

Areneophana of chalk lands of eastern Ukraine

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Introduction

Underlying bedrock of chalk creates specific conditions for the forming of a chalk biota. Geological history of the landscape, structure features of the chalk, high albedo, low daily moisture and temperature fluctuation of the upper layers promote development of extrazonal communities, where a great number of relic and endemic species are presented, as well as thermophilous and xerophilous ones that enrich local fauna with southern elements. Spiders of chalk lands of Eastern Europe have not been studied purposely. In literature, there are only a short remark of the species richness for South-Eastern Ukraine (Polchaninova, Prokopenko, 2003), and records in the lists of local faunas of North-Eastern Ukraine and Southern Russia (Kulczynski, 1913; Prisny, 2003; Ponomarev, Polchaninova, 2006; Polchaninova, Prokopenko, 2007; Polchaninova, 2009).

Material and methods

In the South of Central Russian Upland, chalk lands, with chalk bedrock on the upper interflaves and right high river banks of the river Don basin, occupy a vast region. The altitude of hills does not exceed 300 meters. In the forest-steppe natural zone, as well as on the Donetsk Ridge, that is regarded as an island of the forest-steppe in the steppe zone, the upland and right river banks are partly covered with oak forests. Among them, relic tertiary forests of *Pinus cretaceus* are scattered as small patches. Grasslands on the northern slopes are represented by a meadow steppe. In the steppe natural zone, these slopes are occupied by a forbgrass-feathergrass-fescue steppe, while on the upper part and on the southern slopes in both zones, specific calcareous vegetation forms an azonal chalky steppe.

Our investigations were carried out in 12 localities of Eastern Ukraine within the three administrative regions.

Results and discussion

In total, 179 spider species were registered on chalk lands of Eastern Ukraine; among them, 100 species in steppe communities, and 134 species in the forest ones. In chalk grasslands, as in all steppes types, Gnaphosidae is the richest family of the fauna (Tabl. 1), being the most numerous in granite and forbgrass steppes. Excluding Linyphiidae, the other six main families are equally represented in the chalk community.

Table 1

Species composition of the main families in the spider fauna of different steppe types of Eastern Ukraine (number of species and %)

Families	Steppe type									
	Chalk		Limestone		Granite		Forbgrass		Total	
Theridiidae	12	12,0%	6	7,5%	12	9,4%	20	10,6%	22	9,6%
Linyphiidae	5	5,0%	5	6,3%	10	7,8%	27	14,3%	28	12,3%
Araneidae	10	10,0%	6	7,5%	7	5,5%	13	6,9%	15	6,6%
Lycosidae	14	14,0%	8	10,0%	12	9,4%	19	10,1%	21	9,2%
Gnaphosidae	17	17,0%	17	21,3%	27	21,1%	25	13,2%	41	18,0%
Thomisidae	11	11,0%	9	11,3%	14	10,9%	17	9,0%	18	7,9%
Salticidae	11	11,0%	14	17,5%	16	12,5%	29	15,3%	36	15,8%
Others	20	20,0%	15	18,8%	30	23,4%	39	20,6%	47	20,6%
Total	100	100%	80	100%	128	100%	189	100%	228	100%

In the grass layer of chalk habitats, common steppe dominants as *Theridion impressum* L.K., *Agalenatea redii* (Scop.) *Argiope bruennichi* (Scop.) *Neoscona adiantum* (Walck.), *Dictyna arundinacea* (L.), *Tibellus oblongus* (Walck.), *Xysticus cristatus* (Cl.), *X. striatipes* L.K.,

Heliophanus flavipes (Hahn) prevail. Beccides, *Mangora acalypha* (Walck.) and *Cheiracanthium pennyi* O.P.-C. are numerous in the North of the area in question, with *Dictyna latens* (Fabr.), *Tibellus macellus* Sim., *Thomisus onustus* Walck., *Phylaeus chrysops* (Poda) dominating in the South. *Linyphia triangularis* (Cl.), *L. tenuipalpis* Sim., and *Philodromus cespitum* (Walck.) densely settle low shrub thickets. In the litter, a bulk of common species *Meioneta rurestris* (C.L.K.), *Alopecosa sulzeri* (Pav.), *Berlandina cinerea* (Mg), *Drassodes pubescens* (Thor.), *Thanatus arenarius* L.K., *Xysticus kochi* Thor. is typical; in addition to them, local dominants *Trochosa robusta* (Sim.), *T. ruricola* (De Geer), *T. terricola* Thor., *Gnaphosa taurica* Thor., and less numerous *Atypus muralis* Bertk., *Eresus cinnaberinus* (Oliver), *Stemonyphantes lineatus* (L.), *Asianellus festivus* (C.L.K.), *Phlegra fasciata* (Hahn) were found. Only 5 species were recorded exclusively in chalk grasslands. *Uloborus walckenaerius* Latr., a typical dweller of sand habitats, settles *Artemisia* thickets; the other 4 species were rare. In the forest-steppe zone of Ukraine, some polytopic mesophilous species (*Micrommata virescens* (Cl.), *Pisaura mirabilis* (Cl.), *Phrurolithus festivus* (C.L.K.), *Alopecosa cuneata* (Cl.) settle northern chalk slopes. Northwards, in Central Forest-Steppe, the tendency is more evident; a lot of species never occurring in this habitat southwards appear on chalk hills (*Robertus lividus* (Bl.), *Microlinyphia pusilla* (Sund.), *Neriene clathrata* (Sund.), *Araniella cucurbitina* (Cl.), *Araneus marmoreus* Cl., *Zora nemoralis* (Bl.), etc). There are no specific spider species characteristics of calcareous grasslands. Uniqueness of the spider complex consists in presence of the southern and eastern elements which have an area disjunction and sometimes northern- or westernmost bounds of their distribution, penetrating to other natural zones along the chain of chalk lands. As an example, the following species can be referred: *Pardosa italica* Torng., *Alopecosa cursor* (Hahn), *Gnaphosa licenti* Schenkel, *G. steppica* (Ovtsh.), *G. mongolica* Sim., *G. taurica* Thor., *Micaria rossica* Thor., *Zora pardalis* Sim., *Xysticus ninni* Thor.

In a pine forest on chalk hills on the Donetsk Ridge, 112 spider species were registered. Two families (Linyphiidae, 17%, and Theridiidae, 13% of the fauna) were dominants, the other main families (see table 1), including Philodromidae, made up from 7 to 8,8%. More than a half species (62) was presented by forest or polytopic mesophiles, typical of forests of the forest-steppe and steppe zones. Photophilous dwellers of grasslands penetrate under the canopy and/or occupy glades and cuttings (*Enolpognatha thoracica* (Hahn), *Simitidion simile* (C.L.K.), *Theridiom impressum*, *Th. nigrovariegatum* Sim., *Meioneta rurestris*, *Stemonyphantes lineatus*, *Cyclosa oculata* (Walck.), *Hypsosinga sanguinea* (C.L.K.), *Neoscona adianta*, *Alopecosa trabalis* (Cl.), *Dictyna latens*, *Tibellus macellus*, *Aelurillus festivus*, *Phylaeus chrysops* and others, 20 species altogether), 30 species are rare or sporadic. The bulk of dominants of the grass and lower shrub layer was composed of *Mangora acalypha*, *Araneus diadematus* Cl., *Zilla diodia* (Walck.), *Gibbaranea bituberculata* (Walck.), *Tetragnatha pinicola* L.K., *Linyphia hortensis*, *L. triangularis*, *Philodromus cespitum*; in the litter, it included *Atypus muralis*, *Alopecosa sulzeri*, *Arctosa lutetiana* (Sim.), *Haplodrassus umbratilis* (L.K.), *Thanatus sabulosus* (Mg), *Asianellus festivus* in pitfall traps and *Tenuiphantes flavipes* (Bl.) in quadrat samples. On the whole, the spider fauna of calcareous pine forest is richer than that of pine forests on sand soil in river valleys (we collected in the three local fauna in Eastern Europe 72, 77 and 89 species, respectively). However, in spite of its ancient age, we have not found any spider species preferring or typical of this very habitat.

In the neighbouring oak forest, 129 spider species were found. Linyphiidae was the most numerous – 24% of the fauna, the second group was composed of Gnaphosidae, Theridiidae and Lycosidae (11-13,5%), the third one was formed of Araneidae, Thomisidae and Salticidae (7% each). Unlike to pine forest, the family Philodromidae was very poor (3%). In this habitat, a half of species also belonged to common forest dwellers; a guild of photo- and thermophiles enriched the spider complex with atypical elements (*Ero aphana* (Walck.), *Microlinyphia pusilla*, *Pardosa palustris* (L.), *Trochosa robusta*, *Titanoeca schineri* L.K., *Cheiracanthium erraticum* (Walck.), *Zelotes electus* (C.L.K.), *Xysticus robustus* (Hahn) etc, 24 species altogether).

During the Quaternary Period, the Donetsk Ridge was not covered with ice, suggesting that representatives of nemoral biota might have survived here. *Gnaphosa montana* (L.K.), *G. bicolor*

(Hahn), *Thanatus sabulosus*, *Ozyptila brevipes* (Hahn), and *Xerolycosa nemoralis* (Westr.) have been found far away from their main area in the forest zone o (for the last one), in the north of the forest-steppe zone. The six species, typical of the forests (*Diplocephalus erythropus* (Sim.), *D. melanogaster* (C.L.K.), *Ceratinella scabrosa* (O.P.-C.), *Tapinopa longidens* (Wid.), *Ozyptila claveata* (Walck.), and *Cozyptila blackwalli* (Sim.) do not advance southward in the steppe zone. *Zelotes aurantiacus* Mill., *Gnaphosa taurica*, *Trachyzelotes pedestris* (C.L.K.) are characteristics of steppe communities and/or polytopic on the North coast on the Black see. There is the sole example of their finds in oak forests of East Europe.

A comparison of spider fauna of chalk oak forests with that of the three local plane forests in the South of the Forest-Steppe, shows a gradual decrease of the Linyphiidae ratio from 40 to 24%, a slight increase of the Lycosidae (4-8%) and Theridiidae (9-12%) families, and a leap in the Gnaphosidae richness from 5 to 10%. Many close species display specific patterns of distribution in these forests. *Atypus piceus* (Sulz.) occurs in plane forests in the driest places. In the chalky forest it was found on the North wet slope, while on the South one, only *A. muralis* was numerous. *Phrurolitus festivus* is common in the first case and very rare in the second one. *Pachygantha listeri* Sund., *Agroeca brunnea* (Walck.), *Clubiona caerulescens* L.K., *Zelotes aszheganovae* Esyunin, Efimik, *Z. laterillei* (Sim.), *Xysticus ulmii* (Hahn), *X. luctator* L.K. do not occur in the chalky forest, where *P. degeeri* Sund., *A. cuprea* Mg., *C. pseudoneglecta* Wund., *Z. electus*, *X. robustus* are present in single finds, and *Z. kukushkini* Kovblyuk and *Z. pedestris* are numerous. So, the araneofauna of chalky oak forests is heterogeneous, constituted of common forest species with an addition of northern and southern elements.