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Oribatid mites (Acari, Oribatida) of steppe vegetation on cape Tarhankut in Crimea (Ukraine)

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Abstract: Oribatid mites were investigated in patches of steppe vegetation, dominated by esparto (*Stipa* sp.), other grasses, *Artemisia caucasica*, *Sedum* sp., mosses, or lichens, on cape Tarhankut in Crimea (Mediterranean climate). These mites were quite abundant and rich in species there, probably thanks to the fresh sea breeze and geographic expansion of species from the Mediterranean region, Central Asia, and Europe. They achieved the highest density in patches of steppe grasses other than esparto, but most species occurred in sedum patches. The most abundant was *Tectocepheus velatus*, especially in patches of steppe grasses other than esparto, and relatively abundant were *Scutovertex* sp. 1, *Jacotella neonominata* and *Scheloribates laevigatus*. In populations of these species the adults usually dominated, but their age structure greatly depended on vegetation type.

Keywords: Crimea, Tarhankut, steppe vegetation, Oribatida, mites, population, juvenile stages

INTRODUCTION

The Crimea Peninsula lies in south Ukraine, on the Black Sea, and has the same latitude as Venice. Therefore its climate is Mediterranean, with a warm (or hot) dry season, which lasts from May to October, and a cool season with some precipitation, which lasts from November to April. Generally, precipitation is low here, but the fresh sea breeze slightly lowers the costal temperature and increases air moisture. Winter is usually mild here, mainly due to the high mountains in the north, which protect Crimea from cool continental winds.

Cape Tarhankut lies in the west part of Crimea and comprises a lowland area, with steppe grasses and herbs and patches of shrubs. Among the shrubs, hawthorn (*Crataegus pojarcoviae* L.) is common, with bushy elms (*Ulmus* sp.) and rose (*Rosa* sp.). Herbaceous flora is extremely rich in species, mainly due to the geographic expansion of species from the Mediterranean region, Central Asia, and Europe.

The aim of this paper is to compare the populations of oribatid mites and their communities from various steppe vegetation patches on cape Tarhankut in Crimea.

MATERIAL AND METHODS

Samples of 500 cm^3 each were taken on 15–20 July 2004, in 3 replicates, from 6 patches of steppe vegetation, dominated by esparto (*Stipa* sp.), other steppe grasses, *Artemisia caucasica* Willd., *Sedum* sp., mosses, or lichens. The mites were extracted in Tullgren funnels, preserved, and identified to species or genus level, including the juvenile stages. Nearly 13 500 oribatid mites were extracted in total. Each oribatid species was characterized by the abundance (A = mean number of individuals per sample) and dominance index (D = % of the total number of oribatid mites per sample). Oribatid mite communities in individual vegetation types were compared by mean density of all oribatid mites, number of species, and the Shannon index H' (Odum 1971). Names of oribatid species follow Subías (2004) and partly Weigmann (2006).

RESULTS

In the investigated habitats, oribatid mites were most abundant in patches of steppe grasses other than esparto, relatively abundant in patches of mosses and sedum, and the least abundant in patches of lichens (Table 1). The richest in species of oribatid mites were patches of sedum, relatively rich were patches of esparto, mosses and grasses, while the poorest in species were patches of lichens. Consequently the Shannon index for these mite communities was the highest in patches of mosses, and the lowest in patches of lichens.

Table 1. Characteristics of oribatid communities in Crimean steppe: mean density (individuals per mean sample, i.e. 500 cm^3, n = 3), number of species, and Shannon index of diversity (H')

Characteristic	Esparto	Other grasses	Artemisia	Sedum	Mosses	Lichens
Mean density of Oribatida	189.3	824.0	202.7	558.0	645.3	90.0
Number of species	35	32	20	40	35	19
Shannon index H'	2.50	2.09	2.07	2.00	2.82	1.89

In patches of steppe vegetation, the most abundant and common was *Tectocepheus velatus* (Michael, 1880), which preferred patches of steppe grasses other than esparto, but was relatively abundant also in sedum patches (Table 2). Other relatively abundant species included *Scutovertex* sp. 1, *Trhypochthonius tectorum* (Berlese, 1896), and *Liebstadia similis* (Michael, 1888) in patches of sedum, *Jacotella neonominata* Subías, 2004, *Oribatula* sp. 2 and *Ramusella fasciata* (Paoli, 1908) in patches of mosses, and *Scheloribates laevigatus* (C. L. Koch, 1835) and *Oribatula* sp. 3 in patches of steppe grasses other than esparto.

Table 2. Characteristics of oribatid species in Crimean steppe: abundance (*A* = individuals per mean sample, i.e. 500 cm³, *n* = 3) and dominance index (*D* = % of the total number of oribatid mites in the mean sample). Species with maximum *A* ≤ 10 are listed below the table

Species		Esparto	Other grasses	Artemisia	Sedum	Mosses	Lichens
Arthrodamaeus sp. 1	*A*	15.0	8.3	1.3	2.3	41.3	1.3
	D	7.9	1.0	0.6	0.4	6.4	1.4
Berniniella azerbeidjanica (Kuliev, 1962)	*A*	0	13.3	0	0	0	0
	D	0	1.6	0	0	0	0
Cosmochthonius lanatus (Michael, 1885)	*A*	0	0	0	0	38.7	0
	D	0	0	0	0	6.0	0
Eupelops acromios (Hermann, 1804)	*A*	9.0	2.3	6.3	5.3	16.3	1.0
	D	4.7	0.2	3.0	0.9	2.5	1.1
Galumna sp. 1	*A*	1.3	2.0	12.0	0	0	1.0
	D	0.5	0.2	5.9	0	0	1.1
Haplochthonius simplex Willmann, 1930	*A*	3.3	0	2.3	0	16.3	0
	D	1.6	0	1.0	0	2.5	0
Jacotella neonominata Subías, 2004	*A*	18.3	24.3	0	1.7	116.3	0
	D	9.5	2.9	0	0.2	18.0	0
Liebstadia similis (Michael, 1888)	*A*	0	0	17.0	59.0	0	0
	D	0	0	8.4	10.6	0	0
Liebstadia sp. 1.	*A*	0	4.3	0	1.3	11.3	0
	D	0	0.5	0	0.2	1.7	0
Lucoppia burrowsi (Michael, 1890)	*A*	1.3	17.7	0	0	48.0	0
	D	0.5	2.1	0	0	7.4	0
Neoliodes theleproctus (Hermann, 1804)	*A*	24.0	9.3	0	6.3	7.3	2.3
	D	12.6	1.1	0	1.1	1.1	2.2
Oribatula sp. 1	*A*	6.3	40.7	0	9.0	5.3	1.3
	D	3.2	4.9	0	1.6	0.8	1.4
Oribatula sp. 2	*A*	0	0	0	0	96.0	0
	D	0	0	0	0	14.9	0
Oribatula sp. 3	*A*	0	100.3	7.3	0	0	0
	D	0	12.1	3.5	0	0	0
Passalozetes hispanicus Mihelčič, 1953	*A*	34.3	44,3	0	4.7	11.0	0
	D	17.9	5.3	0	0.8	1.7	0
Peloribates pilosus Hammer, 1952	*A*	0	1.3	32.7	0	0	0
	D	0	0.1	15.8	0	0	0
Ramusella fasciata (Paoli, 1908)	*A*	1.0	1.0	0	0	85.7	0
	D	0.5	0.1	0	0	13.2	0
Scheloribates laevigatus (C. L. Koch, 1835)	*A*	4.0	108.3	8.3	22.3	19.3	0
	D	2.1	13.1	3.9	3.9	3.0	0
Sphaerochthonius splendidus (Berlese, 1904)	*A*	2.3	23.7	1.7	0	15.0	0
	D	1.1	2.8	0.8	0	2.3	0
Scutovertex sp. 1	*A*	4.3	35.7	7.3	180.7	30.3	0
	D	2.1	4.3	3.5	32.4	4.7	0
Tectocepheus velatus (Michael, 1880)	*A*	47.3	357.0	88.3	147.3	41.0	30.3
	D	24.7	43.3	43.4	26.3	6.4	32.6
Trhypochthonius tectorum (Berlese, 1896)	*A*	1.3	2.3	5.3	85.0	1.3	45.3
	D	0.5	0.2	2.5	15.2	0.2	38.4

Less frequent oribatid species found in studied vegetation types:
Esparto: *Achipteria* sp. 1; *Aphelacarus acarinus* (Berlese, 1910); *Ceratozetes* sp.; *Galumna tarsipennata* (Oudemans, 1913); *Malaconothrus monodactylus* (Michael, 1888); *Metabelba pulverulenta* (C. L. Koch, 1839); *Micreremus brevipes* (Michael, 1888); *Microppia minus* (Paoli, 1908); *Microtritia* sp.; *Oppiella nova* (Oudemans, 1902); *Oribatula* sp. 4; *Peloptulus phaenotus* (C. L. Koch, 1844); *Phthiracarus* sp. 1; *Phyllozetes emmae* (Berlese, 1910); *Protoribates obtusus* (Mihelčič, 1956); *Punctoribates punctum* (C. L. Koch, 1839); *Quadroppia quadricarinata* (Michael, 1885); *Ramusella clavipectinata* (Michael, 1885); *Suctobelba* sp.; *Trichoribates incisellus* (Kramer, 1897).
Other grasses: *Brachychthonius* sp.; *Carabodes* sp.1; *Ceratozetes* sp.; *Liacarus coracinus* (C. L. Koch, 1841); *Licneremaeus licnophorus* (Michael, 1882); *Metabelba pulverulenta*; *Microppia minus*; *Oppiella nova*; *Oribatula* sp. 5; *Peloptulus phaenotus*; *Phyllozetes emmae*; *Suctobelba* sp.; *Trichoribates incisellus*; *T. trimaculatus* (C. L. Koch, 1835).
Artemisia: *Brachychthonius* sp.; *Camisia horrida* (Hermann, 1804); *Galumna tarsipennata*; *Metabelba pulverulenta*; *Microppia minus*; *Oppiella nova*; *Phyllozetes emmae*; *Trichoribates incisellus*; *T. trimaculatus*.
Sedum: *Achipteria* sp. 1; *Aphelacarus acarinus*; *Berniniella* sp.; *Bipassalozetes* sp.; *Brachychthonius* sp.; *Camisia horrida*; *Ceratozetes* sp.; *Chamobates* sp.1; *Conchogneta tragardii* (Forsslund, 1947); *Liacarus coracinus*; *Galumna lanceata* (Oudemans, 1900); *G. tarsipennata*; *Hypochthonius rufulus* (C. L. Koch, 1835); *Licnobelba* sp. 1; *Nanhermannia comitalis* Berlese, 1916; *Nothrus anauniensis* Canestrini et Fanzago, 1876; *Oppiella nova*; *Oribatula tibialis* (Nicolet, 1855); *Oribatula* sp. 5; *Peloptulus phaenotus*; *Phthiracarus* sp. 1; *Platynothrus peltifer* (C. L. Koch, 1839); *Protoribates* sp. 1; *Ramusella clavipectinata*; *Scheloribates barbatulus* (Mihelčič, 1956); *Suctobelba* sp.; *Trichoribates incisellus*; *T. trimaculatus*.
Mosses: *Achipteria* sp. 1; *Austrocarabodes* sp.1; *Brachychthonius* sp.; *Ceratozetes* sp.; *Chamobates* sp. 1; *Dissorhina ornata* (Oudemans, 1900); *Dorycranosus curtipilis* Willmann 1935; *Galumna tarsipennata*; *Eueremaeus* sp.1; *Licnodamaeus* sp. 1; *Oppiella nova*; *Oribatula* sp. 4 and 5; *Peloptulus phaenotus*; *Protoribates obtusus*; *Punctoribates punctum*; *Suctobelba* sp.; *Trichoribates trimaculatus*.
Lichens: *Achipteria* sp. 1; *Brachychthonius* sp.; *Ceratozetes* sp.; *Galumna tarsipennata*; *Malaconothrus monodactylus*; *Oribatula* sp. 4 and 5; *Peloptulus phaenotus*; *Protoribates* sp.1; *Ramusella clavipectinata*; *Trichoribates incisellus*; *T. trimaculatus*.

Among the oribatid mites, adults usually dominated, except for lichens, where juvenile stages were more abundant, mainly due to *Trhypochthonius tectorum*, as its juveniles were 6.5 times more abundant than the adults (Table 3). The age structure of oribatid mites greatly depended on vegetation type.

DISCUSSION

In the investigated patches of vegetation in Crimean habitats, the density and species number of oribatid mites were highly differentiated and depended on vegetation type. In Mediterranean climate, the main limiting factors for oribatid mites are high temperature and low precipitation (Attenborough et al. 1989), so the kind of plant cover is important for mites. For example, patches of dense steppe grasses (other than esparto) form a turf, which stores more water, protects the soil against evaporation, and provides the mites with food, which resulted in the highest density of mites. The patches of sedum and mosses are probably also able to store more wa-

Table 3. Age structure of some oribatid species in Crimean steppe habitats: mean density of individuals per 500 cm^3 (n = 3) of juvenile stages (Juv) and adults (Ad)

Species	Habitat	Juv	Ad	Total
Arthrodamaeus sp. 1	Mosses	12.0	29.3	41.3
Neoliodes theleproctus	Esparto	8.3	15.7	24.0
	Other grasses	4.3	5.0	9.3
Oribatula sp. 2	Mosses	36.7	59.3	96.0
Scheloribates laevigatus	Other grasses	81.3	27.0	108.3
	Mosses	6.3	13.0	19.3
Scutovertex sp. 1	Sedum	77.0	103.7	180.7
	Other grasses	9.3	26.4	35.7
Tectocepheus velatus	Other grasses	25.7	331.3	357.0
	Sedum	57.0	90.3	147.3
	Mosses	30.7	10.3	41.0
	Lichens	16.3	14.0	30.3
Trhypochthonius tectorum	Sedum	54.3	30.7	85.0
	Lichens	39.3	6.0	45.3

ter, so the density of mites in them was distinctly higher than in patches of esparto, artemisia, and lichens.

Among oribatid mites in Crimean steppe, the highest density was achieved by *Tectocepheus velatus*, which is cosmopolitan (Nübel-Reidelbach 1994, Subias 2004), and can be abundant in both extremely dry and wet habitats (Rajski 1968). Relatively abundant were *Scutovertex* sp. 1, *Jacotella neonominata*, *Trhypochthonius tectorum* and *Liebstadia similis*, which prefer dry habitats, while *Scheloribates laevigatus* is typical for meadows (Rajski 1968, Pérez-Íñigo 1993). Generally, in patches of steppe plants, 1–2 species achieved a high density and dominance index, which indicate in the light of Thienemann's (1939) principles rather low soil fertility, probably because of low precipitation. For example, in patches of artemisia and steppe grasses other than esparto, *Tectocepheus velatus* comprised 43.3% of all oribatid mites, while in patches of lichens this species and *Trhypochthonius tectorum* comprised jointly 71% of all oribatid mites. However, the oribatid communities were richer in individuals and species than those from the south part of Andalusia and Rhodes Island (Subías at al. 1985, Seniczak & Seniczak 2006, Seniczak & Seniczak 2009), probably due to the fresh sea breeze, which slightly lowers the temperature and increases air moisture in the hot season, and also due to expansion of mites from Central Asia and Europe. Probably that is also why the Shannon index of oribatid mite communities of Crimean steppe was higher than in patches of vegetation in south Andalusia (Seniczak & Seniczak 2009).

Adults usually dominated in mite communities, but the age structure of species depended greatly on vegetation type, which was conspicuous in *Tectocepheus velatus*. In patches of steppe grasses other than esparto this species was abundant, but poor in juveniles, while in patches of mosses it was not abundant, but juveniles dominated. Based on the list of oribatid species from the Caucasus and Crimea (Karppinen et. al. 1987), *Jacotella neonominata* Subías, 2004 [= *Jacotella ornata* (Pérez-Íñigo, 1972)] and *Lucoppia burrowsi* (Michael, 1890) are new to Crimea.

CONCLUSIONS

1. The summer oribatid mite communities of investigated patches in Crimean steppe were rather abundant and rich in species, which was probably caused by the fresh sea breeze and geographic expansion of species from the Mediterranean region, Central Asia and Europe.
2. Oribatid mites achieved the highest density in patches of steppe grasses other than esparto, while most species occurred in sedum patches.
3. Among oribatid mites, the highest density was achieved by *Tectocepheus velatus*, especially in patches of steppe grasses other than esparto, and relatively abundant were *Scutovertex* sp. 1, *Jacotella neonominata* and *Scheloribates laevigatus*.
4. In populations of oribatid species the adults usually dominated, but age structure greatly depended on vegetation type.

REFERENCES

Attenborough D., Whitfield P., Moore P. D., Cox B. 1989. The atlas of the living world. Marshal Edition Ltd.

Karppinen E., Krivoluckij D. A., Tarba Z. M., Shtanchaeva U. Ya, Godreeva E. W. 1987. List of oribatid mites (Acarina, Oribatei) from northern Palaearctic region. IV. Caucasus and Crimea. An. Ent. Fen. 53: 119–137.

Nübel-Reidelbach E. 1994. Taxonomie und Systematik der Gattung *Tectocepheus* Berlese, 1895 [Taxonomy and systematic of genus *Tectocepheus* Berlese, 1895]. Andrias. 12: 3–94.

Odum E. P. 1971. Fundaments of ecology. W. B. Saunders Co., Georgia.

Pérez-Íñigo C. 1993. Acari, Oribatei, Poronota. In: Fauna Iberica (Ramos A. et al., Eds), vol. 3: 1–320. Museo de Ciencias Naturales, Madrid.

Rajski A. 1968. Autecological-zoogeographical analysis of moss mites (Acari, Oribatei) on the basis of fauna in the Poznań environs. Part. II. Fragm. Faun. 14: 277–403.

Seniczak S., Seniczak A. 2006. The oribatid mites (Acari) of some habitats of Rhodes Island (Greece). Biological Lett. 43: 215–219.

Seniczak S., Seniczak A. 2009. The oribatid mites (Acari, Oribatida) of some habitats of south part of Andalusia (Spain). Biological Lett. (in press).

Subías L. S. 2004. Listado sistemático, sinonímico y biogeográfico de los Ácaros Oribátidos (Acariformes, Oribatida) del mundo (1758–2002) [Systematic, synonymic and biogeographical check – list of the world's oribatid mites (Acariformes, Oribatida) (1758–2002)]. Graellsia. 60: 3–305.

Subías L. S., Ruiz E., Minguez M. E. 1985. Aportación al conocimiento de las comunidades de Oribatidos (Acari) del erial mediterráneo [Contribution to the knowledge of the communities of Oribatida (Acari) from the Mediterranean heath]. Actas do II Congresso Ibérico de Ent. 1: 389–398.

THIENEMANN A. 1939. Grundzüge einer allgemainen Oecologie [Principle of general ecology]. Arch. Hydrobiol. 35: 267–285.

WEIGMANN G. 2006. Hornmilben (Oribatida) [Oribatid mites (Oribatida)]. In: Die Tierwelt Deutschland und der angrenzenden Meeresteile (DAHL F. Ed), 76. Teil, pp. 1–520, Goecke & Evers, Keltern.