀ – on the wall and under the table, S1, 26.6.2014; 1 ♀ – on *Ficus* sp., G3, 1.7.2014; 1 ♀ – on a table between flowerpots, G5, 11.7.2014; 1♂ – on *Lycopersicon esculentum*, S4, 15.8.2014.

Uloborus plumipes, known as the "garden centre spider", is a pantropical species originating from Central and West Africa. It is commonly distributed via plants to garden and shopping centres (e.g. Rozwałka et al. 2013, Šich 2014). The first and only published record from Slovakia was reported from the BG PJŠU (Suvák 2013). Since then it has become well-established in its greenhouses and finally one adult male was recorded confirming sexual activity (Fig. 9). This spider

Fig. 9: Male of *Uloborus plumipes* from Slovakia

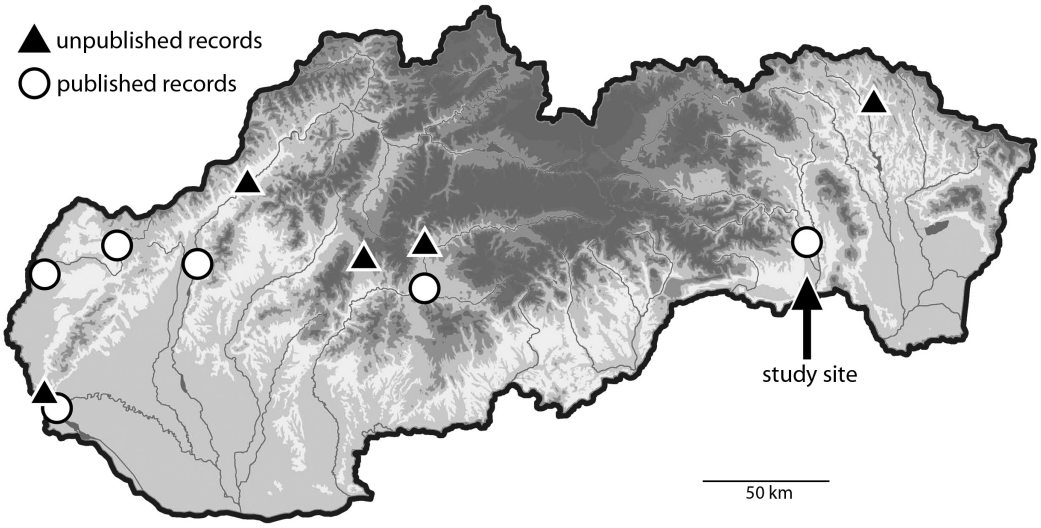

Fig. 10: Distribution of *Opilio canestrinii* in Slovakia based on published records (Klimeš 1999, Mašán & Mihál 2007, Stašiov et al. 2010), the present study and unpublished records (based on photos, http://www.fotonet.sk)

should be present in every florist's shop with imported plants in Slovakia, but was probably overlooked due to its small size (3–6 mm) and frequent showering of plants in garden centres. Moreover, dealers are not willing to talk about invasive species in their shops. However, some females were collected in a hypermarket in the section with plants and in garden centres of DIY markets (Šestáková, pers. observation). Although *U. plumipes* is considered as native in Europe occurring in the open land in southern regions (Nentwig et al. 2016), it is listed in several other countries as alien species (e.g. DAISIE 2008), because it can survive there only in buildings with stable warmer climate. In Slovakia, it was recorded exclusively in heated buildings, thus it is not native to our country.

Harvestmen (Opiliones)

Only one harvestman species (4 ex.) native to our country was collected inside greenhouses (Tab. 1). We presume that more species could be found there.

Phalangiidae

Opilio canestrinii (Thorell, 1876)

Material examined. 1 subad. ♀ – on the wall under a table, G2, 25.6.2014; 2 subad. ♀♀ – on the wall, G1, 2.7.2014; 1♂ – on a flowerpot, G5, 11.7.2014.

Opilio canestrinii is a Mediterranean species native to Italy, adjacent islands and North Africa (Gruber 1984, 1988). The history of its distribution in Europe is obscure due to frequent misidentification, so the first official record in Central Europe was assigned to the 1960s in Austria (Gruber 1984). In Slovakia it was reported for the first time from the western region by Klimeš (1999), who presumed its expansion. Nowadays *Opilio canestrinii* is established in Slovakia and is considered a hemisynanthropic species with an invasive character occurring in urban and rural areas, and found on walls of buildings and on trees (Mašán & Mihál 2007, Stašiov et al. 2010). It could be introduced as eggs in soil or as live specimens among plants (Mašán & Mihál 2007). The easternmost published record was known from Central Slovakia (Stašiov et al. 2010), so our finding expands its range to the eastern region. Since the species can be identified from photographs, we provide a distribution map comparing published and unpublished records based on photographs to show its spreading (Fig. 10).

Microwhip scorpions (Palpigradi)

Material examined. 1 ex. – pitfall trap, C1, 9. – 16.3.2016.

Only one damaged specimen of a palpigrade was collected using pitfall traps. It very likely belongs to the species *Eukoenenia florenciae*, which was found in Bratislava (Christian & Christophoryová 2013), but for proper identification it is necessary to find more specimens. Collecting palpigrades is complicated, for example only four specimens of *E. florenciae* were collected in Bratislava (Christian & Christophoryová 2013). Since the soil samples were not separated immediately after collection, palpigrades could die before extraction. Although the examination of the soil close to the pitfall trap was unsuccessful, in our opinion a small population may live in the greenhouses in the BG PJŠU.

Pseudoscorpions (Pseudoscorpiones)

Altogether 22 specimens of four pseudoscorpion species from three families were identified (Tab. 1), but no alien species was found. Two species were recorded from the family Chthoniidae; one species was identified from each of the families Neobisiidae and Chernetidae. The most abundant species was *Chthonius tetrachelatus*.

Chthoniidae

Chthonius* (*Chthonius*) *ressli Beier, 1956

Material examined. 3♂♂, 3♀♀, 1 tritonymph – extraction of soil sample collected under old trees, C3, 23.4.2013.

The type locality of *C. ressli*, Purgstall, is located in the neighbouring country of Austria. It was collected under stones near a train station (Beier 1956). The species is quite rare, only a few records are known so far: Austria (Beier 1956), Italy – in mole nests and under stones (Inzaghi 1981), France – under stones (Judson 1990), the Czech Republic – in leaf litter (Šťáhlavský 2006) and Hungary – in caves (Novák & Kutasi 2014). In Slovakia, one specimen was collected in Klenbová Cave in the Čierna hora Mts. and was identified as *Chthonius* cf. *ressli* (Mock et al. 2004, 2005) and needs to be confirmed in the future. Recently, several specimens of *C. ressli* were found in compost heaps in Slovakia and the identification was checked by Dr. Giulio Gardini (Kaňuchová et al. 2015). The current records in the greenhouse in the BG PJŠU Košice confirmed the occurrence of this rare species in Slovakia.

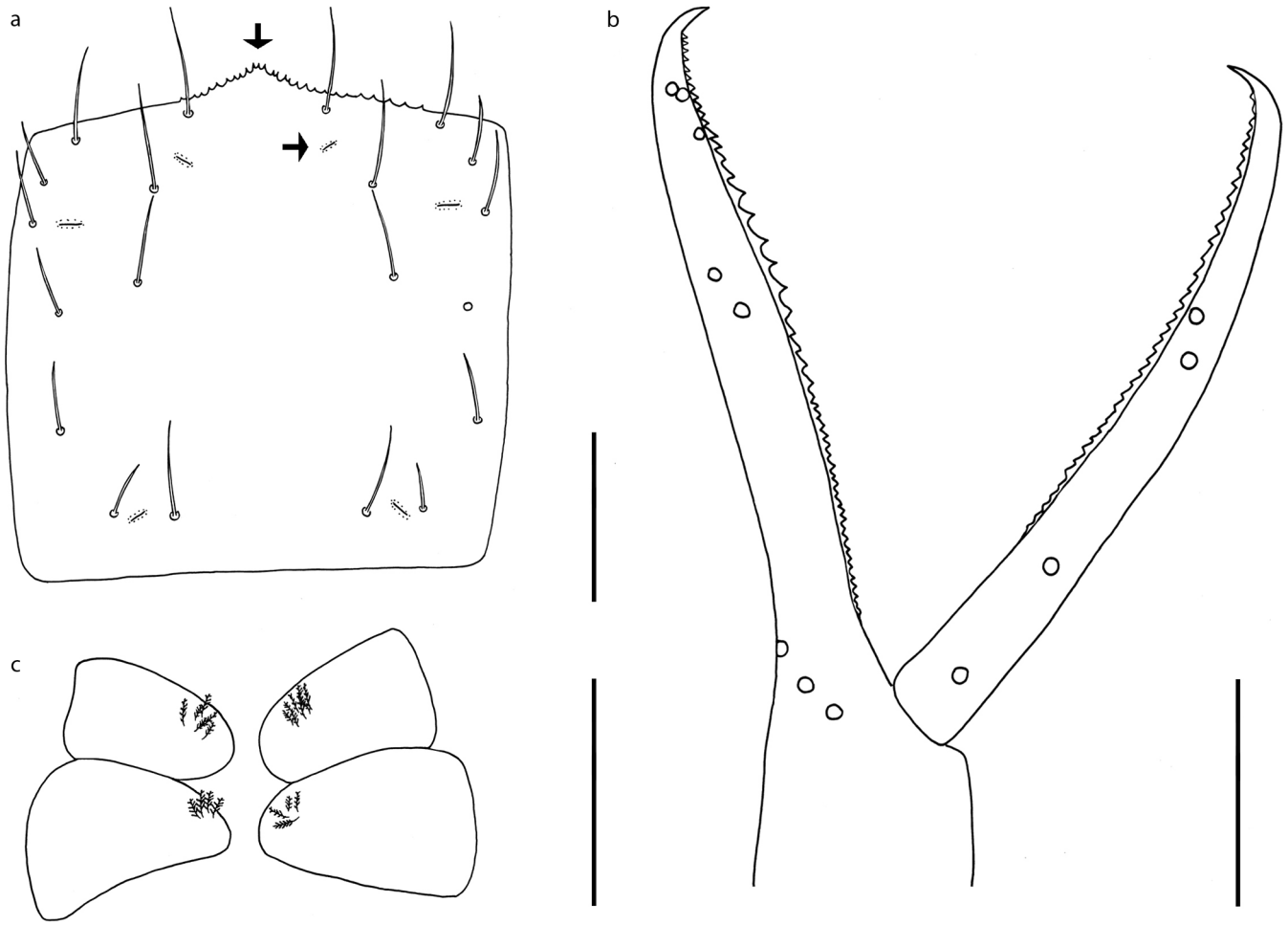

Fig. 11: Male of *Chthonius ressli*; **a.** carapace, arrows point to epistome and lyrifissure; **b.** chelal fingers; **c.** pedal coxae II and III with coxal spines; scales: 0.1 mm

Description

Carapace (Fig. 11a): approximately as long as broad, smooth, with conspicuous and distinctly serrated epistome on its anterior margin; no eyes or eyespots present; chaetotaxy of carapace: 20 thick setae, anterior margin with 4 and posterior margin with 2 macrosetae and 2 microsetae, no microchaetae present; 3 pairs of slit-like lyrifissures present on carapace. Chelicerae: relatively large and strongly sclerotized, 6 setae on cheliceral hand, one on movable cheliceral finger; movable cheliceral finger with spinneret: well-developed in females as tubercle, less markedly in males; 11–12 teeth situated on fixed cheliceral finger (♀♀: 11–12, ♂: 11), 2 of them distinctly larger; 9–12 teeth on movable cheliceral finger (♀♀: 11–12, ♂: 9), the first one larger, isolated subdistal tooth on movable cheliceral finger present; cheliceral rallum with 10 blades. Palps (Fig. 11b): smooth, chelal hand without any depression dorsally, distinctly bulbous, in lateral view the dorsum is not level with the finger but clearly rounded; chelal fingers of approximately equal length, movable chelal finger slightly shorter than fixed finger, with normal number of trichobothria (8 on fixed chelal finger and 4 on movable chelal finger); fixed chelal finger with 42–49 contiguous teeth (♀♀: 42–43, ♂: 49); movable chelal finger with 32–36 teeth (♀♀: 32–36, ♂: 36). Coxae II with 6–8 and 7–8 coxal spines (♀♀: 7–8 and 7–8, ♂: 6 and 8) and coxae III with 3–4 coxal spines (♀♀: 3–4 and 3–4, ♂: 4 and 4) (Fig. 11c); long tactile seta on metatarsus and arsus IV present and situated in basal third of the segments. Tergites I–IV bearing 4 setae; tergites V–IX 6 setae (one ♀ with 5 setae on tergite IX), tergite X 4 setae. Sternites IV bearing 11–12 setae (♀♀: 11, ♂: 12), sternite V 7–8 setae (♀♀: 7, ♂: 8), sternite VI–IX 6 setae and sternite X 7–8 setae (♀♀: 7, ♂: 8). Female genital operculum anteriorly with 8–9 setae and 2 lyrifissures, genital operculum posteriorly with 12 setae and 2 lyrifissures. Male genital operculum anteriorly with 7 setae and 2 lyrifissures, genital operculum posteriorly with 8 setae, 3+3 microsetae and 2 lyrifissures.

Both sexes of the species were measured; all data are summarized in Tab. 2. Two males and some characters of the described specimens were not measured or scored, because the specimens were damaged during the collection or preparation.

Remarks on description. Most of the characters correspond with the known descriptions of the species (Beier 1956, Inzaghi 1981, Judson 1990, Novák & Kutasi 2014). In some of them, eyes were present on *C. ressli* specimens (Inzaghi 1981, Judson 1990, Novák & Kutasi 2014). All specimens from the BG PJŠU had no eyes or eyespots, which corresponds with the description of Beier (1956). Compared to the Slovak specimens, Novák & Kutasi (2014) noticed different setae numbers on tergite X (8 setae) and sternite X (6 setae) on the Hungarian specimens.

Chthonius* (*Ephippiochthonius*) *tetrachelatus (Preyssler, 1790)

Material examined. 1 deutonymph – extraction of dead wood and peat, C2, 9.5.2012; 1♂ – pitfall trap, on a table with

Tab. 1: List of arachnids recorded in the greenhouses of the Botanical Garden in Košice. Abbreviations: * – species recorded in Slovakia for the first time; ** – species recorded in Slovakia for the second time; A – alien species in Slovakia; dn – deutonymph; EX – extraction of material; HC – hand collection; j – juvenile; N – native species in Slovakia; P – photo-monitoring, species which were not collected only photographed; PT – pitfall traps; s – subadult; S – synanthropic species in Slovakia; tn – tritonymph

Order/Family/Species		Status	Methods of collection			
			EX	HC	P	PT
ARANEAE						
Agelenidae						
1	*Agelena labyrinthica* (Clerck, 1757)	N		1♀, 2s♂, 2s♀, 1j	1s♂, 32j	
2	*Tegenaria* cf. *domestica* (Clerck, 1757)	S		1s♂, 5s♀, 5j	2s♀, 2j	
3	*Tegenaria ferruginea* (Panzer, 1804)	N/S		1s♂, 1s♀	1♂, 1s♀	
Amaurobiidae						
4	*Amaurobius ferox* (Walckenaer, 1830)	N/S		1s♂, 3s♀, 1j	1s♀	
Anyphaenidae						
5	*Anyphaena accentuata* (Walckenaer, 1802)	N		1s♀	4♀♀, 4s♀, 4j	
Araneidae						
6	*Araneus angulatus* Clerck, 1757	N		1j		
7	*Araneus diadematus* Clerck, 1757	N		3j	2s♂, 6s♀, 2j	
8	*Araniella* sp.	N			2s♂	
9	*Mangora acalypha* (Walckenaer, 1802)	N		1♂, 1♀	2♀♀, 1s♂, 1s♀, 7j	
10	*Nuctenea umbratica* (Clerck, 1757)	N		2s♀, 3j	2♀♀, 1s♀, 4j	
11	*Zilla diodia* (Walckenaer, 1802)	N		2♀♀	1s♂, 3s♀	
Clubionidae						
12	*Clubiona* sp.				1s♀	
Dictynidae						
13	*Dictyna* sp.				1♀	
14	*Nigma flavescens* (Walckenaer, 1830)	N			1♂, 1♀	
Dysderidae						
15	*Dysdera hungarica* Kulczyński, 1897	N/S		1♀, 1s♀		1♂
	Dysdera sp.					1j
Eutichuridae						
16	*Cheiracanthium mildei* L. Koch, 1864	N/S		1♀, 1s♀, 1j	2s♀	
Gnaphosidae						
17	*Trachyzelotes pedestris* (C. L. Koch, 1837)	N				1♂, 1j
18	*Zelotes apricorum* (L. Koch, 1876)	N		1♀		
Linyphiidae						
19	*Agyneta rurestris* (C. L. Koch, 1836)	N		1♂	1♂	
20	*Lepthyphantes leprosus* (Ohlert, 1865)	N		1♂, 2♀♀, 1s♀	1♂, 2♀♀, 1s♀, 2j	
21	*Lepthyphantes* cf. *minutus* (Blackwall, 1833)	N		1s♀		
22	*Linyphia tenuipalpis* Simon, 1884	N		1s♂		
23	*Linyphia triangularis* (Clerck, 1757)	N		1s♂, 1j		
24	* *Mermessus trilobatus* (Emerton, 1882)	A		1♂, 1♀		
25	*Oedothorax retusus* (Westring, 1851)	N			1♀	1♀
26	*Palliduphantes pillichi* (Kulczyński, 1915)	N		1♀		
27	*Tenuiphantes flavipes* (Blackwall, 1854)	N		1s♀	1♂, 2♀♀	1♀
	Tenuiphantes sp.					1s♂, 2j
Lycosidae						
28	*Pardosa amentata* (Clerck, 1757)	N		1s♀	1j	
29	*Pardosa* sp. (*monticola* group)				2s♂, 2s♀	
	Pardosa sp.				2j	
30	*Piratula hygrophila* (Thorell, 1872)	N		1♀		
Mimetidae						
31	*Ero aphana* (Walckenaer, 1802)	N		1s♂, 1j	1♀, 5s♀, 2j	
Oonopidae						
32	** *Triaeris stenaspis* Simon, 1891	A		2♀♀	3♀♀	10♀♀, 2s♀, 8j
Philodromidae						
33	*Philodromus margaritatus* (Clerck, 1757)	N		1j		
34	*Philodromus* cf. *dispar* Walckenaer, 1826	N		1j	2s♂, 1s♀	
35	*Philodromus* sp. (*aureolus* group)			1j	1s♀	

Order/Family/Species		Status	Methods of collection			
			EX	HC	P	PT
Pholcidae						
36	*Hoplopholcus* sp.			1s♂		
37	*Pholcus opilionoides* (Schrank, 1781)	N/S		2♂♂, 3♀♀, 1s♂	1♂, 2♀♀	
38	*Pholcus phalangioides* (Fuesslin, 1775)	S		4♂♂, 2♀♀, 2s♂, 3s♀, 5j	3♂♂, 15♀♀, 17s♀, 5j	
Pisauridae						
39	*Pisaura mirabilis* (Clerck, 1757)	N			1♂, 2♀♀, 2s♂, 7s♀, 2j	
Salticidae						
40	*Ballus chalybeius* (Walckenaer, 1802)	N			1s♂, 3s♀	
41	*Evarcha arcuata* (Clerck, 1757)	N			3♂♂	
42	* *Hasarius adansoni* (Audouin, 1826)	A		2♂	5♂♂, 3j	1♀, 1s♀
43	*Marpissa muscosa* (Clerck, 1757)	N		1♂		
44	*Salticus scenicus* (Clerck, 1757)	N/S		1♀		
45	*Sitticus pubescens* (Fabricius, 1775)	N/S		1♂, 8♀♀, 4j	1♂, 1♀, 4s♂, 6s♀, 14j	
Tetragnathidae						
46	*Metellina merianae* (Scopoli, 1763)	N		1s♀	2s♂, 6s♀, 3j	
47	*Tetragnatha* sp.				3s♀, 1j	
Theridiidae						
48	** *Coleosoma floridanum* Banks, 1900	A		1♂, 1♀	6♂♂, 13♀♀, 5s♂, 3s♀, 4j	1j
49	*Dipoena melanogaster* (C. L. Koch, 1837)	N		1s♂	1s♂	
50	*Enoplognatha ovata* (Clerck, 1757)	N			2♂♂, 3♀♀, 1s♂, 1s♀, 3j	
51	*Neottiura bimaculata* (Linnaeus, 1767)	N		1♂♂	6♂♂, 2♀♀, 1s♂, 1s♀, 5j	
52	*Parasteatoda tabulata* (Levi, 1980)	N/S		1♂♂, 2♀♀, 4s♂, 2s♀, 2j	1♂, 2♀♀, 3s♂, 7s♀, 13j	
53	*Parasteatoda tepidariorum* (C. L. Koch, 1841)	S		1♂♂, 10♀♀, 5s♂, 8s♀, 3j	16♂♂, 23♀♀, 8s♂, 41s♀, 36j	
	Parasteatoda sp. [*tepidariorum / tabulata*]			8j	1♀, 6s♂, 4s♀, 61j	2j
54	*Phylloneta* sp.				1♀	
55	*Steatoda bipunctata* (Linnaeus, 1758)	N/S			1♀	
56	*Steatoda triangulosa* (Walckenaer, 1802)	S		4♀♀, 2s♀, 8j	4♀♀, 3s♀, 2j	
57	*Theridion varians* Hahn, 1833	N		5♀♀, 2s♂	2♂♂, 11♀♀, 14s♂, 17s♀, 18j	
Thomisidae						
58	*Diaea dorsata* (Fabricius, 1777)	N			1s♀, 1j	
59	*Misumena vatia* (Clerck, 1757)	N			1♀, 1s♀	
60	*Tmarus piger* (Walckenaer, 1802)	N			2s♀	
61	*Xysticus ulmi* (Hahn, 1831)	N		1j		
	Xysticus sp. [damaged]				1j	
Uloboridae						
62	*Uloborus plumipes* Lucas, 1846	A		1♂, 7♀♀, 1j	2j	
OPILIONES						
Phalangiidae						
1	*Opilio canestrinii* (Thorell, 1876)	N/S		1♂, 3s♀		
PALPIGRADI						
Eukoeniidae						
1	cf. *Eukoenenia florenciae* [damaged]	A?				1
PSEUDOSCORPIONES						
Chthoniidae						
1	** *Chthonius ressli* Beier, 1956	N	3♂♂, 3♀♀, 1tn			
2	*Chthonius tetrachelatus* (Preyssler, 1790)	N	2♂♂, 1♀, 1tn, 4dn	1♂		2♂♂, 1♀
Neobisiidae						
3	*Neobisium carcinoides* (Hermann, 1804)	N	1tn, 1dn			
Chernetidae						
4	*Lamprochernes* sp. [see text]	N	1♂			
Total number of different taxa			**4 spp.**	**47 spp.**	**47 spp.**	**9 spp.**
Total number of specimens			**18 ex.**	**193 ex.**	**599 ex.**	**38 ex.**

fern, C2, 20. – 27.3.2013; 1 tritonymph – soil sample extraction, G6, 23.4.2013; 3 deutonymphs – extraction of soil sample collected under old trees, C3, 23.4.2013; 1 ♂ – extraction of soil sample collected under old trees, C1, 23.4.2013; 1♀ – extraction of soil sample collected under old trees, unspecified greenhouse, 23.4.2013; 1♂ – extraction of soil sample,

Tab. 2: Morphometric data for females and male of *Chthonius ressli* (measurements in mm)

Characteristics	♀	♀	♀	♂
Body				
length	1.02	1.28	1.07	0.93
Carapace				
length	0.34	0.34	0.34	0.31
width	0.37	0.39	0.40	0.29
length/width ratio	0.92	0.87	0.85	1.07
Chelicera				
length	0.30	0.30	0.30	0.25
width	0.16	0.15	0.15	0.13
length/width ratio	1.88	2.00	2.00	1.92
Cheliceral movable finger, length	0.15	0.15	0.15	0.13
Palpal trochanter				
length	0.14	0.14	0.14	0.12
width	0.08	0.08	0.09	0.07
length/width ratio	1.75	1.75	1.56	1.71
Palpal femur				
length	0.36	0.36	0.36	0.32
width	0.08	0.08	0.08	0.06
length/width ratio	4.50	4.50	4.50	5.33
Palpal patella				
length	0.17	0.16	0.17	0.15
width	0.09	0.08	0.09	0.07
length/width ratio	1.89	2.00	1.89	2.14
Palpal hand				
length	0.19	0.20	0.20	0.17
width	0.12	0.12	0.12	0.09
length/width ratio	1.58	1.67	1.67	1.89
Palpal finger				
length	0.35	0.35	0.37	0.31
Palpal chela				
length	0.56	0.57	0.56	0.49
length/palpal hand width	4.67	4.75	4.67	5.44
Leg I trochanter				
length	0.08	0.08	0.08	0.07
width	0.07	0.06	0.06	0.06
length/width ratio	1.14	1.33	1.33	1.17
Leg I femur				
length	0.18	0.18	0.19	0.17
width	0.04	0.04	0.04	0.03
length/width ratio	4.50	4.50	4.75	5.67
Leg I patella				
length	0.09		0.09	0.08
width	0.04	0.04	0.04	0.04
length/width ratio			2.25	2.00
Leg I tibia				
length	0.12	0.11	0.10	0.11
width	0.03	0.03	0.03	0.03
length/width ratio	4.00	3.67	3.33	3.67
Leg I tarsus				
length	0.21	0.22	0.21	0.21
width	0.03	0.03	0.03	0.03
length/width ratio	7.00	7.33	7.00	7.00
Leg IV femoropatella				
length	0.28	0.30	0.25	0.27
width	0.09	0.11	0.09	0.09
length/width ratio	3.11	2.73	2.78	3.00
Leg IV tibia				
length	0.20	0.18		0.16
width	0.05	0.05		0.04
length/width ratio	4.00	3.60		4.00
Leg IV tarsus I				
length	0.11	0.10		0.09
width	0.04	0.04		0.03
length/width ratio	2.75	2.50		3.00
Leg IV tarsus II				
length	0.20	0.20		0.19
width	0.03	0.03		0.03
length/width ratio	6.67	6.67		6.33

C3, 25.10.2013; 1♂ – individual collecting under a table, G5, 11.7.2014; 1♂, 1♀ – pitfall trap, G6, 19.2. – 5.3.2015.

Pickard-Cambridge (1906) listed *C. tetrachelatus* among the species found in the Royal Botanic Gardens, Kew in London without specifying a habitat or number of specimens. Van der Hammen (1969) found the species in greenhouses in botanical gardens in the Netherlands. In Slovakia, it is the most common species of the family Chthoniidae and is considered to be eurytopic (Christophoryová 2013). The finding of *C. tetrachelatus* in greenhouses represents a new habitat type for the species in Slovakia.

Neobisiidae

Neobisium* (*Neobisium*) *carcinoides (Hermann, 1804)

Material examined. 1 tritonymph, 1 deutonymph – extraction of soil sample collected under old trees, C3, 23.4.2013.

Pickard-Cambridge (1906) listed *N. carcinoides* among the species found in the Royal Botanic Gardens, Kew in London without specifying a habitat or number of specimens. In Slovakia, it is the most common species of the family Neobisiidae and it is considered to be eurytopic (Christophoryová 2013). The species *N. carcinoides* was recorded for the first time in greenhouses in Slovakia.

Chernetidae

***Lamprochernes* sp.** Tömösváry, 1882

Material examined. 1♂ – extraction of soil sample, C3, 25.10.2013.

Until now, *L. chyzeri* and *L. nodosus* (Schrank, 1803) were known from Slovakia (Christophoryová et al. 2012), but the majority of characters used to distinguish these species overlap each other (Christophoryová et al. 2011). Therefore, we did not identify this specimen at species level. The collected specimen is currently used in a detailed molecular and taxonomic analysis. Before the present study, Krumpál et al. (1997) recorded one male of *L. chyzeri* from a greenhouse in the Botanical Garden in Bratislava, Slovakia.

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