An updated checklist of spiders (Arachnida: Araneae) of Left-Bank Ukraine

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An updated checklist of spiders (Arachnida: Araneae) of Left-Bank Ukraine

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Abstract. The current checklist of spiders from Left-Bank Ukraine includes 741 species in 270 genera and 34 families. The families Linyphiidae (215 species, 29% of the fauna), Gnaphosidae (83 species, 11%) and Salticidae (79 species, 11%) are the most species-rich. The Linyphiidae species diversity declines from north to south – from 33% of the fauna in the forest zone to 16% of the fauna in the bunchgrass steppe subzone. In contrast, the proportion of Gnaphosidae increases from 7% to 13%, respectively. A total of 407 spider species was recorded from the forest natural zone, 515 species from the forest-steppe, 583 species from the forb-bunchgrass steppe subzone of the steppe zone and 375 species from the bunchgrass steppe subzone. In terms of administrative division, the araneofauna of the Donetsk Region is the richest with 514 species, the faunas of the Kharkiv (426 species), Luhansk (402 species) and Chernihov (391 species) regions follow it. The poorest is the Zaporizhzhia Region with 122 species. In total, spiders have been collected at 269 localities and the results have been published in 369 papers. Faunistic and ecological studies are the main directions of arachnological research in Left-Bank Ukraine.

Keywords: Arthropoda, distribution, fauna inventory, species list, Ukraine

Zusammenfassung. Eine aktualisierte Checkliste der Spinnen (Arachnida: Araneae) der Linksufer-Ukraine (linkes Ufer des Dnjepr). Die derzeitige Checkliste der Spinnen der Linksufer-Ukraine enthält 741 Arten aus 270 Gattungen und 34 Familien. Die Linyphiidae (215 Arten, 29 % der Fauna), die Gnaphosidae (83 Arten, 11 %) und die Salticidae (79 Arten, 11 %) sind am artenreichsten. Die Artenvielfalt der Linyphiidae nimmt von Norden nach Süden ab: von 33 % Anteil in der Waldzone bis auf 16 % in der Horstgras-Steppen-Subzone. Im Gegenzug nimmt der Anteil der Gnaphosidae von 7 % auf 13 % zu. Ingesamt sind 407 Spinnenarten in der natürlichen Waldzone, 515 Arten in der Waldsteppe, 583 Arten in der Hochstauden-Grassteppen-Subzone und 375 Arten in der Horstgras-Steppen-Subzone nachgewiesen. Nach Verealtungseinheiten ist die Spinnenfauna der Region Donetsk mit 514 Arten am artenreichsten, gefolgt von der Regionen Kharkiv (426 Arten), Luhansk (402 Arten) und Chernihov (391 species). Die Region Zaporizhzhia ist mit 122 Arten am artenärmsten. Insgesamt wurden an 269 Fundorten Spinnen gesammelt und die Ergebnisse in 369 Artikeln publiziert. Faunistische und ökologische Studien sind der Schwerpunkt der arachnologischen Forschung in der Linksufer-Ukraine.

The araneofauna of Ukraine has been studied unevenly. The latest total list based on the state of knowledge up to 2011 made reference to 1008 species including 537 species recorded from the Ukrainian Carpathians and 520 species from the Crimea (Mikhailov 2013). Since that time, a catalogue of the spiders of Left-Bank Ukraine has been published (Polchaninova & Prokopenko 2013, 2017), and a checklist of spiders from the Crimea has been updated (Kovblyuk & Kastrygina 2015). A conservation status was assessed for 386 species from the Ukrainian Carpathians (Gajdoš et al. 2014), but a complete detailed list of the spiders from this region still needs to be compiled. The rest of Ukraine remains poorly investigated. The present-day list of Ukrainian spiders as part of the total European list accounts for 1049 species (Nentwig et al. 2018).

The catalogue of the spiders of Left-Bank Ukraine contains information on the history of study as well as published and original records supported by collection material, a list of erroneous and doubtful records, synonymies, geographic coordinates of collecting localities, general geographic distribution and species habitat preferences within the natural zones and subzones. The first catalogue listed 709 spider species in 247 genera and 35 families (Polchaninova & Prokopenko 2013). Four years later, Addendum I enlarged this list to 728 species of 266 genera (Polchaninova & Prokopenko 2017). The analysed data covered the period from 1836 to 2016, and included species collected in 263 localities.

Nevertheless, new finds and changes in nomenclature over the past two years have required data revision, reexamination of some items from personal and museum collections, and updating of the total list. The purpose of the present paper is to summarize the state of knowledge of the spiders of Left-Bank Ukraine, to make a checklist based on species zonal distribution, and to outline prospective directions for future studies.

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Material and methods

Left-Bank Ukraine is defined as the part of Ukraine east of the Dnieper River. Its total area covers more than 200 thousand square kilometres. Traditionally, the plain territory of the country is divided into the right- and left-bank parts along the Dnieper flow, which is justified both historically and biogeographically (Fig. 1). Left-Bank Ukraine encompasses the south-western part of the Central Russian Upland as well as western and central parts of the Donetsk Ridge, which are both low altitude hills on the East European Plain. The study area lies in three natural zones: forest, forest-steppe and steppe (Fig. 2). The steppe zone, in its turn, is divided into three subzones: forb-bunchgrass steppes (forb-fescue-feather grass), bunchgrass steppes (fescue-feather grass) and sagebrush-bunchgrass, or semi-desert steppes (sagebrush-fescue-feather grass). The borders of the zones/subzones presented on the map are adopted from geo-botanical regioning of Ukraine (Barbarych 1977, Didukh & Shelyag-Sosonko 2003).

The checklist of species is organized as a table, which provides records from the administrative regions of Left-Bank Ukraine and references to the summary surveys (Tab. 1, electronic appendix). The regions are arranged from north-west to south-east within the natural zones. Some of the regions are mentioned twice as they are located in two neighbouring zones. Species are given alphabetically by family and then by genera within the families, the nomenclature following the World Spider Catalogue (WSC 2018). Numbers in parenthesis show the number of species in each family in the corresponding zones/subzones, and in the study area as a whole.

Fig. 1: Map of Ukraine with the outlined study area

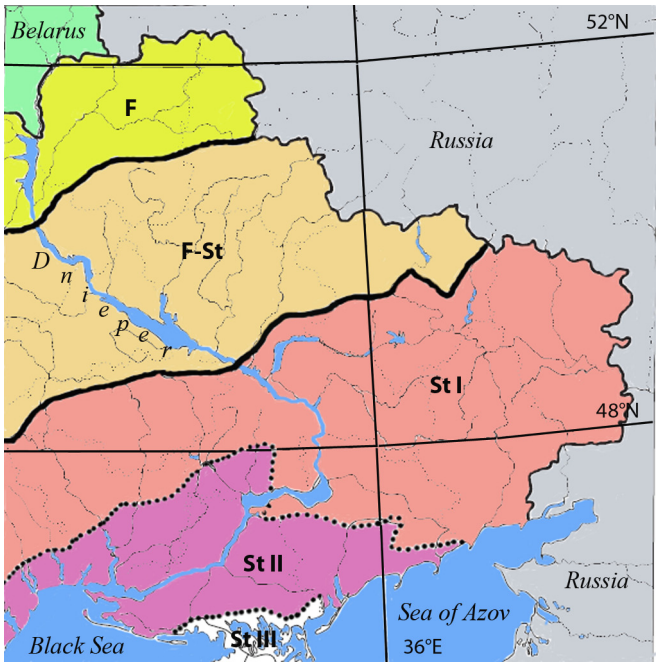

Fig. 2: Borders of natural zones and subzones in Left-Bank Ukraine. Zones: F – forest, F-St – forest-steppe, St – steppe; subzones: St I –forb-bunchgrass steppes, St II – bunchgrass steppes, St III – sagebrush-bunchgrass steppes

We marked with three exclamation marks (!!!) species registered for the first time in Ukraine, with (!!) species registered for the first time in Left-Bank Ukraine, and with (!) species cited in literature as new to Left-Bank Ukraine in 2017, i.e. after the issue of the Catalogue and Addendum I (Polchaninova & Prokopenko 2013, 2017). We marked boundaries of the species' geographic ranges by a letter in case they are running through the study area: N – northern, NW – north-western, W – western, NE – north-eastern, E – eastern, S – southern, SE – south-eastern, and SW – south-western, intr – introduced. The list is based on original and literature-derived data that can be checked on the available collection materials.

If a species was recorded from material in a lost collection (or lost individuals from available collections) and its finding had not been proved later by other authors, we referred it to the category "need confirmation". A list of such species is given separately after the main species list. We also compiled a list of erroneous records based on misidentifications. Seven species were mentioned in both "erroneous" and "doubtful" lists since their misidentifications were proved for some localities, but remained unconfirmed for the others (Table 2, 3, electronic appendix). The rationale for the exclusion of these species from the main list is given in the Catalogue and Addendum I (Polchaninova & Prokopenko 2013, 2017).

Species distribution is given based on Mikhailov (2013), Polchaninova & Prokopenko (2013), Kovblyuk & Kastrygina (2015), Ponomarev (2017), Ponomarev et al. (2017), Nentwig et al. (2018), WSC (2018) and the authors' personal data.

Results

To date, 741 spider species from 270 genera and 34 families have been recorded from Left-Bank Ukraine. The number of families has decreased compared with the previous list, since *Argyroneta,* the only regional genus in Cybaeidae, was transferred to the family Dictynidae. Thus, Cybaeidae was excluded from the araneofauna of Left-Bank Ukraine. The following genera are the most speciose: *Pardosa* – 20 species, *Clubiona*, *Xysticus* – 17 species each, *Gnaphosa*, *Zelotes, Walckenaeria* – 16 species, *Alopecosa* – 15 species, *Agyneta* – 14 species, *Micaria* – 11 species, and *Haplodrassus, Centromerus* – 10 species. Four species listed here (*Alopecosa steppica*, *Palludiphantes pillichi*, *Calositticus inexpectus*, *Pellenes allegrii*) are new to the Ukrainian fauna; two species (*Gnaphosa opaca* and *Centromerus abditus*) are new to Left-Bank Ukraine. Four species (*Altella hungarica*, *Erigonoplus spinifemuralis*, *Walckenaeria wunderlichi*, *Synageles ramitus*) were recorded as new to Ukraine in 2017 (Ponomarev et al. 2017) after the publication of the Addendum I of the catalogue, and are now added to the general list. *Ostearius melanopygius* and *Heliophanus kochii* were absent in the 2013 catalogue, *Gnaphosa rufula* and *Dysdera longirostris* were restored to the list from the doubtful records, and *Gnaphosa dolanskyi* was distinguished from *G. modestior* and described as new to science (Řezáč et al. 2018). Thus, the previous list has been replenished with 15 species. On the other hand, *G. modestior* and *G. moesta* have been excluded, so the list of erroneous records now comprises 41 species while that of doubtful records accounts for 47 species.

The family Linyphiidae is the most species-rich in Left-Bank Ukraine (215 species, 29% of the fauna), with Gnaphosidae and Salticidae following it (83 and 79 species, respectively, about 11% each). The ratio of families changes from north to south across zones and subzones (Fig. 3). The proportion of Linyphiidae declines from 33% in the forest zone to 16% in the bunchgrass steppe subzone (steppe II). In contrast, the ratio of Gnaphosidae grows from 7% in the forest zone to 13% in the steppe subzones. Fluctuation of the relative species richness of other families is not so evident. Diversity of major spider families is the most even in the bunchgrass steppe subzone (steppe II) due to the lower ratio of Linyphiidae (Fig. 3). The sagebrush-bunchgrass steppe subzone has not been analyzed here because of the lack of sufficient data on its spider fauna.

The richest is the araneofauna of the steppe I (583 species). All major families, except Linyphiidae, are the most diverse there (Table 1). The steppe II is the poorest (375 spider

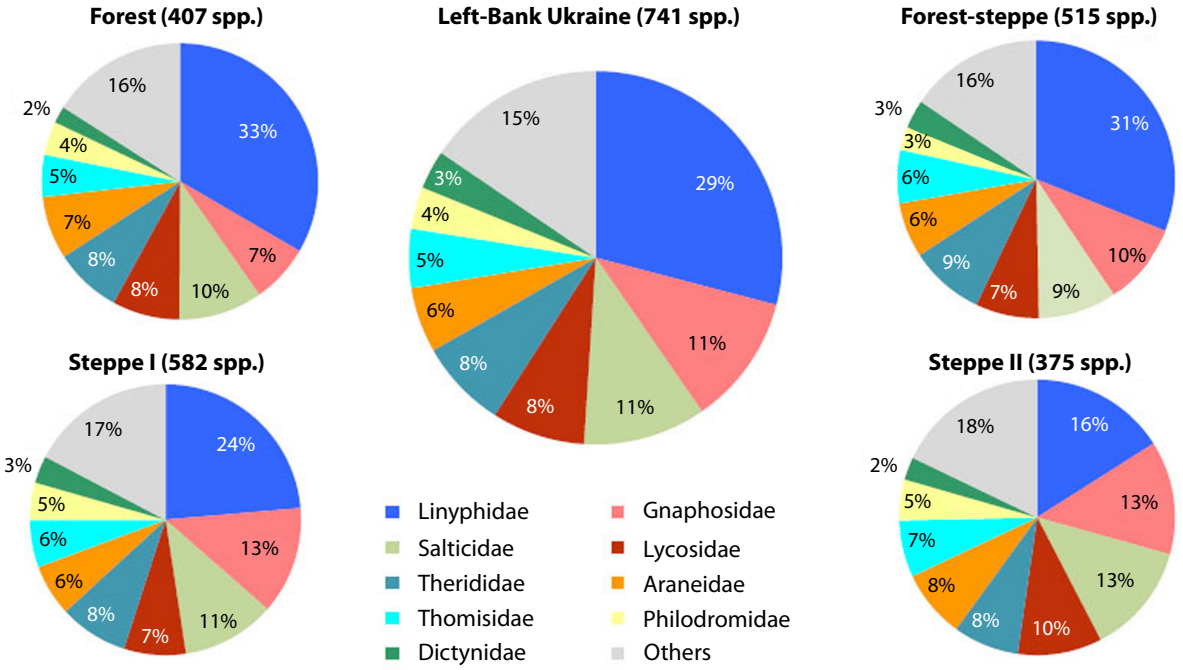

Fig. 3: Species richness of spider families in the faunas of natural zones and subzones of Left-Bank Ukraine. For abbreviations, see Fig. 2

species). A total of 194 species (26.1% of the fauna) is widely distributed across the four compared zones/subzones (Tab. 1), while 163 species (22.1%) were registered in only one of them: 29 species (7% of the zonal fauna) in the forest zone, 41 species (7.9%) in the forest-steppe, 69 species (12 %) in the steppe I, and 24 species (6.4%) in the steppe II. Concerning administrative divisions, the largest number of spider species has been registered in Donetsk Region (Fig. 4). The number of species in the other six regions completely (or almost completely) located within Left-Bank Ukraine ranges from 122 to 426.

There are no endemics in the study area. Nevertheless, the boundaries of geographic ranges of a number of species run through its territory. They are mostly northern (47 species) and western (25 species) boundaries. Besides, twelve species have eastern margins of their areas, two species north-eastern, four species north-western, two species south-western, and three species southern margins (Table 1). Noteworthy are rare species with patchy distribution in Europe, like *Altella hungarica, Cheiracanthium gratum, Gnaphosa rufula*, *Haplodrassus bohemicus, Talanites strandi, Caviphantes dobrogicus, Metapanamomops kaestneri, Minicia candida, Pardosa maisa, Sibianor larae*, and *Pachygnatha clercoides*. Some species with narrow ranges are known to date only from the south (*Harpactea azowensis, Liocranoeca spasskyi*) and/or southeast (*Alopecosa steppica, Trachyzelotes cumensis, Theridion innocuum*) of the East European Plain. The others extend their ranges to the Crimea (*Lathys lehtineni, Micaria bosmansi*, *Centromerus abditus, Mecynargus minutipalpis, Talavera logunovi*) or to the Caucasus (*Dysdera ukrainensis*). Species with more or less wide Ancient Mediterranean or Mediterranean areas offer examples of the northern geographic boundaries in the study area, while the ranges of a bulk of Central Asian species (*Araneus pallasi, Devade tenella, Gnaphosa cumensis, Agyneta birulaioides, Thanatus mongolicus, Attulus inopinabilis, Pellenes allegrii*) are limited in the west by the lower Dnieper flow.

Over the entire period of arachnological research in Left-Bank Ukraine (since 1836 to the present day), 369 papers based on original material and/or museum collections have been published. The faunistic data were summarized in regional species lists, key books and/or catalogues; the most significant of them were compiled by Kharitonov (1932), Mikhailov (1997, 2013) and Polchaninova & Prokopenko (2013, 2017). The first period of the records' accumulation lasted over 130 years, with no more than one or two papers published a year (Fig. 5). There were only 185 species known from the study area until early 1970s, when interest in spiders increased and resulted in publications of some local species lists. By 1990, the total list of spiders had accounted for about 350 species.

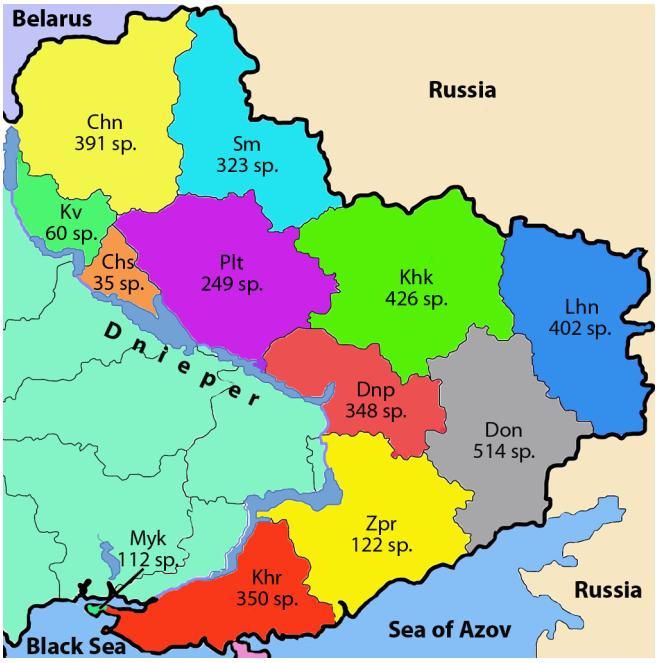

Fig. 4: Administrative division of Left-Bank Ukraine and the number of spider species registered in each region. Chn – Chernihiv, Chr – Cherkassy, Dnp – Dnipropetrovsk, Don – Donetsk, Khk – Kharkiv, Khr – Kherson, Kv – Kyiv, Lhn – Luhansk, Myk – Mykolaiv, Plt – Poltava, Sm – Sumy, Zpr – Zaporizhzhia

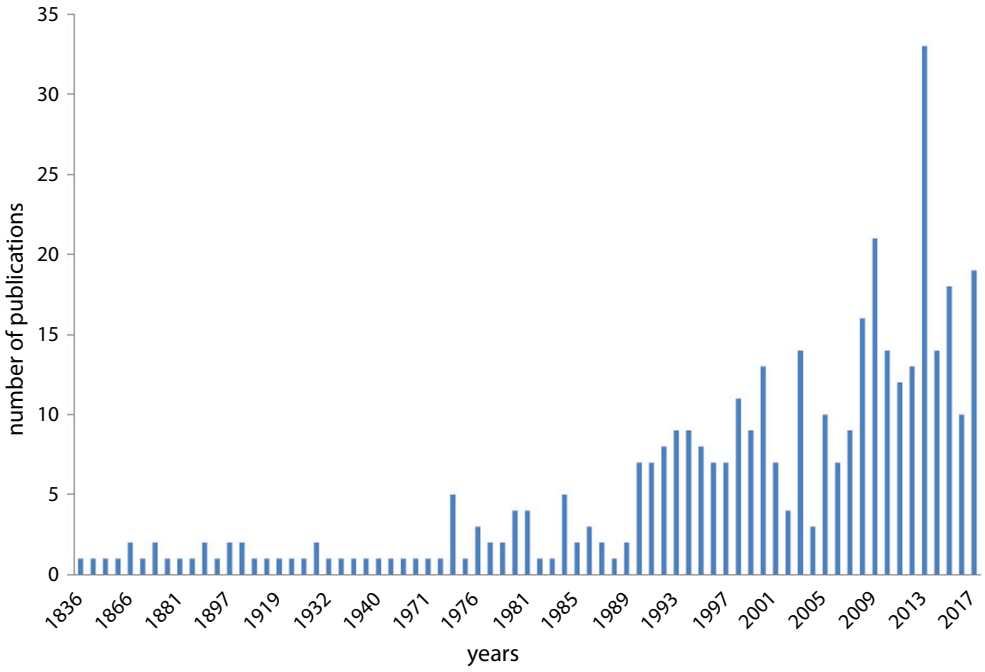

Fig. 5: Dynamics of the number of publications concerning spiders of Left-Bank Ukraine during the surveyed period (1836–2018)

Since the early 1990s, the spider studies have been developing in various directions. Investigations of the spider fauna and habitat distribution remain the focus of most research (204 faunistic papers, including 98 papers concerning protected areas). There were 30 conservation areas studied in Left-Bank Ukraine. The most species-rich are the local faunas of the National Parks 'Sviati Hory' (Donetsk Region, 288 species) and 'Homilshanski Lisy' (Kharkiv Region, 258 species), the Nature Reserves 'Kamiani Mohyly' (Donetsk Region, 258 species) and 'Prydintsivska Zaplava' (Luhansk Region, 252 species), and the Ivano-Rybalchanskyi and Solenoozernyi segments of the Black Sea Biosphere Reserve (Kherson Region, 255 species). The nature conservation studies required investigations of the impact of land management, such as hay mowing (Polchaninova 2004), cattle grazing (Polchaninova et al. 2016a) or burning (Prokopenko & Savchenko 2013, Polchaninova 2015, Polchaninova et al. 2016b), on spider communities. Six spider species were included in the Red Data Book of Kharkiv Region (Tokarsky 2013); twelve species were listed in the Red Data Book of the Donetsk Region (Zalevskiy & Bronskov 2017).

Spiders of transformed lands have been studied mainly in urban ecosystems (33 papers), reclaimed coalmine waste banks, oil drilling sites and/or ash damps of waterpower plants (16 papers). The araneofauna of Donetsk City is investigated best (257 species) (Prokopenko 2013). For the city of Kharkiv, the largest city in the study area, only 160 spider species are known (Polchaninova & Prokopenko 2013). Despite the fact that agricultural lands occupy vast areas in Left-Bank Ukraine, they are almost neglected in terms of spider studies (nine papers only). Fourteen papers deal with a role of spiders in food webs as predators and prey in natural and man-made ecosystems; nine papers discuss biological aspects of individual spider species.

Systematics studies in Left-Bank Ukraine (69 papers) include descriptions of new species and/or genera revisions, which use spider specimens collected in the study area as comparative material (see Kovblyuk 2005, Kovblyuk & Nadolny 2007, Kovblyuk et al. 2012). Twenty-six species from the present-day territory of Ukraine were described as new to science and 17 of them are valid. Only the family Dysderidae (Kovblyuk et al. 2008) and the genus *Sintula* (Gnelitsa 2012) have been surveyed in the whole of Ukraine. However, both taxa are poor in the left-bank area (six and two species, respectively).

Discussion

Despite the long history of research, the spider fauna of Left-Bank Ukraine is still far from being well studied. The number of registered species (741) is lower than in other countries in eastern or eastern-central Europe, regardless of their area (Nentwig et al. 2018): e.g., Bulgaria (110994 km²) – 1038 species, Romania (238397 km²) – 1007, Slovakia (49035 km²) – 980, Czech Republic (78865 km²) – 888, Poland (312679 km²) – 847 and Hungary (93030 km²) – 804. The area of Left-Bank Ukraine is approximately 242 088 km². However, the relatively poor faunistic list can be explained not only by the insufficient data but also by the plain landscape of the study area. The adjacent region of Central European Russia also hosts only 698 species (Mikhailov 2013, Nentwig et al. 2018). The lack of geographically detached regions results in the lack of endemic spiders. Though the Donetsk Ridge, located mainly within Left-Bank Ukraine, is an endemic area for a number of plant species (Didukh 2009), spiders with the similar geographic ranges are not known.

The araneofauna of the forb-bunchgrass steppe subzone is the richest in Left-Bank Ukraine. This was to be expected given its large area, variety of climatic conditions, and the highest habitat diversity – from floodplain forests in the north to dry steppes and seashore in the south. Moreover, it hosts the largest number of protected areas and has been best studied. The administrative regions of Left-Bank Ukraine remain unequally inventoried. Only the fauna of the Donetsk Region (514 species) can be considered sufficiently studied. We can compare it with the araneofauna of the adjacent Rostov-on-Don Region of Russia, which accounts for about 600 spider

species (Ponomarev 2005, 2017, Ponomarev et al. 2016). Yet here we have to take into consideration that the Rostov Region is four times larger and includes an area of semi-desert steppes absent in the Donetsk Region. The worst studied in Left-Bank Ukraine are the Zaporizhzhia and Poltava regions.

There is a huge gap in arachnological taxonomic studies in both Left-Bank Ukraine and Ukraine as a whole. Permanent systematic research is being conducted only in the Crimea, mainly in the families Gnaphosidae, Philodromidae, Linyphiidae, and superfamily Lycosoidea (Gnelitsa 2009, Kovblyuk et al. 2012, Kastrygina & Kovblyuk 2013, 2014, Nadolny 2014). The Linyphiidae is under study throughout Ukraine (V. Gnelitsa's research), but the results have not been summarized yet.

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Electronic pdf-supplement

Appendix: Tab. 1: List of spider species and their distribution in the natural zones/subzones and administrative regions of Left-Bank Ukraine, Tab. 2: List of misidentifications of the spiders from Left-Bank Ukraine, Tab. 3: List of doubtful records of spiders from Left-Bank Ukraine, Tab. 4: Nomina dubia, References for tab. 1-4: 1-32