



Contribution to the knowledge on distribution in Hungary and habitat preferences of *Gnaphosa modestior* Kulczyński, 1897 a little-known spider species

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Abstract

Background and purpose: The aim of this review is to present current knowledge on the occurrence of a little-known gnaphosid species *Gnaphosa modestior* Kulczyński, 1897. Early it was mentioned as *G. alpica* species in Middle Europe. In this study, we reported the new occurrence of this species in Hungary and we examined of the effect of shrub control and mowing on this species abundance.

Materials and methods: Our arachnological research was conducted in the Mátra Mountains, the highest range of volcanic massin northern Hungary, between 2007 and 2016.

Result and conclusion: We recorded 13 specimens from five habitats of the southern part of the Mátra Mountains. This species can be found mainly in untreated shrubby habitats from April to June. In general, it can say that *G. modestior* is a stenochronous spider species which lives in habitats not influenced by human activities in the Mátra Mountains. However, this attributes of species differ in some European countries.

INTRODUCTION

Gnaphosa Latreille, 1804 is a large Holarctic genus of ground-dwelling spiders (family *Gnaphosidae*) with 146 described species (1). Besides *G. modestior* Kulczynski, 1897 eight species of the genus *Gnaphosa* have been reported in Hungary: *G. alpica* Simon, 1878, *G. bicolor* (Hahn, 1833), *G. lucifuga* (Walckenaer, 1802), *G. lugubris* (C.L. Koch, 1839), *G. microps* Holm, 1939, *G. mongolica* Simon, 1895, *G. opaca* Herman, 1879 (2) and *G. rufula* (L. Koch, 1866) (3).

Gnaphosa modestior is a rare European gnaphosid spider species (4). It's occurrence data are known from Szerencs of Hungary (5 as *Gnaphosa laeta*), Đakovó in Croatia, Balatonalmádi in Hungary, Baziás in Romania (5), Lobau and Leitha Mountain in Austria (4), Calabria in Italy (6), Slovenia (7), Czech Republic (8).

Hungarian occurrence of species are from Péter Hill in Balatonarács, Apró Hills in Balatongyörök, Somló in Doba, Pető Hill in Gyenesdiás, Szarvaskő, Bélkő and Molnár rock in Bükk Mountain (9 as *Gnaphosa laeta*), also, Nagypirit (10), Téglavető-dűlő in Somlójenő (11), Nagybajom (12) and Háros Island (13). In the past the species was synonymized a couple of time as *G. laeta* (5) and as *G. modestior* (4, 5, 14) and as *G. alpica* (15). After revalidation in 2018 (16) it is *G. modestior* again.

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The Mátra region is part of Northwestern Carpathians located in northeastern Hungary (Figure 1). This mountain has typical Pannon biogeographical characteristics in vegetation aspect consisting different plant species and phytocoenosis close to each other by this forming diverse vegetation (17). The whole Mátra Mountains is Special Protection Area (SPA) designated respectively under the Habitat Directive as a part of the Natura 2000 network, the aim of which is the protection of biodiversity and conservation of natural habitats and rare and vulnerable species (18). In the Mátra Mountains grassland managements are used in order to save the original grassy habitats and by this maintain the habitats for several rare and protected species. This reconstruational and maintenance work was coordinated and supported by Mátra Landscape Protection Area.

The original goal of this research is an examination of the effect of shrub control and mowing on spider communities, during which *G. modestior* specimens were recorded. This study reveals the habitat preference and susceptibility to interference of *G. modestior* in the Mátra Mountains. Also, this paper represents the habitus and genitalia photos of the species.

MATERIALS AND METHODS

Twenty sampling sites were selected in the Mátra Mountains. Double-glass pitfall traps filled with ethylene glycol were established on 20 sampling sites between 2012 and 2016. Five traps were settled from each other 4-5 m along a transect. The traps were deployed twice (April-July, September-November) over a six week period each

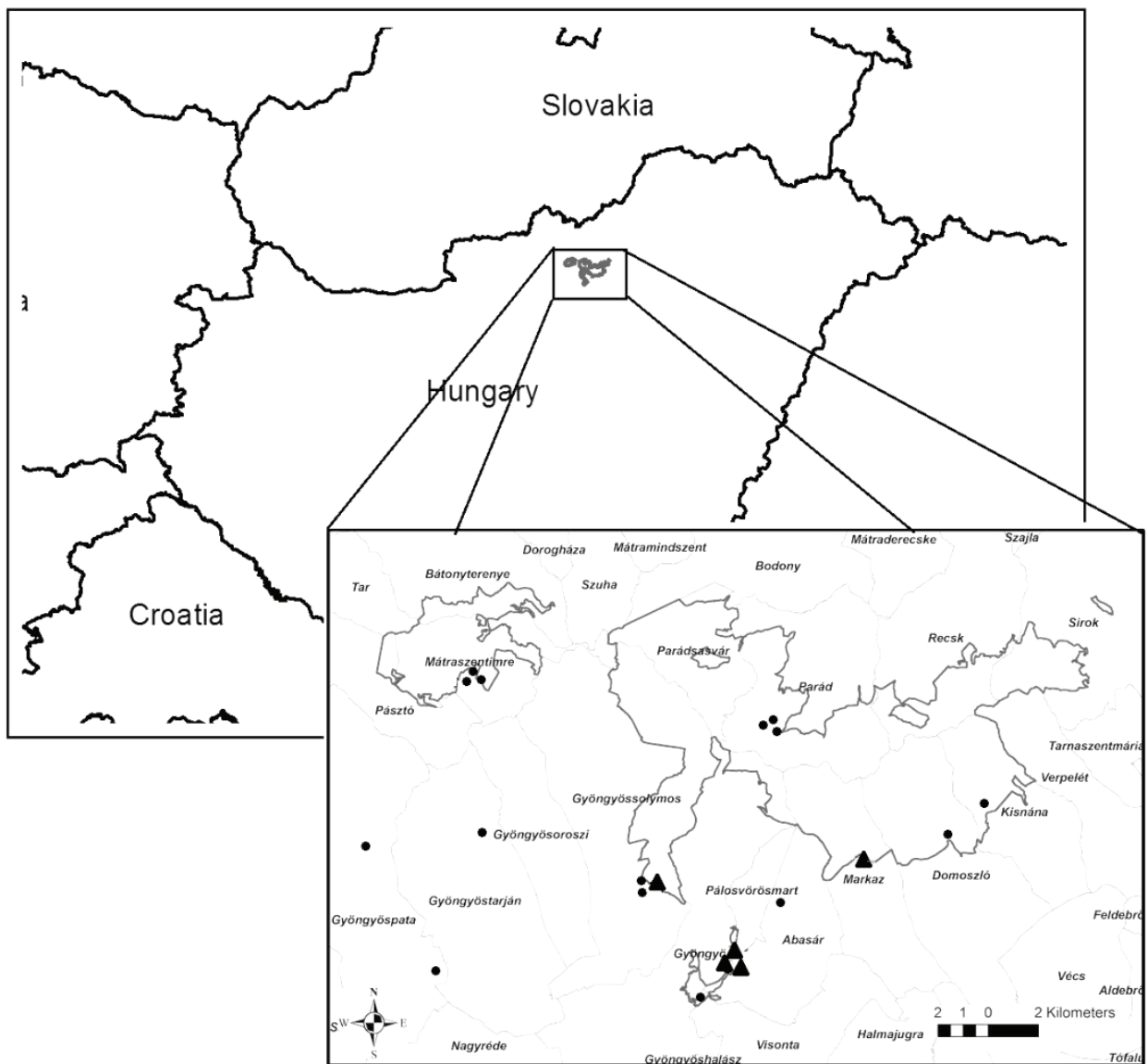


Figure 1. Occurrence data of *Gnaphosa modestior* Kulczyński in the Mátra Mountains. (▲: *G. modestior* is present, ●: *G. modestior* is absent)



Figure 2. *Gnaphosa modestior* Kulczyński: habitus (A), pedipalp (B), epigyne (C) and vulva (D).

year. Individuals were stored in 75 % ethyl-alcohol. The specimens were identified using the available identification keys on the web page „Spiders of Europe” (19). Specimens and copulatory organs were studied using a Leica MZ FL III stereomicroscope and photographed by Canon Q Imaging Micro 5.0 RTV at the Institute of Genetics, Biological Research Centre (BRC, Szeged).

RESULTS AND DISCUSSION

The occurrence of *G. modestior* has never been recorded in the Mátra Mountains, where previously Chyzer & Kulczyński (20) and Kolosváry (21) made an arachnological research which listed 33 spider species including only one gnaphosid species: *Kishidaia conspicua* (L. Koch, 1866).

During the pedofaunistic monitoring between 2012 and 2016 a total of 13 specimens (10 males, 3 females) of *G. modestior* were found. This species was collected among 20 habitats only in 5 habitats of southern part of the Mátra Mountains (Figure 1). *G. modestior* is a stenochronous species which can be collected from April to August (9, 22), nevertheless it was mentioned as thermophilic species in the study of Steinberger (23). This is supported by this research according to which it was seen mainly from April to June (Table 1).

Taxonomic status of *G. alpica* was unclear until these years. Early was mentioned as *G. alpica* species in Middle

Europe. Study of Dankaninová & Gajdos (24) revealed the species in vineyard terraces of the Little Carpathians, in this study the question mark next to species name may show the uncertainty of species. Authors of the Italian checklist refers to that the Italian record of *G. modestior* has to be listed as *G. alpica* (6). Both species have the similar color pattern characterized by dark brown-red to black-brown body with yellowish legs. But two species can easily be distinguished. *G. modestior* has much longer retrolateral tibial apophysis of males and much longer epigynal hood of females. Its vulva is reddish brown. Body length of males is 8-9 mm, while females are 8-9,2 mm in length (19) (Figure 2).

The habitat preferences of the species have rarely been recorded. During the sampling, the most collected specimens were found in shrubby habitats (Table 1, Figure 3). Similarly to our data, Steinberger (23) recorded the species in edges and forests in Austria while Loksa (9) revealed it from low forests in Hungary. Besides these, species less frequently in open habitats of mainly grass steppe (25, 26) and sandy grassland (27) in the Czech Republic. In Slovakia, it lives in uncultivated and wired vineyards, and rocky habitats with shrubs and forest vegetation as well as on rocky walls without vegetation (28, 24).

Besides *G. modestior* among the genus *Gnaphosa*, only *G. lucifuga* can be found in the Mátra Mountains. Phenology of two species is different: *G. lucifuga* is a diplo-

Table 1. A list of sampling sites with types of habitat where *Gnaphosa modestior* Kulczyński were collected in Hungary.

Localities	Sampling sites	Plant community	Number	Sampling year and months
Sár Hill Nature Reserve	Shrub	<i>Pruno spinosae-Crataegetum</i> Soó (1927) 1931	6♂, 2♀	2012 (06.08) 2013 (05.10, 05.24) 2014 (05.20, 06.06, 06.26)
	Meadow	<i>Pulsatillo montanae-Festucetum rupicolae</i> (Dostál 1933) Soó 1964 corr. Borhidi 1997 – <i>Pruno spinosae-Crataegetum</i> Soó (1927) 1931	1♂	2012 (05.26)
	Cleared shrub	<i>Pulsatillo montanae-Festucetum rupicolae</i> (Dostál 1933) Soó 1964 corr. Borhidi 1997	1♂, 1♀	2013 (06.26)
Gyöngyös-solymos	Shrub	<i>Pruno spinosae-Crataegetum</i> Soó (1927) 1931 with forest steppe items e.g. <i>Acer tataricum</i>	1♂	2012 (05.26)
Markáz	Clearing forest	<i>Corno-Quercetum pubescentis</i> Jakucs & Zólyomi ex Máthé et Kovács 1962	1♂	2014 (04.28)

chronous species which can be collected from May-July and September. Also, habitat preference is differed in this area in that the *G. lucifuga* lives mainly in open habitats which are maintained by mowing.

Susceptibility to interference of *G. modestior* less information has been known. Based on occurrence data of species can be concluded wide scale of the naturalness of its habitats such as vineyards or mountain habitats. According to some studies the species tolerates minimal human activity such as mowing (25) and can be found in disturbed areas such as vineyards, and sand - and stone pits (26), also formerly arable field and its ecotones (27). This research targeted the examination of the effect of grassland management such as mowing and shrub control on spiders. According to our data treatment has not positive effect on abundance because the most individuals were collected in untreated habitats minimally influenced by human activities. Similarly to Steinberger (23), who says that this species prefers natural habitats. Presence of *G. modestior* is not surprising in Sár Hill Nature Reserve which is southern edge hill of Mátra. This has specific biogeography situation allowing the mixing of the conti-

mental and piedmont species, many rare and protected plant and animal species live in this area. Also, the hill is significant in arachnological respect besides protected *Nemesia pannonica* Herman 1879 (29) providing habitats for more rare and protected spider species (30).

It can be said, *G. modestior* is a stenochronous species which was recorded firstly in the Mátra Mountains. This rare and little known species in Europe lives in several habitat types, prefers natural habitats but successfully adapts to former disturbed habitats, as well. The aim of shrub control as grassland management is the maintenance of mountain meadows but some valuable species such as *G. modestior* prefers shrubby habitats. Therefore it is worth considering the suitable coordination of shrub control and maintaining mosaic habitats because of different habitat demands of rare and protected spider species.

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Figure 3. The shrubby habitat of *Gnaphosa modestior* Kulczyński in the Sár Hill Nature Reserve of the Mátra Mountains.

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