MITES FROM MEDIEVAL SCHEEMDA

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ABSTRACT: The results of the study of the mite remains from medieval Scheemda (the Netherlands) are presented. The influence of the sea during the 14th and 15th centuries is monitored and an attempt is made to characterize the fills of two pits.

KEYWORDS: Acaro-archaeology, palaeo-ecology, salinity, latrines.

1. INTRODUCTION

Only recently man has begun to realize the dangers of the profound climatic and ecological changes that may be the result of the greenhouse effect. One place on earth where people should seriously take into account the possible consequences of global warming is the Netherlands, since a rise of the mean temperature of the sea water by merely 1 or 2°C will result in the flooding of most of the Low Countries.

Although the anthropogenic aspect is unprecedented, this threat of the sea is nothing new to the Dutch people. The constant 'battle against the sea' is proverbial in the Netherlands and has been fought with varying success ever since prehistoric times, when man first settled in the coastal plains of the Rhine-Meuse delta. Through the ages the inhabitants of the Netherlands have developed various methods to protect themselves from the sea. Artificially raised dwelling mounds were first erected as refuges for man and domestic animals as early as 2000 BC during the Late Neolithic period. Much later, during the Middle Ages, people first attempted to protect not only their dwelling-places but also their farmland by constructing dikes. These dikes, however, were not always a guarantee of safety. There are scores of historical records of floods caused by dike-bursts. One of these records, presented by de Smet (1961), describes the fate of the area around the settlement of Scheemda in the north-east of the Netherlands. In or shortly after the year 1509 the Dollard estuary flooded the low area around Scheemda, resulting in the abandonment of the settlement and its subsequent rebuilding on a nearby boulder-clay ridge.

In 1988 and 1989 parts of the original site of Scheemda (53°11'N, 6°58'E) were excavated under the pressure of planned motorway construction. During these excavations, the remains of two consecutive churches as well as a brick wall and a ditch surrounding the youngest church were found beneath the Dollard clay deposits. The second church and the contemporary wall and ditch were dated to the third quarter of the 13th century on the basis of brick size and the ground plan of the church and on associated finds of pottery (Molema, 1990). Historical records from this period are unclear with regards to the amount of influence of the sea (Emo & Menko, n.d.).

Acaro-archaeology, the study of the remains of mites in an archaeological context, has proved to be a powerful tool in the reconstruction of changing ecological conditions. Therefore, samples were taken at the 1988/1989 excavations to be used in an acaro-archaeological study of the past ecological conditions at Scheemda. The main aim of this study was to establish whether the influence of the sea was detectable at Scheemda prior to AD 1509. The reconstruction of local environments on the basis of remains of oribatid mites (Schelvis, 1990) gives a first impression of the changes in the amount of marine influence. Additional research was performed to characterize the fills of two pits. These characterizations are primarily based on the identifications and subsequent interpretations of the remains of predatory mites.

2. MATERIAL AND METHODS

2.1. The samples

At Scheemda four samples were collected for the analysis of mite remains. Three of these samples were taken from the fill of the ditch encircling the church and churchyard. In the bottom of this ditch several long, more or less rectangular pits were found. The first sample (SOK A09) consisted of 1.36 kg of the fill of one of these pits. The function of these pits is unclear but they were definitely dug during the construction of the ditch and are therefore dated to the last quarter of the 13th century AD. Two other samples, SOK A10 (1.27 kg) and SOK A12 (2.73 kg), were taken from the fill of

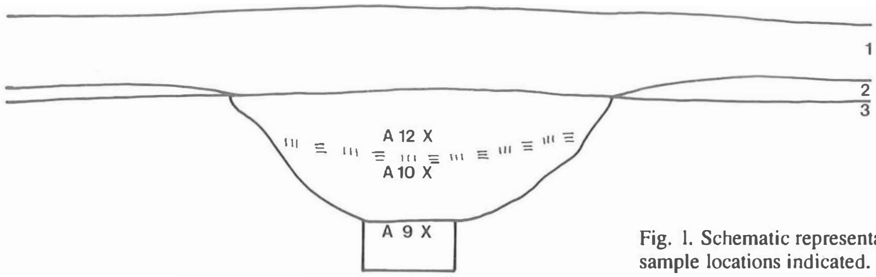

Fig. 1. Schematic representation of the profile of the ditch with the sample locations indicated.

the ditch directly above SOK A09. These two samples, which were separated by a thin deposit of rubble, could not be dated accurately. However, it is clear that they are both younger than SOK A09, that SOK A10 is older than SOK A12 and that both SOK A10 and SOK A12 were taken from a layer deposited prior to AD 1509. In that year a thick Dollard clay deposit (fig. 1) covered the ditch completely during the major flood which caused the abandonment of Scheemda.

The fourth sample (SOK A13) was taken outside the churchyard, some 50 metres away from the three other samples. This sample consisted of 1.25 kg of the fill of a pit. This pit, whose function is again not known, was one of a number of similar pits of c. 1x3 metres. The pits were covered by the medieval ploughland which, in its turn, was covered by the thick Dollard clay deposit. Although not accurately dated there are indications that these pits were dug in the period during which the second church was built. Sample SOK A13 is therefore tentatively dated to the late 13th century. This sample was taken in order to establish the nature of the fill of these pits. The three other samples were taken primarily to monitor the amount of influence of the sea during the 14th and 15th centuries.

2.2. The mites

The remains of mites can be used in a number of ways to produce archaeologically relevant data. One taxonomic group, the order Oribatida (moss or beetle mites), is particularly suitable for reconstructing local environmental conditions (Schelvis, 1990). Oribatid mites are unable to respond instantaneously to a sudden drastic change in the ecological parameters of their surroundings, such as flooding by seawater, because they cannot fly. The frequency of flooding is reflected in the salinity tolerance of the mite fauna. Occasional floodings will not alter the mite fauna substantially as long as the time interval between the floodings exceeds the recolonization time. However, when the frequency of flooding increases, thereby obstructing recolonization, the mite fauna will be restricted to those species which are physiologically adapted to a brackish environment. Studying the relative frequencies of the halobiontic and halophobic species in stratigraphical samples can therefore produce insight into the process of salinization of the environment (Schelvis, 1989).

Another group of mites which is used successfully in archaeozoology is the order Gamasida. These predatory mites thrive in places where there is a high level of decomposition and biological turnover. The mite fauna of these 'dirty' places, such as compost heaps, dunghills and cesspits, is therefore characterized by a high relative abundance of these predatory mites. Preliminary results (Schelvis, 1991) show that an archaeological dung deposit can be recognized as such on the basis of the predatory mite death-assemblage.

2.3. Methods

The adapted version of the paraffin flotation method of Kenward, Hall & Jones (1980) given by Schelvis (1987) was used to extract the mite remains. Subsequent identifications of the mite remains are based on direct comparisons with the B.A.I. reference collection as well as on identification tables given by Balogh & Mahunka (1983), Sellnick (1960) and Siepel (in prep.) for the Oribatida, Hirschmann & Zirngiebl-Nicol (1961-1967) and Karg (1989) for the Uropodina and Karg (1971) for the Gamasina. The nomenclature of the Oribatida is based on Siepel (in prep.).

To study the marine influence in more detail all oribatids are classified according to their salinity tolerance: NaCl preferring, NaCl indifferent or NaCl intolerant (Schelvis, 1989). The allotment of the oribatid species to one of these groups is done on the basis of data given in the literature, supplemented with the results of my own fieldwork in the Dutch littoral region.

To see if there is any animal dung present in the samples they are checked for remains of Dung-Indicating species (Schelvis, in press).

3. RESULTS

3.1. General results

The relative abundances of the species as well as the numbers of identified mite remains extracted from each of the four samples taken near Scheemda are given in the appendix. Table 1 summarizes the most important parameters of each of the samples.

It is evident (table 1) that sample A12 is the poorest sample of all. The diversity and richness as well as the density of mite remains are considerably lower than in the three other samples. By contrast, sample A13 shows relatively high values for diversity, richness and density of remains.

3.2. Environmental reconstructions

In the appendix each of the oribatid species is allocated to one of the 20 ecological groups defined by Schelvis (1990). On the basis of the distribution of the oribatid mite remains over these ecological groups, environmental reconstructions were made for each of the four samples from Scheemda (fig. 2).

It is clear from these spectra that all samples from Scheemda are dominated by ecological group XI, the group which is optimally represented in soaking wet moorland. Other groups such as groups IX and XVIII also reflect these very wet conditions, whereas groups XIII and XIV point towards an open landscape, with some marine influence. It should be noted, however, that the influence of the sea, as expressed by the representation of ecological group XIV, is relatively slight in comparison to contemporary samples from other sites in the north of the Netherlands (Schelvis, 1988 & unpublished results). Furthermore, the importance of ecological group XIV decreases from the bottom of the ditch (6.5% in A09) through the middle layer (2.6% in A10) to the top layer (1.2% in A12).

3.3. Salinity

Finally, the appendix also gives the preference or intolerance of the oribatid species towards a brackish environment. Table 3 summarizes these results for the three stratigraphical samples from the ditch fill.

Table 1. For each sample is given: N ind. Number of individuals; N sp. Number of species; Id.%. Percentage of identified mites. Diversity H' given by the Shannon-Wiener function: $H' = -\Sigma P_i * \log_e(P_i)$ (P_i being the relative abundance of species i); Richness dl calculated as $dl = [N sp - 1]/\log_e(N ind)$ and the approximate number of mite remains extracted in the first flotation of 1 kg of sample (Ind./kg.).

Sample	A09	A10	A12	A13
N ind.	523	628	172	1237
N sp.	41	42	18	63
Id.%	94%	93%	87%	92%
H'	2.49	2.46	2.07	2.69
dl	6.42	6.44	3.30	8.71
Ind./kg.	400	500	50	2000

Table 2. Legend for the ecological groups presented in fig. 2.

Group I	Moss, lichen and litter on dry sandy soil in *Calluna* heath and on dry and moist soil in moorland, sparsely in dry woodland soils
Group IV	Dry and moist, rarely wet, litter as well as moss in woodland and also in dry and moist soils in *Calluna* heath
Group IX	Soaking wet moorland and grassland as well as swamp woodland
Group XI	Constantly soaking wet mosses, especially *Sphagnum*, in moorland
Group XIII	Moist as well as soaking wet, either fresh or saline grassland
Group XIV	Saline grassland only
Group XVI	Dry mosses on solid surfaces
Group XVII	Moss, lichen and litter on dry sandy soil in *Calluna* heath and dry mosses on solid surfaces
Group XVIII	Aquatic habitats
Group XIX	Anthropogenic habitats, rich in decaying organic matter

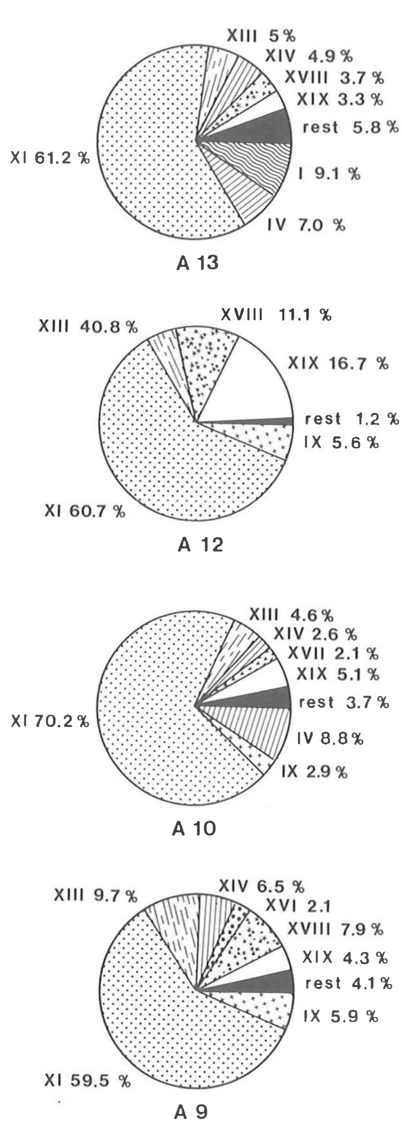

Fig. 2. Spectra of the ecological groups of oribatid mites found in the medieval samples from Scheemda.

Table 3. The distribution of the oribatid species from Scheemda according to their salinity tolerance. From these results it is again clear that there is a decrease in the absolute number as well as the frequency of NaCI tolerant species from the oldest (A09) to the youngest (A12) deposit.

Sample	A09	A10	A12
Tolerant	23/62.2%	22/57.9%	9/50.0%
Intolerant	14/37.8%	16/42.1%	9/50.0%

Table 4. Presence of dung-indicating species in the four medieval samples from Scheemda. N indicates the number of retrieved individuals.

	Dung-indicating species	N
SOK A09	*Trichouropoda orbicularis*	3
SOK A10	–	–
SOK A12	–	–
SOK A13	*Androlaelaps casalis*	4
	Uroobovella pyriformis	1
	Trichouropoda orbicularis	1

3.4. Characterization of the pit fills

The results of the analysis of oribatid mite remains tend to reflect the 'natural' surroundings of the site. The spectra of ecological groups given in figure 2 are therefore of little use in the characterizations of samples A09 and A13. The only ecological group that is characteristic for man made habitats (group XIX) is represented by only 4.3% in A09 and by 3.3% in A13.

To gain more insight into the nature of the pit fills the remains of predatory mites were studied. Studies of characteristic predatory mite faunas in excrements of domestic animals (Schelvis, in press.) allow us to detect the presence of animal dung in archaeological deposits. This is done by identifying the remains of Dung-Indicating species (table 4).

4. DISCUSSION

The results presented in table 1 indicate that the samples A12 and A13 both deviate considerably from the two fairly similar samples A09 and A10. But why is sample A12 so poor and why is sample A13 so rich? The very rich sample A13 is easy to explain. Apparently, more diverse material has accumulated in the pit outside the churchyard than in the ditch itself. This does not necessarily mean that the environment was more diverse during the period of deposition. It is also possible, and in this case even likely, that the deposits were formed in different ways. The deposits in the ditch will most likely have accumulated 'naturally' with possible minor additions of dumped waste material. On the other hand, material may have been dumped deliberately into the pit from which sample A13 was taken. Later, when the pits had served their purpose they were probably intentionally filled in to level the surface before they disappeared beneath the medieval ploughland.

The lower values for diversity and richness in sample A12, as compared to A9 and A10, may reflect a genuine difference in ecological conditions since both H' and dl are independent of the number of individuals (Cruz-Uribe, 1988). However, the very low density of mite remains in A12 is more difficult to explain. This difference could have been caused by a difference in conservation conditions, since there is not only a lower density of remains but the remains are also less well preserved. This difference in preservation quality is reflected in a somewhat lower identification percentage and especially in a markedly different distribution of the remains over the five classes of preservation defined by Erickson (1988). For example, more than 28% of the mite remains in sample A12 belong to class V (worst preservation) whereas only 10% of the mite remains of sample A09 fell into this class. The cause of this difference in conservation quality is not known but a higher degree of mechanical disturbance in the topmost deposits seems to be the most logical explanation.

On the basis of table 4 it can be concluded that both sample A09 and sample A13 probably contained dung. The results of a study of characteristic predatory mite faunas in the excrements of five different domestic animals allow us to identify the animals which produced this dung (Schelvis, in press.). Sample A09 probably contained poultry droppings, whereas the remains of predatory mites in sample A13 indicate the presence of both poultry droppings and horse dung. Prummel (1990) demonstrated a remarkably strong representation of horse remains at Scheemda, which seems to be in agreement with these results. Domestic fowl, however, was virtually absent in her samples.

The study of recent dung mites, however, did not include the predatory mites living specifically in or on human faeces. So far I have sampled only one recent cesspit and one 17th-century cesspit. A direct comparison of the species composition (including the oribatids) of sample A13 with these two samples reveals some interesting similarities. Of the 25 oribatid species found in the 17th-century cesspit from Groningen 14 species, including 8 of the 10 most common species, were also found in sample A13 from Scheemda. In the recent cesspit only 5 oribatid species were found, including *Hypochthonius rufulus* and *Paradamaeus clavipes*. These two species which also turned up in sample A13 are very rare in archaeological samples. *H. rufulus* had never before been found in an archaeological context, while the only other archaeological find of *P. clavipes* was in the above-mentioned cesspit from the Martinikerkhof in Groningen. It is therefore suggested that sample A13 also contained excreta of human origin. Whether these enigmatic pits were indeed used as some sort of latrines may possibly be established by further research on mites with a predilection for human ordure.

Useful information may also be gained from studies on the presence of ova and cysts of intestinal parasites (Jones, 1982).

5. CONCLUSIONS

During the 14th and 15th centuries the landscape around the site at Scheemda known as 'Ol Kerkhof' was a very open and wet one. The environment consisted of a raised peat bog interspersed with wet meadows and some swamp woodland. The influence of the sea was fairly slight and did not increase during the period in which the deposits in the ditch encircling the churchyard were formed.

There are indications that the pit found at the bottom of the ditch contained poultry droppings. The pit outside the churchyard also contained various excreta and its use as a latrine is tentatively suggested.

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APPENDIX: The number of identified individuals, the relative abundance, the salinity tolerance and the ecological group of the mite species found in each of the four medieval samples from Scheemda. Legend: N. Number of retrieved individuals; RA. Relative abundance; Sal. Salinity tolerance: 1 = NaCl preferring; 2 = NaCl intolerant; 3 = NaCl indifferent; 4 = NaCl tolerance unknown; Ecol. = Ecological group according to Schelvis (1990).

	N	RA	Sal.	Ecol.
Scheemda A09				
Oribatida				
Limnozetes ciliatus	207	40.8	2	XI
Punctoribates punctum	42	8.3	2	–
Hydrozetes lacustris	39	7.7	3	XVIII
Latilamellobates incisellus	22	4.3	1	XIV
Limnozetes rugosus	20	3.9	2	XI
Oppiella nova	19	3.7	3	XX
Tectocepheus velatus	16	3.2	3	XX
Nanhermannia coronata	15	3.0	4	–
Scheloribates laevigatus	13	2.6	3	XIII
Chamobates schützi	10	2.0	2	IV
Achipteria coleoptrata	10	2.0	3	–
Platynothrus peltifer	9	1.8	3	IX
Liebstadia similis	8	1.6	3	XIII
Trichoribates trimaculatus	8	1.6	3	I
Minunthozetes semirufus	7	1.4	3	IX
Phauloppia lucorum	7	1.4	3	XVI
Pantelozetes paolii	6	1.2	2	XII
Eupelops occultus	5	1.0	3	XIII
Ceratozetes parvulus	5	1.0	2	–
Ramusella clavipectinata	5	1.0	3	XIX
Galumna elimata	3	0.6	3	IX
Trichoribates novus	2	0.4	3	XIII
Oppia nitens	2	0.4	2	XIX

Appendix (Continued)

	N	RA	Sal.	Ecol.
Oribatella quadricornuta	2	0.4	2	III
Fuscozetes fuscipes	2	0.4	3	IX
Punctoribates hexagonus	2	0.4	1	XIV
Hermannia subglabra	1	0.2	1	XIV
Melanozetes mollicomus	1	0.2	2	VIII
Humerobates rostrolamellatus	1	0.2	3	II
Rhysotritia ardua	1	0.2	2	VII
Liacarus coracinus	1	0.2	2	III
Dissorhina ornata	1	0.2	3	XX
Suctobelbella palustris	1	0.2	2	X
Zygoribatula propinquus	1	0.2	2	–
Pilogalumna tenuiclava	1	0.2	2	XI
Pergalumna nervosa	1	0.2	3	VII
Uropodina				
Trichouropoda orbicularis	3	0.6	4	
Uropoda minima	2	0.4	3	
Dinychus inermis	1	0.2	4	
Nenteria breviunguiculata	1	0.2	4	
Gamasina				
Sejus borealis	1	0.2	4	
Scheemda A10				
Oribatida				
Limnozetes ciliatus	218	37.3	2	XI
Ceratozetes parvulus	70	12.0	2	–
Tectocepheus velatus	59	10.1	3	XX
Chamobates schützi	32	5.5	2	IV
Oppiella nova	31	5.3	3	XX
Punctoribates punctum	26	4.5	2	–
Ramusella clavipectinata	19	3.3	3	XIX
Latilamellobates incisellus	15	2.6	I	XIV
Nanhermannia coronata	14	2.4	4	–
Platynothrus peltifer	9	1.5	3	IX
Achipteria coleoptrata	9	1.5	3	–
Liebstadia similis	8	1.4	3	XIII
Minunthozetes semirufus	6	1.0	3	IX
Banksinoma lanceolata	6	1.0	3	XX
Trimalaconothrus novus	5	0.9	2	XI
Hydrozetes lacustris	5	0.9	3	XVIII
Limnozetes rugosus	5	0.9	2	XI
Scutovertex minutus	4	0.7	2	XVII
Scheloribates laevigatus	4	0.7	3	XIII
Parachipteria punctata	3	0.5	2	III
Rhysotritia ardua	3	0.5	2	VII
Melanozetes mollicomus	3	0.5	2	VIII
Eupelops bilobus	2	0.3	2	II
Carabodes schatzi	2	0.3	3	I
Trichoribates novus	2	0.3	3	XIII
Dissorhina ornata	2	0.3	3	XX
Suctobelbella palustris	2	0.3	2	X
Peloptulus montanus	2	0.3	2	XI
Trichoribates trimaculatus	2	0.3	3	I
Medioppia subpectinata	2	0.3	2	–
Punctoribates hexagonus	2	0.3	I	XIV
Fuscozetes fuscipes	1	0.2	3	IX
Microppia minus	1	0.2	2	IV
Humerobates rostrolamellatus	1	0.2	3	II
Liacarus coracinus	1	0.2	2	III
Peloptulus phaenotus	1	0.2	1	XIII
Suctobelbella falcata	1	0.2	3	VI

Appendix (Continued)

	N	RA	Sal.	Ecol.
Uropodina				
Uroobovella pulchella	1	0.2	4	
Uropoda minima	1	0.2	3	
Dinychus carinatus	1	0.2	4	
Nenteria stylifera	1	0.2	4	
Gamasina				
Sejus borealis	2	0.3	3	
Scheemda A12				
Oribatida				
Limnozetes ciliatus	49	28.5	2	XI
Tectocepheus velatus	21	12.2	3	XX
Punctoribates punctum	19	11.0	2	–
Oppiella nova	17	9.9	3	XX
Minunthozetes semirufus	12	7.0	3	IX
Ramusella clavipectinata	8	4.7	3	XIX
Ceratozetes parvulus	4	2.3	2	–
Liebstadia similis	3	1.7	3	XIII
Suctobelbella palustris	2	1.2	2	X
Latilamellobates incisellus	2	1.2	1	XIV
Hydrozetes lacustris	2	1.2	3	XVIII
Hydrozetes converfae	2	1.2	2	XVIII
Medioppia subpectinata	2	1.2	2	–
Hypochthonius rufulus	2	1.2	2	–
Limnozetes rugosus	2	1.2	2	XI
Peloptulus phaenothus	1	0.6	1	XIII
Scheloribates latipes	1	0.6	2	XX
Ameronothrus maculatus	1	0.6	3	–
Scheemda A13				
Oribatida				
Limnozetes ciliatus	498	46.2	2	XI
Punctoribates punctum	68	6.3	2	–
Oppiella nova	63	5.8	3	XX
Ceratozetes parvulus	53	4.9	2	–
Tectocepheus velatus	50	4.6	3	XX
Chamobates schützi	49	4.5	2	IV
Hydrozetes lacustris	40	3.7	3	XVIII
Latilamellobates incisellus	38	3.5	I	XIV
Trichoribates trimaculatus	33	3.1	3	I
Carabodes schatzi	20	1.9	3	I
Limnozetes rugosus	19	1.8	2	XI
Nanhermannia coronata	18	1.7	4	–
Liebstadia similis	16	1.5	3	XIII
Phauloppia lucorum	14	1.3	3	XVI
Parachipteria punctata	10	0.9	2	III
Scheloribates laevigatus	10	0.9	3	XIII
Ramusella clavipectinata	9	0.8	3	XIX
Oribatella quadricornuta	7	0.6	2	III
Astegistes pilosus	7	0.6	3	XII
Scheloribates latipes	6	0.6	2	XX
Platynothrus peltifer	6	0.6	3	IX
Eupelops occultus	4	0.4	3	XIII
Banksinoma lanceolata	4	0.4	3	XX
Suctobelbella palustris	4	0.4	2	X
Galumna lanceata	3	0.3	4	III
Pergalumna nervosa	3	0.3	3	VII

Appendix (Continued)

	N	RA	Sal.	Ecol.
Peloptulus montanus	3	0.3	2	XI
Acrogalumna longipluma	3	0.3	2	–
Hermannia scabra	3	0.3	4	–
Hermannia subglabra	3	0.3	1	XIV
Oppia nitens	3	0.3	2	XIX
Micreremus brevipes	3	0.3	2	–
Hypochthonius rufulus	3	0.3	2	–
Dissorhina ornata	3	0.3	3	XX
Ceratoppia bipilis	2	0.2	2	–
Rhysotritia duplicata	2	0.2	2	IV
Scutovertex sculptus	2	0.2	3	XIII
Carabodes marginatus	2	0.2	4	I
Minunthozetes semirufus	2	0.2	3	IX
Suctobelbella tuberculata	2	0.2	4	VI
Epidamaeus glabriseta	2	0.2	4	–
Achipteria coleoptrata	2	0.2	3	–
Melanozetes mollicomus	1	0.1	2	VIII
Punctoribates hexagonus	1	0.1	1	XIV
Punctoribates sellnicki	1	0.1	3	X
Galumna elimata	1	0.1	3	IX
Paradamaeus clavipes	1	0.1	2	–
Humerobates rostrolamellatus	1	0.1	3	II
Fuscozetes fuscipes	1	0.1	3	IX
Berniniella bicarinata	1	0.1	2	–
Diapterobates humeralis	1	0.1	2	–
Ceratozetes gracilis	1	0.1	2	–
Uropodina				
Uropoda minima	12	1.1	3	
Uropoda orbicularis	2	0.2	4	
Nenteria breviunguiculata	2	0.2	4	
Uroobovella pyriformis	1	0.1	4	
Trichouropoda orbicularis	1	0.1	4	
Gamasina				
Sejus necorniger	15	1.4	3	
Androlaelaps casalis	4	0.4	4	
Sejus borealis	3	0.3	3	
Pergamasus vagabundus	2	0.2	3	
Alliphis siculus	1	0.1	4	