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Tygarrup javanicus (Chilopoda, Geophilomorpha) – an exotic species that has reached Poland

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Abstract: For the first time in Poland, centipedes of a tropical species *Tygarrup javanicus* (Attems, 1907) (Geophilomorpha) were found in the hothouses with the tropical vegetation of the Botanical Garden in Wrocław. This Asian species has increasingly been reported from European greenhouses. Its spread is facilitated, among other factors, by small body size and parthenogenesis. In Poland one should also expect other exotic species which have already been found in neighbouring countries.

Key words: alien species, botanical garden, centipedes, tropical species

Introduction

Chilopoda are a group of predatory terrestrial arthropods living in the soil. They are found both in deep soil, as well as on the surface – in leaf litter, dead wood, under stones, bark, etc. Sometimes transported with the soil, even beyond their natural range of occurrence, centipedes may find conditions suitable for survival in a new place where they persist for a long time and even spread. Two species of centipedes introduced in this way to Poland were found recently: the Mediterranean species *Henia vesuviana* (Newport, 1844) (Leśniewska & Leśniewski 2008) and the Central and West European species *Haplophilus subterraneus* (Shaw, 1789) (Leśniewska & Wojciechowski 1992).

Ever since people have become aware of the dangers that alien species may pose to native faunas and floras, interest in environments such as greenhouses and hothouses among scientists has increased (Kenis & Branco 2010). The artificial habitats of greenhouses are invaded by species that are carried over accidentally along with exotic plants and soil. Soil animals, such as myriapods, including Chilopoda, are easily carried over by humans along with horticultural soil and plants. Artificial habitats of greenhouses provide them with ideal living conditions. Humidity and temperature (both of soil and air) – factors that are essential to myriapods – are usually high here, which is why many Myriapoda species prefer greenhouses (Lewis 1981, Voigtländer 2011). Food is also available, but there are almost no natural enemies. Given this situation, some species breed in great numbers. Alien species may try to get out and spread outside the greenhouse, but most often they do not succeed. The difference in climatic conditions between artificial and natural environments is often too great. Tropical species are not able to survive winter frosts or summer drought that may occur in temperate climates. Sometimes, however, alien species get out of greenhouses and if they find the right conditions, they become acclimatized, spread and can pose a threat to native fauna (Moszyński & Urbański 1932, Urbański 1950).

In addition to species carried over from other countries, native species also enter the greenhouses. They can wait out unfavourable conditions in the greenhouse or even inhabit it permanently. Oligochaetes, crustaceans, arachnids, myriapods, and snails are just a few examples of invertebrates that can be found in greenhouses (Moszyński & Urbański 1932).

In recent years, a number of studies

provide data on centipedes from European greenhouses (e.g. Enghoff 1975, Andersson *et al.* 2005, Barber 2005, 2009a, 2009b, Lee 2005, Lewis 2007, Geoffroy & Iorio 2009, Stoev *et al.* 2010, Decker & Hannig 2011, Decker *et al.* 2014, Tuf *et al.* 2018). The presence of tropical Chilopoda species introduced from various regions of the world has been reported from them. Polish hothouses and greenhouses have not previously been a subject of special studies on myriapods. It is only in the course of other research that centipedes, thus far always belonging to the native fauna, were occasionally caught (Kaczmarek 1979, 1980).

Since 2016, we have been conducting research on the Chilopoda of Polish greenhouses. In this work, we discuss a species found in Poland for the first time.

Material and methods

Centipedes were collected by hand from under bark, litter, stones and flowerpots in April, July and October 2018 in the greenhouses of the Botanical Garden in Wrocław, Poland.

The Botanical Garden of the University of Wrocław was founded in 1811 in a post-fortification area (approximately 5 ha). The origin of the collection is traced back to 427 plants. Currently, the area of the Garden covers 7.4 ha (and 0.33 ha under glass) and it is inhabited by approximately 7 500 species of greenhouse and soil plants (Mularczyk 2002).

Fig. 1. *Tygarrup javanicus* – female, habitus.

Fig. 2. *Tygarrup javanicus* – head capsule and first tergites.

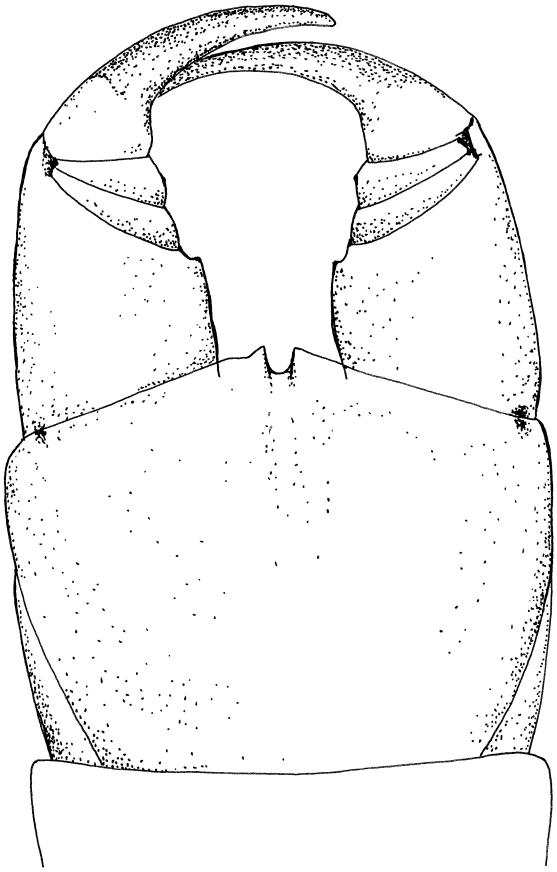

Fig. 3. *Tygarrup javanicus* – forcipules.

Fig. 4. *Tygarrup javanicus* – sternites.

Fig. 5. *Tygarrup javanicus* – female, posterior extremity, ventral.

Fig. 6. *Tygarrup javanicus* – female, posterior extremity, dorsal.

Photographs of specimens used in the work were taken by Laboratory of Electron and Confocal Microscopy (Faculty of Biology, Adam Mickiewicz University, Poznań).

Results

In the greenhouses with the tropical vegetation of the Botanical Garden in Wrocław, one of us (A.D.) collected 36 specimens (females) of *Tygarrup javanicus*. The species had not been recorded in Poland previously.

Tygarrup javanicus belongs to the family Mecistophalidae, so far represented in Poland by one native European species – *Dicellophilus carniolensis* (C. L. Koch, 1847). All the specimens of the newly recorded species fit redescriptions and illustrations by Titova 1983, Lewis & Rundle 1988, Bonato *et al.* 2004, Bonato & Minelli 2010. This species is easily distinguishable from all the known Chilopoda species in Poland. The characteristic features of *T. javanicus* include among others: small body – to 20 mm long, color – pale yellow with brownish-orange anterior end, number of leg pairs – 45 (Fig. 1). Head is longer than wide, cephalic capsule has a transverse suture (Fig. 2). Forcipular coxosternite, forcipular trochanteroprefemur and tibia have denticles (Fig. 3). Forcipular tarsungulum has no basal denticle (Fig. 3). Anteriormost 10 or 11 sternites have scattered pores medially. The median thickenings are present on sternites 2–16 (Fig. 4). Last sternite is subtriangular, subequally long and wide at base. Each coxopleuron has about 15 – 20 ventral and lateral pores and a pair of larger ones at edge of the sternite (Fig. 5, 6). However, smallest juveniles may have not coxal pores (Fig. 7). Anal pores are present.

Discussion

Thus far, the following centipede species have been reported from Polish greenhouses: *Geophilus electricus* (Linnaeus, 1758), *Geophilus flavus* (De Geer, 1778), *Lamyctes emarginatus* (Newport, 1844), *Lithobius forficatus* (Linnaeus, 1758), *Stenotaenia linearis* (C.L. Koch, 1835), *Strigamia crassipes* (C.L. Koch, 1835) (Kaczmarek 1979, 1980) and

Fig. 7. *Tygarrup javanicus* – terminal segments of a juvenile specimen, ventral.

in the course of our research *Cryptops hortensis* (Donovan, 1810), *Lithobius crassipes* L. Koch, 1862, *L. lapidicola* Meinert, 1872, *L. microps* Meinert, 1868, *Schendyla nemorensis* (C. L. Koch, 1837) (unpublished data). These species are commonly found in our country.

Tygarrup javanicus is a species recently frequently reported from greenhouses in Central Europe. It is a South Asian species, described from Java by Attems (1907). Then the species was also reported from Indochina (Attems 1938, 1953), Seychelles (Demange 1981, Bonato & Minelli 2010), Cambodia and Vietnam (Titova 1983) and the Hawaii Islands (Bonato *et al.* 2004.) *T. javanicus* was carried over to greenhouses in Great Britain (Lewis & Rundle 1988, Barber 2009b), Austria (Christian 1996), Germany (Decker *et al.* 2014), and also the Czech Republic and Slovakia (Tuf *et al.* 2018) (Fig. 8). The species was found recently in the hothouse of South Siberian Botanical Garden (Altai Krai) as new for Russia (Nefediev 2019).

Tuf *et al.* (2018) underline the adaptations that facilitate the species of Chilopoda not only to settle in greenhouses, but also to survive in these artificial conditions. These include small body sizes as well as parthenogenesis. The first of these features increases both the likelihood of transfer, even with a small amount of soil, as well as the possibility of hiding and surviving adverse conditions. Parthenogenesis makes it possible to generate a large population in a short time. The aforementioned authors (Tuf *et al.* 2018) also draw attention to the frequent instability of the population of centipedes carried over to the greenhouse due to the use of plant protection products that can deprive animals of life or food. Temperature and humidity changes outside the tolerance range of the species are also very unfavourable, because they can cause disturbances in the population size until its total extinction.

Our research covered several types of greenhouses, including greenhouses with decorative flowering plants, vegetables, mushrooms, etc. *T. javanicus* was caught only in greenhouses with tropical plants, where high humidity and air temperature are maintained throughout the year.

According to Kaczmarek (1979) Polish greenhouses are inhabited by native species of Chilopoda exclusively but tropical species are found among Diplopoda and Isopoda – groups that usually accompany centipedes in their natural habitats. According to this author (Kaczmarek 1979), it is easier to introduce and maintain herbivorous and saprophagous species of Diplopoda and Isopoda under artificial conditions (due to their stronger association with plants and slower movement) than predatory and fast centipedes.

It seems to us that the species we reported could have lived in Polish greenhouses for a long time. It is due to their small size that the chances of noticing them by accident were slim, and this was the nature of all the previous reports from Polish greenhouses.

However, possibly, the absence of previous

Fig. 8. Distribution of *Tygarrup javanicus* in European greenhouses (after Tuf *et al*. 2018, updated); the red dot – the Botanical Garden in Wrocław, Poland.

reports on the species that we found could be attributed to political and economic reasons. In the years when Kaczmarek conducted research (1950–1991), Poland belonged to the Council for Mutual Economic Assistance and therefore its trade relations were very limited. The fact that the species composition in our greenhouses is probably close to that of other similar European facilities can be attributed to the current opening of borders and extensive trade exchange. Thus it can be expected that Polish greenhouses are inhabited by other alien species, such as *Cryptops doriae* Pocock, 1891, *Lamyctes coeculus* (Brölemann, 1889), *L. africanus* (Porath, 1871), *Pectiniunguis pauperatus* Silvestri, 1907 or *Polygonarea silvicola* Lawrence, 1955 reported from other European greenhouses (e.g. Andersson *et al.* 2005, Stoev *et al.* 2010, Enghoff *et al.* 2013, Iorio 2016, Dányi & Tuf 2016, Decker *et al.* 2017).

The list of Chilopoda species in Poland can therefore be longer – it can include greenhouse species or other species carried over particularly to synanthropic habitats, as well as species living in less researched regions.

Newly found in Poland tropical species does not currently threaten the native centipede fauna, because it depends on high temperature and humidity throughout the year and in the Polish climate it would not be able to survive in winter outside the greenhouses.

Over several years of research conducted in the Wrocław Botanical Garden (Leśniewska 2012), *T. javanicus* has never been found outside of the greenhouses.

The species structure of Chilopoda in Polish greenhouses should be more thoroughly studied in the near future in order to assess possible threats to native fauna and to take necessary precautions.

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References

Andersson G, Meidell B, Scheller U, Djursvoll P, Budd G & Gärdenfors U. 2005. *Mångfotingar – Myriapoda – National-nyckeln till Sveriges flora och fauna.* Art Databanken, SLU, Uppsala, 351 pp.

Attems C. 1907. Javanische Myriapoden gesammelt von Direktor Dr. K. Kraepelin in Jahre 1903. *Mitteilungen aus dem Hamburgischen Zoologischen Museum*, 24: 77–142.

Attems C. 1938. Die von Dr. C. Dawydoff in Franzosisch Indochina gesammelten Myriopoden. *Memoirs du Museum National d'Histoire Naturelle Paris*, 2: 187–353.

Attems C. 1953. Myriopoden von Indochina, Expedition von Dr. C. Dawydoff (1938–1939). *Memoirs du Museum National d'Histoire Naturelle Paris Ser. A*, 5(3): 151–172.

Barber AD. 2005. Myriapods from the Eden Project, Cornwall. *British Myriapod and Isopod Group Newsletter*, 11: 1-2.

Barber AD. 2009a. Centipedes, millipedes and woodlice in the Eden Project. *Bulletin of the Peninsular Invertebrate Forum*, 19: 1–4.

Barber AD. 2009b. *Centipedes*. Synopses of the British Fauna (New Series). The Linnean Society of London, 58: 228 pp.

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, Minelli A. 2010. The geophilomorphs centipedes of the Seychelles (Chilopoda: Geophilomorpha). *Phelsuma* 18: 9–38.

Christian E. 1996. Die Erdläufer (Chilopoda, Geophilida) des Wiener Stadtgebietes. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Österreich*, 133: 107–132.

Dányi L, Tuf IH. 2016. Out of Africa: The first introduced African geophilomorphs centipede record from a European greenhouse (Chilopoda: Geophilidae). *Zootaxa*, 4067(5): 585–588. https://doi.org/10.11646/zootaxa.4067.5.6

Decker P, Hannig K. 2011. Checkliste der Hundert- und Tausendfüßer (Myriapoda: Chilopoda, Diplopoda) Nordrhein-Westfalens. *Abhand-lungen aus dem Westfälischen Museum für Naturkunde*, 73(1): 3–48.

Decker P, Reip HS, Voigtländer K. 2014. Millipedes and centipedes in German greenhouses (Myriapoda: Diplopoda, Chilopoda). *Biodiversity Data Journal*, 2: e1066. https://doi.org/10.3897/BDJ.2.e1066

Decker P, Wesener T, Spelda J, Lindner EN, Voigtländer K. 2017. Barcoding reveals the first record of *Lamyctes africanus* (Porath, 1871) in Germany (Chilopoda: Lithobiomorpha). *Bonn Zoological Bulletin*, 66(1): 3–10.

Demange JM. 1981. Contribution 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 de Zoologie Africaine*, 95(3): 623–652.

Enghoff H. 1975. Notes on *Lamyctes coeculus* (Brölemann), a cosmopolitic, parthenogenetic centipede (Chilopoda, Henicopidae). *Entomologica Scandinavica*, 6: 45–46. https://doi.org/10.1163/187631275X00334

Enghoff H, Akkari N, Pedersen J. 2013. Aliquid novi ex Africa? *Lamyctes africanus* (Porath, 1871) found in Europe (Chilopoda: Lithobio-morpha: Henicopidae). *Journal of*

Natural History, 47(31–32): 2071–2094. https://doi.org/10.1080/00222933.2012.763062

Geoffroy J, Iorio E. 2009. The French centipede fauna (Chilopoda): updated checklist and distribution in mainland France, Corsica and Monaco. *Soil Organisms*, 81(3): 671–694.

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.

Kaczmarek J. 1979. *Pareczniki (Chilopoda) Polski*. UAM Poznań, Seria Zoologia, 9: 99 pp.

Kaczmarek J. 1980. *Pareczniki (Chilopoda) Polski. Katalog Fauny Polski*. PWN, Warszawa, 36: 43 pp.

Kenis M, Branco M. 2010. Impact of alien terrestrial arthropods in Europe. In: Roques A, Kenis M, Lees D, Lopez-Vaamonde C, Rabitsch W, Rasplus J & Roy D. (Eds). *Alien terrestrial arthropods of Europe*. BioRisk 4(1): 51–71. https://doi.org/10.3897/biorisk.4.42

Lee P. 2005. A definite new British species from Kew (and Sheffield). *British Myriapod and Isopod Group Newsletter*, 11: 2.

Leśniewska M. 2012. *Morphological Anomalies of Haplophilus subterraneus (Shaw, 1794) (Chilopoda: Geophilomorpha)*. Kontekst, Poznań, 207 pp.

Leśniewska M, Leśniewski P. 2008. First record of *Henia* (*Chaetechelyne*) *vesuviana* (Newport, 1845) (Chilopoda: Geophilida) in Poland. *Schubartiana*, 8: 1–4.

Leśniewska M, Wojciechowski J. 1992. *Haplophilus subterraneus* (Shaw, 1794) (Chilopoda, Geophilomorpha) – nowy dla fauny Polski przedstawiciel pareczników. *Przegląd Zoologiczny*, 37: 133–136.

Lewis JGE. 1981. The biology of centipedes. *Cambridge University Press*, 476 pp.

Lewis JGE. 2007. On Cryptops doriae Pocock, from the wet tropical biome of the Eden Project, Cornwall (Chilopoda, Scolopendroorpha, Cryptopidae). *Bulletin of the British Myriapod and Isopod Group*, 22: 12–16.

Lewis JGE, Rundle AJ. 1988. *Tygarrup javanicus* (Attems), a geophilomorphs centipede new to the British Isles. *Bulletin of the British Myriapod Group*, 5: 3–5.

Moszyński A, Urbański J. 1932. Étude sur la faune des serres de Poznań (Pologne). *Bulletin Biologique de la France et de la Belgique*, Paris 1: 45–76.

Mularczyk M. 2002. Ogród Botaniczny Uniwersytetu Wrocławskiego. In: Łukasiewicz A, Puchalski J. (Eds). *Ogrody botaniczne w Polsce*. Fundacja Homo et Planta, Warszawa, pp. 39–49.

Nefediev PS. 2019. New Records of geophilomorph centipedes (Chilopoda: Geophilomorpha) from natural and anthropogenic habitats of Siberia. *Fare Eastern Entomologist*, 380: 23–28. https://doi.org/10.25221/fee.380.4

Stoev P, Zapparoli M, Golovatch SI, Enghoff H, Akkari N, Barber AD. 2010. Myriapods (Myriapoda). Chapter 7.2. In: Roques A, Kenis M, Lees D, Lopez-Vaamonde C, Rabitsch W, Rasplus J, Roy D. (Eds). *Alien terrestrial arthropods of Europe*. BioRisk, Pensoft, 4(1): 97–130. https://doi.org/10.3897/biorisk.4.51

Titova LP. 1983. 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 IH, Mock A, Dvořák L. 2018. An exotic species spreads through Europe: *Tygarrup javanicus* (Chilopoda: Geophilomorpha: Mecistocephalidae) is reported from the Slovakia and the Czech Republik. *Journal of Asia-Pacific Entomology*, 21: 560–562. https://doi.org/10.1016/j.aspen.2018.03.004

Urbański J. 1950. Fauna Cieplarni. *Wszechświat*, 4: 103–109.

Voigtländer K. 2011. Chilopoda – Ecology. Lifeforms and ecological strategies. In: Minelli A. (Ed.). *Treatise on Zoology – Anatomy, Taxonomy, Biology. The Myriapoda. Vol. 1.* Leiden & Boston, Brill, pp. 309–32.