

Millipedes and centipedes (Myriapoda: Diplopoda, Chilopoda) in Swiss heated greenhouses, with seven species new for Switzerland

Authors: Gilgado, José D., Cabanillas, David, and Bobbitt, Ian

Source: *Revue suisse de Zoologie*, 129(1) : 85-101

Published By: Muséum d'histoire naturelle, Genève

URL: <https://doi.org/10.35929/RSZ.0063>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Millipedes and centipedes (Myriapoda: Diplopoda, Chilopoda) in Swiss heated greenhouses, with seven species new for Switzerland

José D. Gilgado^{1*}, David Cabanillas² & Ian Bobbitt¹

¹ Section of Conservation Biology, University of Basel, St. Johannis-Vorstadt 10, CH-4056 Basel, Switzerland

² Biological Pest Control and Ecosystem Services Laboratory, Instituto Murciano de Investigación y Desarrollo Agrario y Medioambiental. C/ Mayor s/n, La Alberca, 30150 Murcia, Spain

* E-mail: josedomingo.gilgado@gmail.com

Abstract: The international plant trade provides opportunities for the introduction of exotic species into tropical greenhouses around the world. The millipede and centipede fauna of greenhouses is barely known in Switzerland. We conducted a survey in greenhouses of nine botanical gardens and other institutions across Switzerland. We captured and identified 1390 individuals belonging to 14 millipede species and 43 individuals belonging to 9 centipede species. Most millipede individuals recorded (80.3%) were non-native as were the species (8/14). Most centipede individuals (55.3%) were non-native, but not the majority of the species (4/10). The species composition varied strongly among greenhouses with species originating from different parts of the world. Seven species already known from greenhouses in other European countries are reported for the first time in Switzerland. These are the millipedes *Cylindrodesmus hirsutus* Pocock, 1889, *Poratia obliterated* (Kraus, 1960), *Paraspirobolus lucifugus* (Gervais, 1836) and the centipedes *Mecistocephalus guildingii* Newport, 1843, *Tygarrup javanicus* Attems, 1929, *Lamyctes (Lamyctes) coeculus* (Brölemann, 1889b), and *Cryptops (Cryptops) doriae* Pocock, 1891. The relevance of these findings is discussed.

Keywords: Artificial habitats - botanical gardens - hothouses - invasive species - non-native species - passive dispersal - soil fauna - urban biodiversity.

INTRODUCTION

Millipedes (Diplopoda) and centipedes (Chilopoda) are two diverse groups of arthropods belonging to subphylum Myriapoda. Millipedes comprise around 11 000 described species worldwide (Enghoff *et al.*, 2015), while centipedes comprise around 3300 (Edgecombe & Giribet, 2007; Bonato & Zapparoli, 2011; Bonato *et al.*, 2016). In general, millipedes are mostly detritivores whilst centipedes are venomous predators. Myriapods are predominantly soil or ground-dwelling organisms but some species have adapted to other habitats and live in aerial parts of trees or show amphibious habits (Golovatch & Kime, 2009; Tsukamoto *et al.*, 2021). Millipedes and centipedes are usually found in humid and sheltered microenvironments in forests, mainly amongst leaf-litter, under tree bark or beneath stones (Golovatch & Kime, 2009; Voigtländer, 2011). However, some species are able to live in extreme environments such as deserts, high mountains, caves or littoral habitats (Demange, 1958; Barber, 2009a; Golovatch, 2009; Gobbi *et al.*, 2020). Millipedes and centipedes are present in all continents

except Antarctica. Four of the five extant centipede orders (Scutigleromorpha, Lithobiomorpha, Geophilomorpha, and Scolopendromorpha) have very wide distributions, but the fifth one (Craterostigmomorpha) with only two known species, is only found in Tasmania and New Zealand (Bonato & Zapparoli, 2011). On the other hand, millipede orders tend to have smaller distribution ranges, making them a suitable group for biogeographical studies (Enghoff, 2015) and most millipede species have small distribution areas (Golovatch & Kime, 2009). Nevertheless, several millipede and centipede species have increased their distribution range by being transported by human means, settling in areas where they are not native and, in some cases, even becoming invasive (Stoev *et al.*, 2010).

International trade of cultivated plants and soil material allow the colonization of European plant nurseries and greenhouses, from where these species may have subsequently spread (Stoev *et al.*, 2010). In Europe, introduced myriapods seem to pose only a minor problem for the native biodiversity and human economic activities

(Stoev *et al.*, 2010). Wittenberg (2005) agrees on this, but also states that the knowledge on introduced Myriapods in Switzerland is so scarce that no comprehensive list could be provided. However, some species such as the invasive *Oxidus gracilis* (C.L. Koch, 1847) have become a pest in several European countries (Stoev *et al.*, 2010; Gilgado, 2020) but their effect on native biodiversity has not yet been studied (Iniesta *et al.*, 2020). *Oxidus gracilis* was first reported in Switzerland by Bigler (1913) from greenhouses and it is currently the second most abundant inhabitant of urban private gardens in the city of Basel (Braschler *et al.*, 2020).

Since heated greenhouses and plant nurseries are most likely hotspots for exotic myriapods in Europe, their examination is a prerequisite for the prevention of future invasions. These artificial environments provide a very special set of conditions such as higher and more stable temperature and humidity, and the presence of non-native plant species, compared to other synanthropic outdoor habitats in Europe (Decker *et al.*, 2014). Decker *et al.* (2014) provide an overview of the literature with millipede and centipede records in greenhouses of Europe, but since then several new findings have been reported (see for example Tuf *et al.*, 2018; Dolejš *et al.*, 2019; Damasiewicz & Leśniewska, 2020; Gregory & Lugg, 2020; Gregory, 2021). In Switzerland, the literature with greenhouse myriapods records is scarce (Bigler, 1913; Holzapfel, 1932; Pedroli-Christen, 1993; Golovatch *et al.*, 2001a). Regarding millipedes, only four non-native species have been reported in Swiss greenhouses: *Amphitomeus attemsi* (Schubart, 1934), native to South America (Golovatch *et al.*, 2001a); *Cylindroiulus truncorum* (Silvestri, 1896a), of Mediterranean origin (Holzapfel, 1932; Pedroli-Christen, 1993); *Oxidus gracilis*, an east Asian species (Bigler, 1913; Holzapfel, 1932; Pedroli-Christen, 1993); and *Poratia digitata* (Porat, 1889) of neotropical origin (Holzapfel, 1932; Pedroli-Christen, 1993). When the first records of *C. truncorum* and *O. gracilis* were made, they were limited to greenhouses (Bigler, 1913; Holzapfel, 1932; Pedroli-Christen, 1993), but they are currently widespread in other urban habitats in Switzerland (Vilisics *et al.*, 2012; Braschler *et al.*, 2020; Gilgado, 2020). Regarding centipedes, only four European native species, namely *Lithobius melanops* Newport, 1845, *Cryptops (Cryptops) hortensis* (Donovan, 1810), *Stenotaenia linearis* (C.L. Koch, 1835) and *Schendyla nemorensis* (C.L. Koch, 1837) have been reported from Swiss greenhouses (Holzapfel, 1932). These species live in the wild in Switzerland (Stöckli, 2009; Bonato *et al.*, 2016).

In the present work we present an updated list of the millipede and centipede species inhabiting heated greenhouses of Switzerland and provide new records for seven non-native species.

MATERIAL AND METHODS

We were granted permission to sample in heated greenhouses of nine institutions across Switzerland (Table 1): the Botanical Garden of Basel University, Basel Zoo, Botanical Garden of the University of Bern, Conservatory and Botanical Garden of the City of Geneva, Botanical Garden of St. Gallen, Botanical Garden of the University of Fribourg, Botanical Garden of the University of Zurich, the Jurassica Botanical Garden (Porrentruy), and the Papiliorama Tropical Garden in Kerzers. The greenhouses were visited between June and December 2019. In each greenhouse two methods for invertebrate sampling were used: active search and pitfall trapping. At localities where more than one greenhouse was present (Porrentruy, Geneva, Zurich, and Fribourg), we used both sampling methods in the greenhouse that had the highest air temperature and humidity, and only applied active search in the other one. Active search was carried in each greenhouse by the same two members of the team (J.D.G and I.B.) for 30 minutes. We visually searched for millipedes and centipedes, which were captured with forceps and placed in vials with 70% ethanol. The active search targeted millipedes and centipedes on the ground, in leaf litter, under deadwood, stones, plates, pots, etc., and on the bark or plant stems. The pitfall consisted of plastic cups (5.8 cm in diameter each) half filled with propylene glycol and covered by a plastic plate to prevent water or leaves to fall in. We distributed eight pitfall traps throughout the soil area of the main greenhouse of each locality, hiding them as much as possible from the view of the visitors. The traps worked for seven days. Captured specimens were sorted in the lab and transferred to 70% ethanol.

Specimens were identified by J. D. Gilgado (Diplopoda) and D. Cabanillas (Chilopoda) by comparison of external morphology and/or sexual characters, by using keys of identification (Titova, 1981; Eason, 1982; Bonato *et al.*, 2009, 2014; Mitić *et al.*, 2012; Enghoff *et al.*, 2013; Lewis, 2013) and the original descriptions or redescriptions of the species known to inhabit Switzerland (Pedroli-Christen, 1993; Stöckli, 2009; Gilgado 2020) or greenhouses of Europe (Kime & Enghoff, 2011, 2017; Decker *et al.*, 2014). Specimens were prepared for long-term storage in ethanol and a voucher collection is deposited in the Naturhistorisches Museum Basel. Photos were taken using a KEYENCE VHX-6000 and a Panasonic Lumix DMC-FZ200 camera equipped with a Raynox DCR-250 macro lens.

TAXONOMIC PART

A total of 1390 individuals belonging to 14 millipede species and 47 individuals of 10 centipede species were identified (Table 2). Of them, 1116 millipede individuals (80.3%), belonging to 8 species (57.1%) and 26 centipede individuals (55.3%) belonging to 4 species (40%) were

Table 1. Names, location, and dates of visit of the greenhouses examined. The asterisk indicates additional active captures (not standardized).

Institution	Locality, Canton	Greenhouse	Code	Coordinates	Date 1	Date 2
Basel Zoo	Basel, Basel-Stadt	Altes Vogelhaus (Old bird house)	BZV	47°32'53.56"N, 7°34'43.13"E	3.10.19	10.10.19
Botanical Garden of St. Gallen	St. Gallen, St. Gallen	Tropischer Regenwald (Tropical rainforest)	SGR	47°26'24.12"N, 9°24'24.44"E	2.10.19	9.10.19
		Tropische Nutzpflanzen (Tropical cultures)*	SGN	47°26'24.50"N, 9°24'25.15"E	2.10.19	9.10.19
Botanical Garden of the University of Basel	Basel, Basel-Stadt	Tropenhaus (Tropical house)	BAT	47°33'31.06"N, 7°34'54.36"E	26.6.19	3.7.19
		Viktoriahaus (Victoria greenhouse)*	BAV	47°33'32.75"N, 7°34'54.06"E	20.03.19	
Botanical Garden of the University of Bern	Bern, Bern	Palmenhaus (Palm house)	BEP	46°57'8.99"N, 7°26'44.26"E	4.12.19	11.12.19
Botanical Garden of the University of Fribourg	Fribourg, Fribourg	Forêt tropicale (Tropical forest)	FRF	46°47'35.42"N, 7°9'18.17"E	23.10.19	30.10.19
		Plantes utiles tropicales (Tropical useful plants)*	FRP	46°47'33.70"N, 7°9'21.26"E	23.10.19	30.10.19
Botanical Garden of the University of Zurich	Zurich, Zurich	Tropischer Tieflandregenwald (Tropical lowland forest)	ZUT	47°21'28.45"N, 8°33'42.59"E	5.12.19	12.12.19
		Tropischer Bergwald (Tropical mountain forest)*	ZUB	47°21'28.49"N, 8°33'41.14"E	5.12.19	12.12.19
Conservatory and Botanical Garden of Geneva	Geneva, Geneva	Serre Tropicale Principale (Main Tropical Greenhouse)	GEP	46°13'31.44"N, 6°8'43.07"E	15.10.19	22.10.19
		Jardin d'hiver (Winter garden)*	GEH	46°13'33.61"N, 6°8'44.97"E	15.10.19	22.10.19
Jurassica Botanical Garden	Porrentruy, Jura	La Petite Serre Tropicale (The small tropical greenhouse)	JUP	47°24'48.78"N, 7°4'36.89"E	7.11.19	14.11.19
		La Grande Serre Tropicale (The large tropical greenhouse)*	JUG	47°24'48.88"N, 7°4'36.60"E	7.11.19	14.11.19
Papiliorama	Kerzers, Fribourg	Jungle Trek	PAP	46°59'24.05"N, 7°12'4.14"E	12.9.19	19.9.19

Table 2. Summary of the number of captured individuals of each species by greenhouse. An asterisk indicates that the species is a new record for Switzerland, (+) indicates that the locality was sampled during additional visual search. Abbreviations of the greenhouse names as in Table 1.

Class <i>Diplopoda</i>		Locality (Institution/greenhouse)																		
Order	Family	Species	Origin	Total	BZV	SG		BA			BE		FR		ZU		GE		JU	PAP
						SGR	SGN (+)	BAT	BAT (+)	BAV (+)	FRF	FRP (+)	ZUT	ZUB (+)	GEP	GEH (+)	JUP	JUG (+)		
Julida	Blaniulidae	<i>Blaniulus guttulatus</i> (Fabricius, 1798)	Native	98	—	2	—	—	—	—	—	—	4	4	—	—	—	—	—	—
		<i>Choneiulus palmatus</i> (Némec, 1895)	Native	81	1	—	—	—	—	—	—	—	6	3	—	—	—	—	—	—
		<i>Nopoiulus kochii</i> (Gervais, 1847)	Native	86	—	—	—	—	—	—	—	—	—	—	—	7	42	1	—	—
Julida	Julidae	<i>Cylindroiulus latestriatus</i> (Curtis, 1845)	Native	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		<i>Cylindroiulus salictivornis</i> Verhoeff, 1908	Italy	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		<i>Cylindroiulus truncorum</i> (Silvestri, 1896a)	Mediterranean	202	6	—	6	1	—	—	7	—	—	—	—	11	12	135	22	—
Polydesmida	Haplodesmidae	<i>Cylindrodesmus hirsutus</i> Pocock, 1889*	Indonesia or Melanesia	317	—	—	—	—	—	—	—	—	—	—	—	35	—	—	—	2
Polydesmida	Oniscodesmidae	<i>Amphitomeus attemsi</i> (Schubart, 1934)	South America	153	3	—	10	—	—	—	5	—	17	2	43	1	49	10	3	10
Polydesmida	Paradoxosomatidae	<i>Oxidus gracilis</i> (C.L.Koch, 1847)	East Asia	362	6	—	1	10	1	—	1	—	132	—	67	13	74	22	1	34
Polydesmida	Polydesmidae	<i>Brachydesmus superus</i> Latzel, 1884	Native	8	—	—	—	—	—	—	—	—	—	8	—	—	—	—	—	—
		<i>Propolydesmus testaceus</i> (C.L.Koch, 1847)	Native	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Polydesmida	Pyrgodesmidae	<i>Poratia digitata</i> (Porat, 1889)	Neotropical	3	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		<i>Poratia obliterata</i> (Kraus, 1960)*	Neotropical	9	—	—	—	—	—	—	6	—	—	—	3	—	—	—	—	—
Spirobolida	Spirobolellidae	<i>Paraspirobolus lucifugus</i> (Gervais, 1836)*	South America	65	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	65

Table 2. Continued.

Class Chilopoda		Locality (Institution/greenhouse)																		
		Species	Origin	Total	BZV	SG		BA			BE	FR		ZU		GE		JU		PAP
SGR	SGN (+)					BAT	BAT (+)	BAV (+)	FRF	FRP (+)		ZUT	ZUB (+)	GEP	GEH (+)	JUP	JUG (+)			
Geophilomorpha	<i>Geophilus flavus</i> (De Geer, 1778)	Native	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Geophilidae																				
Geophilomorpha	<i>Mecistocephalus guildinigi</i> Newport, 1843*	Amphi-atlantic	11	—	—	—	—	—	—	—	—	—	—	—	—	7	4	—	—	—
Mecistocephalidae																				
Lithobiomorpha	<i>Tygarrip javanicus</i> Attems, 1929*	South Asia	5	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	1
Henicopidae																				
Lithobiomorpha	<i>Lamyctes coeculus</i> (Brölemann, 1889)*	Unclear	9	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—	—
Henicopidae																				
Lithobiomorpha	<i>Lithobius forficatus</i> (Linnaeus, 1758)	Native	15	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	—
Lithobiidae																				
Lithobiomorpha	<i>Lithobius melanops</i> Newport, 1845	Native	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lithobiidae																				
Scolopendromorpha	<i>Cryptops anomalans</i> Newport, 1844	Native	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cryptopidae																				
Cryptopidae	<i>Cryptops doriae</i> Pocock, 1891*	Palaeotropical	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cryptopidae																				
Cryptopidae	<i>Cryptops hortensis</i> (Donovan, 1810)	Native	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cryptopidae																				
Cryptopidae	<i>Cryptops parisi</i> Brölemann, 1920	Native	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cryptopidae																				

non-native. This corresponds to 50% of the total number of species recorded and to 79.3% of the total number of individuals captured. Seven species are reported in Switzerland for the first time.

First records for the Swiss Fauna

Class Diplopoda de Blainville in Gervais, 1844

Order Polydesmida Pocock, 1887

Family Haplodesmidae Cook, 1895

Genus *Cylindrodesmus* Pocock, 1889

***Cylindrodesmus hirsutus* Pocock, 1889**

Fig. 1

Material examined: NMB; 115 females, 9 juveniles; Switzerland, Basel-Stadt, Botanical Garden of the University of Basel, Tropenhaus, 47°33'31"N, 7°34'54"E, 270 m; 03.07.2019; J.D. Gilgado and I. Bobbitt leg. – 151 females, 5 juveniles; same data but in the collection of J.D.G. – NMB; 31 females, 2 juveniles; Switzerland, Zurich, Botanical Garden of the University of Zurich, Tropischer Tieflandregenwald, 47°21'28"N, 8°33'42"E, 438 m; 12.12.2019; J.D. Gilgado and I. Bobbitt leg. – 2 females; same data but in the collection of J.D.G. – NMB; 2 females; Switzerland, Fribourg, Kerzers, Papiliorama, Jungle Trek, 46°59'24"N, 7°12'4"E, 438 m; 19.09.2019; Gilgado and I. Bobbitt leg.

Distribution: According to Recuero (2018), who compiled all the records of the species, it is currently

a pantropical species appearing in many greenhouses in Europe (see also Dolejš *et al.*, 2019). It may be originally native to Indonesia or Melanesia (Golovatch *et al.*, 2001b).

Remarks: It is a small, white, or pinkish white species, with a hairy appearance. Some populations of this species include males (Read, 2008), but others are parthenogenetic and thus composed only by females (Golovatch *et al.*, 2000). All the individuals collected in Switzerland were females or juveniles. More detailed information about its morphology can be found in Read (2008), Golovatch *et al.* (2000) and Golovatch *et al.* (2001b).

Family Pyrgodesmidae Silvestri, 1896b

Genus *Poratia* Cook & Cook, 1894

***Poratia obliterata* (Kraus, 1960)**

Fig. 2

Material examined: NMB; 1 subadult male, 2 females, 1 juvenile; Switzerland, Bern, Botanical Garden of the University of Bern, Palmenhaus, 46°57'9"N, 7°26'44"E, 520 m; 11.12.2019; J.D. Gilgado and I. Bobbitt leg. – 2 females; same data but in the collection of J.D.G. – NMB; 1 female; Switzerland, Zurich, Botanical Garden of the University of Zurich, Tropischer Tieflandregenwald, 47°21'28"N, 8°33'42"E, 438 m; 12.12.2019; J.D. Gilgado and I. Bobbitt leg. (Table 2). – 2 juveniles; same data but in the collection of J.D.G.

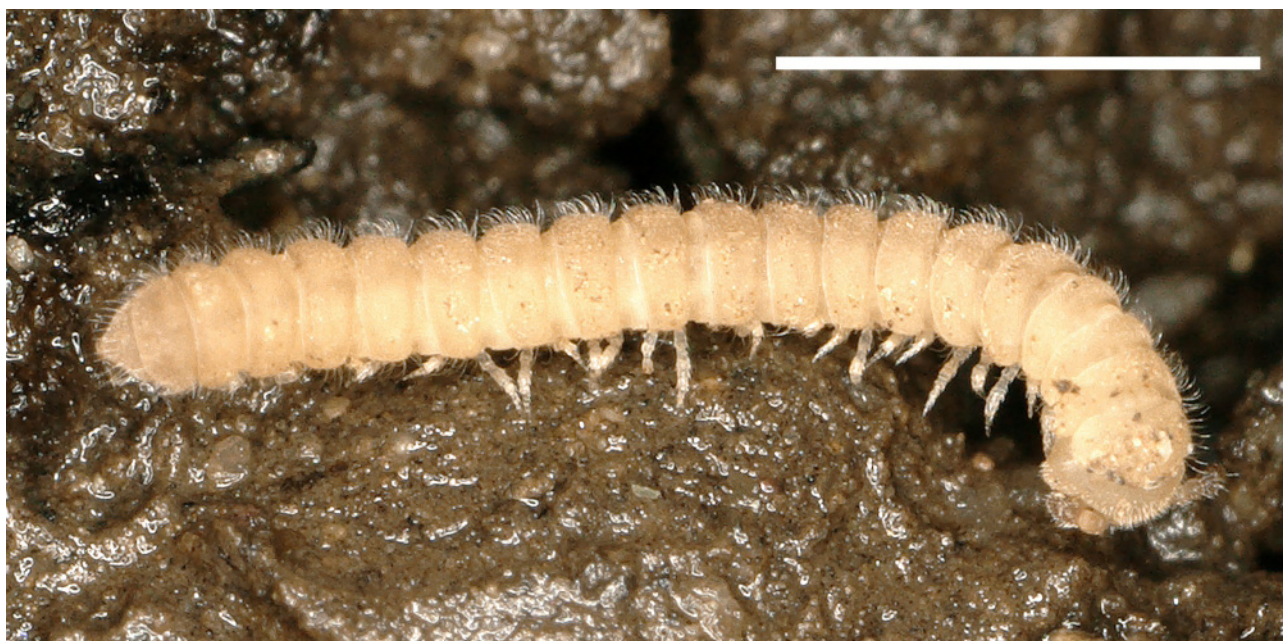


Fig. 1. Living specimen of *Cylindrodesmus hirsutus* from the Tropenhaus of the Botanical Garden of the University of Basel. Scale bar: 2 mm.

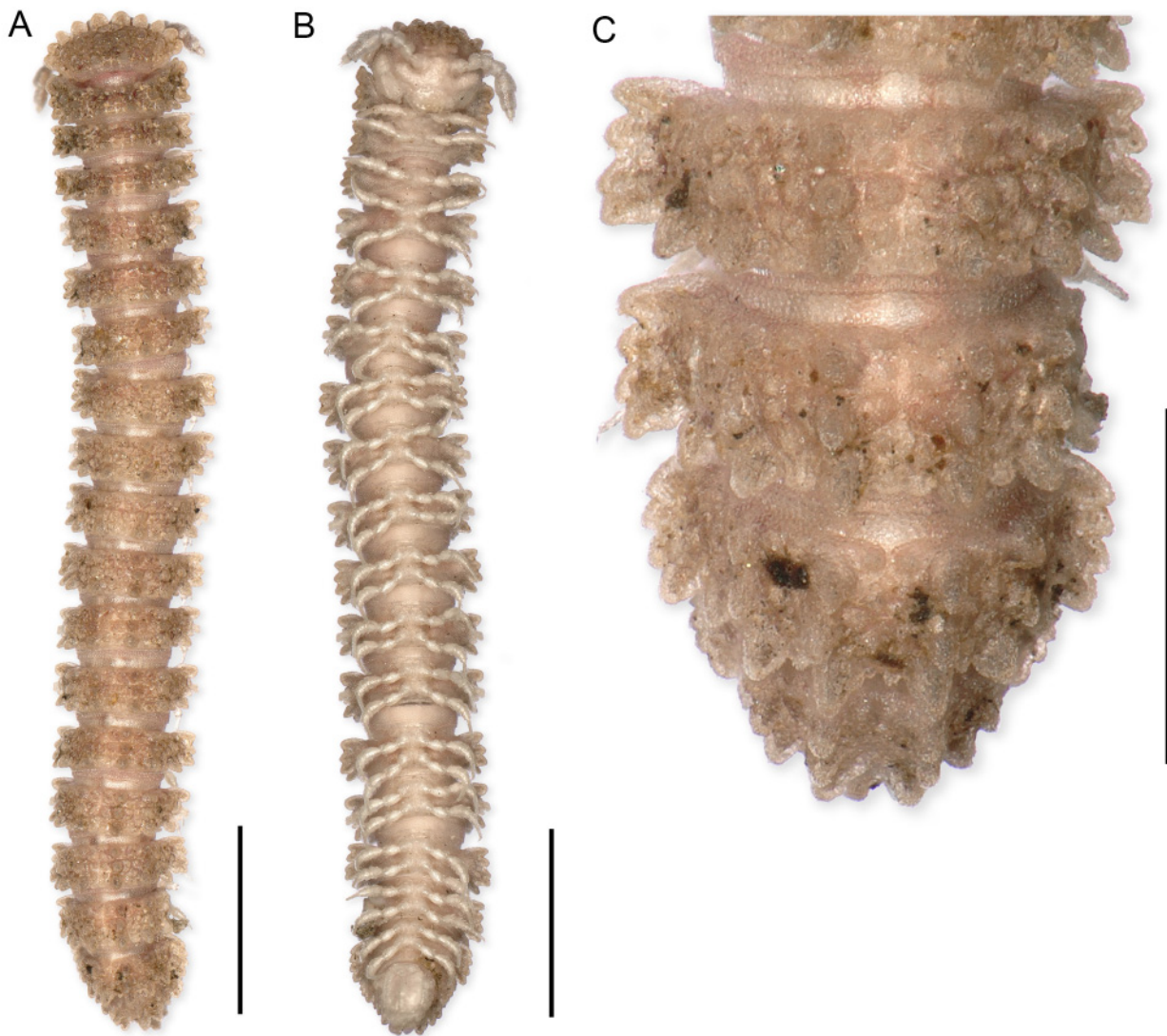


Fig. 2. *Poratia obliterata* from the Botanical Garden of the University of Bern. (A) Dorsal view. (B) Ventral view. (C) Detail of the last body rings. Scale bars: A, B, 1 mm; C, 0.5 mm.

Distribution: This species is found in the wild in Peru, Brazil and Colombia, and in Costa Rica (Golovatch & Sierwald, 2001). In Europe, the species has been recorded in greenhouses in Kiel, Germany (Wilck, 2000; Decker *et al.*, 2014) and in Paris, France (Golovatch & Sierwald, 2001).

Remarks: It is very similar to *Poratia digitata*, also known in greenhouses of botanical gardens of Europe, but it can be distinguished by the number of rings (20 in *P. obliterata* and 19 in *P. digitata*) and the number of lateral lobulations in paraterga of ring 16-18(19) (always 4 in *P. obliterata* and mostly 3 in *P. digitata*) (Golovatch & Sierwald, 2001). All the individuals collected in Switzerland were females or juveniles.

Order Spirobolida Bollman, 1893
Family Spirobolellidae Brölemann, 1913
Genus *Paraspirobolus* Brölemann, 1902
***Paraspirobolus lucifugus* (Gervais, 1836)**

Fig. 3

Material examined: NMB; 17 males, 10 females, 7 juveniles; Switzerland, Fribourg, Kerzers, Papiliorama, Jungle Trek, 46°59'24"N, 7°12'4"E, 438 m; 19.09.2019; Gilgado and I. Bobbitt leg. – 20 males, 11 females; same data but in the collection of J.D.G. (Table 2).

Distribution: This originally South American species has been found in greenhouses in England (Read, 2008), Denmark (Enghoff, 1975a) and Germany (Decker *et al.*, 2014). In Germany, it was found in six different locations.

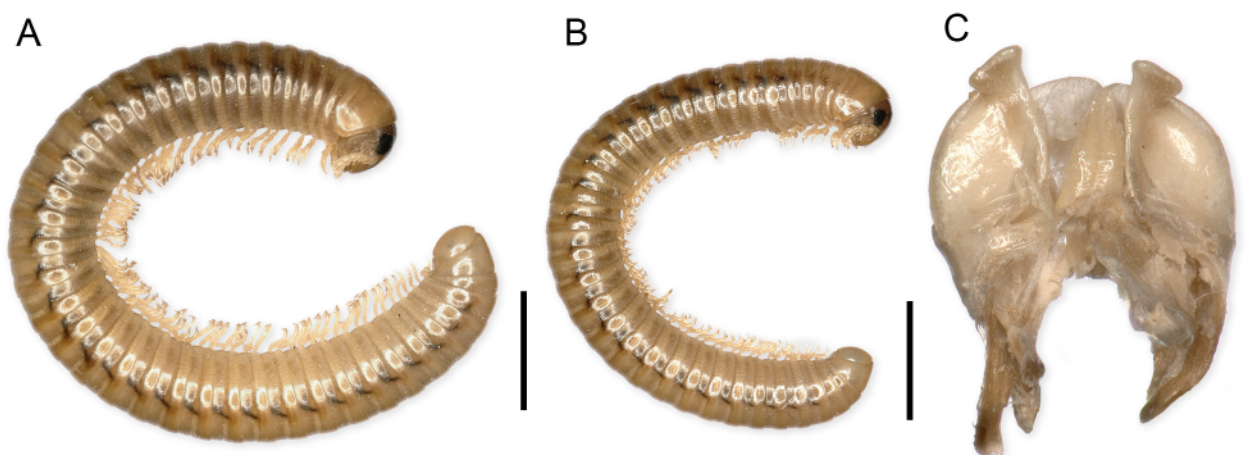


Fig. 3. *Paraspirobolus lucifugus* from the Papiliorama. (A) Adult female. (B) Adult male. (C) Gonopods. Scale bars: A, B, 2 mm; C, 0.5 mm.

Remarks: A description of the species can be found in Read (2008). Both males and females were collected in the present work. As a curiosity, this is one of the few known bioluminescent myriapods (Rosenberg & Meyer-Rochow 2009; Oba *et al.*, 2011).

Class Chilopoda Latreille, 1816
Order Geophilomorpha Pocock, 1896
Family Mecistocephalidae Bollman, 1893
Genus Mecistocephalus Newport, 1843
***Mecistocephalus guildingii* Newport, 1843**

Fig. 4

Material examined: NMB; 2 males, 4 females; Switzerland, Geneva, Conservatory and Botanical Garden of Geneva, Serre Tropicale Principale, 46°13'31"N, 6°8'43"E, 389 m; 22.10.2019; J.D. Gilgado and I. Bobbitt leg. – 1 male, 2 females, 2 juveniles; same data but in Jardin d'hiver, in the collection of D.C. (Table 2).

Distribution: *M. guildingii* is an amphi-Atlantic species that inhabits Atlantic islands and coastal or tropical mainland sites from the Americas to West Africa (Bonato *et al.*, 2009). According to Bonato *et al.* (2009), *M. guildingii* is present in at least the Greater and Lesser Antilles, Bermuda Islands, Florida, Panama and Brazil in the Western Atlantic, but also in Madeira, the Cape Verde archipelago, Gambia, and Liberia in the Eastern Atlantic. Additionally, *M. guildingii* has been reported from coastal localities of the Pacific Ocean, specifically from Puerto Vallarta (Bonato *et al.*, 2009) and the Botanical Garden of Culiacán Rosales in Mexico (López-Bonel *et al.*, 2019). Zodinpui *et al.* (2019) also reported *M. guildingii* from forests and cultivations of Mizoram in the northeast of India but this record seems highly uncertain and therefore needs verification.

This species has been introduced to Europe, namely in France, Germany, and United Kingdom, where it is confined to hothouses (Latzel, 1895; Brölemann, 1930; Barber, 2008; Tillier, 2018).

Remarks: This species could be confused with *Mecistocephalus maxillaris* (Gervais, 1837) in European greenhouses. However, the two species can be distinguished by examining the proportion between the length of the areolate clypeus and the plagulae. In *M. guildingii*, the areolate clypeus is twice the length of the plagulae, whilst in *M. maxillaris* both structures are of the same length (Bonato *et al.*, 2009). Both males and females of *M. guildingii* were detected in Swiss greenhouses.

Genus Tygarrup Chamberlin, 1914
***Tygarrup javanicus* Attems, 1929**

Fig. 5

Material examined: NMB; 1 female, 1 juvenile; Switzerland, Geneva, Conservatory and Botanical Garden of Geneva, Jardin d'hiver, 46°13'31"N, 6°8'43"E, 389 m; 22.10.2019; J.D. Gilgado and I. Bobbitt leg. – 1 female; Switzerland, St. Gallen, Botanical Garden, Tropische Nutzpflanzen, 47°26'24"N, 9°24'24"E, 662 m; 09.10.2019; J.D. Gilgado and I. Bobbitt leg.; in the collection of D.C. – NMB; 1 female; Switzerland, Jura, Porrentruy, Jurassica Botanical Garden, La Grande Serre Tropicale, 47°24'48"N, 7°4'36"E; 430 m; 14.11.2019; J.D. Gilgado and I. Bobbitt leg. – NMB; 1 female; Switzerland, Fribourg, Kerzers, Papiliorama, Jungle Trek, 46°59'24"N, 7°12'4"E, 438 m; 19.09.2019; Gilgado and I. Bobbitt leg. (Table 2).

Distribution: *Tygarrup javanicus* is probably native to southeastern Asia, originally described from the island of Java in Indonesia (Attems, 1929), with later

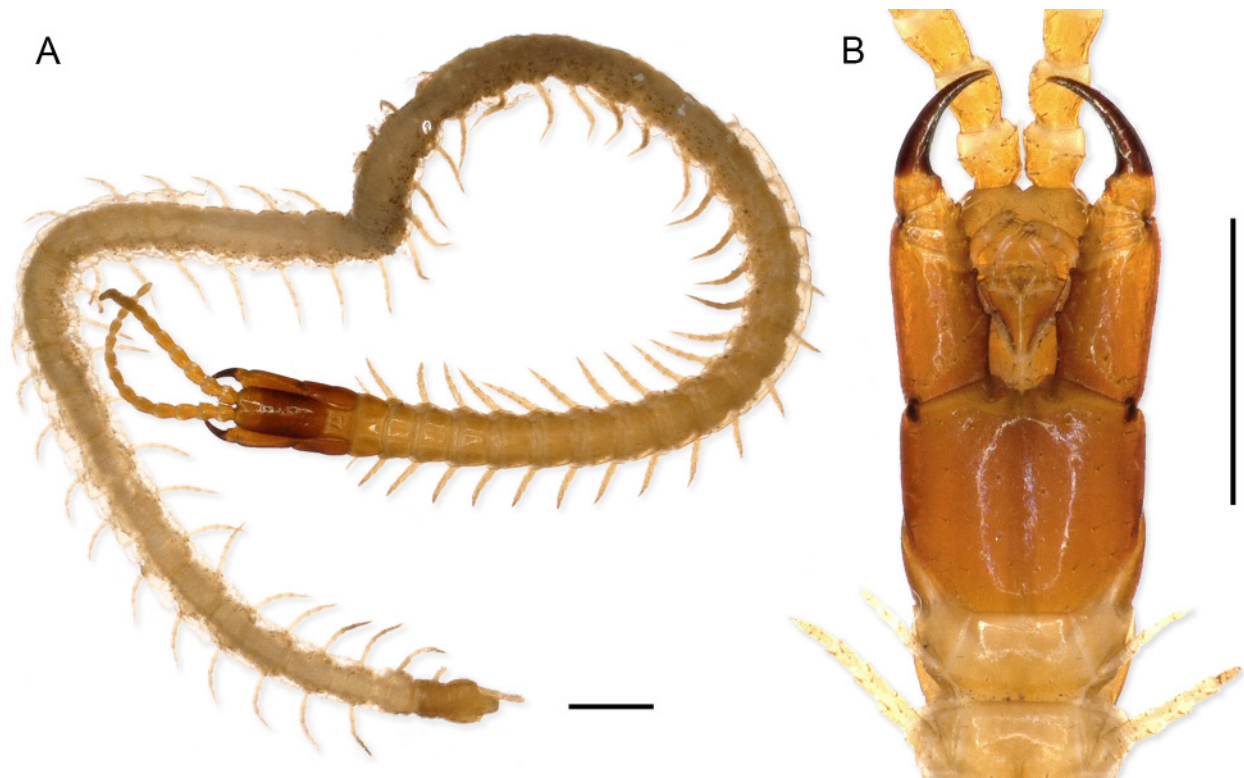


Fig. 4. *Mecistocephalus guildingii* from the Conservatory and Botanical Garden of Geneva. (A) Dorsal view. (B) Head in ventral view. Scale bars: 1 mm.



Fig. 5. *Tygarrup javanicus* from the Papiliorama, Kerzers. Dorsal view. Scale bar: 1 mm.

records in the Seychelles, Cambodia, Vietnam, and Mauritius (Demange, 1981; Titova, 1981; Bonato & Minelli, 2010). This species was presumably introduced to the Hawaiian islands (Bonato *et al.*, 2004) and also to Europe. The species has been recorded in Austria, Czech Republic, Germany, Poland, Russia, Slovakia, and United Kingdom, where it is only capable of living in heated greenhouses (Lewis & Rundle, 1988;

Christian, 1996; Barber, 2009b, c; Decker *et al.*, 2014; Tuf *et al.*, 2018; Nefediev, 2019; Damasiewicz & Leśniewska, 2020).

Remarks: Complete data about its morphology can be consulted in Bonato *et al.* (2004). All adult specimens from Swiss greenhouses were sexed as females.

Order Lithobiomorpha Pocock, 1895**Family Henicopidae Pocock, 1901****Genus *Lamyctes* Meinert, 1868****Subgenus *Lamyctes* Meinert, 1868*****Lamyctes (Lamyctes) coeculus* (Brölemann, 1889b)**

Fig. 6

Material examined: NMB; 1 female; Switzerland, Zurich, Botanical Garden of the University of Zurich, Tropischer Tieflandregenwald, 47°21'28"N, 8°33'42"E, 438 m; 12.12.2019; J.D. Gilgado and I. Bobbitt leg. – NMB; 2 females, 1 juvenile; Switzerland, Fribourg, Botanical Garden of the University of Fribourg, Plantes utiles tropicales, 46°47'35"N, 7°9'18"E; 631 m; 30.10.2019; J.D. Gilgado and I. Bobbitt leg. – NMB; 3 females; Switzerland, Geneva, Conservatory and Botanical Garden of Geneva, Serre Tropicale Principale, 46°13'31"N, 6°8'43"E, 389 m; 22.10.2019; J.D. Gilgado and I. Bobbitt leg. – 2 females; same data but in the collection of D.C. (Table 2).

Distribution: The family Henicopidae is native to the Southern Hemisphere, although the origin of *L. coeculus* is uncertain. This species was first detected in a greenhouse in Italy (Brölemann, 1889a) and subsequently reported from greenhouses in Sweden,

France, Illinois (U.S.A.), Finland, Denmark, United Kingdom, Germany, and the Asian part of Russia (Lohmander, 1923; Brölemann, 1930; Auerbach, 1952; Lehtinen, 1960; Enghoff, 1975b; Barber, 2009c; Decker *et al.*, 2014; Nefediev *et al.*, 2016). This species has been recently recorded in new greenhouses of France (Tillier, 2018) and the United Kingdom (Gregory & Lugg, 2020). *Lamyctes coeculus* has been reported outdoor in Australia, Hawaii, the Galapagos Islands, Mexico, Argentina, Cuba, the Canary Islands, Democratic Republic of Congo, Tanzania, Madagascar, La Réunion and Palestine (Negrea *et al.*, 1973; Enghoff, 1975b; Matic *et al.*, 1977; Peck, 1990; Enghoff & Eason, 1992; Shear & Peck, 1992; Negrea & Matic, 1996; Zapparoli & Shelley, 2000; Edgecombe & Giribet, 2003; Edgecombe, 2004; Cupul-Magaña, 2011, 2015). It has been also recorded in Venezuela, but no collecting data were provided (Turk, 2009). Currently, this species could have a subcosmopolitan distribution and be widely extended all over the world, possibly due to anthropochory and thelytoky (Enghoff, 1975b; Edgecombe & Giribet, 2003; Enghoff *et al.*, 2013).

Remarks: Worth mentioning another blind henicopid species which could potentially inhabit European



Fig. 6. *Lamyctes coeculus* from the Conservatory and Botanical Garden of Geneva. (A) Dorsal view. (B) Lateral view of head and first segments of trunk. Scale bars: A, 1 mm; B, 0.5 mm.

greenhouses and be confused with *L. coeculus* (Enghoff *et al.*, 2013): *Lamyctes (Lamyctes) hellyeri* Edgecombe & Giribet, 2003, which differs in having a higher number of antennal articles (29–33 vs. 24 in *L. coeculus*) and the presence of a distal spinose projection on the tibiae of legs 12 (Edgecombe & Giribet, 2003). All examined specimens of *L. coeculus* from Swiss greenhouses were sexed as females.

Order Scolopendromorpha Pocock, 1895

Family Cryptopidae Kohlrausch, 1881

Genus *Cryptops* Leach, 1814

Subgenus *Cryptops* Leach, 1814

***Cryptops (Cryptops) doriae* Pocock, 1891**

Fig. 7

Material examined: NMB; 1 juvenile; Switzerland, Fribourg, Kerzers, Papiliorama, Jungle Trek, 46°59'24"N, 7°12'4"E, 438 m; 19.09.2019; Gilgado and I. Bobbitt leg. (Table 2).

Distribution: *Cryptops doriae* is natively found in tropical areas of Asia and Australia, namely in the Seychelles, Kazakhstan, Uzbekistan, Nepal, India, Burma, Laos, Vietnam, Cambodia, Philippines, Pahang (Malaysia), Sumatra and Java (Indonesia), Tonga, and Papua New Guinea (Pocock, 1891; Silvestri, 1894a; Attems, 1907, 1938; Lewis, 1999, 2007a, 2010; Schileyko, 2001, 2007; Schileyko & Stoev, 2016; Khanna, 2008; Nguyen *et al.*, 2019; Dyachkov, 2020; Dyachkov & Nedoev, 2021). Additionally, *C. doriae* has been detected in European greenhouses in the United

Kingdom (Lewis, 2007b) and in Germany (Decker *et al.*, 2014).

Remarks: *Cryptops doriae* can be readily distinguished from native species by the presence of one or two saw teeth on the ventral surface of the femora of the ultimate leg pair. The morphology of the species has been studied in depth by Lewis (2009, 2013).

DISCUSSION

With some variation among greenhouses, millipedes were generally much more abundant (1390 individuals) than centipedes (47 individuals). Despite the differences in abundance, the number of centipede species (10) was not much lower than that of millipedes (14), as few millipede species had very high abundances (Table 2). The reason for the higher abundance of millipedes may be related to their trophic level. Millipedes are mostly detritivores consuming decaying leaf litter (David, 2015), a frequently occurring resource in greenhouses. Centipedes are predators (Voigtländer, 2011) and their populations depend, among others, on the abundance of prey. Centipedes are also rapid runners often escaping the forceps of the samplers. However, this may not explain the difference of the 30 times higher abundance of millipedes.

The high numbers of non-native millipede and centipede species found are remarkable. Interestingly, seven of these species have not previously been recorded in Switzerland. However, their presence in greenhouses in Switzerland was expected, as these species were already



Fig. 7. *Cryptops doriae* from the Papiliorama. Dorsal view. Scale bar: 2 mm.

found in greenhouses of other European countries (see for example Decker *et al.*, 2014). In addition to the comments made on the new records, it is also worth mentioning the millipede *Cylindroiulus salicivorus* Verhoeff, 1908 (Table 2), an Italian species that is spreading outdoors across Europe (Read *et al.*, 2002; Lee, 2006; Spelda, 2005; Kime & Enghoff, 2017) and has been only recently recorded in Switzerland from two urban private gardens in Basel (Gilgado, 2020). Conversely, the non-native centipede species found in the present work, *M. guildingii*, *T. javanicus*, *L. coeculus* and *C. doriae*, have never been reported outdoors in Europe, most probably because they may not be able to survive in temperate climates.

There is increasing literature on non-native myriapods found in greenhouses in Europe (see for example Dányi & Tuf, 2016; Tuf *et al.*, 2018; Dolejš *et al.*, 2019; Damasiewicz & Leśniewska, 2020; Gregory, 2021). However, there are few comprehensive species lists for countries, an exception being Decker *et al.* (2014) for Germany. These authors used data from 46 greenhouses and re-surveyed 29 of them. Despite the higher number of greenhouses examined, Decker *et al.* (2014) reported a similar percentage of non-native species from different continents (34%) as found in our study (41.7%; Table 2). Most of the myriapod species found in Swiss greenhouses are also present in greenhouses in Germany. However, some native Western European species found in Swiss greenhouses were not recorded in German greenhouses, such as *Propolydesmus testaceus* (C.L. Koch, 1847), *Cryptops (Cryptops) anomalans* Newport, 1844 and *Cryptops (Cryptops) parisi* Brölemann, 1920, as well as some non-native species such as *C. salicivorus* (in Germany only known from parks or gardens) or *M. guildingii*. On the other hand, Decker *et al.* (2014) reported 10 non-native myriapoda species in German greenhouses that were not found in the present study. The apparent absence of these species in Switzerland might be due to the lower number of greenhouses examined, although preventive measures taken by some institutions, use of pesticides, or presence of predators such as birds, may also reduce the number of introduced species.

The results on millipedes and centipedes indicate that despite greenhouses harbouring a mix of native and non-native species, the latter are predominant. Native centipedes from this study are mostly eurioic species able to colonise and exploit new habitats. Amongst them, *L. forficatus* (Linnaeus, 1758), *L. melanops* and *C. hortensis* were previously recorded by Holzapfel (1932) in Swiss greenhouses and are also common in other European hothouses (Decker *et al.*, 2014, Gregory & Lugg, 2020). The native millipedes recorded in our study are synanthropic species usually found in urban and suburban environments (Pedroli-Christen, 1993; Kime & Enghoff, 2011, 2017; Vilisics *et al.*, 2012; Braschler *et al.*, 2020). The non-native species found have various original distribution areas (Table 1), but those from

tropical or subtropical areas are the most abundant, most probably favoured by the higher temperature and humidity in the greenhouses.

Several hypotheses have been proposed to explain the introduction and survival of alien centipedes in greenhouses, for example small body size that allows them to be passively transported with pot-plants and the presumable reproduction by thelytoky (Enghoff, 1975b; Golovatch, 2009; Stoev *et al.*, 2010). These explanations could firmly support the presence and expansion of *L. coeculus* and *T. javanicus* throughout European greenhouses since they are small-sized species and only females have been ever detected in Europe (Enghoff, 1975b; Tuf *et al.*, 2018). Other biological features such as high fertility, short development time and early maturity have been proposed to explain the ability of non-native millipedes and centipedes to survive in greenhouses (Golovatch, 2009; Tuf *et al.*, 2018).

It is also possible that the absence of seasonal variations in environmental conditions negatively affects native millipede species in greenhouses, as some temperate species are adapted to seasonal variations in light, temperature and humidity in order to complete their life cycle (Fujiyama, 1996; David *et al.*, 2003). Most of the non-native species coming from tropical areas have little potential to settle in the wild in Europe but some species from subtropical or temperate climates seem to spread into synanthropic habitats in Central Europe (Gilgado, 2020). This could be due to a lower number of competing species, absence of natural predators and parasites, etc. (Tilman, 1999). Thus, greenhouse managers should do their best to prevent the introduction of non-native soil-dwelling arthropods into their greenhouses and their later escape into the wild.

Regarding millipedes, the last comprehensive checklist for Switzerland made by Pedroli-Christen (1993) contains 127 taxa (125 species, two of them with two subspecies each), including those living indoors. Several new records have been made ever since: Bogyó *et al.* (2013) added *Polydesmus rupicursor* Verhoeff, 1907, Golovatch *et al.* (2001a) added *Amphitomeus attemsi*. Gilgado (2020) added *Cylindroiulus britannicus* (Verhoeff, 1891), *C. salicivorus*, *C. vulnerarius* (Berlese, 1888), *Heteroiulus intermedius* (Brölemann, 1892), *Anamastigona pulchella* (Silvestri, 1894b) and *Macrosterodesmus palicola* Brölemann, 1908. These records in the literature, added to the three new records in greenhouses reported in this study, result in a total of 136 millipede species for Switzerland. However, a revision is needed, because the validity of some of the species listed is discussed (Pedroli-Christen 1993). According to the checklist provided by Stöckli (2009), 62 centipede species have been reported from Switzerland (but precise data for two of them has not been published yet), although the author estimates that the number could reach 90 species for the country. The present study provides four new records for the Swiss

centipede fauna and adds seven species to the catalogue of centipedes able to live in Swiss greenhouses. Despite this progress, more centipede species could potentially be detected in further studies, for example *Polygonarea silvicola* Lawrence, 1955, *M. maxillaris*, *Pectiniunguis pauperatus* Silvestri, 1907 or *Lamyctes (Metalamyctes) africanus* (Porat, 1871), since they have been previously reported from other European greenhouses (Andersson *et al.*, 2005; Stoev *et al.*, 2010; Enghoff *et al.*, 2013; Dányi & Tuf, 2016; Iorio, 2016).

In conclusion, our work provides the first comprehensive list of millipedes and centipedes in Swiss heated greenhouses (Table 2). Our results show a high share of non-native species from different regions of the world and provides seven new records for Switzerland. Not all exotic species reported in greenhouses of other European countries were found, probably because the small number of greenhouses examined and/or prevention measures taken in Swiss greenhouses. The present work suggests that the managers of these greenhouses should keep working on the prevention of introduction of exotic invertebrates.

ACKNOWLEDGEMENTS

We are thankful to the greenhouse managers for allowing us to sample invertebrates, and to the gardeners for their assistance during sampling. We would like to specially thank Bruno Erny, David Meierhofer and Inayat Olmedo (Botanical Garden of the University of Basel); Michael Kessler, Peter Enz, René Stalder and Manfred Knabe (Botanical Garden of the University of Zurich), Damien Becker and Alain Mertz (Jurassica); Chantal Derungs and Nadja Fischer (Papillorama Kerzers); Hanspeter Schumacher (Botanical Garden of St. Gallen); Didier Roguet, Nicolas Freyre and Vincent Goldschmidt (Conservatory and Botanical Garden of Geneva); Alain Mueller and Christine Jakob (Botanical Garden of the University of Fribourg); Markus Fischer and Bill Juerg (Botanical Garden of the University of Bern); and Friederike von Houwald (Basel Zoo). We would like to express our gratitude to John Lewis for the taxonomical support and to Mihaela Ion and Carlos Martínez-Muñoz for providing us bibliographic material. We are thankful to Professor Bruno Baur for providing us with the contacts of several of these managers, for his advice when we prepared the sampling design, and for proofreading this manuscript. We also thank the two referees, Peter Decker and Carlos Martínez-Muñoz for their helpful comments on the manuscript. We are grateful to Edi Stöckli for helping in the preparation of the voucher collection for the Naturhistorisches Museum Basel. We are also thankful to the University of Basel for providing the funding for this research.

REFERENCES

- Andersson G., Meidell B., Scheller U., Djursvoll P., Budd G., Gärdenfors U. 2005. Mångfotingar – Myriapoda – Nationalnyckeln till Sveriges flora och fauna. *Art Databanken*, 351 pp.
- Attems C. 1907. Javanische Myriopoden gesammelt von Direktor K. Kraepelin im Jahre 1903. *Mitteilungen aus dem Naturhistorischen Museum in Hamburg* 2: 77-142.
- Attems C. 1929. Myriapoda. 1. Geophilomorpha - Das Tierreich. *De Gruyter, Berlin*. 52: 1-388.
- Attems C. 1938. Die von C. Dawydoff in Französisch Indochina gesammelten Myriopoden. *Mémoires du Muséum National d'Histoire Naturelle (N.S.)* 6: 334-340.
- Auerbach S.I. 1952. Taxonomic notes on an exotic centipede taken from Illinois. *Annals of the Entomological Society of America* 45: 413-414.
- Barber A.D. 2008. Key to the identification of British centipedes. *Field Study Council Occasional Publications*, 130: 96 pp.
- Barber A.D. 2009a. Littoral myriapods: a review. *Soil Organisms* 81(3): 735-760.
- Barber A.D. 2009b. Centipedes. Synopses of the British Fauna (New Series) No. 58. *Field Studies Council, Shrewsbury, United Kingdom*. 228 pp.
- Barber A.D. 2009c. Centipedes, millipedes & woodlice in the EDEN project. *Bulletin of the Peninsular Invertebrate Forum* 19: 1-4.
- Berlese A. 1888. Acari, Myriopoda et Scorpiones hucusque in Italia reperta. Volumen VI. Fasc. LI-LX. *Sumptibus Auctoris, Padova*, 10 pp.
- Bigler W. 1913. Die Diplopoden von Basel und Umgebung. *Revue suisse de Zoologie* 21: 675-793.
- Bogyó D., Vilisics F., Moretti M., Trivellone V. 2013. Isopoda and Diplopoda fauna of vineyards in Southeast-Switzerland. In: Abstract book of the 12th Central European Workshop on soil zoology in *České Budějovice, Czech Republic*, p. 14.
- Bollman C.H. 1893. The Myriapoda of North America. *Bulletin of the United States National Museum* 46: 1-210.
- Bonato L., Minelli A. 2010. The geophilomorph centipedes of the Seychelles (Chilopoda: Geophilomorpha). *Phelsuma* 18: 9-38.
- Bonato L., Zapparoli M. 2011. Chilopoda – geographical distribution. In: Minelli A. (Ed.), *Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda*, vol. 1. *Brill, Leiden-Boston*, pp. 327-337.
- Bonato L., Foddai D., Minelli A., Shelley R. 2004. The centipede order Geophilomorpha in the Hawaiian islands (Chilopoda). *Bishop Museum Occasional Papers* 78: 13-32.
- Bonato L., Cupul-Magana F.G., Minelli A. 2009. *Mecistocephalus guildingii* Newport, 1843, a tropical centipede with amphi-Atlantic distribution (Chilopoda: Geophilomorpha). *Zootaxa* 2271(1): 27-42.
- Bonato L., Minelli A., Lopresti M., Cerretti P. 2014. ChiloKey, an interactive identification tool for the geophilomorph centipedes of Europe (Chilopoda, Geophilomorpha). *ZooKeys* 443: 1-9.
- Bonato L., Chagas-Junior A., Edgecombe G.D., Lewis J.G., Minelli A., Pereira L.A., Shelley R.M., Stoev P., Zapparoli M. 2016. ChiloBase 2.0 - A World Catalogue of Centipedes (Chilopoda). Available at <http://chilobase.biologia.unipd.it> [last access on 12th July 2021].
- Braschler B., Gilgado J.D., Zwahlen V., Rusterholz H.P., Buchholz S., Baur B. 2020. Ground-dwelling invertebrate

- diversity in domestic gardens along a rural-urban gradient: Landscape characteristics are more important than garden characteristics. *PLoS one*, 15(10): e0240061.
- Brölemann H.W. 1889a. Contributions à la faune myriapodologique méditerranéenne. *Annales de la Société Linnéenne de Lyon* 35: 273-285.
- Brölemann H.W. 1889b. Contributions à la faune myriapodologique méditerranéenne. Trois espèces nouvelles. *Annales de la Société Linnéenne de Lyon* 36: 269-282.
- Brölemann H.W. 1892. Contributions à la faune myriapodologique méditerranéenne. Dix espèces nouvelles. *Annales de la Société Linnéenne de Lyon*, 29: 91-126.
- Brölemann H.W. 1902. Myriapodes du Musée de Sao Paulo. *Revista do Museu Paulista* 5: 35-237.
- Brölemann H.W. 1908. Description d'un genre nouveau et d'une espèce nouvelle de Myriapodes de France. *Bulletin de la Société entomologique de France* 1908(7): 94-96.
- Brölemann H.W. 1913. Un nouveau système de Spirobolides [Myriapoda. Diplopoda]. *Bulletin de la Société entomologique de France* 1913(19): 476-478.
- Brölemann H.W. 1920. Un nouveau Cryptops de France (Myriap.). *Bulletin de la Société d'Histoire Naturelle de Toulouse* 48: 9-13.
- Brölemann, H.W. 1930. Eléments d'une faune des myriapodes de France. Chilopodes. In: Lechevalier P. (ed.). Faune de France, vol. 25. *Imprimerie Toulousaine, Toulouse*, 405 pp.
- Chamberlin R.V. 1914. The Stanford Expedition to Brazil 1911 John C. Branner Director. The Chilopoda of Brazil. *Bulletin of the Museum of Comparative Zoology at Harvard College* 58: 151-221.
- Christian E. 1996. Die Erdläufer (Chilopoda: Geophilida) des Wiener Stadtgebietes. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich* 133: 107-132.
- Cook O.F. 1895. Introductory notes on the families of Diplopoda. In: Cook O.F., Collins G.N. (eds), The Craspedosomatidae of North America. *Annals of the New York Academy of Sciences* 9: 1-100.
- Cook O.F., Cook A.C. 1894. A Monograph of *Scytonotus*. *Annals of the New York Academy of Sciences* 8(1): 233-248.
- Cupul-Magaña F.G. 2011. Nueva distribución de *Lamyctes coeculus* (Brölemann, 1889) (Chilopoda: Lithobiomorpha: Henicopidae) en México. *Acta zoológica mexicana* 27(1): 197-200.
- Cupul-Magaña, F.G. 2015. Ciempiés (Myriapoda: Chilopoda) de las islas María Madre y María Cleofas, Archipiélago de las Islas Marias, Pacífico de México. *Boletín de la Sociedad Entomológica Aragonesa* 56: 335-338.
- Curtis J. 1845. Observations on the natural history and economy of the insects called wireworms, affecting the turnips, corn-crops, etc.; also of their parents the Elators or beetles, called skip-jacks, click-beetles, etc. *Journal of the Royal Agricultural Society of England* 5(1): 180-237.
- Damasiewicz A., Leśniewska M. 2020. *Tygarrup javanicus* (Chilopoda, Geophilomorpha) – an exotic species that has reached Poland. *Polish Journal of Entomology* 89(1): 52-58.
- Dányi L., Tuf I.H. 2016. Out of Africa: The first introduced African geophilomorph centipede record from a European greenhouse (Chilopoda: Geophilidae). *Zootaxa* 4067(5): 585-588.
- David J.F. 2015. Diplopoda–Ecology. In: Minelli A. (Ed.), Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda, vol. 2. *Brill, Leiden-Boston*, pp. 303-327.
- David J.F., Geoffroy J.J., Célérier M.L. 2003. First evidence for photoperiodic regulation of the life cycle in a millipede species, *Polydesmus angustus* (Diplopoda: Polydesmidae). *Journal of Zoology* 260(2): 111-116.
- De Geer C. 1778. Mémoires pour servir à l'histoire des insectes. Tome VII. *P. Hesselberg, Stockholm*, VI+950 pp.
- Decker M.P., Reip H.S., Voigtländer K. 2014. Millipedes and centipedes in German greenhouses (Myriapoda: Diplopoda, Chilopoda). *Biodiversity Data Journal* 2: e1066.
- Demange J.M. 1958. Sur quelque Myriapodes cavernicoles de France et de Suisse. *Revue suisse de Zoologie* 65: 843-855.
- Demange J.M. 1981. Contributions à l'étude de la faune terrestre des îles granitiques de l'archipel des Séchelles (Mission P.L.G. Benoit–J.J. Van Mol 1972). Myriapoda – Chilopoda. *Revue Zoologique Africaine* 95: 623-652.
- Dolejš P., Kocourek P., Hula V. 2019. *Cylindrodesmus hirsutus* Pocock, 1889 new for Czechia (Diplopoda: Polydesmida: Haplodesmidae). *Schubartiana* 8: 37-42.
- Donovan E. 1810. The Natural History of British Insects. 14. *F. & C. Rivington, London*, pp. 23-24, pl. 475.
- Dyachkov Y.V. 2020. New data on the scutigermorph and scolopendromorph centipedes (Chilopoda: Scutigermorpha: Scutigeridae; Scolopendromorpha: Scolopendridae, Cryptopidae) from Kazakhstan. *Arthropoda Selecta* 29(2): 173-184.
- Dyachkov Y.V., Nedoev K.K. 2021. A contribution to the centipede (Chilopoda: Geophilomorpha, Scolopendromorpha) fauna of Uzbekistan and Turkmenistan. *Ecologica Montenegrina* 41(1): 41-50.
- Eason E.H. 1982. A review of the north-west European species of Lithobiomorpha with a revised key to their identification. *Zoological Journal of the Linnean Society* 74(1): 9-33.
- Edgecombe G.D. 2004. *Remylamyctes*, a henicopid centipede from Madagascar and Réunion. *Zootaxa* 686(1): 1-11.
- Edgecombe G.D., Giribet G. 2003. A new blind *Lamyctes* (Chilopoda: Lithobiomorpha) from Tasmania with an analysis of molecular sequence data for the *Lamyctes-Henicops* Group. *Zootaxa* 152(1): 1-23.
- Edgecombe G.D., Giribet G. 2007. Evolutionary biology of centipedes (Myriapoda: Chilopoda). *Annual Review of Entomology* 52: 151-170.
- Enghoff H. 1975a. *Paraspirobolus dictyonotus* (Latzel, 1895), et væksthustusindben nyt for Danmark (Diplopoda, Spirobolida, Spirobolellidae). *Entomologiske Meddelester* 43: 17-20.
- Enghoff H. 1975b. Notes on *Lamyctes coeculus* (Brölemann), a cosmopolitan, parthenogenetic centipede (Chilopoda: Henicopidae). *Entomologica Scandinavica* 6: 45-46.
- Enghoff H. 2015. Diplopoda - Geographical distribution. In: Minelli A. (Ed.), Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda, vol. 2. *Brill, Leiden-Boston*, pp. 329-336.
- Enghoff H., Eason E.H. 1992. The lithobiomorph centipedes of the Canary Islands (Chilopoda). *Insect Systematics & Evolution* 23(1): 1-9.
- Enghoff H., Akkari N., Pedersen J. 2013. Aliquid novi ex Africa? *Lamyctes africanus* (Porath, 1871) found in Europe (Chilopoda: Lithobiomorpha: Henicopidae). *Journal of Natural History*, 47(31-32): 2071-2094.
- Enghoff H., Golovatch S., Short M., Stoev P., Wesener T. 2015. Diplopoda - taxonomic overview. In: Minelli A. (ed.). Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda, volume 2. *Brill, Leiden-Boston*, pp. 363-453.

- Fabricius J.C. 1798. Supplementum Entomologiae systematicae. *Proft and Storch, Hafniae [= Copenhagen]*, 572 pp.
- Fujiyama S. 1996. Annual thermoperiod regulating an eightyear life-cycle of a periodical diplopod, *Parafontaria laminata armigera* Verhoeff (Diplopoda). *Pedobiologia* 40: 541-547.
- Gervais P. 1836. Communications (*Julus lucifugus*). *Annales de la Société entomologique de France, Sér. 1*, 5: LV-LVI.
- Gervais P. 1837. Etudes pour servir à l'histoire naturelle des Myriapodes. *Annales des Sciences Naturelles, série 2* 7: 35-60.
- Gervais P. 1844. Etudes sur les Myriapodes. *Annales des Sciences Naturelles, Zoologie et Biologie Animale* 3: 51-80.
- Gervais P. 1847. Myriapodes. In: Walckenaer C.A., Gervais P. (eds). Histoire naturelle des Insectes Aptères. *Mémoires du Muséum national d'Histoire naturelle* 4: 1-57, 210-623.
- Gilgado J.D. 2020. Hidden in plain sight: six millipede species (Myriapoda: Diplopoda) new for the fauna of Switzerland. *Revue suisse de Zoologie* 127(2): 249-259.
- Gobbi M., Caccianiga M., Compostella C., Zapparoli M. 2020. Centipede assemblages (Chilopoda) in high-altitude landforms of the Central-Eastern Italian Alps: Diversity and abundance. *Rendiconti Lincei. Scienze Fisiche e Naturali* 31(4): 1071-1087.
- Golovatch S.I. 2009. Millipedes (Diplopoda) in extreme environments. In: Golovatch S.I., Makarova O.L., Babenko A.B., Penev L. (eds). Species and Communities in Extreme Environments. Festschrift towards the 75th Anniversary and a Laudatio in Honour of Academician Yuri Ivanovich Chernov. *Pensoft & KMK Scientific Press, Sofia-Moscow*, pp. 87-112.
- Golovatch S.I., Kime R.D. 2009. Millipede (Diplopoda) distributions: a review. *Soil Organisms* 81(3): 565-597.
- Golovatch S.I., Sierwald P. 2001 for 2000. Review of the millipede genus *Poratia* Cook & Cook, 1896 (Diplopoda: Polydesmida: Pyrgodesmidae). *Arthropoda Selecta* 9(3): 181-192 (for 2000).
- Golovatch S.I., Gruber J., Adis J., Knapinski S., Zerm M., Hansen B. 2000. Parthenogenetic populations of the millipede *Cylindrodesmus laniger* Schubart, 1945 to be recorded in Europe for the first time (Diplopoda: Polydesmida: Haplodesmidae). *Arthropoda Selecta* 9(3): 193-198.
- Golovatch S.I., Knapinski S., Adis J. 2001a. On the identity of the European hothouse millipede *Amphitomeus attemsi* (Schubart, 1934), with first biological observations of this parthenogenetic species (Diplopoda: Polydesmida: Oniscodesmidae). *Arthropoda Selecta* 10(2): 137-146.
- Golovatch S.I., Hoffman R.L., Knapinski S., Adis J. 2001b. Review of the millipede genus *Cylindrodesmus* Pocock, 1889 (Diplopoda: Polydesmida: Haplodesmidae). *Fragmenta Faunistica* 44(2): 179-201.
- Gregory S.J. 2021 *Brachyiulus lusitanus* Verhoeff, 1898 new for the UK from the Eden Project (Diplopoda: Julida: Julidae). *Bulletin of the British Myriapod & Isopod Group* 33: 63-67.
- Gregory S.J., Lugg K. 2020. Some recent observations of woodlice (Isopoda: Oniscidea), millipedes (Diplopoda) and centipedes (Chilopoda) from artificially heated glasshouses. *Bulletin of the British Myriapod & Isopod Group* 32: 35-43.
- Holzappel M. 1932. Die Gewächshausfauna des Berner botanischen Gartens. *Revue suisse de Zoologie* 39: 325-371.
- Iniesta L.F., Bouzan R.S., Rodrigues P.E., Almeida T.M., Ott R., Brescovit A.D. 2020. Ecological niche modeling predicting the potential invasion of the non-native millipede *Oxidus gracilis* (CLKoch, 1847) (Polydesmida: Paradoxosomatidae) in Brazilian Atlantic Forest. *Annales de la Société entomologique de France (NS)* No. 56(5): 387-394.
- Iorio E. 2016. Confirmation of the presence of *Lamyctes africanus* (Porath, 1871) in France (Chilopoda, Lithobiomorpha: Henicopidae). *Bulletin of the British Myriapod & Isopod Group* 29: 44-48.
- Khanna V. 2008. Fauna of Pin Valley National Park, Lahaul Spiti, Himanchal Pradesh (Chilopoda: Scolopendromorpha). *Fauna of Pin Valley National Park, Conservation Area Series* 34: 29-32.
- Kime R.D., Enghoff H. 2011. Atlas of European millipedes (Class Diplopoda), vol. 1: orders Polyxenida, Glomerida, Platydesmida, Siphonocryptidae, Polyzoniida, Callipodida, Polydesmida. *Fauna Europea invertebrata, Pensoft, Sofia-Moscow*, 282 pp.
- Kime R.D., Enghoff H. 2017. Atlas of European millipedes, vol. 2: order Julida (class Diplopoda). *European Journal of Taxonomy* 346: 1-299.
- Koch C.L. 1835-1844. Deutschlands Crustaceen Myriapoden und Arachniden. In: (Panzer) Herrich-Schaeffer's Deutschlands Insecten. *Pustet, Regensburg*.
- Koch C.L. 1847. System der Myriapoden mit den Verzeichnissen und Berichtigungen zu Deutschlands Crustaceen, Myriapoden und Arachniden [pp. 1-196]. In: Panzer K., Herrich-Schäffer A. (eds). Kritische Revision der Insectenfauna Deutschlands, III. Bändchen. *Pustet, Regensburg*, 270 pp.
- Kohlrausch E. 1881. Gattungen und Arten der Scolopendriden. *Archiv für Naturgeschichte* 47(1): 50-132.
- Kraus O. 1960. Myriapoden aus Peru, IX. *Senckenbergiana biologica* 41(3-4): 241-264.
- Latreille P.-A. 1816 for 1817. La quatrième classe des animaux articulés. Les insectes. In: Cuvier G. (ed). Le Règne Animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée, 3. Les crustacés, les arachnides et les insectes. *Déterville, Paris*, pp: 125-653.
- Latzel R. 1884. Die Myriapoden der Österreichisch-Ungarischen Monarchie. 2. Bd.: Die Symphylen, Pauropoden und Diplopoden. *Alfred Hölder, Wien*, 414 pp.
- Latzel R. 1895. Myriopoden aus der Umgebung Hamburgs. *Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten* 12: 99-109.
- Lawrence R.F. 1955. A revision of the centipedes (Chilopoda) of Natal and Zululand. *Annals of the Natal Museum* 13: 121-174.
- Leach W.E. 1814. Crustaceology. In: Brewster's Edinburgh Encyclopaedia 7(2): 383-437.
- Lee P. 2006. Atlas of the Millipedes (Diplopoda) of Britain and Ireland. *Pensoft, Sofia*, 216 pp.
- Lehtinen P.T. 1960. First records of *Geophilus carpophagus* Leach and *Lamyctes coeculus* Brol. (Chilopoda) from Finland. *Archivum Societatis zoologicae botanicae fennicae 'Vanamo'* 15: 103-105.
- Lewis J.G.E. 1999. On the genus *Cryptops* Leach in Nepal with redescription of *Cryptops australis* Newport and *C. doriae* Pocock (Chilopoda, Scolopendromorpha, Cryptopidae). *Senckenbergiana Biologica* 79: 19-38.
- Lewis J.G.E. 2007a. Scolopendromorph centipedes from Seychelles with a review of previous records (Chilopoda: Scolopendromorpha). *Phelsuma* 15: 8-25.

- Lewis J.G.E. 2007b. On *Cryptops doriae* Pocock from the wet tropical biome of the Eden Project, Cornwall (Chilopoda, Scolopendromorpha, Cryptopidae). *Bulletin of the British Myriapod & Isopod Group* 22: 12-16.
- Lewis J.G.E. 2010. Order Scolopendromorpha Pocock, 1895. In: Gerlach J. & Marusik Y. (Eds.), *The Arachnida and Myriapoda of the Seychelles Islands*. Siri Scientific Press, Manchester, pp. 379-386.
- Lewis J.G.E. 2013. A review of the species in the genus *Cryptops* Leach, 1815 from the Old World and the Australasian region related to *Cryptops (Cryptops) doriae* Pocock, 1891 (Chilopoda: Scolopendromorpha: Cryptopidae). *Zootaxa* 3683(1): 1-34.
- Lewis J.G.E., Rundle A.J. 1988. *Tygarrup javanicus* (Attems), a geophilomorph centipede new to the British Isles. *Bulletin of the British Myriapod Group* 5(1): 3-10.
- Linnaeus C. 1758. *Systema naturae*. Editio Decima. *Holmiae* 1: 824 pp.
- Lohmander H. 1923. Göteborgstraktens Myriopoder. *Göteborgstraktens Natur*, pp. 376-408.
- López-Bonel F., Ávila-Gaxiola C.P., Cupul-Magaña F.G. 2019. Ciempiés de Sinaloa, México (Myriapoda: Chilopoda): nuevos registros de especies y ampliación de su distribución estatal. *Dugesiana* 26(2): 79-85.
- Matic Z., Negrea S., Fundora Martínez C. 1977. Recherches sur les Chilopodes hypogés de Cuba. II. In: *Résultats des expéditions biospéologiques cubano-roumaines à Cuba, II*. Editura Academiei Republicii Socialiste Romania, București, pp. 277-301.
- Meinert F. 1868. Danmarks Scolopender og Lithobier. *Naturhistorisk Tidsskrift* (3)5: 241-268.
- Mitić B.M., Ilić B.S., Makarov S.E. 2012. First record of *Cryptops parisi* Brolemann, 1920 (Chilopoda: Scolopendromorpha: Cryptopidae) in Serbia. *Kragujevac Journal of Science* 34: 97-100.
- Nefediev P.S. 2019. New Records of geophilomorph centipedes (Chilopoda: Geophilomorpha) from natural and anthropogenic habitats of Siberia. *Fare Eastern Entomologist* 380: 23-28.
- Nefediev P.S., Tuf I.H., Farzalieva G.S. 2016. Centipedes from urban areas in southwestern Siberia, Russia (Chilopoda). Part 1. Lithobiomorpha. *Arthropoda Selecta* 25(3): 257-266.
- Negrea S., Matic Z. 1996. Contribution à la connaissance des lithobiomorphes (Chilopoda) de la région palestinienne. *Mémoires du Muséum national d'histoire naturelle* 169: 225-233.
- Negrea S., Matic Z., Fundora Martínez C. 1973. Recherches sur les chilopodes hypogés de Cuba (I). In: *Résultats des Expéditions Biospéologiques Cubano-Roumaines à Cuba, I*. Editura Academiei Republicii Socialiste Romania, București, pp. 233-239.
- Němec B. 1895. O nových českých Diplopodech. *Vestník Královské České Společnosti Nauk, Třída Mathematicko-Prírodovedecká* 38: 1-8.
- Newport G. 1843. On some new genera of the class Myriapoda. *Proceedings of the Zoological Society of London* 10(1842): 177-181.
- Newport G. 1844. A list of the species of Myriapoda order Chilopoda contained in the cabinets of the British Museum with synoptic descriptions of forty-seven new species. *Annals and Magazine of Natural History* 13: 94-101.
- Newport G. 1845. Monograph of the class Myriapoda order Chilopoda; with observations on the general arrangement of the Articulata. *Transactions of the Linnean Society of London* 19: 265-302, 349-439.
- Nguyen D.H., Tran T.T. B., Nguyen T.T.H., Dang Q.T.C., Le X.S. 2019. Diversity of centipedes (Chilopoda: Scolopendromorpha and Scutigermorpha) in Xuan Nha Nature Reserve, Son La province, Vietnam. *Can Tho University Journal of Science* 11(3): 75-82.
- Oba Y., Branham M.A., Fukatsu T. 2011. The terrestrial bioluminescent animals of Japan. *Zoological science* 28(11): 771-789.
- Peck S.B. 1990. Eyeless arthropods of the Galapagos Islands, Ecuador: Composition and origin of the cryptozoic fauna of a young, tropical, oceanic archipelago. *Biotropica* 22(4): 366-381.
- Pedroli-Christen A. 1993. Faunistique des mille-pattes de Suisse (Diplopoda) - Faunistik der Tausendfüßler der Schweiz (Diplopoda). *Documenta Faunistica Helveticae* 14: 1-167.
- Pocock R.I. 1887. On the classification of the Diplopoda. *Annals and Magazine of Natural History, ser. 5*, 20: 283-295.
- Pocock R.I. 1889. Arachnida, Myriapoda and Crustacea of the Christmas Island. *Proceedings of the Zoological Society of London* 1888: 556-564.
- Pocock R.I. 1891. On the Myriopoda of Burma. Part 2. Report upon the Chilopoda collected by Sig. L. Fea and Mr. E. W. Oates. *Annali del Museo Civico di Storia Naturale di Genova, ser. 2*, 10: 401-432.
- Pocock R.I. 1895. Chilopoda. Part CXXVI, signatures B-D [pp. 1-24, pls i-ii]. In: Godman F.D., Salvin O. (eds). *Biologia Centrali-Americana; or, Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America*. Zoology. Pocock R. I. (1895-1910): Volume 14. Chilopoda and Diplopoda. *Taylor & Francis, London*, 217 pp.
- Pocock R.I. 1896. Chilopoda. Part CXXVII, signatures E-F, [pp. 25-40, pl. iii]. In: Godman F.D., Salvin O. (eds). *Biologia Centrali-Americana; or, Contributions to the Knowledge of the Fauna and Flora of Mexico and Central America*. Zoology. Pocock R. I. (1895-1910): Volume 14. Chilopoda and Diplopoda. *Taylor & Francis, London*, 217 pp.
- Pocock R.I. 1901. LVII.—Some new Genera and Species of Lithobiomorphous Chilopoda. *Journal of Natural History* 8(47): 448-451.
- Porat C.O. 1871. Myriopoda Africae australis in Museo Regio Holmiensi asservata recensuit. Pars I. Chilopoda. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar* 28: 1135-1167.
- Porat C.O. 1889. Nya bidrag till skandinaviska halföns Myriapodologi. *Entomologisk Tidsskrift* 10: 33-48, 65-80, 113-148.
- Read H.J. 2008. Records of millipedes from Kew Gardens and the Eden Project, including descriptions of three species. *Bulletin of the British Myriapod and Isopod Group* 23: 27-35.
- Read H.J., Corbet G., Jones D. 2002. *Cylindroiulus salicivorus* Verhoeff 1908: a millipede new to Britain. *Bulletin of the British Myriapod and Isopod Group* 18: 41-44.
- Recuero E. 2018. The invasive species *Cylindrodesmus hirsutus* Pocock (Diplopoda: Polydesmida: Haplodesmidae) spreads to the northern Caribbean, with a compilation of published localities. *International Journal of Tropical Insect Science* 38(4): 299-302.

- Rosenberg J., Meyer-Rochow V.B. 2009. Luminescent myriapoda: A brief review. In: Meyer-Rochow V.B. (Ed.). *Bioluminescence in Focus - A Collection of Illuminating Essays. Research Signpost, Kerala, India*, pp. 139-146.
- Schileyko A.A. 2001. New data on chilopod centipedes of Vietnam. In: Korzun L.P. & Kalyakin M.V. (eds), Data on zoological and botanical studies in Vu Quang National Park (Ha Tinh Province, Vietnam). *Moscow - Hanoi*, pp. 417-414.
- Schileyko A.A. 2007. The scolopendromorph centipedes (Chilopoda) of Vietnam, with contributions to the fauna of Cambodia and Laos. Part 3. *Arthropoda Selecta* 16: 71-75.
- Schileyko A.A., Stoev P.E. 2016. Scolopendromorpha of New Guinea and adjacent islands (Myriapoda, Chilopoda). *Zootaxa* 4147(3): 247-280.
- Schubart O. 1934. Tausendfüßler oder Myriapoda. I: Diplopoda. In: Dahl F. (ed.), *Die Tierwelt Deutschlands* 28. *Fischer, Jena*, 318 pp.
- Shear W.A., Peck S.B. 1992. Centipeds (Chilopoda) and Symphyla of the Galapagos Islands, Ecuador. *Canadian Journal of Zoology* 70(11): 2260-2274.
- Silvestri P. 1894a. Chilopodi e diplopodi della Papuasias. *Annali del Museo Civico di Storia Naturale Giacomo Doria di Genova* 34: 619-658.
- Silvestri F. 1894b. Contribuzione alla conoscenza dei Chilopodi, Symphili, Pauropodi e Diplopodi dell'Umbria e del Lazio. *Bollettino della Società Romana per gli Studi Zoologici* 3(5-6): 191-201.
- Silvestri F. 1896b. I diplopodi. Parte I – Sistematica. *Annali del Museo Civico di Storia Naturale di Genova* 36: 121-254.
- Silvestri F. 1896a. Una escursione in Tunisia (Symphyla, Chilopoda, Diplopoda). *Il Naturalista siciliano, Nuova Serie* 15(8-12): 143-161.
- Silvestri F. 1907. Neue und wenig bekannte Myriopoden des Naturhistorischen Museums in Hamburg (1. Teil). *Mitteilungen aus dem Naturhistorischen Museum in Hamburg* 2: 229-257.
- Spelda J. 2005. Improvements in the knowledge of the myriapod fauna of southern Germany between 1988 and 2005 (Myriapoda: Chilopoda, Diplopoda, Pauropoda, Symphyla). *Peckiana* 4: 101-129.
- Stöckli E. 2009. Literature-based survey on the Swiss fauna of Chilopoda. *Soil Organisms* 81(3): 647-669.
- Stoev P., Zapparoli M., Golovatch S., Enghoff H., Akkari N., Barber A. 2010. Myriapods (Myriapoda). Chapter 7.2. *BioRisk* 4(1): 97-130.
- Tillier P. 2018. Contribution à la connaissance des Chilopodes d'Ile-de-France: première mention de *Lithobius (Lithobius) dentatus* CL Koch, 1844 et synthèse des connaissances régionales (Myriapoda Chilopoda). *L'Entomologiste* 74(2): 115-128.
- Tilman D. 1999. The ecological consequences of changes in biodiversity: a search for general principles. *Ecology* 80: 1455-1474.
- Titova L.P. 1981. Two new *Tygarrup* Chamb. (Chilopoda, Geophilida, Mecistocephalidae) from Indochina. *Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie* 85: 147-156.
- Tuf I.H., Mock A., Dvořák L. 2018. An exotic species spreads through Europe: *Tygarrup javanicus* (Chilopoda: Geophilomorpha: Mecistocephalidae) is reported from the Slovakia and the Czech Republic. *Journal of Asia-Pacific Entomology* 21(2): 560-562.
- Tsukamoto S., Hiruta S.F., Eguchi K., Liao J.R., Shimano S. 2021. A new amphibious species of the genus *Scolopendra* Linnaeus, 1758 (Scolopendromorpha, Scolopendridae) from the Ryukyu Archipelago and Taiwan. *Zootaxa* 4952(3): 465-494. DOI: 10.11646/zootaxa.4952.3.3
- Verhoeff K.W. 1891. Ein Beitrag zur mitteleuropäischen Diplopodenfauna. *Berliner entomologische Zeitschrift* 36(1): 115-166.
- Verhoeff K.W. 1907. Über Diplopoden. 7. (27.) Aufsatz: Europäische Polydesmiden. *Zoologischer Anzeiger* 32(12-13): 337-354.
- Verhoeff K.W. 1908. Über Diplopoden. 10. (30.) Aufsatz: Zur Kenntnis der Juliden und über einige Polydesmiden. *Archiv für Naturgeschichte* 73(1): 423-474.
- Vilisics F., Bogyó D., Sattler T., Moretti M. 2012. Occurrence and assemblage composition of millipedes (Myriapoda, Diplopoda) and terrestrial isopods (Crustacea, Isopoda, Oniscidea) in urban areas of Switzerland. *ZooKeys* 176: 199-214. DOI: 10.3897/zookeys.176.2153
- Voigtländer K., 2011. Chilopoda–Ecology. In: Minelli A. (ed.), *Treatise on Zoology-Anatomy, Taxonomy, Biology. The Myriapoda*, vol. 1. *Brill, Leiden-Boston*, pp. 309-325.
- Wilck L. 2000. Zur Morphologie, Artenidentität, Parthenogenese und Biologie von *Muyudesmus obliterated* Kraus 1960 sowie *Poratia digitata* (Porat, 1889) (Diplopoda: Polydesmida: Pyrgodesmidae) aus dem botanischen Tropenhaus Kiel und dem Amazonasgebiet. *Diploma thesis, Christian-Albrechts-Universität zu Kiel, Kiel*, 101 pp.
- Wittenberg R. (ed.). 2005. An inventory of alien species and their threat to biodiversity and economy in Switzerland. CABI Bioscience Switzerland Centre report to the Swiss Agency for Environment, Forests and Landscape. The environment in practice no. 0629. *Federal Office for the Environment, Bern*, 417 pp.
- Zapparoli M., Shelley R.M. 2000. The centipede order Lithobiomorpha in the Hawaiian Islands (Chilopoda). I. The epigeal fauna. Records of the Hawaii Biological Survey for 1999. *Bishop Museum Occasional Papers*, 63: 35-49.
- Zodinpuui B., Lalnuntluanga X., Lalthanzara H. 2019. Diversity of soil macroarthropods in shifting cultivation and forest ecosystem of Mizoram, Northeast India. *Journal of Applied and Natural Science* 11(3): 601-611.