

Threats to a rare European spider species, *Tetragnatha reimoseri* (Araneae: Tetragnathidae), and fishponds as an alternate habitat

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## Abstract

*Tetragnatha reimoseri* is a European spider species recorded thus far in only a few sites in Middle and Eastern Europe. It has been listed in red books of extinct and endangered species in Belgium, Germany and Poland. In the last decade, this species was discovered in new sites in eastern Poland, thus extending the previously known range farther to the northeast. The dispersion of *T. reimoseri* in Middle Europe is likely associated with global warming as with *Argiope bruennichi*, but suitable habitats are limited. *T. reimoseri* may have been more widespread during warmer periods in European history, but its range has likely become restricted due to climatic changes and human environmental impacts. This species has specific habitat requirements since it primarily inhabits sedge rushes and peatland moss-sedge communities. Land reclamation, eutrophication and intensive agricultural management, all of which lead to habitat destruction, are considered the most important threats to *T. reimoseri*. Since the natural habitats of this species are disappearing, extensively used fishponds might serve as a substitute habitat for the species. Most likely a stable population of *Tetragnatha reimoseri* has been occurred in a projected nature reserve “Stawy Siedleckie” on South Podlasie Lowland since 1998.

## Key words

Spiders, endangered species, aquatic and peatland habitats, substitute habitats, fishponds, distribution, threats, protection, *Tetragnatha reimoseri*.

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## Introduction

*Tetragnatha reimoseri* is a European spider (Platnick 2007) whose scarcity is evident in its limited geographic range, the small size of local populations and specific habitat requirements. This scarcity explains why the spider was placed in red books of extinct and endangered species in Belgium, Germany and Poland (Platen et al. 1996, 1999, Maelfait et al. 1998, Staręga et al. 2002).

Until recently, *T. reimoseri* was known to exist in only a few sites in Middle and Eastern Europe. One or more sites have been identified in the Netherlands (Tutelaers 2001), Belgium (Janssen 1994), Austria (Nemenz 1967), Hungary (Szinetár 1995, 2000, 2001) and in the Danube Delta of Romania – (Rosca 1939; Vasiliu 1968; Vasiliu 1970; Blick et al. 1993; Weiss et al. 1998). In Germany 19 sites are known in the northeastern part of the country (Crome 1954; a review in: Staudt 2007) (Fig. 1). In Poland *T. reimoseri* has also been found in several sites: five in Wielkopolska Lowland (Dziabaszewski 1974, 1978, 1989; Szymkowiak 1993 and unpubl.), two in Podlasie Lowland in the Narew (J. Kupryjanowicz, M. Kwiatkowski unpubl.)

and the Biebrza (Kupryjanowicz 2005) river valleys, six sites in Polesie Lubelskie Region (Rozwałka 2005) and three in Lubelska Upland (R. Rozwałka unpubl.) (Figs 1, 2). In many sites the densities of *T. reimoseri* are difficult to estimate since no rigorous studies have been conducted. The relatively small number of individuals recorded per year on the more frequently studied sites suggests that the spider densities are low (Crome 1954; Dziabaszewski 1974; Szymkowiak 1993; Kupryjanowicz 2005).

Natural rush communities, particularly sedge rushes and moss-sedge peatland, are suitable habitats for *Tetragnatha reimoseri* (Crome 1954; Dziabaszewski 1974, 1989; Ulm et al. 1992; Szymkowiak 1993). However, land reclamations, the regulation of rivers, and water pollution have all contributed to the transformation or disappearance of natural communities of aquatic marsh and peatland vegetation in large areas of Poland and Europe (Szafer and Zarzycki 1977; Succow and Jeschke 1990). With the decreasing area of natural habitats for *T. reimoseri*, artificial water reservoirs such as fishponds with extensive fish farming might become substitute habitats for this species.

# Research

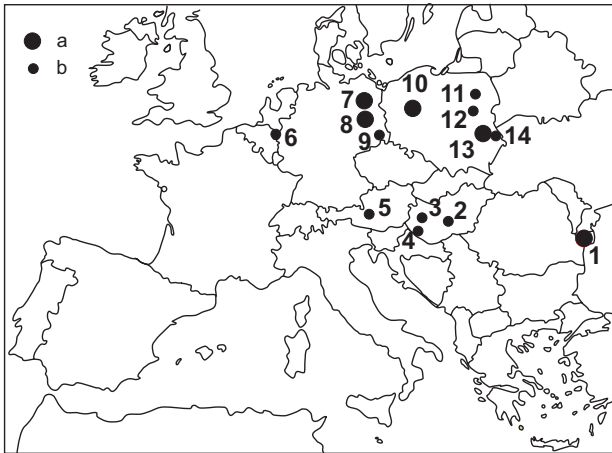


Fig. 1. Distribution of *Tetragnatha reimoseri* in Europe. 1 – Rumania, 2 – the Danube Delta; Hungary, 3 – Great Hungarian Plain, 4 – Balaton Lake, 5 – Somogy county; Austria, 6 – Neusiedler Lake region; Belgium/Netherlands, 7 – Limburg province; Germany, 8 – Mecklenburg-Vorpommern province, 9 – Brandenburg - Berlin provinces, 10 – Sachsen province; Poland, 11 – Nizina Wielkopolska lowland, 12 – Nizina Północnopodlaska lowland, 13 – Nizina Południowopodlaska lowland, 14 – Polesie Lubelskie lowland, 15 – Wyżyna Lubelska upland; a – 1–3 locations, b – 5–7 locations.

## Methods

### Biology of the species

*Tetragnatha reimoseri* (Rosca 1939) (syn. *Eucta kaestneri* Crome 1954) belongs to the family Tetragnathidae (Platnick 2007). Individuals of this species can achieve a body length of 15 mm and the longest first pair of limbs can reach lengths of 24 mm (Vasiliiu 1968). They are characterised by the abdomen which is elongated behind the spinnerets and, depending on the growth phase, is more or less pointed (Figs 3 and 4). Despite relatively large sizes, these spiders are difficult to observe. *T. reimoseri* has very specific habitat requirements. In Germany most individuals are found in a zone close to the shore and overgrown by sedges. Fewer individuals are found farther from the shore where the rush community is penetrated by common reed (Ulm et al. 1992). In the daytime spiders are usually inactive and assume a masking pose while sitting on leaves of sedges or other plants. As other representatives of the genus *Tetragnatha*, they stretch the two anterior pairs of limbs forward and two posterior pairs backward. At dusk, and less frequently early in the morning, they build a circular web with a diameter of 12 – 22 cm horizontally over the water surface at a height of up to 70 cm. They often catch prey with their anterior limbs while using their posterior limbs to hold onto a plant or

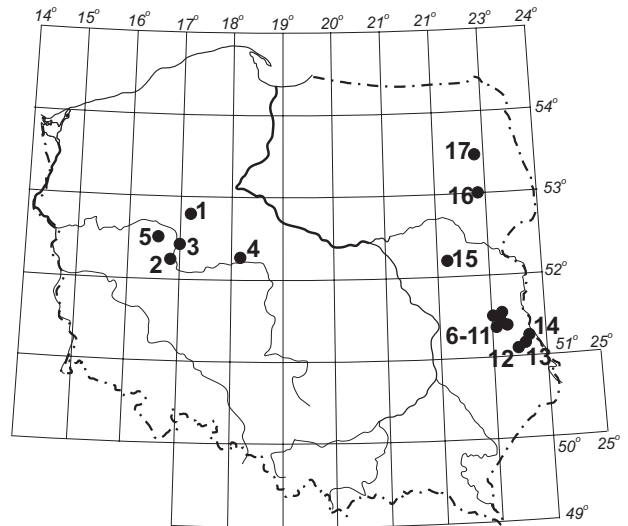


Fig. 2. Locations of *Thetragnatha reimoseri* in Poland. 1 – Rgielskie Małe Lake (Dziabaszewski 1974), 2 – Wielkopolski National Park, Góreckie Lake (Dziabaszewski 1978), 3 – Poznań, Maltańskie Lake (Dziabaszewski 1989), 4 – „Mielno” nature reserve (Szymkowiak 1993), 5 – Bytyńskie Lake (Szymkowiak dane nie publ.), 6-11 – Poleski National Park: Pieszowola, Zienki, Łukie Lake, Moszne Lake, Kolonia Wola Wereszczyńska, Michałów (Rozwałka 2005), 12 – Bagno Serebryskie (R. Rozwałka dane nie publ.), 13 – Brzeźno (R. Rozwałka dane nie publ.), 14 – Hnieszów (R. Rozwałka dane nie publ.), 15 – Siedlce, “Stawy Siedleckie” planned reserve (this article), 16 – Narew National Park, Bokiny, 17 – Biebrza National Park, Goniądz (Kupryjanowicz 2005). The map generated by GNOMON version 3.3.

the web (Crome 1954). Crome (1954) reported that males in the laboratory did not spin webs but Dziabaszewski (1974) observed the construction of webs by males. Dipterans of the families Culicidae, Chironomidae and smaller specimens of Tipulidae are the primary food of these spiders. In Germany individuals of *T. reimoseri* achieve sexual maturity in the beginning of May at the age of two years. Females typically copulate with several



Fig.3. *Tetragnatha reimoseri* – female. Photo P. Jastrzębski.

males which die after copulation. Females lay eggs from the middle of June to the end of July in several elongated greenish-yellow cocoons 15 – 20 mm in length and 5 – 7 mm wide. Each cocoon contains 50 – 70 eggs. After 10 – 13 days the young leave the cocoons and disperse with the help of spun threads raised by the wind (i.e. ballooning). The abdomen has one of two morphological types depending on the time of egg laying and hatching of the young. When temperatures drop below 12°C in the laboratory, the spiders become inactive (Crome 1954).

### Materials

Spiders were collected with an entomological net from near-shore vegetation of fishponds in May or June in the years 1998-2001 and 2004-2006. Over this time, 13 specimens were captured: 1 ♀ - 06.06.1998, 1 ♀ - 22.05.1999, 1 ♂ - 27.05.2000, 1 ♂ - 09.06.2001, 1 ♀ - 28.05.2004, 1 ♀ - 04.06.2004, 1 ♂, 1 ♀ - 28.06.2005, 3

♀♀ - 08.06.2006, 1 ♂, 1 ♀ - 13.06.2006. One specimen (1 ♀ - 04.06.2004) was from the collection of Ł. Wójcik – a student of the Department of Zoology at the University of Podlasie who conducted a year-long study of araneofauna in the area. Every two weeks from spring to autumn, he collected samples with an entomological net (100 sweeps) from the near-shore vegetation of the fishponds.

### Area

The complex of fishponds sampled in this study is located outside of Siedlce, to the northeast (UTM square EC88, 52°7' i 52° 12' N, 22°11' i 22°20' E), on South Podlasie Lowland in the belt of Mid-Poland Lowlands. The fishponds were constructed in a valley fed with the Helenka river which is a tributary of the Liwiec river (the Bug river catchment basin). A dense network of unmanaged and overgrown drainage ditches exist in adjacent areas. These fishponds are used for extensive fish farming. The entire complex covers an area of 224 ha and the ponds are overgrown to varying degrees (Dombrowski et al. 1994; Falkowski et al. 2002; Falkowski and Solis 2003). Water in all ponds is well aerated and relatively poor in nutrients. These conditions favour the development of rush communities typical for meso- and moderately eutrophic waters (Falkowski and Solis 2003). The area is provisioned for the “Stawy Siedleckie” nature reserve (Falkowski et al. 2002) due to its ecological value, particularly as a nesting place for waterfowl.

One managed area is located along the main dike between ponds III and V (Falkowski and Solis 2003) - 52°11' N, 22°18' E. The sedges *Caricetum gracilis* and *Caricetum acutiformis*, the horsetail *Equisetum fluvatile*, and the tall rushes *Typhetum angustifoliae*, *Typhetum latifoliae* and *Phragmitetum australis* grow in this area.

### Discussion

Sites of *Tetragnatha reimoseri* in eastern Poland, including those in “Stawy Siedleckie”, are located at the northeastern edge of this species' natural range (Figs 1 and 2). Due to the two-year life cycle and sensitivity of these spiders to decreased temperatures, Crome (1954) suggests that *T. reimoseri* is a southern species. Upon analysing the geographic distribution of *Tetragnatha reimoseri* one might assume that it spreads over Middle Europe, as do other southern species, from southeastern Europe (Szafer and Zarzycki 1977). A similar route was taken by species colonising Middle Europe in the post-glacial period as demonstrated by the analysis of their genetic material. An analysis of 10 taxa (including mammals, amphibians, insects and gymnosperm and angiosperm plants) showed that areas

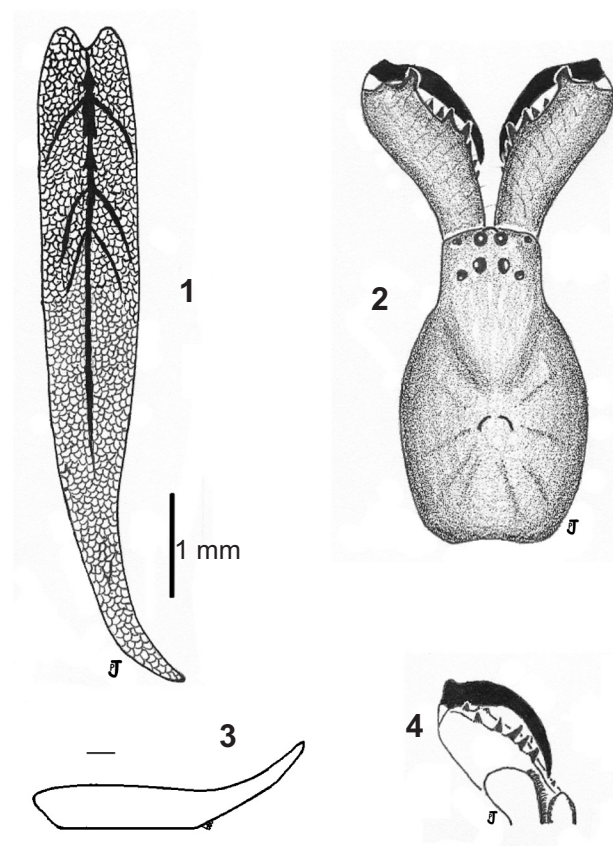


Fig. 4. *Tetragnatha reimoseri* - female: 1 – Abdomen's pattern, dorsal view, 2 – Shape of cephalothorax, dorsal view, 3 – Shape of abdomen, lateral view, 4 – Chelicera, labium and maxilla, ventral view. Scales = 1 mm. Pictures P. Jastrzębski.



# Research

of present-day Germany and Poland were colonised from the Balkan region (Taberlet et al. 1998). It is likely that the migration of *T. reimoseri* takes place primarily in lowlands along the river valleys, through oxbow lakes to lakes and other bodies of water. Mountain ranges and submountains are a visible barrier to movement of the species. It is possible that *T. reimoseri* was more widespread in Europe during warmer periods. Then, due to climatic and environmental changes caused by human activity the distribution of populations may have become more limited.

Since there are no natural barriers on the eastern and western borders of Poland, the migration of species may freely proceed in both directions (Szafer and Zarzycki 1977). *T. reimoseri* may colonise areas of Poland from both Eastern and Western Europe. Such a model of dispersion is suggested for the wasp spider *Argiope bruennichi* which probably entered Poland first from the west along the Warsaw-Berlin Valley and later from the east through Przemyśl Gate (Zięba 2005). Populations of *A. bruennichi* in Europe have markedly increased during the last 10 years. This species has spread northward onto deforested and managed grounds, with dispersion favoured by warmer climatic conditions (Geiser 1997; Barabasz and Górz 1998; Smithers 2000). The dispersion of *T. reimoseri* over Middle Europe is probably associated with global warming, however, in contrast with *Argiope bruennichi*, the selection and size of appropriate habitats is much smaller for the former species. The number of sites acceptable for *T. reimoseri* decreases westward with the distance from the probable centre of dispersion and with the degree of human transformation of the natural environment. This lack of appropriate habitats poses a threat to this species. In Poland this species is considered endangered (Starega et al. 2002). In Germany (Brandenburg, Mecklenburg-Vorpommern) it also belongs to the category of endangered species and in Belgium (Flanders) it is critically endangered (Platen et al. 1996, 1999; Maelfait et al. 1998). Land reclamation, eutrophication and intensive agricultural practices are considered the greatest threats posed to *Tetragnatha reimoseri* (Platen et al. 1999). Reclamations drain the ground and the canalization of streams and rivers, especially reinforcement of their banks, lead to the destruction of associated plant communities. Similarly, the eutrophication of bodies of water transforms natural near-shore vegetation and decreases their natural range (Solińska-Górnicka and Symonides 2001). Eutrophication of sedge peatlands results in overgrowing of vegetation (Chmielewski and Radwan 1993). Intensive agriculture contributes to the disappearance of suitable habitats for *T. reimoseri* through the liquidation of small bodies of water on large croplands (Platen et al. 1999). Particularly dangerous is the decrease in area of the sedge communities

(Szafer and Zarzycki 1977; Jasnowski 1990; Succow and Jeschke 1990; Chmielewski and Radwan 1993) that are preferred by this species.

Most sites of *Tetragnatha reimoseri* were found in national parks or in nature reserves which encompass biologically valuable aquatic and peatland areas such as the biosphere reserve in the Danube Delta (Vasiliu 1968, 1970), nature reserves: "Großer Schwerin mit Steinhorn" (Mecklenburg-Vorpommern) (Blick et al. 1993) and „Mielno" (Szymkowiak 1993); Polesie National Park (Rozwałka 2005), Biebrza and Narew National Parks (Kupryjanowicz 2005). Artificial bodies of water, however, also appear to be appropriate habitats for this species (Dziabaszewski 1989; Rozwałka 2005). With the destruction of many natural sites, extensively used fishponds like "Stawy Siedleckie" seem to be of particular importance. The presence of *Tetragnatha reimoseri* has been recorded almost every year during the last decade which can be evidence of population stability. The existence of *Tetragnatha reimoseri* population is possible due to large areas covered by sedge rushes (Falkowski and Solis 2003) which are the plant communities appropriate for this species.

In regions devoid of natural bodies of water such as South Podlasiian Lowland, artificial fishponds are a substitute habitat and reserve for many plants and animals (Dobrowolski 1995; Falkowski and Nowicka-Falkowska 2001). There are 390 species of vascular plants in "Stawy Siedleckie", 13 of which are legally protected and six of which are endangered (Falkowski et al. 1998, 2000). The fishponds are a water complex of national importance as a nesting place for waterfowl and a resting place for migrating birds (Wesołowski and Winięcki 1988). Forty-seven species of waterfowl and water-related passerine birds were found to nest there (Dombrowski et al. 1994; Sachanowicz et al. 1998), six of which were listed in the "Polish Red Book of Animals" (Głowaciński 2001).

Moreover, the presence of a Euro-Asiatic dragonfly *Orthetrum albistylum* (Odonata) was noted in "Stawy Siedleckie" which is the most northward site recorded for this species in Europe. Similarly, a coleopteran species rare in Poland, *Rhantus consputus* (Coleoptera: Dytiscidae), which has spread in middle and southeastern Europe and in southern Siberia (Mielewczyk 1998) was found in this area. The presence of these insect species confirms the role of "Stawy Siedleckie" as a refuge of rare species, particularly for southern species that are associated with water reservoirs.

Artificial bodies of water such as fishponds may play an important role as substitute habitats for *Tetragnatha reimoseri* and for other species. Intensive fish farming or total abandonment of management leads to a decrease

in the diversity of plant communities associated with the ponds and to an impoverishment in species richness of vascular plants (Falkowski and Nowicka-Falkowska 2004). The disappearance of some plant communities may in turn result in the disappearance of habitats appropriate for other species. As shown, the population of *T. reimoseri* is maintained near fishponds with extensive management which counteracts the excessive shallowing and overgrowing of reservoirs.

Despite the fact that *T. reimoseri* (as with most spiders) is passively dispersed by wind, the disappearance of stable shallow bodies of water overgrown by sedge communities limits the possibility of its settlement and further expansion. With the lack of natural sites, substitute habitats become very important for the dispersion of this species.

In the case of organisms that are difficult to observe, including most spiders, the only possibility of their protection is to protect their habitats (Rafalski 1992; Hajdamowicz 2003, 2004; Rozwałka 2004; Stańska 2004). The projected nature reserve "Stawy Siedleckie", when extensively managed, should provide appropriate habitats for *T. reimoseri*.

In rush and sedge communities occupied by *T. reimoseri* other rare and relatively large species like the recently described *Tetragnatha shoshone* Levi, 1981 and *Larinia jeskovi* Marusik, 1986 (Kupryjanowicz 2005; Szinetár 2000) might occur. The latter species was found in the Biebrza river Valley (Kupryjanowicz 1995) while the southern species – *T. shoshone* has not yet been found in the country.

More intensive studies conducted in Poland in habitats of these three rare spider species will expand our knowledge on their dispersion across Europe.

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