Gnaphosa badia (Araneae: Gnaphosidae) in the Ukrainian Carpathians with comments on its distribution

Author: Anna Hirna
Source: Arachnologische Mitteilungen: Arachnology Letters, 57(1) : 54-59
Published By: Arachnologische Gesellschaft e.V.
URL: https://doi.org/10.30963/aramit5710
The ground spider *Gnaphosa badia* (L. Koch, 1866) belongs to the *Gnaphosa bicolor*-group (*Gnaphosidae*), which contains a small number of exclusively Palaearctic species (Ovtsharenko et al. 1992). The species has a disjunctive distribution inhabiting some mountainous regions of Eurasia, and has a preference for high altitude ecosystems (1600–2800 m, Grimm 1985). Perhaps because of its chorological peculiarities and ecological preferences, this spider remains poorly investigated. For example, in some regions there are only one or two known localities of *G. badia* in the second half of the 20th century; thus the information is relatively old and was not confirmed by current records, and remains fragmentary regarding certain territories. Some records are doubtful, especially those for lowland areas. From 1971 onwards, the data relating to the occurrence of this species within the Ukrainian Carpathians was repeatedly copied into several publications. Mistakes were neither being detected, nor was it stated precisely where the specimens had been collected. All these factors reveal the need for a generalized approach towards the published data on the distribution of *G. badia*.

### Material and methods

Material was collected in the Ukrainian Carpathians on the territory of the Chornohora and the Rakhiv Mountain massifs in the subalpine and alpine zones. The study was conducted based on standard collecting methods, such as pitfall traps and hand collecting. Spiders were identified using the key of Nentwig et al. (2018). Nomenclature follows the World Spider Catalog (WSC 2018). Material of *G. badia* is deposited in the collections of the Institute of Ecology of the Carpathians NAS of Ukraine (Lviv). Photographs were taken using an Olympus DP72 camera connected to an Olympus SZX10 stereoscope (Center for collective use of the scientific equipment, National Museum of Natural History, NAS of Ukraine, Lviv).

The Chornohora Mountain massif is the highest mountain group of the Ukrainian Carpathians. Its main range extends for about 40 km. The western part of the massif contains Mt. Petros (2020 m), from which extends a group of lower mountains. The eastern section is a range with 11 summits over 1800 m (the highest peak is Hoverla with 2061 m), with a minimum elevation of 1750 m above sea level. The subalpine zone (1600–1650 m to 1800–1850 m) is represented by treeline ecotones, green alder and *Pinus mugo* scrub, secondary *Fuscinium* heaths and *Juniperus* thickets, subalpine tall grass communities and *Nardus stricta* swards. The alpine zone (1800–1850 m to 2061 m) is dominated by alpine heaths, alpine meadows, and moss and lichen communities. Large areas of the summits of the mountain range are covered with scree, consisting of fragments of rocks that have accumulated on the tops of mountains or on the slopes. The Rakhiv Mountain massif is located in Romania (main part) and Ukraine (northern and north-western parts). The highest peak on the Ukrainian side is Pip Ivan Marmarosh’skyy (1936 m). The Western ridge of the massif with the mountains Zherban (1793 m), Polonynka (1627 m) and Preluka (1281 m) creates a natural border between the countries.

The vegetation of the subalpine zone (up to 1600 m) of this ridge is represented by dense thickets of *Pinus mugo* and *Juniperus sibirica* growing on rocky slopes, and in places by green alder scrub (in treeline ecotones).
Localities of *Gnaphosa badia* in the Ukrainian Carpathians (Fig. 1)

**Material not examined** (Legotay’s material of *Gnaphosa badia* was not preserved): Inner Eastern Carpathians (The Volcanic Ridge), Vynohradivs'ke vulkanichne horbohir'ya. Zakarpats’ka oblast’, Botanical Reserve “Chorna hora”: Mt. Chorna Hora (48.1500’N, 23.0736’E; 503 m a.s.l.), meadows, 10. Apr. 1971: 1 ♀, 1 juv., 1.–30. May 1971: 4 ♂♂, 2 ♀♀, 1.–30. Jun. 1971: 9 ♂♂, 2 ♀♀, 1 juv., 1.–30. Jul. 1971: 1 ♂, 1.–30. Aug. 1971: 2 ♂♂, 9. May 1970: 1 ♂, 6 ♀♀; oak forests, 1.–30. Jun. 1971: 1 ♂, 3 ♀♀, 1.–30. Jul. 1971: 1 juv.; vineyards, 10. Apr. 1971: 1 ♂ (Legotay 1974).

**Valid records:** Polonyna Carpathians, Chornohora mountain massif. Ivano-Frankivs’ka oblast’. Mt. Brebeneskul (48.0992’N, 24.5800’E; 1982 m a.s.l.), alpenrose (*Rhododendron myrtifolium*) heath, in Ice-alpine wet rock communities, in pitfall traps, Jun.–Jul. 2012: 3 ♂♂, 1 ♀. Mt. Petros (48.1714’N, 24.4206’E; 1925 m a.s.l.), alpine wet rock grooves with tall grass (*Festuca*), communities, in pitfall traps, Jun.–Jul. 2012: 3 ♂♂, 1 ♀. Mt. Petros (48.1714’N, 24.4206’E; 1996 m a.s.l.), siliceous screes of the alpine level, under stones, 20. Jun. 2013: 1 ♀, 20. Aug. 2014: 1 ♂; between dead grass remains, 2. Jul. 2015: 1 ♂ (Hirna et al. 2016); siliceous screes of the alpine level, in pitfall traps, Jun.–Jul. 2012: 1 ♂, Jun.–Jul. 2015: 5 ♂♂, 4 ♀♀ (unpubl. data, leg. A. Hirna). Mt. Rognes-Tomnatyk (48.1500’N, 23.3742’E; 1640 m a.s.l.), subalpine thickets (*Juniperus sibirica*), in Alpine wet rock, 20. Jun. 2013: 3 ♂♂ (Hirna et al. 2016).

Maratuny Mountains, Rakhiv mountain massif. Zakarpats’ka oblast’, Carpathian Biosphere Reserve: Mt. Zherban (47.9119’N, 24.2981’E; 1761 m a.s.l.), subalpine (*Pinus mugo*) scrub with thickets (*Juniperus sibirica*), in Icelandic moss under *Juniperus*, 10. Aug. 2015: 1 ♂, 1 ♀ (unpubl. data, leg. A. Hirna).

**Results**

*Gnaphosa badia* occurs sporadically in the highlands of the Ukrainian (Eastern) Carpathians. Adult individuals were caught in the period June to September. Photos of the male palp and vulva are shown in Fig. 2. Specimens were collected at an altitude over 1600 m a.s.l., which corresponds to records of specimens in the territory of the Eastern Carpathians within northern Romania. At lower altitudes, in the spruce forest zone of the investigated mountain massifs, *G. badia* was not found.

![Fig. 1: Localities of *Gnaphosa badia* in the Ukrainian Carpathians (white circle – dubious records from 1970–1971; black circles – valid records from 2012–2016)](https://bioone.org/journals/Arachnologische-Mitteilungen:-Arachnology-Letters/27 Apr 2019)

**Fig. 2:** *Gnaphosa badia* from Ukraine (the mountain massif Chornohora, Mt. Petros), male palp: **a.** ventral view; **b.** retrolateral view; **c.** vulva

Tab. 1: Spider communities of the alpine zone of the Chornohora Mt. massif (period from June to July). In bold: relative abundance >3.2 %; according to Engelmann (1978): eudominant – 32–100 %, dominant – 10–31.9 %, subdominant – 3.2–9.9 %. A – Mt. Hutyn Tomnatyk, B – Mt. Petros, C – Mt. Petros, D – Mt. Brebeneskul

| Taxon | A 2012 | B 2015 | C 2016 | D 2016 | % of the total number of specimens |
|-------|--------|--------|--------|--------|-----------------------------------|
| Ozyptila trux (Blackwall, 1846) | 0.6 | 0.5 | 0.4 | 0.6 | . |
| Xysticus obscurus Collett, 1877 | 0.9 | . | 0.4 | 1.8 | . |
| Coelotes pikardi carpathensis Ovtchinnikov, 1999 | . | . | . | . | . |
| Clubiona alpicola Kulczyński, 1882 | 1.3 | 0.5 | 2.1 | 4.1 | . |
| Glyphodes denticulatus (C. L. Koch, 1833) | . | . | . | . | . |
| Groenbech nabonacris Grassi, 1891 | 3.9 | 5.2 | 5.1 | 5.0 | . |
| Macargus rufus (Wider, 1834) | . | . | . | . | . |
| Macrobis uncinatus (C. L. Koch, 1833) | . | . | . | . | . |
| Targenches subalpinus (Blackwall, 1853) | . | . | . | . | . |
| Tisca vagans (Blackwall, 1834) | . | . | . | . | . |
| Walckaenia candidata Blackwall, 1833 | . | . | . | . | . |
| Atoleposa palustrilenta (Clerck, 1757) | . | . | . | . | . |
| Emblypterus uncinatus (Blackwall, 1853) | . | . | . | . | . |
| Euryopis stali (Blackwall, 1833) | . | . | . | . | . |
| Melanolycosa truncata (Blackwall, 1833) | . | . | . | . | . |
| Ozyptila trux (Blackwall, 1846) | 0.6 | 0.5 | 0.4 | 0.6 | . |
| Xysticus obscurus Collett, 1877 | 0.9 | . | 0.4 | 1.8 | . |
| Total number of species | 13 | 12 | 14 | 11 | . |
In addition, the species was not confirmed at other localities known from the literature (Legotay 1974), therefore, the data from the Mt. Chorna Hora are doubtful.

In general, a limited number of species were caught in the alpine zone of the mountain massif Chornohora using pitfall traps: from 11 to 14 (Tab. 1). Three of them, *Pardosa saltuaria*, *Haplodrassus signifer* and *Coelotes pickardi carpathensis* have a high relative abundance in all spider communities (84.6–92.2 % of the total number captured). Species richness and composition do not differ very much between different mountain tops. The relative abundance of *G. badia* ranges from 0.5 to 3.8 %. Most specimens were caught in the alpine zone of Mt. Petros, in 2015 (3.8 %).

In the subalpine zone only several specimens of *G. badia* were observed under *Juniperus sibirica* thickets at two localities: Mt. Rogneska and Mt. Zherban (Tab. 2; in pitfall traps that had been placed for a duration similar to the exposition in the alpine zone, no specimens were captured). These two localities differ in their levels of human activity. A known tourist route passes through the Mt. Rogneska area, as well as sheep movement to the pastures. On the contrary, Mt. Zherban is located on the border between Ukraine and Romania, but is hard-to-reach for tourists because of the steep slopes and dense thickets of subalpine shrubs.

In the Ukrainian Carpathians *G. badia* has a preference for the alpine zone (over 1800 m a.s.l.) and occasionally occurs in the subalpine zone. The species is localized mainly in the gaps between stones and in clumps of Icelandic moss, actively hunting on the surface of the soil and stones.

**Discussion**

The species was described by Ludwig Koch as *Pythonissa ba-dia* from the Alps (historical region – Tyrols and the Bavarian Alps, Koch 1866). Today, besides the Alps (Austria, Italy, France, Germany, Liechtenstein, Slovenia and Switzerland), the species is found in other mountain systems of Europe: the Pyrenees (Andorra), the Central System (Spain), the Bohemian Forest (Czech Republic: Šumava, Germany: Bava-

---

**Table 2:** Spiders of subalpine (*Juniperus*) thickets of the Chornohora Mt. massif and the Rakhiv Mt. massif (three samples of Icelandic moss 40 cm × 40 cm, under *Juniperus sibirica*). A – Chornohora Mt. massif: Mt. Rogneska, B – Rakhiv Mt. massif: Mt. Zherban

| Taxon | A | B |
|-------|---|---|
|       | 20 Jun. 2013 | 10 Aug. 2015 |
| *Coelotes terrestris* (Wider, 1834) | 1 ♀ | - |
| *Calllobius caustellus* (Hahn, 1833) | - | 1 ♂ |
| *Cybaeus angustiarum* L. Koch, 1868 | - | 1 ♂ |
| *Gnaphosa badia* (L. Koch, 1866) | 3 ♀♀ | 1 ♀, 1 ♀ |
| *Agyneta rarestris* (C.L. Koch, 1836) | 5 ♀♀ | - |
| *Bathyphantes alietes* (Sundevall, 1833) | 1 ♂ | - |
| *Centromerus arcatus* (O. P.-Cambridge, 1873) | - | 1 ♂, 6 ♀♀ |
| *Centromerus pabulator* (O. P.-Cambridge, 1875) | - | 2 ♂♂, 1 ♀ |
| *Centromerus sylvaticus* (Blackwall, 1841) | 4 ♀♀ | - |
| *Diaphochelus latifrons* (O. P.-Cambridge, 1863) | 4 ♀♀ | 1 ♀ |
| *Mansuphantes arciger* (Kulczyński, 1882) | 1 ♀ | 1 ♂ |
| *Mansuphantes mansuetus* (Thorell, 1875) | - | 1 ♀ |
| *Minyriolus pusillus* (Wider, 1834) | 2 ♂♂ | 1 ♂, 7 ♀♀ |
| *Mughiphantes mughi* (Fickert, 1875) | 1 ♂ | 1 ♂, 4 ♀♀ |
| *Walckenaeria cuspidata* (Blackwall, 1833) | 2 ♀♀ | - |
| *Pardosa amentata* (Clerck, 1757) | 3 ♀♀ | 1 ♀ |
| *Pardosa pullata* (Clerck, 1757) | - | 1 ♀ |
| *Pardosa saltuaria* (L. Koch, 1870) | 3 ♀♀ | 1 ♂ |
| *Robertus lividus* (Blackwall, 1836) | 3 ♀♀ | - |
| *Robertus scoticus* Jackson, 1914 | - | 2 ♀♀ |
| *Robertus truncorum* (L. Koch, 1872) | - | 1 ♂ |
Gnaphosa badia in the Ukrainian Carpathians

The possible occurrence of *G. badia* in the Carpathian Mountains was proposed by Kolosváry (1939). In his work, Kolosváry used known publications relating to the altitudinal distribution of spider species in the European mountains. Based on the faunal list of Lessert (1909) it was indicated that *G. badia* should occur in the alpine zone of the Carpathians at altitudes of 2300–2700 m a.s.l.

Information on records of *G. badia* from the Ukrainian (Eastern) Carpathians (the Chorna Hora Mt., Vynohradiv rayon, Zakarpats'ka Oblast') was presented in a PhD thesis by Legotay (1974; the data are given above in 'Material and methods'); Figs 1, 3). In a later paper based on the material of this PhD thesis it was not specified where the specimens had been collected (Legotay 1989). Since 1971, the species has also been known to occur in the Ukrainian Carpathians (without localities being specified) from another published work (Tyschchenko 1971), and later from the catalogues by Mikhailov (1997, 1998, 2013) as well as from other papers (Ovtsharenko 1982, Ovtsharenko et al. 1992).

In 2005–2006, the species was recorded within the Eastern Carpathians in northern Romania: the Pietrosul Mare Scientific Reserve (subalpine zone: 1650–1800 m; the Rodna Mountains; Nitzu et al. 2008; Fig. 3). Recently, it was found in the Chornohora (Ukraine) and added to the checklist of the spiders of this massif (Hirna et al. 2016).

According to the literature, *G. badia* occurs also in Europe within the East European Plain (Mikhailov 1997, 1998, 2013), in particular in the Caspian Depression (Minoransky 1988: the Chechen Republic, Russia, Budar Lake region, and Terek-Kuma Lowland of Ciscaucasia; Fig. 3). In several places the Caspian Depression is below sea level (0 to -28 m), and in the Budar Lake region between 4 and 15 m. The lake region, located in the steppe zone, includes agricultural land, vineyards and floodplain forests of the Terek River. Therefore, it is most likely the specimens from this locality were misidentified. *Gnaphosa badia* has also been recorded within the Burgas Plain territory of Bulgaria (Burgas (Deltchev 1976: “1 2/15. jun. 1948”), Deltchev et al. 1998, Fig. 3), and included in the checklist of spiders of this country (Blagoev et al. 2018). The data from these lowland areas are also doubtful and in need of confirmation.

The notifications attributed to *G. badia* within the East European Plain from the forest-steppe zone of Ukraine (Kharkiv oblast'; Kirilenko & Legotay 1981), the Volga Upland (Ehorov 2012: cit. by Sidorenko & Dunin, 1997, Sidorenko 1998: the Chuvash Republic, Russia, NN “Chavash Varmane”), and also from Fenno-Scandinavia (Mikhailov 1998, 2013, Olgier 2003: Russia, Ladoga Lake region, on the verge of Leningrad Oblast’ and Karelian) were all based on erroneous identifications (Tsvietkov 2007, Polchаницова & Prokopenko 2013, M. V. Sidorenko and T.I. Oligier pers. comm.: based on the revision of collected material).

*Gnaphosa badia* is mentioned as part of the spider fauna of the mountain systems of Asia by Mikhailov (1997, 1998, 2013) and Otto (2017). In particular, the species is known from the Caucasus Mountains (Dunin 1989: Azerbaijan, Transcaucasia, Greater Caucasus; Fig. 3) and the mountain systems of the Cis-Baikal (Izmailova 1977, 1989: Russia; Irkuts'k Oblast’, Primors’k mountain range, on the outskirts of vil. Nizhnii Kocherhat; Fig. 3). However, the data by M. Izmailova are based on the identification of adult females; the published figure of a vulva (Izmailova 1977, 1989) does not give an unambiguous answer about the correctness of the identification. Records of several specimens (up to three) at an altitude up to 1200 m on both the Caucasus and the Cis-Baikal are quite old: there have been no confirmations for more than 30–40 years. Ovtsharenko et al. (1992) omitted them in the summarizing work about North Asian ground spiders of the genus *Gnaphosa*, where the authors pointed out: “We have seen no material of this species from the USSR, but the species has been recorded from the Carpathian mountains (Tyschchenko, 1971, Kirilenko & Legotai, 1981)

In 2010, the discovery of *G. badia* was reported from the Altai Mountains (Volkovskij & Romanenko 2010: on the outskirts of vil. Chemal; Fig. 3). However, in 2013, these data were not included the list of spiders of the Russian Altai (Azarkina & Trilikaskas 2013) due to their doubtful nature (G. Azarkina pers. comm.).

The specimens from the Sikhote-Alin mountain range in the reserve “Lazovsky” (2004, Russia, Primorsky Krai, Sundukov & Shokhrin 2004, leg. and det. T.I. Oligier) were misidentified (Olgier pers. comm.).

Apparently, not only data from lowland areas of Europe, but also from mountain systems of Asia appear questionable. Until there are verified records of specimens from these territories, the range of *G. badia* should be delimited to the mountain systems of Europe: in the south-west in the Central System of the Iberian Peninsula, the Pyrenees, the Alps, the Bohemian Forest, the Fichtel Mountains and the most easternmost ones in Carpathians.

Comparison of the chorological and ecological peculiarities of *G. badia* within different mountain systems is difficult due to the differences of alitudinal zones. The habitats of this species in the Carpathians are similar to those described in the researches for the Alps, in particular subalpine-alpine grasslands, heaths and scrub, and scree; but in the Carpathians the species does not occur in coniferous forests (Grimm 1985, Kropf & Horak 1996, Zingerle 2000, Steinberger 2013). The spider fauna of the two mountain systems is different, however in both of them *G. badia* have a high relative abundance in some epigee spider communities, for example a sub-dominant position in a high altitude (2100 m) in the Zillertal Alps (Paulus & Paulus 1997). It should be noted that in the Bohemian Forest (Šumava: Czech Republic and Bavarian Forest: Germany) and in the Fichtel Mountains (Germany), the species occurs at the lower hypsometric levels. Nevertheless, most of the records are at an altitude more than 1000 m (from 830 to 1350 m in the Bavarian Forest (unpublished data of T. Blick), Buchar 1962, Kůrka 1995, Růžička 1997, Buchar & Růžička 2002).

In the Ukrainian Carpathians *G. badia* only occasionally occurs in the subalpine zone and mainly belongs to the spider communities of the alpine zone, which are relatively species-poor, have a specific composition and are adapted to a number...
of climatic factors. These factors are, in particular, the low average annual temperatures (the average temperature is between -6 and -12 °C in January, and between +8 and +12 °C in July), with long-term freezing of the soil, strong gusty winds (up to 40 meters per second), high air humidity and significant annual precipitation (more than 1500 mm per year, Holubets et al. 1988).

The alpine zone occupies only 0.1% of the Ukrainian Carpathians (14.2 km²). Despite the fact that the territory is protected, the main habitats of G. badia within the Chornohora Massif are suffering from an annual uncontrolled increase in the number of tourists. The consequences of this are heavily trampled areas on the summits of mountains and on their slopes adjacent to the many paths as well as an accumulation of plastic litter under stones. Besides this, in the last decade an increase in annual average temperatures and a longer period of vegetative growth has caused an upward movement of the tree line and overgrowing of the alpine zone by subalpine scrubs. Ecological and chorological peculiarities of G. badia, as well as human impact on its habitats and uncertainty about the impact of climate change on the native fauna of the highlands determine a need to include this species in the list of threatened species of the Carpathians mountain system.

Acknowledgements
I am especially grateful to Volodymyr Lyesnik (Lviv, Ukraine) for help during the collecting of the arachnological material and to Barry Jareckyj (Scotland, UK) for linguistic help. Thanks to Galina Azarkina (Novosibirsk, Russia), Tatjana Olinger (the Nizhnevorsky Nature Reserve, Russia), Michail Sidorenko (Nizhny Novgorod, Russia) and Eugenij Zhukovets (Minsk, Belarus) for their comments on distribution and records of Gnaphosa badia, and to the revision of collection specimens. I also thank the editors Theo Blick and Petr Dolež, the reviewers Karl-Hinrich Kielhorn and Anna Šestáková, and Marjan Komenov for their valuable comments and corrections that improved the paper.

References
Arachnologische Gesellschaft 2018 Atlas der Spinnentiere Europas. – Internet: https://atlas.araghes.de (20. Jan. 2018)

Azarkina GN & Trilikauskas LA 2013 Spider fauna (Aranei) of the Russian Altai, part II: families Gnaphosidae, Hahniidae, Linyphiidae, Liocranidae and Lycosidae. – Euroasian Entomological Journal 12: 51-67

Blačog G, Deltshev C, Lazarov S & Naumova M 2018 The spiders (Araneae) of Bulgaria. Version: August 2018. – Internet: http://www.mmhns.com/spiders-bulgaria (2018 Sep.)

Bliek T, Bolsmans R, Buchar J, Gajdos P, Hänggi A, Helsdingen P van, Rütžička V, Starga W & Thaler K 2004 Checkliste der Spinnen Mitteleuropas. Checklist of the spiders of Central Europe. (Arachnida: Araneae). Version 1. Dezember 2004. – Internet: https://arages.de/fileadmin/Pdf/checklist2004_araneae.pdf (20. Sep. 2018)

Buchar J & Rütžička V 2002 Catalogue of spiders of the Czech Republic. Buchar P, Praga. 351 pp.

Buchar J 1962 Beiträge zur Arachnofauna von Böhmen I. – Acta Universitatis Carolinae – Biologicae 1962: 1-7

Cardoso P & Morano E 2010 The Iberian spider checklist (Araneae). – Zootaxa 2495: 1-52 – doi: 10.11646/zootaxa.2495.1.1

Czech Arachnological Society 2018 Distribution maps of Arachnids in Czechia. – Internet: https://arachnology.cz/rad/araneae-1.html (10 Jan. 2018)

Deltschev C 1976 [Spiders (Araneae) along the Bulgarian Black Sea coast]. In: Terrestrial fauna of Bulgaria. Bulgarian Academy of Sciences, Sofia. pp. 83-95 [In Bulgarian]

Deltschev C, Andreev S, Blagoev G, Golemanskyy V, Milojkova G, Peneva V, Dobrev D, Todorov M & Hubenov Z 1998 Invertebrates (non-Insecta) in Bulgaria. In: Meine C (ed.) Bulgaria’s biological diversity: conservation status and needs assessment. Volumes I and II. Pensoft, Sofia & Moscow. pp. 109-161

Dunin PM 1989 [Fauna and altitudinal distribution of spiders (Arachnida, Araneae) of the Azerbaijani part of the southern macroslope of the Greater Caucasus]. In: [The fauna and ecology of spiders and scorpions. Collection of arachnological papers]. Nauka Publishers, Moscow. pp. 31-39 [in Russian]

Ehorov LV 2012 [Invertebrates of the “Chavash Varmane” National Park: the current state of knowledge]. [Scientific Proceedings of the “Chavash Varmane” National Park]. 4. Cheboksary. pp. 5-103 [in Russian] – Internet: https://www.zin.ru/animalia/coleoptera/pdf/egorov_2012_a.pdf

Eyunin SL & Efimkin VE 1996 [Catalogue of the Spiders (Arachnida, Araneae) of the Urals]. KMK Scientific Press, Moscow. 228 pp. [in Russian]

Grimm U 1985 Die Gnaphosidae Mitteleuropas (Arachnida, Aranei). – Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg 26: 1-318

Hirna A, Gneditsa V & Zhukovets E 2016 A checklist of the spiders (Araneae) of the Chornohora Mountain massif (Ukrainian Carpathians). – Arachnologische Mitteilungen 51: 16-38 – doi: 10.5431/aramit5104

Holubets MA, Honchar MT, Komendar VI, Kucheryayi VA & Odynak YP (eds) 1988 Ukrainskie Karpaty. Pirirosa [The Ukrainian Carpathians. Nature]. Naukova Dumka, Kyiv. 208 pp. [in Russian]

Izmailova MV 1977 [Materials on the spider family Gnaphosidae of the Upper Priangarje]. In: Organizatsiya i tekhnologiya proizvodstva v okhotnikykh khozjaistvakh kosherochny Sibiri. State University Publishing, Irkutsk. pp. 68-72 [in Russian]

Izmailova MV 1989 [Fauna of Spiders of the South Part of Eastern Siberia]. Irkutsk, State University Publishing, Irkutsk. 184 pp. [in Russian]

Kirilenko VA & Legotay MV 1981 [To the study of the Aranea fauna in the eastern forest-steppe of Ukraine]. In: [The fauna and ecology of insects]. Perm University, Perm. pp. 45-54 [in Russian]

Kropf C & Horak P 1996 Die Spinnen der Steiermark (Arachnida, Araneae). – Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark, Sonderheft 1996: 5-112

Koch L 1866 Die Arachniden-Familie der Drassiden. Hefte 1-6. Lotzbeck, Nürnberg. pp. 1-304

Komarov V 1939 Über die verticale Verbreitung der Spinnen in den Karpatherländern. – Folia Zoologica et Hydrobiologica 9: 337-341

Kostanjšek R & Kuntner M 2015 Araneae Sloveniae: a national spider species checklist. – ZooKeys 474: 1-91 – doi: 10.3897/zookeys.474.8474

Körk A 1995 Some rare and remarkable spider species (Araneida) from peatbogs of the Czech Republic. – Časopis Národního muzea, Rada přírodněvědě: 164: 77-86

Klotzbeck, Nürnberg. pp. 1-304

Legotay MV 1974 [Spiders of the Ukrainian Carpathians]. Dissertatio, Uzhhorod State University. 245 pp. [in Russian]

Legotay MV 1989 [Materials on the spider fauna (Arachnida, Araneae) of Transcarpathia]. In [The fauna and ecology of spiders and scorpions. Collection of arachnological papers]. Nauka Publishers, Moscow. pp. 16-30 [in Russian]

Lessert R de 1909 Notes sur la repartition géographique des araignées de la Causette. – Revue Suisse de Zoologie 17: 483-499

Mikhaliov KG 1997 Catalogue of the spiders of the territories of the former Soviet Union (Arachnida, Araneae). Zoological Museum, Moscow State University, Moscow. 416 pp.

Mikhaliov KG 1998 Catalogue of the spiders (Arachnida, Araneae) of the territories of the former Soviet Union. Addendum 1. KMK Scientific Press, Moscow. 48 pp.

Mikhaliov KG 2013 The spiders (Arachnida: Araneae) of Russia and adjacent countries: a non-annotated checklist. – Arthropoda Select, Supplement 3: 1-262
Minoranskij VA 1988 [Materials on the spider fauna (Aranei) of Checheno-Ingushetia]. In [The fauna and ecology of arachnids. Collection of arachnological papers], Perm University, Perm. pp. 34-42 [in Russian]

Nentwig W, Blick T, Gloor D, Hänggi A & Kropf C 2018 Spiders of Europe. Version 07.2018. – Internet: http://www.araneae.nmbe.ch (20. Jul. 2018)

Nitou E, Popa I, Nae A & Iuşan C 2008 Faunal researches on the invertebrates (Coleoptera, Orthoptera, Collembola and Araneae) in the Rodnei Mountains Biosphere Reserve. – Travaux de l’Institut de Speologie «Emile Racovitza» 47: 3-52

Oliger TI 2003 Epigeic spider assemblages of the Sphagnum biotopes in Lake Ladoga region, north-west Russia. – Arthropoda Selecta, Special Issue 1: 219-224

Otto S 2017 Caucasian spiders. A faunistic database on the spiders of the Caucasus. Version 08.2017. – Internet: http://caucasus-spiders.info (20. Jul. 2018)

Ovtsharenko VI 1982 [A systematic list of the spider family Gnaphosidae (Aranei) of the European part of the USSR and the Caucasus]. – Entomologicheskoe Obozrenie 61: 830-844 [in Russian, English summary]

Ovtsharenko VI, Platnick NI & Song DX 1992 A review of the North Asian ground spiders of the genus Gnaphosa (Araneae, Gnaphosidae). – Bulletin of the American Museum of Natural History 212: 1-88

Paulus U & Paulus HF 1997 Zur Zönologie von Spinnen auf dem Gletschervorfeld des Hornkees in den Zillertaler Alpen in Tirol (Österreich) (Arachnida, Araneae). – Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck 84: 227-267

Polchaninova NY & Prokopenko EV 2013 Catalogue of the spiders (Arachnida, Aranei) of Left-Bank Ukraine. – Arthropoda Selecta, Supplement 2: 1-268

Růžička V 1997 Spiders (Araneae) of dwarf Norway spruces. In: Zakha M (ed.) Proceedings of the 16th European Colloquium of Arachnology. Wyzsa Skóla Rolnictwo-Pedagogiczna, Siedlce. pp. 281-287

Sidorenko MV 1998 [The spiders (Arachnidae [sic!], Aranei) of the “Chavash Varmane” National Park]. In [Entomological research in Chuvashia: Proceedings of the First Republican entomological conference], Cheboksary, pp. 85-87 [in Russian]

Sidorenko MV & Dunin PM 1997 [To the fauna and ecology of spiders (Arachnidae [sic!], Aranei) of Chuvashia]. In [The fauna and ecology of the animals of the “Chavash Varmane” National Park (the Chuvash Republic)], Issue 1. Cheboksary, pp. 9-22 [in Russian]

Steinberger K-H 2013 Die Spinnen (Araneae) und Weberknechte (Opiliones) der Jagdberggemeinden. In Naturmonografie Jagdberggemeinden. pp. 543-568

Sundukov YN & Shokhrin VP 2004 [Invertebrate animals. Annex 3. List of arachnids (Arachnida) and insects (Insecta) known from the territory of the Lazovsky Reserve as of January 1, 2004]. In [Chronicles of Nature of the Lazovsky Reserve]. Tom 47. Lazo. pp. 152-191 [in Russian]

Thaler K & Knoflach B 2003 Zur Faunistik der Spinnen (Araneae) von Österreich: Gnaphosidae, Thomisidae (Dionycha pro parte). – Linzer Biologische Beiträge 36: 417-484

Tsvetkov AS 2007 [The spiders of family Gnaphosidae from the southeast of the East European Plain]. Dissertation, University Rostov on Don. 190 pp. [in Russian]

Tyschenko VP 1971 [An identification guide to the spiders of the European part of the USSR]. Nauka Publishers, Leningrad. 281 pp. [in Russian]

Utochkin AS & Pakhorukov NM 1976 [Materials to the spider fauna of the Reserve]. – [Proceedings of the Pechoro-Ilychsky State Reserve] 13: 78-88 [in Russian].

Volkovskij EV & Romanenko VN 2010 Population of spiders (Aranei) of soil-surface tier of Altay Region mountain valleys. – Vestnik Tomskogo Gosudarstvennogo Universiteta 3(11): 60-67 [in Russian, English summary]

WSC 2018 World Spider Catalog. Version 18.5 Natural History Museum Bern. – Internet: http://wsc.nmbe.ch (10. Jan. 2018) – doi: 10.24436/2

Zingerle V 2000 Epigäische Spinnen und Weberknechte aus den nördlichen Dolomiten: Valparola-Pass und Weißhorn (SE-Alpen, Italien). – Berichte des naturwissenschaftlich-medicinischen Vereins in Innsbruck 87: 165-207

Gnaphosa badia in the Ukrainian Carpathians 59