



Occurrence of the greenhouse camel cricket *Tachycines asynamorus* Adelung, 1902 (Orthoptera: Rhaphidophoridae) in Poland

Przemysław ŻURAWLEW^{1*}, Robert ROZWALKA² and Michał BRODAKCI^{3,4}

¹The Orthoptera of Poland Project, Żbiki 45, 63–304 Czermin, Poland, ORCID 0000-0001-8043-7883,
e-mail: grusleon@gmail.com (*corresponding author)

²Department of Zoology and Animal Ecology, University of Life Sciences in Lublin, Akademicka 13, 20-950 Lublin,
Poland, ORCID 0000-0002-5631-395X, e-mail: arachnologia@wp.pl

³The Orthoptera of Poland Project, Poland

⁴Towarzystwo Badań i Ochrony Przyrody, Sienkiewicza 68, 25-501 Kielce, Poland, e-mail: m.brod@wp.pl

Abstract: The greenhouse camel cricket *Tachycines asynamorus* is an insect of the order Orthoptera, native to Eastern Asia. It was introduced to Europe and North America at the end of the 19th century, probably along with exotic plants imported to botanical gardens, orangeries, and horticultural farms. In the climatic conditions of Central and Northern Europe this insect is exclusively synanthropic, occurring mainly in greenhouses, hothouses, and other permanently heated rooms with high humidity. In Poland, the species has been reported in 24 sites since the beginning of the 20th century. No specific information confirming its occurrence in the country after 1984 has been found in the literature. The search for the greenhouse camel cricket conducted by the authors, along with responses to surveys sent out to scientific institutions and naturalists requesting reports of sightings of the species, enabled us to establish that in 1991–2022 *T. asynamorus* occurred in Poland at 12 sites, mostly in greenhouses in botanical gardens and in aquaria and terraria buildings in zoological gardens. The presence of the species was confirmed at only one site known from the literature.

Key words: Ensifera, *Diestrammena asynamora*, synanthropic insect, distribution, Europe

INTRODUCTION

The greenhouse camel cricket *Tachycines asynamorus* Adelung, 1902 (Figs 1–3) is an orthopteran insect of the suborder Ensifera and family Rhaphidophoridae. It is probably native to the warmer regions of Eastern Asia, from where it was brought with shipments of exotic plants to Europe and North America in the late 19th century (Boettger 1950, Pawłowski 2012). It does not form populations in the wild in the climatic conditions of Central and Northern Europe. It inhabits greenhouses and hothouses in botanical and zoological gardens, palm houses, orangeries, and horticultural farms, and sometimes other rooms that are heated all year round (Pawłowski 2012, Epps et al. 2014, Bellmann et al. 2019).

In Poland, *T. asynamorus* was found for the first time in the early 20th century in Pruszcz Gdański (Lakowitz 1901, Dickel 1905) and Wrocław (Zacher 1907). Subsequent records came from Bielsko-Biała, Gdańsk, Katowice, Poznań, Prószków, Szczawno-Zdrój, Toruń, Wałbrzych and Zielona Góra (Herold 1913, Zacher 1917, Pax 1920, Werner 1921, Simm 1926a, b, Szulczewski 1926, Gruhl 1929). Despite the destruction by World War II, which resulted in the disappearance of many European populations of this species (Boettger 1950), *T. asynamorus* was found after 1945 in Wrocław, Krynica-Zdrój, Opole and a number of other places (Kapuściński 1951, Bazyluk 1955, 1956, Bednarz 1957, Gołaszewska 1977, Grajek 1980, Kwiatkowska 1980, Bazyluk & Liana 2000, Pawłowski 2012). In total, since the beginning of the 20th century *T. asynamorus* has been reported at 24 sites within 22 localities (cities, towns and villages) in Poland (Table 1, Fig. 4).

Since no specific information has been found in the literature regarding the occurrence of the greenhouse camel cricket in Poland after 1984, the aim of this study was to verify the occurrence and persistence of *T. asynamorus* in this country.



Figs 1–3. Greenhouse camel cricket *Tachycines asynamorus*: 1 & 3 – male, 2 – female; Institute of Plant Protection – National Research Institute, library basements, Poznań, Poland, 21 October 2021. Photo by Tomasz Klejdysz.

MATERIAL AND METHODS

The authors searched visually for living and dead camel crickets in the greenhouses of botanical and zoological gardens and in horticultural farms. In parallel, questionnaires were sent out to scientific and educational institutions, as well as individual naturalists, requesting reports on sightings of *T. asynamorus*, and announcements were made in the press and social media about the search for this species. In total, three out of the 24 sites mentioned in the literature, as well as 34 sites from which the insect had not been reported before were inspected. In the results, we also included unpublished information on the occurrence of the camel cricket in Poland in early 1990s contained in the survey responses from 1994 addressed to the late Professor Anna Liana, made available to us by the staff of the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw, Poland.

RESULTS

On the basis of our own studies and the returned questionnaires it was established that in 1991–2022 *T. asynamorus* occurred in Poland at 12 sites out of 37 inspected (Table 2). Eight of them were greenhouses in botanical gardens and buildings with aquaria and herpetaria in zoological gardens. *T. asynamorus* was also found in basements (mostly adjacent to greenhouses), as well as in a fruit and vegetable store and an office building. At four sites (botanical gardens in Kraków and Wrocław, Zoological Garden in Wrocław and an office

building in Poznań) numerous (up to 100) individuals were found. At the remaining sites single or up to several individuals were recorded.

The presence of *T. asynamorus* was not confirmed at the former (mentioned in the literature) localities in Poznań (the Palm House, J. Chrzanowska, M. Michlewicz, A. Pospieszna, P. Szwejkowski, pers. comm.) and Zielona Góra (the Palm House, R. Orzechowski, pers. comm.). The insect was also not found in the following places from which it has been never reported in the past: the Botanical Garden in Łódź (J. Nowak, pers. comm.), the palm houses in Gliwice (B. Trzebińska, pers. comm.), Inowrocław (P. Żurawlew) and Książ (T. Jackiewicz, pers. comm.), Zoological Garden in Zamość (R. Rozwałka), Orchid House in Łañcut (R. Rozwałka), Botanical Garden in Warsaw (R. Rozwałka) and 16 other sites: horticultural farms, ornamental plant greenhouses, etc. (R. Rozwałka).

Table 1. Published records of *Tachycines asynamorus* in Poland; * – the year was determined on the basis of the label of the evidence specimen kept in the collection of the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw, Poland.

Site number	Locality	Region according to the Catalogue of the Fauna of Poland (Bazyłuk & Liana 2000)	UTM grid square	Year(s) of observation	Source(s)
1	Bielsko-Biała	Western Beskid Mts	CA62	1925	Simm 1926a, b
2	Gdańsk	Baltic Coast	CF42	1917 or before	Zacher 1917
3	Katowice	Upper Silesia	CA56	1925	Szulczewski 1926
4	Kraków	Kraków-Wieluń Upland	DA24	2012 or before	Pawłowski 2012
5	Krynica-Zdrój	Western Beskid Mts	DV97	1956 or before	Bazyłuk 1956
6	Krzyszowice	Kraków-Wieluń Upland	DA05	1948	Kapuściński 1951
7	Krzyż Wielkopolski	Wielkopolska-Kujawy Lowland	WU65	1979	Kwiatkowska 1980
8	Księginice ad Trzebnica	Trzebnickie Hills	XS48	1950s	Bednarz 1957
9	Opole	Lower Silesia	YS01	1956 or before	Bazyłuk 1956
10	Ostrów Wielkopolski	Wielkopolska-Kujawy Lowland	XT92	1956 or before	Bazyłuk 1956
11	Piastów (presently Psary) ad Wrocław	Lower Silesia	XS47	1950s	Bednarz 1957
12	Poznań	Wielkopolska-Kujawy Lowland	XU20	1917 or before, 1926, 1950s	Zacher 1917, Szulczewski 1926, Moszyński & Urbański 1932, Bednarz 1957
13	Prószków	Lower Silesia	YS00	1917 or before	Zacher 1917
14	Pruszcz Gdański	Pomeranian Lakeland	CF41	1901 or before, 1905 or before	Lakowitz 1901, Dickel 1905
15	Sobótka ad Ostrów Wielkopolski	Wielkopolska-Kujawy Lowland	XT94	1979	Grajek 1980
16	Szczawno-Zdrój	Western Sudety Mts	WS82	1921 or before	Werner 1921
17	Toruń	Wielkopolska-Kujawy Lowland	CD37	1913 or before, 1922	Herold 1913, Simm 1926a, b
18	Wałbrzych	Western Sudety Mts	WS92	1917 or before, 1953	Zacher 1917, Bednarz 1957
19	Warszawa	Mazovian Lowland	EC08	1984*	Bazyłuk & Liana 2000
20, 21	Wrocław (at least 2 sites)	Lower Silesia	XS46	1907 or before, 1915 or before, 1920 or before, 1952–1956	Zacher 1907, Moser 1915, Pax 1920, Bednarz 1957
22	Ząbkowice Śląskie	Lower Silesia	XS20	1957 or before	Bednarz 1957
23, 24	Zielona Góra (at least 2 sites)	Wielkopolska-Kujawy Lowland	WT35	1929, 1975, 1977	Gruhl 1929, Gołaszewska 1977

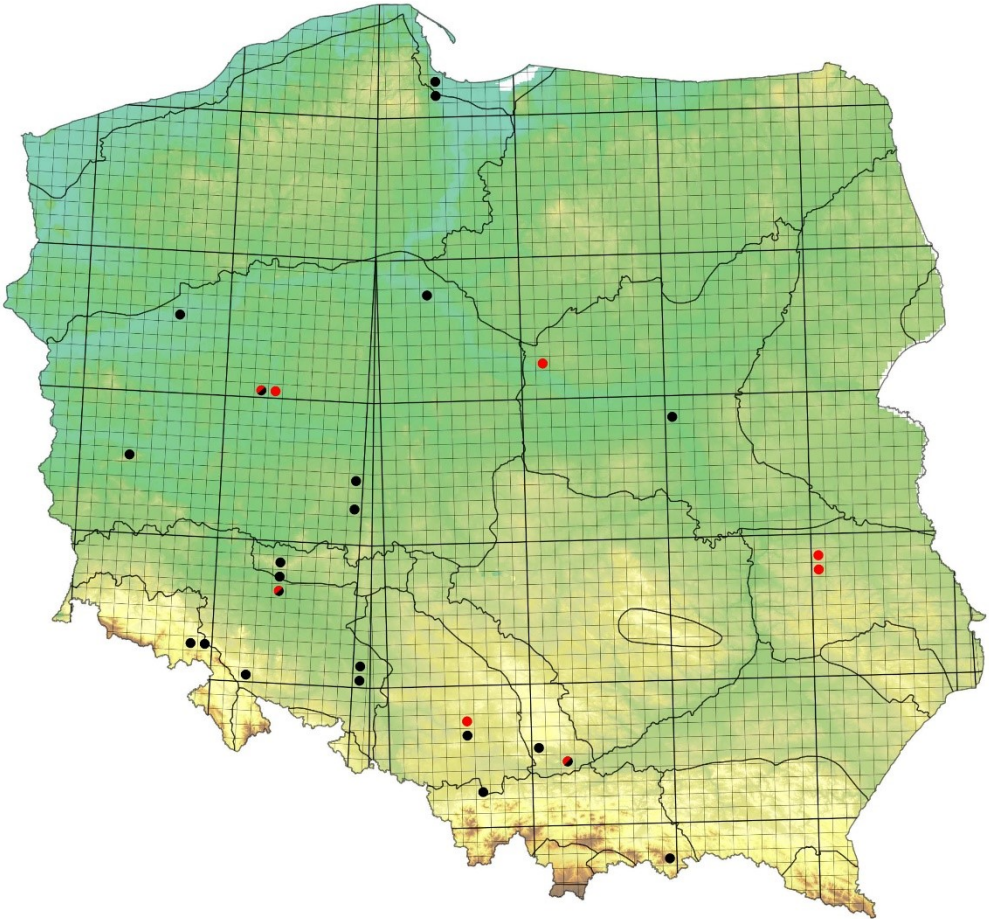


Fig. 4. Distribution of *Tachycines asynamorus* in Poland in the UTM (Universal Transverse Mercator coordinate system) grid: black circles – published records, red circles – new records, black and red circles – published and new records. The circles represent single or multiple sites of occurrence (listed in Tables 1 and 2) within 10×10 km squares of the grid.

DISCUSSION

The genus *Tachycines* Adelung 1902 includes more than 90 species of camel crickets inhabiting Southeast and East Asia, especially China (Cigliano et al. 2022). They are mostly troglobionts or troglaphiles found in cave environments. They feed on organic debris such as bat droppings and arthropod remains (Qin et al. 2018, Zhou & Yang 2020, Zhu et al. 2020).

T. asynamorus is most likely native to Southern China within the monsoon climate zone (Pawłowski 2012). It has spread over a large area of the Holarctic, along with exotic plants brought to botanical gardens, palm houses, conservatories and greenhouses (Epps et al. 2014, Bellmann et al. 2019). It is currently reported in several regions of China, Korea, Japan, Europe and North America (Qin et al. 2018). In Europe, the species was first found in 1891 in Prague (Krejčí 1897) and 1892 in Hamburg (Kraepelin 1901), and in the USA in 1898 (Rehn 1944), although it was not correctly identified in these earliest reports (Boettger 1950). A formal description of the species was made by Adelung (1902) based on specimens collected in a palm house in St. Petersburg, where *T. asynamorus* was already present around 1896 (Adelung 1902).

Table 2. Unpublished records of *Tachycines asynamorus* in Poland in the years 1991–2022; * – perhaps the same locality which Pawłowski (2012) listed as Kraków without giving details.

Site number	Locality	Region according to the Catalogue of the Fauna of Poland (Bazyluk & Liana 2000)	UTM grid square and geographical localisation	Site of occurrence	Year(s) of observation	Abundance	Source of information
1	Chorzów	Upper Silesia	CA57, 50.280348 N, 18.994288 E	Silesian Zoological Garden, rooms with aquariums, reptiles and amphibians	2009–2019	one to several individuals recorded regularly	K. Koźlik
2	Kraków	Kraków-Wieluń Upland	DA24, 50.065106 N, 19.924966 E	University of Agriculture, cellars by greenhouses	1991–2020	small number of individuals recorded regularly	P. Zięba*
3	Kraków	Kraków-Wieluń Upland	DA24 50.063596 N 19.956531 E	Botanical Garden of the Jagiellonian Univ., palm house	1994	not specified	B. Baran via A. Liana
				Botanical Garden of the Jagiellonian Univ., greenhouses and cellars	2018–2019	many individuals	K. Kapala & P. Adamczyk
4	Płock	Mazovian Lowland	DD12, 52.537335 N, 19.698794 E	Zoological Garden, building with reptiles and amphibians, aquarium breeding facilities	2000–2019	most often single individuals, maximum seven specimens simultaneously	I. Postolska
5	Poznań	Wielkopolska-Kujawy Lowland	XU20, 52.419999 N, 16.881944 E	Botanical Garden of Adam Mickiewicz Univ., greenhouses	1991	not specified	A. Łukasiewicz via A. Liana
6	Poznań	Wielkopolska-Kujawy Lowland	XU30, 52.411076 N, 16.921118 E	Military Infrastructure Board, heated office buildings	ca. 1995	many individuals	P. Szwejkowski
7	Poznań	Wielkopolska-Kujawy Lowland	XU20, 52.396707 N, 16.854835 E	Institute of Plant Protection – National Research Institute, library basements	2021	1♂, 1♀	T. Klejdysz
8	Lublin	Lublin Upland	FB07, 51.242948 N, 22.540743 E	Faculty of Biology and Biotechnology, Maria Curie-Skłodowska Univ., greenhouses	ca. 2005–2006	1 individual	Anonymous
9	Lublin	Lublin Upland	FB07, 51.245987 N, 22.544053 E	M. Curie-Skłodowska Street, a fruit and vegetable shop	ca. 2006–2007	1 individual (dead)	R. Rozwałka
10	Lublin	Lublin Upland	FB08, 51.263409 N, 22.513245 E	Botanical Garden, greenhouses	2019–2021	ca. 30 individuals on an insect glue and the paper trap on 25 Feb 2019, and the greenhouses observed in the later period	R. Rozwałka and the employees of the houses
				Zoological Garden	2002	1♂, 2♀♀	J. Czerniel
11	Wrocław	Lower Silesia	XS46, 51.104270 N, 17.072400 E	Zoological Garden, new aquarium building	2008–2009	numerous individuals	P. Bielak-Bielecki
				Zoological Garden, building with primates	2012	ca. 30 individuals	M. Michlewicz
				Zoological Garden, old aquarium building	2019–2020	one hundred individuals	M. Graczyk
12	Wrocław	Lower Silesia	XS46, 51.116320 N, 17.045857 E	Botanical Garden, greenhouses	2019, 2022	numerous individuals	P. Fedorow, R. Rozwałka

Soon afterward the species was recorded in Belgium (Adelung 1902), Denmark (Boas 1906), Austria (Feigl 1909), France (Chopard 1913), Great Britain (Burr 1913), Hungary (Chopard 1914), and other countries (Boettger 1950, Skejo et al. 2018). In many places, such as the British Isles (Marshall & Haes 1988), the United States (Epps et al. 2014), the Netherlands (Kleukers & Niuwenhuis 2016), and Russia (EnglishRussia 2022), the extent of its expansion was remarkable. It is currently recorded in most European countries, but occurs in scattered localities, mainly in large cities (e.g. Pawłowski 2012, Kočárek et al. 2013, Zuna-Kratky et al. 2017, Bellmann et al. 2019, Fischer et al. 2020, iNaturalist 2022, Krištín et al. 2022, Norwegian Biodiversity Information Centre 2022).

T. asynamoros feeds primarily on snails, small earthworms and other terrestrial invertebrate prey, rarely supplementing its diet with plant food such as soft fruit parts. Its presence does not cause negative effects to plants, and due to its predation on harmful snails and other invertebrates it may be useful for horticulture (Boettger 1950, Bednarz 1957). Under suitable habitat conditions (moist, dark places) and thermal conditions (year-round high temperatures), and with an abundance of food, *T. asynamoros* can increase its numbers very rapidly (Boettger 1950, Bednarz 1957, Epps et al. 2014). In the greenhouse of the Botanical Garden Bratislava the population density reaches locally over 10 individuals/m² (Krištín et al. 2022).

In Poland up until the 1950s, *T. asynamoros* formed very numerous populations (up to 2000 individuals) in the greenhouses of some botanical gardens, e.g. in Bielsko-Biała, Toruń and Wrocław (Herold 1913, Simm 1926a, b, Bednarz 1957). After 1960 this species began to disappear from many known sites. The widespread use of chemical plant protection products in greenhouses was suggested as a cause (Bazyłuk & Liana 2000, Pawłowski 2012). Despite this, new localities of this insect were reported up to the 1980s (Gołaszewska 1977, Grajek 1980, Kwiatkowska 1980, Bazyłuk & Liana 2000) (Table 1).

As shown by our study, the greenhouse camel cricket has persisted in Poland throughout subsequent decades. In the years 1991–2022 it has been observed, sometimes in large numbers (up to 100 individuals), at 12 sites within 6 cities. Only one site was reported earlier in the literature (out of three examined): the botanical garden in Wrocław. However, *T. asynamoros* had not been recorded there for over 60 years, so it cannot be ascertained whether it had persisted there continuously for several decades. It may have been overlooked, but it is also possible that the populations recorded there in the 1950s (Bednarz 1957) went extinct (perhaps due to chemical plant protection chemicals) and later on a subsequent accidental introduction gave rise to new populations. The persistence and dynamics of greenhouse camel cricket populations in Poland requires further, long term study.

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STRESZCZENIE

[Występowanie śpieszka cieplarnianego *Tachycines asynamor* Adelung, 1902 (Orthoptera: Rhaphidophoridae) w Polsce]

Śpieszek cieplarniany *Tachycines asynamor* jest owadem z rzędu Orthoptera, pochodzącym z Azji Wschodniej. Do Europy i Ameryki Północnej został wprowadzony pod koniec XIX wieku, prawdopodobnie wraz z egzotycznymi roślinami sprowadzonymi do ogrodów botanicznych, oranżerii i gospodarstw ogrodniczych. W warunkach klimatycznych Europy Środkowej i Północnej jest to gatunek wyłącznie synantropijny, występujący głównie w szklarniach i innych stale ogrzewanych pomieszczeniach o dużej wilgotności. W Polsce od początku XX wieku gatunek notowany był na 24 stanowiskach. W literaturze brak było informacji potwierdzających jego występowanie w Polsce po 1984 roku. Przeprowadzone przez autorów poszukiwania tego gatunku oraz odpowiedzi na ankiety wysłane do instytucji naukowych i indywidualnych przyrodników pozwoliły ustalić, że w latach 1991–2022 *T. asynamor* występował w Polsce na 12 stanowiskach. Większość z nich to szklarnie w ogrodach botanicznych oraz budynki z akwariami i herpetariami w ogrodach zoologicznych. Obecność gatunku potwierdzono tylko na jednym stanowisku znanym z literatury.