PREDATORY SOIL MITES (ACARI, MESOSTIGMATA, GAMASINA) FROM THE WESTERN BALTIC COAST OF LATVIA

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SOIL MICROARTHROPODS
GAMASINA, BALTIC COAST
COASTAL HABITATS, DUNES,
DRIFTLINE

SUMMARY : Sampling (organic debris of the driftline and rhizosphere of characteristic plants of the primary and yellow dunes) was made at six sites along the Kurzeme Coast of Latvia (Eastern Europe). Among 37 Gamasina species recorded, 14 were new for fauna of Latvia. Yellow dunes were the most rich in species (25 species), then driftline habitats (18 species) and primary dunes with 16 species. The maximum of abundance was found in driftline habitats followed by yellow and primary dunes. At the investigated habitats distinct Gamasina communities were found, with about $^2/_3$ of all species being typical for each habitat stand. Great differences in the numbers of individuals among the investigated habitat types revealed consequences of the diversity of ecological conditions. *Minirhodacarellus minimus* seems to have a preference for *Festuca rubra* (s.l.).

MICROARTHROPODES
DU SOL, GAMASINA,
CÔTE BALTE,
HABITAT CÔTIER, DUNES,
LAISSES DE MER

RÉSUMÉ : L'échantillonage de débris organiques sur les rivages et les rhizosphères des plantes caractéristiques des dunes a été effectué sur la côte de Lettonie (côte Kurzeme). Quatorze nouvelles espèces pour la Lettonie ont été récoltées sur 37 espèces de Gamasina. Les dunes jaunes sont les plus riches (25 espèces) par rapport à la ligne de rivage (18) et les dunes primaires (16). L'abondance maximale est enregistrée sur la zone de rivage (laisses de mer). La diversité des conditions écologiques se traduit par les différences notées de l'abondance des individus, alors que 2/3 des espèces sont caractéristiques de chaque habitat. *Minirhodacarus minimus* présente une préférence pour *Festuca rubra.*

INTRODUCTION

Gamasina mites play an important role in the coastal ecosystems (KOEHLER *et al.* 1995). Important predators on the arthropods and nematodes in the soil, they contribute to the regulation of their population dynamics and, in relation to that, to force dune sand stabilization. KADITE described Gamasina species from the seashore habitats of the Baltic Sea Coast (EITMINAVICHUTE, 1976), including some coastal habitats of Latvia. Unfortunately, this study gave only weak evidence on the Latvian Gamasina mites' fauna of the seashore habitats. The project "Coastal Ecosystems of the Baltic Sea and Bioindication" within the twinning of the Universities of Bremen and Riga was started in 1992. Thus leaded to the increased research activities in the coastal habitats (KOEHLER *et al.* 1992, 1995; KOEHLER mscr. 1994;

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MELECIS et al. 1995; PAULINA & SALMANE 1996).

The present paper discusses data from the sampling carried out at six sites of the North-western Baltic Coast of Latvia. We used semi-quantitative sampling to investigate the species spectrum of Gamasina taxocenoses. As well we wanted to investigate possible correlations of Gamasina species' occurrences in the rhizospheres of the specific plant species (KOEHLER *et al.* 1992). For this purpose sampling was made in the rhizosphere of the selected characteristic plants.

MATERIAL AND METHODS

Six sites of the Kurzeme Coast, North-western of Riga – Roja (22°45′/57°30′), Kolkasrags (22°30′/57°40′), Luzna (21°55′/57°35′), Ventspils (21°30′/57°25′), Pavilosta (21°15′/56°55′) and Liepaja (21°0′/56°30′) (fig.1) were investigated. The distances between sampling sites vary between 30 and 50 km.

Altogether 128 soil samples were taken, 22 of them at each sampling site: 6 from the driftlines, 8 from the primary and 8 from the yellow dunes. The last two habitats are generally characterized by their specific vegetation (ELLENBERG, 1986). In Liepaja, the number of driftline samples was reduced to 2, as a distinct driftline was missing. Each sample comprised approximately 350 cm^3 of organic debris and sand (driftline) or fine roots and sand (primary and yellow dunes).

As known from the our own investigations (HELDT, unpubl.; SALMANE, 1999; 2000) and literature (ANDRÉ *et al.* 1994), the dispersion of Gamasina in the sandy habitats shows aggregations to the rhizosphere of plants. Density of the individuals in the bare sand is very low with the exception of the driftline areas rich in washed ashore material. Sampling was carried out by hand and material was taken to the laboratory in the plastic bags. Half of the samples from each site were extracted on the Tullgren funnels exposed to 25° C for a period of 14 days. For the second half, extraction in a MacFadyen canister type apparatus was practised. Temperature was raised every 24 hours for 5° C from 25 to 60° C.

The determination and nomenclature of Gamasina species are based upon to the keys of BREGETOVA

FIG. 1. — Sampling sites along the Kurzeme Coast of Latvia.

(1977) and KARG (1993). Additionally, the keys of BŁASZAK & EHRNSBERGER (1993), EVANS & HYATT (1960), HIRSCHMANN (1960, 1971), KOLODOCHKA (1978), LAPINA (1976 a, b), and SCHERBAK (1980) were used.

The occurrence of those species, which were found at least at three sites, was examined more closely concerning preferences for specific plants′ rhizospheres, and the frequencies (cf. TISCHLER, 1984) of species' occurrences were determined. Data for TABLE 2 were interpreted in the following way: in the case of rooting systems in a respective soil sample consisting of more than one plants' roots, determined individuals are quoted once for each plant species found in the respective soil sample.

RESULTS

Altogether 37 species were found in the seashore habitats of the Kurzeme Coast (TAB. 1). The number of species ranged from 18 to 25. About $^2/_3$ of the species are typical for one of the three habitat types showing three distinct Gamasina communities in the driftline, the primary and the yellow dunes. Some of these species were recorded from a wide range of various habitats in Latvia (TAB. 3).

	< 5%	5 - 20%	> 20%	
	Driftline	Primary dunes	Yellow dunes	Number of sites
Cheiroseius necorniger (Oudemans, 1903)	37,29			3
Halolaelaps balticus Willmann, 1957	23,65	18,79		4
Thinoseius spinosus Willmann, 1939	11,79	0,87	1,39	5
Parasitus kempersi Oudemans, 1902	12,07		0,20	2
Halolaelaps incisus Hyatt, 1956	5,46			2
Arctoseius cetratus (Sellnick, 1940)	4,09	19,36	1,19	6
Gamasodes bispinosus (Halbert, 1915)	1,91			1
Amblyseius marinus (Willmann, 1952)	0,75	0,87	0,60	4
Halolaelaps marinus (Brady, 1875)	0,75			1
Lasioseius sp. (subgen. *Criniacu*K arg, 1980)	0,34			1
Halolaelaps sp. (subgen. *Halolaelaps* Berlese & Trouessart, 1889)	0,34			1
Dendrolaelaps fallax (Lettner, 1949)	0,07			1
Amblyseius agrestis (Karg, 1960)	0,61	0,29	0,40	1
Parasitus halophilus (Sellnick, 1957)	0,27	7,80	0,20	6
Dendrolaelaps nostricornutus Hirschmann & Wisniewski, 1982	0,34	11,85	2,78	5
Leioseius insignis Hirschmann, 1963	0,07	4,62	18,49	6
Amblyseius bicaudus Wainstein, 1962	0,14		0,80	3
Pergamasus vagabundus Karg, 1968	0,07		0,20	1
Leioseius bicolor (Berlese, 1948)		18,50	5,77	6
Dendrolaelaps arenarius Karg, 1971		14,45	2,78	3
Prozercon trägardhi (Halbert, 1923)		0,87		1
Rhodacarellus silesiacus Willmann, 1935		0,58	1,19	2
Seiulus sp.		0,29		1
Parazercon radiatus Berlese, 1914		0,29		1
Amblyseius sp.		0,29		1
Minirhodacarellus minimus (Karg, 1961)			26,44	4
Leioseius sp.			15,11	2
Rhodacarus haarlovi Shcherbak, 1977		0,29	11,93	5
Hypoaspis aculeifer (Canestrini, 1883)			4,77	3
Hypoaspis sclerotarsa Costa, 1968			2,98	2
Hypoaspis similisetae Karg, 1965			0,99	1
Hypoaspis kargi Costa, 1968			0,80	1
Dendrolaelaspis angulosus Willmann, 1936			0,20	1
Hypoaspis vacua (Michael, 1891)			0,20	1
Amblyseius barkeri (Hughes, 1948)			0,20	1
Leioseius sp.			0,20	1
Hypoaspis sp. Canestrini, 1885			0,20	1
Total number of individuals	1467	346	503	
species number	18	16	25	

TABLE 1. — Gamasina species and their relative abundances in the driftlines, primary and yellow dunes of the Kurzeme Coast, Latvia. (Relative abundances calculated from the total number of individuals).

	DETR		tidal debris		*Atriplex*		*Chenopodium*		*Juncus*		*Polygonum*		*Scirpus*		*Cakile*		*Honckenya*		*Salsola*	
species' names	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre
Cheiroseius necorniger	547	13	200	5	18	1	10	3	5	1	18	1	63	3	274	3				
Halolaelaps balticus	409	12	96	3	92	1					14	1	92	1	142	5			2	1
Thinoseius spinosus	183	27	132	8	17	1	1	1							37	5			3	1
Arctoseius cetratus	134	27	8	4	2	1	1	1			33	1	17	1			3	1		
Amblyseius marinus	17	10											2	1	9	3	1	1		
Parasitus halophilus	32	15					1	1			2	1			1	1	7	3	1	1
Dendrolaelaps nostricornutus	60	15									5	1								
Leioseius insignis	112	27											2	1	1	1	36	3		
Leioseius bicolor	93	18											1	1						
Dendrolaelaps arenarius	64	13															20	1		
Minirhodacarellus minimus	133	9																		
Rhodacarus haarlovi	61	13															1	1		
Hypoaspis aculeifer	24	5																		

	Elymus		*Ammodenia*		*Calamagrostis*		*Calamophila*		*Ammophila*		*Carex*		*Festuca*		*Hieracium*		*Lathyrus*	
	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre	ind	fre
Cheiroseius necorniger																		
Halolaelaps balticus							65	1										
Thinoseius spinosus	1	1					6	6	6	4			5	5	1	1	1	1
Arctoseius cetratus	22	5			8	1	30	5	7	4			7	5			1	1
Amblyseius marinus	2	1					2	3	1	1			3	4	2	3		
Parasitus halophilus	2	3	2	1			16	4	1	1								
Dendrolaelaps nostricornutus	44	5					5	5	5	3			3	3	1	1	1	1
Leioseius insignis	1	1	2	1	2	1	13	4	27	9	4	1	69	12	30	3	3	3
Leioseius bicolor	2	3			1	1	64	6	26	8			5	6	15	4		
Dendrolaelaps arenarius	16	3	3	1			10	4	26	4			13	3			9	1
Minirhodacarellus minimus							70	4	125	6			133	9	100	4	4	1
Rhodacarus haarlovi	1	1					1	1	41	8			50	5	27	5		
Hypoaspis aculeifer							1	1	23	4			4	1	22	3		

TABLE 2. — Occurrences of the Gamasina species found in the various plant species' rooting systems. (DETR — number of the individuals caught in total; ind — number of individuals caught in the rooting systems; fre — frequency in the rooting systems (%)).

The yellow dunes were the richest habitat with 25 Gamasina species, while from the driftline habitats and primary dunes 18 and 16 species, respectively, were gained (TAB. 1). In turn, the highest abundances of the individuals were found in the driftline habitats represented by washed ashore material and followed by the yellow and primary dunes.

Respectively, 7, 4 and 11 species were exclusively restricted to the specific habitats. About 40% of the individuals from the driftline were *Cheiroseius necorniger* and about 20% belonged to *Halolaelaps balticus*. In the dune samples only the individuals of *M. minimus* from the yellow dunes made up to 20 %. Species with the dominance of more than 1 %, showing a concentration in the driftline habitats are *C. necorniger, H. balticus, Thinoseius spinosus, Parasitus kempersi, Halolaelaps incisus, Arctoseius cetratus* and *Gamasodes bispinosus*. In the primary dunes these species were *Arctoseius cetratus, Leioseius bicolor, Parasitus halophilus, Dendrolaelaps nostricornutus* and *Dendrolaelaps arenarius*, and in the yellow dunes *Leioseius insignis, Rhodacarellus silesiacus, M. mini-*

Amblyseius agrestis	plants, *Fragaria* sp., mosses, dunes, washed ashore, fields, meadows
Amblyseius barkeri	soil, plants, in greenhouses
Amblyseius bicaudus	plants, grasses, *Fragaria* sp., litter, dunes, washed ashore, inland and coastal meadows
Amblyseius marinus	dunes, washed ashore
Arctoseius cetratus	humus, forests, agroecosystems, washed ashore, dunes, inland and coastal meadows
Cheiroseius necorniger	humus, agroecosystems, calcareous bog, inland and coastal meadows, washed ashore
Dendrolaelaspis angulosus	coastal meadows, dunes, compost
Dendrolaelaps arenarius	dunes, washed ashore, coastal meadows, humus, roots of *Cakile maritima*
Dendrolaelaps fallax	rotting substrates, litter, dunes
Dendrolaelaps nostricornutus	washed ashore, dunes
Gamasodes bispinosus	washed ashore
Halolaelaps balticus	washed ashore
Halolaelaps incisus	washed ashore
Halolaelaps marinus	washed ashore
Hypoaspis aculeifer	forests, inland and coastal meadows, agroecosystems, washed ashore, dunes, compost, nests of swallows, rodent burrows
Hypoaspis kargi	forest, gardens, rodent burrows, inland and coastal meadows, dunes
Hypoaspis sclerotarsa	dunes
Hypoaspis similisetae	dunes
Hypoaspis vacua	hygrophytic inland meadows, coastal meadows, bogs, agroecosystems, forests, mosses, dunes, rodent burrows, nests of ants
Lasioseius sp.	washed ashore
Leioseius bicolor	forests, agroecosystems, xerophytic meadows, inland and coastal meadows, washed ashore, dunes, humus
Leioseius insignis	inland and coastal meadows, dunes, washed ashore
Minirhodacarellus minimus	dunes
Parasitus halophilus	washed ashore, dunes, coastal meadows, banks of ditches
Parasitus kempersi	washed ashore
Parazercon radiatus	forests, bogs, mosses, inland and coastal meadows, washed ashore, dunes, litter
Pergamasus vagabundus	forests, bogs, agroecosystems, inland and coastal meadows, washed ashore, dunes, *Acer* sp., nests of wildfowl
Prozercon trägardhi	fir-groves, forests, gardens, litter, nests of waterfowl, inland and coastal meadows, washed ashore, dunes
Rhodacarus haarlovi	dunes
Rhodacarellus silesiacus	forests, agroecosystems, washed ashore, dunes, coastal meadows
Thinoseius spinosus	washed ashore, dunes, coastal and calcareous meadows, wet mixed forest

TABLE 3. — Gamasina occurrences in different habitats of Latvia based on LAPINA, 1963; 1976 a, b; 1988; PETROVA et al., 1997; SALMANE, 1999; SALMANE *et al.*, 1999.

mus, Lasioseius sp., Rhodacarus haarlovi, Hypoaspis aculeifer, and *Hypoaspis sclerotarsa.*

Four species were recorded at the all six sampling sites: *A. cetratus, P. halophilus, L. insignis,* and *L. bicolor; T. spinosus, Dendrolaelaps nostricornutus,* and *R. haarlovi* in five sites and *H. balticus, Amblyseius marinus,* and *M. minimus* in four sites were stated.

C. necorniger, H. balticus, T. spinosus, P. kempersi, H. incisus, G. bispinosus, A. marinus, Halolaelaps marinus, and *Amblyseius agrestis* were found as characteristic species of driftline. *Lasioseius sp.* up to now was reported only from the yellow dunes by KOEHLER *et al.* (1995). As characteristic for primary dunes *P. halophilus* and *D. arenarius* and for yellow dunes *M. minimus* and probably *Leioseius sp.* can be regarded.

Only for *M. minimus* a preference for the rhizosphere of certain plant species could be detected (tab. 2). All the determined individuals of the species *M. minimus* were found in the rooting systems of the *F. rubra* alone or in the mixed rooting systems of it and other plant species. In such a way the main occurrence of this species was found in the samples taken from the rooting systems with *F. rubra* (s.l.).

Fourteen species were found for the first time in the fauna of Latvia:

Amblyseius agrestis, Amblyseius marinus, Dendrolaelaps angulosus (key of HIRSCHMANN 1960, 1971 used), *Dendrolaelaps fallax* (in Latvia up to now described as *D. trapezoides*), *Dendrolaelaps nostricornutus, Gamasodes bispinosus, Halolaelaps marinus, Hypoaspis sclerotarsa, Hypoaspis similisetae, Lasioseius sp., Leioseius nov. spec., Minirhodacarellus minimus, Parasitus kempersi, Rhodacarus haarlovi.*

DISCUSSION

In comparison with the driftline habitats, the abundances were about five times lower in the primary and yellow dunes. These differences can be explained by the diverse ecological conditions and differing amount of food at these habitat types. In the most cases driftline habitats were the richest in organics deposited by the sea. In such way, there are favourable life conditions for Gamasina mites and other soil fauna, on which they prey on. Dune habitats have a much lesser content of organics in the soil, especially in the relation to the primary dunes, which had a small number of individuals.

Ten Gamasina species are mainly known from non-coastal habitats (LAPINA, 1988). Eight of them were found in low numbers: *Dendrolaelaps fallax, A. bicaudus, Parazercon radiatus, Hypoaspis sclerotarsa, Hypoaspis similisetae, Hypoaspis kargi, D. angulosus,* and *Amblyseius barkeri. D. nostricornutus,* known to live under the bark of trees (KARG 1993), was abundant in the primary dunes and *R. haarlovi,* known from the meadows (KARG 1993), was abundant in the yellow dunes.

KOEHLER (mscr. 1994) and Salmane (SALMANE 1999; 2000; SALMANE *et al.*, 1999) have been recorded the presence of the Gamasina species *D. arenarius* in the seashore habitats of Latvia. Concerning *Lasioseius* sp., this is definitely identical with "Lasioseius sp." collected by KOEHLER in the dunes of Slowinski National Park in Poland (KOEHLER *et al.* 1995).

Up to now there was only weak evidence for a correlation of single Gamasina species with certain plants (Koehler et al. 1992). However, *M. minimus* seems to have a preference for the *F. rubra* (s.l.) (tab. 2.). KOEHLER *et al.* (1995) found *M. minimus* in the grey dunes of Spiekeroog (North Sea), in samples from the rhizosphere of *F. rubra*, and PURVIS (1982) found *M. minimus* in dunes with *F. rubra* in Southeast Ireland. *M. minimus* is known from a variety of habitats (tab. 3). It is not evident, why its appearance in coastal dunes should be associated with a certain plant species. Maybe the structure of the habitat, fine root system of *F. rubra* is a decisive factor.

It is evident that further research concerning the Gamasina in the coastal ecosystems is needed, especially, when keeping in mind a regulatory function these predatory mites have in the biogenic dune sand stabilization.

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