

# SOME NOTES ON THE ORIBATID FAUNA OF SALT-MARSHES IN DENMARK

BY

P. J. G. POLDERMAN

*Rijksmuseum van Natuurlijke Historie, Leiden*

## INTRODUCTION

In Denmark, the Oribatid faunas of several types of soil have been studied by various authors. Many data are now known from forest-soils (BORNEBUSCH, 1930 ; THAMDRUP, 1932), from grasslands and from soils under shrubs (WEISS-FOGH, 1947 ; HAARLÖV, 1960). THAMDRUP (1932) gives a survey of the distribution of 90 Oribatid species in Denmark. No data, however, were known from Danish salt-marshes. Like many other special environments, the salt-marshes have a number of characteristic Oribatid species. In the German part of the Wadden Sea and Baltic five of such characteristic inhabitants of salt-marshes have been found (WEIGMANN, 1967, 1971). These are *Ameronothrus nigrofemoratus*, *A. schneideri*, *Hermannia subglabra*, *Oribatella arctica litoralis* and *Punctoribates quadrivertex*. These species, which can be considered halophilous species, could also be expected in salt-marshes in Denmark.

LUXTON (1967) described the zonation pattern of Oribatids in a salt-marsh in South-Wales. The general pattern of this zonation along the Irish Sea appeared to be similar to the distribution-pattern of Oribatids in salt-marshes along the Wadden Sea (WEIGMANN, 1967, POLDERMAN, 1972) and the Western part of the Baltic (WEIGMANN, 1971), although there is a slight difference between the lists of important species.

In April and May 1972 the author had the opportunity to investigate the following salt-marshes in Denmark : the salt-marsh of Skallingen situated along Ho Bugt near Esbjerg in the northernmost part of the Wadden Sea ; the salt-marsh of Kysingfjord (Norsminde) some 20 km south of Aarhus and the salt-marshes of kalø and of Hestehave, both some 25 km to the northeast of Aarhus. The latter three salt-marshes are situated along Aarhus Bugt, a bay of the Kattegat.

The hydrology of the salt-marshes along the Kattegat differs from that the Skallingen marsh. Along the Kattegat there is no tide and the average salinity of the Aarhus Bugt is about 20 ‰ S. Immersion of these salt-marshes generally occurs as a consequence of building up of the water by persistent landward wind. Skallingen is washed by the tides, and the flooding water has about the salinity of sea water, some 34 ‰ S.

The specific composition of Oribatids in the salt-marshes of the North Sea coast of Germany does not differ from that in the salt-marshes along the Baltic (WEIGMANN, 1971). In Denmark there appears to be no difference either.

## METHODS

The composition of the Oribatid fauna of the salt-marshes has been investigated by means of a transect-sampling method. When a well-developed zonation pattern was present, samples were taken in a straight line perpendicular to the zonation-pattern, one in each zone. The samples consisted of pieces of soil of  $10 \times 10 \text{ cm}^2$  to a depth of 5 cm with vegetation to match. The vegetation of the higher plants in about  $1 \text{ m}^2$  around the sampled spot was described by means of a modified Braun-Blanquet scale, in which

- 2a means cover 5 - 12.5 %,
- 2b means cover 12.5 - 25 %.

The cover of the most important algae and mosses was also noted down as a percentage. The names of the plant-communities have been used here according to BEEFTINK (1966). At Kalö, the level of the sampled spot has been measured with regard to Dansk Normal Nul (DNN). In this marsh the transect method could not be applied. In table 3 the samples have been arranged according to increasing level above DNN.

The micro-arthropods have been extracted from the samples by means of a slightly modified small-funnel extractor with a high gradient (Mc FADYEN, 1961). This method differs from the method of extraction which the author used for his investigations in The Netherlands, where ordinary Berlese funnels (without bulb) have been used. It seems that for salt-marsh soils the latter method gives similar or slightly better results. This is presumably because of the fact that in The Netherlands the samples were cut into small pieces, in this way considerably shortening the way out for the micro-arthropods.

## THE ORIBATID FAUNA

During the present investigation 21 species have been found (table 1). Five of them (the five halophilous species) are new to the fauna of Denmark. No records for Denmark could be found either for *Banksinoma lanceolata*, *Fuscozetes fuscipes* and *Passalozetes bidactylus*. They are not characteristic of salt-marshes, but *Passalozetes bidactylus* seems to have a coastal distribution (STRENNKE, 1953). All 21 species occurred along the Kattegat; here many more samples have been taken than on Skallingen of which the list of nine species is probably very incomplete (most of the species not found on Skallingen have been reported from other parts of the Wadden Sea). WEIGMANN (1967) mentions *Oribatella arctica litoralis*, which is one of the halophilous species, *Banksinoma lanceolata*, *Oppia clavipectinata*, *Platynothrus peltifer* and *Malaconothrus gracilis*. These and six other species, marked in table 1 with a note of exclamation, have been found in salt-marshes in the Dutch part of the Wadden Sea (POLDERMAN, 1974).

### A. The zonation of the Oribatids in the salt-marsh of Skallingen.

A record from the lowest part of the succession series in this salt-marsh was obtained from an algal mat of a *Spartinetum townsendii*. In this mat a few specimens of *Ameronothrus nigrofemoratus* have been collected. This was the most numerous species in the lower parts of the sampled area, especially in the first zone of the transect (fig. 1), a *Puccinellietum maritimae*. The only other Oribatid species occurring there appeared to be *Punctoribates quadrivertex*. In each of the zones a different Oribatid species was dominant. In the lower part of the next plant community, the *Juncetum gerardii* (fig. 1), this is *Ameronothrus schneideri*. Generally the latter species occurs just as *A. nigrofemoratus* and *Punctoribates quadrivertex* in the *Puccinellietum maritimae*;

TABLE I : List of species found in four salt-marshes in Denmark.

	S	K	H	N
<i>Ameronothrus nigrofemoratus</i> (L. Koch)	+	+	+	—
<i>Ameronothrus schneideri</i> (Oudemans)	+	+	+	+
<i>Banksinoma lanceolata</i> (Michael)	—!	+	—	—
<i>Brachychthonius</i> sp.	—	+	—	—
<i>Chamobates subglobulus</i> (Oudemans)	—!	—	+	—
<i>Eupelops occultus</i> (C. L. Koch)	—!	+	+	—
<i>Eupelops plicatus</i> (C. L. Koch)	—!	—	+	—
<i>Fuscozetes fuscipes</i> (C. L. Koch)	—	+	—	—
<i>Galumna elimata</i> (C. L. Koch)	—!	+	+	—
<i>Hermannia subglabra</i> (Berlese)	+	+	+	+
<i>Liebstadia similis</i> (Michael)	+	+	+	+
<i>Malaconothrus gracilis</i> Van der Hammen	—!	+	—	—
<i>Oppia clavipectinata</i> (Michael)	—!	+	+	+
<i>Oppia nova</i> (Oudemans)	—!	—	—	+
<i>Oribatella arctica litoralis</i> Strenzke	—!	+	+	—
<i>Passalozetes bidactylus</i> (Coggi)	—	+	—	—
<i>Peloptulus phaeonotus</i> (C. L. Koch)	+	—	—	+
<i>Platynothrus peltifer</i> (C. L. Koch)	—!	+	—	—
<i>Punctoribates quadrivertex</i> (Halbert)	+	+	+	+
<i>Scheloribates laevigatus</i> (C. L. Koch)	+	+	+	—
<i>Tectocephus velatus</i> (Michael)	+	+	+	+
<i>Trichoribates incisellus</i> (Kramer)	+	+	+	+
<i>Trimalaconothrus glaber</i> (Michael)	—!	+	—	—

(S= Skallingen K= Kalø; Hestehave; N= Norsminde (Kysingfjord); ! = has been found elsewhere in the Wadden Sea).

according to WEIGMANN (1971) they are characteristic of this community. In the present transect *A. schneideri* was confined to the lower *Juncetum gerardii*. Beside the three species already mentioned, small numbers of *Hermannia subglabra*, the dominant Oribatid in the middle part of the *Juncetum gerardii* (fig. 1), were present. Single specimens of *Trichoribates incisellus* and *Scheloribates laevigatus* completed the fauna in this zone. The favourite habitat of *Hermannia subglabra* appeared to be situated somewhat higher in the marsh than that of the other three halophilous species found in the Skallingen marsh. Five non-halophilous species accompanied *Hermannia subglabra* in the middle part of the *Juncetum gerardii*, among which *Scheloribates laevigatus* was represented by 28 specimens. The distribution in the transect of this species suggests a certain preference for the saltier environment of the middle part of the *Juncetum gerardii*. This impression is partly caused by the low number of specimens in the sample of the highest zone, a dry variant of the *Juncetum gerardii*. The percentage of *Scheloribates* in the high *Juncetum gerardii*, however, is considerably higher than in the mid, viz., 43 % to 26 % of the total number of individuals (fig. 1) During investigations in the Dutch part of the Wadden Sea it was found that *Scheloribates laevigatus* and also *Tectocephus velatus*, *Trichoribates incisellus*, *Liebstadia similis* and *Peloptulus phaeonotus* occur in much higher numbers in the marginal environment of salt-marshes than in the marsh itself. All have a certain salt-tolerance, but they are widely distributed and occur abundantly in several types of non-saline grasslands. In the highest part of the *Juncetum gerardii* no halophilous species have been found. Generally *Hermannia subglabra* is still present in this environment, although in the small numbers.

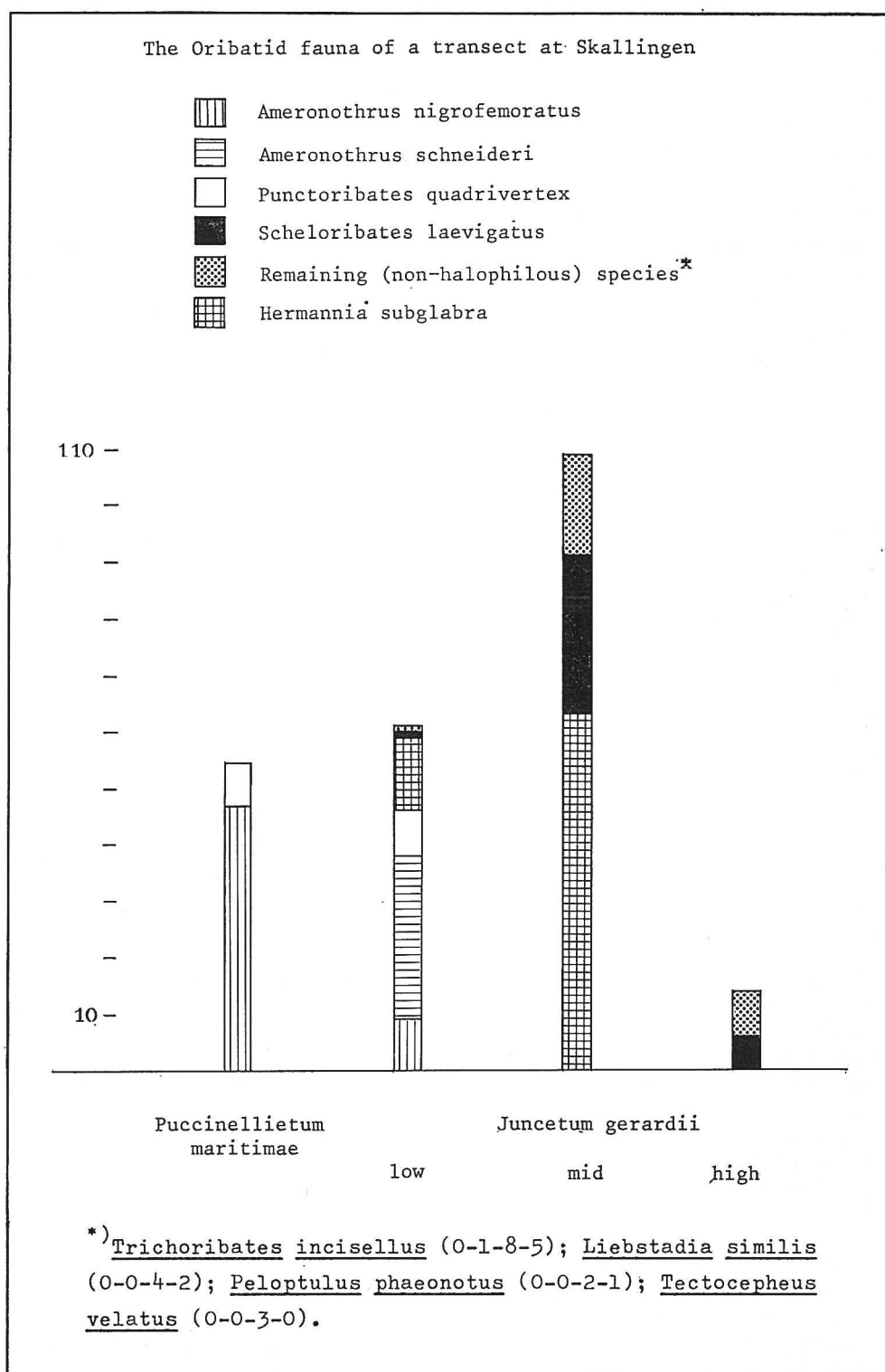


FIG. 1. — The Oribatid fauna of a transect at Skallingen. The number of specimens (adults + nymphs) is given for each species or group of species; one part of the scale represents 10 specimens.

B. The zonation of the Oribatids in the salt-marshes along the Kattegat.

In the salt-marshes along the Kattegat a substitution of the dominant Oribatids takes also place; this replacement is similar to that on Skallingen. In the marsh of kalö (table 2) *Punctoribates quadrivertex* was the most abundant (dominant) Oribatid in the lowest sample, taken in the *Puccinellietum maritimae*. *Ameronothrus nigrofemoratus* and *A. schneideri*, which are also characteristic of the *Puccinellietum maritimae*, are represented in considerable numbers. Another halophilous Oribatid in this sample, *Hermannia subglabra*, was represented by the smallest number in the sample. WEIGMANN (1971) classifies *Hermannia subglabra* and *Oribatella arctica litoralis* into a second ecological group characteristic of environments with a moderate salinity, like mainly occurs in the *Juncetum gerardii*. *Hermannia subglabra* replaced *Punctoribates quadrivertex* as the dominant in the second lowest sample already, taken from a lower situated *Juncetum gerardii* (K 25). Although two samples higher in level still belonged to the *Puccinellietum maritimae*, *Hermannia subglabra* remained the dominant.

TABLE 2 : The Oribatid fauna in the salt-marsh of Kalö

Collectionnumber	K26	K25	K22	K27	K21	K20	K19	K23	K18	K24
Height above DNN in mm	204	300	372	375	401	445	495	550	631	674
Total cover higher plants in %	50	40	60	50	40	50	40	50	60	70
<i>Puccinellia maritima</i> (Huds.) Parl.	3	1	4	3	—	—	—	—	—	—
<i>Spergularia</i> spec.	1	—	1	—	1	—	—	—	—	—
<i>Aster tripolium</i> L.	—	+	—	1	—	—	—	—	—	—
<i>Plantago maritima</i> L.	1	—	1	+	—	+	+	+	+	—
<i>Glaux maritima</i> L.	1	—	—	+	+	1	+	1	+	—
<i>Juncus gerardii</i> Loisl.	—	3	—	—	3	3	2b	3	3	2a
<i>Festuca rubra</i> L.	—	1	—	—	1	2a	2b	2a	3	1
<i>Agrostis stolonifera</i> L.	—	—	—	—	1	—	1	—	1	3
<i>Trifolium repens</i> L.	—	—	—	—	—	—	—	2a	—	1
<i>Leontodon autumnalis</i> L.	—	—	—	—	—	—	—	1	—	—
<i>Lolium perenne</i> L.	—	—	—	—	—	—	—	—	—	3
Total covering of mosses in %	0	0	0	0	0	0	5	0	80	75
<i>Amblystegium serpens</i> (Hedw.) B.S.G.	—	—	—	—	—	—	5	—	80	75
Total cover of algae in %	100	100	100	75	100	100	95	5	1	0
<i>Vaucheria synandra</i> Wor.	—	—	—	—	p	50	—	—	—	—
<i>V. coronata</i> Nordst.	100	p	100	75	p	—	5	—	—	—
<i>V. arcassonensis</i> P. Dang.	—	p	—	—	p	—	—	—	—	—
<i>V. sescuplicaria</i> Christ.	—	p	—	—	—	—	—	—	—	—
<i>Rhizoclonium riparium</i> (Roth) Harv.	a	25	—	a	a	50	40	5	a	a
<i>Enteromorpha torta</i> (Mert.) Reinb.	—	25	—	—	—	—	—	—	—	—
<i>Calothrix aeruginea</i> Born. et Flah.	—	—	—	—	—	—	25	—	—	—
<i>Coccochloris stagnina</i> Spreng.	—	a	—	—	—	a	25	—	a	—
Oribatids :										
<i>Ameronothrus nigrofemoratus</i> (L. Koch)	29	2	2	—	—	—	—	—	—	—
<i>A. schneideri</i> (Oudemans)	34	27	9	19	12	—	—	—	—	—
<i>Punctoribates quadrivertex</i> (Halbert)	61	10	25	29	2	3	5	8	—	1
<i>Hermannia subglabra</i> (Berlese)	11	51	39	33	29	25	24	—	1	—
<i>Oribatella arctica litoralis</i> Strenzke	—	—	—	—	—	—	1	—	—	—
<i>Liebstadia similis</i> (Michael)	—	—	3	62	1	1	13	7	—	7
<i>Scheloribates laevigatus</i> (C.L.Koch)	—	2	—	—	—	—	—	19	56	15

Tectocephus velatus (Michael)	—	—	—	—	—	—	18	—	69	—
Trimalaconothrus glaber (Michael)	—	—	—	—	140	203	—	—	—	—
Platynothrus peltifer (C. L. Koch)	—	—	—	—	18	35	106	129	265	62
Malaconothrus gracilis Van der Hammen	—	—	—	—	—	—	3	—	—	42
Eupelops occultus (C. L. Koch)	—	—	—	—	—	1	5	2	2	2
Oppia clavipectinata (Michael)	—	—	—	—	—	—	—	—	1	—
Banksinoma lanceolata (Michael)	—	—	—	—	—	—	—	—	—	1
Fuscozetes fuscipes (C. L. Koch)	—	—	—	—	—	—	—	—	—	1
Galumna spec.	—	—	—	—	—	—	—	—	—	5
Brachychthonius spec.	—	—	—	—	—	—	1	3	—	—
Trichoribates incisellus (Kramer)	—	—	—	—	1	2	—	4	2	1
Passalozetes bidactylus (Coggi)	—	—	1	—	—	—	—	—	—	—

(p = present, but cover not established exactly ; a = present, but cover negligible. The numbers of the Oribatids concern the total numbers of adults + nymphs).

The area around the level of 40 cm above DNN can be considered a borderland. In the salt-marsh below it, the *Puccinellietum maritimae* is the main vegetation ; in the marsh above it, the *Juncetum gerardii* and vegetations of less saline habitats are present. At the 40 cm level the composition of the Oribatid fauna changed considerably. While the halophilous species dominated in the part below this level, the non-halophilous species did so in the part above it. *Hermannia subglabra*, in K 27 already outnumbered by the non-halophilous *Liebstadia similis*, was replaced as the dominant at this level by *Trimalaconothrus glaber*. Generally, however, *Hermannia subglabra* dominated all over the *Juncetum gerardii*. The *Ameronothrus* spp. did not even occur above the 40 cm border. The number of *Puncatoribates quadrivertex* decreased much slower, but in the upper part of the marsh its number did not exceed ten specimens. Instead of the halophilous species, species more frequent in non-saline environments like *Platynothrus peltifer* and *Eupelops occultus* became the accompanying species above the 40 cm level. Beside *Liebstadia similis* two non-halophilous species only were present below the 40 cm level : *Scheloribates laevigatus* and *Passalozetes bidactylus*. The non-halophilous character of the latter is not absolutely certain. STRENZKE (1953) mentions the species from the drift-accumulation of a beach-plain along the German coast of the Baltic. This, however, does not necessarily imply a bond to salt. In literature there are no records of this species from salt-marshes. Above the 40 cm level more (and more numerous) non-halophilous species have been found roughly increasing with the increasing level of the salt-marsh. Between 40 and 50 cm above DNN three halophilous species were present in the samples, one of which was *Oribatella arctica litoralis*. This species occurs mainly in the *Juncetum gerardii*, but it prefers drier variants of it.

At a level of about 50 cm above DNN, not a single specimen of *Trimalaconothrus glaber* was found. Generally few specimens of a species can still be found in samples taken close to its favourite environment. From this level *Platynothrus peltifer* became the dominant. Most species collected above this level are known to be inhabitants of areas bordering salt-marshes. *Scheloribates laevigatus* and *Liebstadia similis* demonstrate this salt-tolerance in the results of my Kalö investigation, *Oppia clavipectinata* and *Banksinoma lanceolata* have been collected also in the *Puccinellietum maritimae* (POLDERMAN, 1974).

The results of two samples taken in the Hestehave salt-marsh demonstrated the important influence of immersion by salt water on the composition of the Oribatid fauna. In a sample from a vegetation of *Juncus gerardii* and *Plantago maritima* all halophilous Oribatids were represented, accompanied by two salttolerant but non-halophilous species, *Liebstadia similis* and



*Trichoribates incisellus*. In a second sample taken in a vegetation of *Festuca rubra* above the drift-accumulation *Chamobates subglobulus* and *Eupelops occultus* were most numerous. *Chamobates subglobulus* of which, generally, isolated specimens only have been found, was present in this sample with 20 specimens. Beside these two, several other species (table 1) were collected, among which there was, however, not a single specimen of the five halophilous species.

In the halophyte vegetation of the Norsminde salt-marsh four species have been found. Samples were taken in the *Puccinellietum maritimae* and in the higher situated *Artemisietum maritimae*. In the former plant community *Ameronothrus schneideri*, *Punctoribates quadrivertex*, *Hermannia subglabra* and *Liebstadia similis* have been collected. In the latter community also a few specimens of *Liebstadia similis* occurred. One sample had been taken far above the drift-accumulation. In a dry *Agropyro-Rumicion* vegetation on sand six non-halophilous species occurred: *Trichoribates incisellus*, *Tectocephus velatus*, *Peloptulus phaeonotus*, *Oppia nova*, *Oppia clavipectinata* and *Liebstadia similis*.

#### DISCUSSION

The difference in hydrology between the salt-marshes on both coasts of Denmark apparently does not go with differences in the composition of the Oribatid faunas. Taking however into account which species possibly can occur in the Skallingen marsh, there is one difference in the zonation-patterns. In the salt-marshes along the Kattegat the combination of *Ameronothrus nigrofemoratus*, *A. schneideri* and *Punctoribates quadrivertex* is always accompanied by *Hermannia subglabra*. The results from salt-marshes along the Baltic (WEIGMANN, 1971) show something similar. However, *Oribatella arctica litoralis* sometimes has been found in the latter marshes instead of *Hermannia subglabra*. *Oribatella arctica litoralis* occurs in environments similar to those of *Hermannia subglabra*. It is mostly more abundant in the drier variants of these environments. In the Skallingen marsh, a pioneer-stage of the *Puccinellietum maritimae* is well developed. In a sample from this stage (fig. 1): *Puccinellietum*, *Ameronothrus nigrofemoratus* and *Punctoribates quadrivertex* have been collected. Although the characteristic combination was not complete, no other species occurred. This pioneer-stage of the *Puccinellietum maritimae* is absent or very small in the three salt-marshes along the Aarhus Bugt. Probably, the locally present pioneer-stage is too small and consequently insufficiently isolated, to prevent *Hermannia subglabra* from penetrating it everywhere from the *Juncetum gerardii* (the favourite habitat of *Hermannia subglabra*). The fact that, in the lowest part of the Kalö-marsh, the combination characteristic for the *Puccinellietum maritimae* has a dominant position, and the fact that *Hermannia subglabra* represents only a minority, constitute arguments in favour for this hypothesis.

The high numbers of *Trimalaconothrus glaber* in a saline environment constitute also striking phenomenon.

This species is mainly found in moist, temporary inundated habitats. HAARLÖV (1960) mentions considerable numbers of the species from the shore of Lake Madumsö in Denmark. In the Netherlands it has been found in a dune-valley in Voorne, which is inundated in winter. These are however fresh-water habitats. In brackish localities in the Netherlands, De Bol on Texel and a salt-marsh on Vlieland a few species of *Trimalaconothrus glaber* have been found (POLDERMAN, 1974). It is probable that the *Trimalaconothrus* sp., mentioned by WEIGMANN (1971) from a *Juncetum gerardii* near Schlei on the German coast of the Baltic, is also *Trimalaconothrus glaber*. A situation like that on Kalö, where the species was dominant in an optimally developed *Juncetum gerardii*, has been found nowhere before. Judging from the thick

*Vaucheria*-cushions on the *Trimalaconothrus* localities, and the situation along a very shallow creek the condition of a moist environment had been sufficiently fulfilled on Kalö. Apparently, *Trimalaconothrus glaber* has a somewhat greater salt-tolerance than could be assumed from its previously known distribution in freshwater habitats.

The salt-marsh of Kalö differs from the other two marshes along the Kattegat by the presence of a *Juncetum gerardii* instead of a *Artemisietum maritimae*. It was more humid and this appeared to influence the Oribatid fauna. Species with a preference for humidity occurring here are, e.g. *Banksinoma lenceolata*, *Fuscozetes fuscipes*, *Malaconothrus gracilis* and *Platynothrus peltifer* and *Trimalaconothrus glaber*. These species occurred in the Kalö-marsh only.

#### SUMMARY

During April and May 1972 the Oribatid fauna of four salt-marshes in Denmark has been investigated. One of these is situated along the Danish Wadden Sea, the remaining are situated along the Kattegat. Several species new to the fauna of Denmark have been found. The salt-marshes on both coasts have a distinct zonation-pattern as to their Oribatid fauna. In the halophyte vegetation the greater part of the material collected, consisted of halophilous species of which the number decreases with the decreasing salinity of the environment. The zonation-pattern of the halophilous species appeared to be more pronounced in the Skallingen marsh than in the salt-marshes along the Kattegat, where the average salinity of the sea-water is considerably lower. In the *Juncetum gerardii* of one of the marshes along the Kattegat (near Kalö) the number of *Hermannia subglabra* (the species which is usually dominant in this environment) has been greatly surpassed by that of *Trimalaconothrus glaber*, which is mainly known as a species from freshwater environments.

#### RÉSUMÉ

En avril et mai 1972 les Oribates de 4 terrains salés du Danemark ont été étudiés. L'un d'eux est situé le long de la mer de Wadden danoise, les autres le long du Kattegat. Plusieurs espèces nouvelles pour la faune du Danemark ont été récoltées. Les terrains salés des deux rives ont une zonation distincte tout comme leur faune oribatologique.

Dans la végétation halophile la plus grande partie du matériel récolté consiste en espèces halophiles dont le nombre décroît avec la salinité du milieu. La zonation des espèces halophiles est plus prononcée dans les terrains du Skallingen que dans ceux situés le long du Kattegat où la salinité de l'eau de mer est beaucoup plus faible. Dans le *Juncetum gerardii* de l'un des terrains du Kattegat (près de Kalö) le nombre d'*Hermannia subglabra* (l'espèce généralement dominante dans ce milieu), est largement surpassé par celui de *Trimalaconothrus glaber* qui est principalement connu comme une espèce vivant dans les biotopes d'eau douce.

#### ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the Royal Netherlands Academy of Science for the scholarship, which enabled him to make his investigations in Denmark. He also thanks Prof. Dr. H. M. THAMDRUP for the hospitality at the Molslaboratory, Mr. HENNING Petersen for his interest and help with this investigation, Mrs. L. MATHIESEN and Mr. S. SÖK for giving the data about the DNN levels of the samples and Dr. L. van der HAMMEN for critically reading the manuscript.



#### REFERENCES

- BEEFTINK (W. G.), 1966. — Vegetation and habitat of the salt-marshes and beach-plains in the South-Western part of The Netherlands. — *Wentia*, **15** : 83-108.
- BORNEBUSCH (C.), 1930. — The fauna of forest soil. — *Det forstlige Forsøgvaesen i Danmark.*, **11** : 1-158.
- HAARLOV (N.), 1960. — Microarthropods from Danish soils. — *Oikos*, suppl. **3** : 1-176.
- LUXTON (M.), 1967. — The zonation of saltmarsh Acarina. — *Pedobiologia*, **7** : 55-66.
- MC FADYEN (A.), 1961. — Improved funnel-type extractors for soil Arthropods. — *J. Anim. Ecol.*, **30**, 171-184.
- POLDERMAN (P. J. G.), 1972. — De mosmijten (Oribatida) van de Wester Grie op Ameland. — *Zeepaard*, **32**, 3/4 : 49-56.
- , 1974. — The Oribatida (Acari) of saline areas in the western part of the Dutch Wadden Sea. — *Neth. J. Sea Res.*, **8** (1) : 49-72.
- STRENZKE (K.), 1953. — *Passalozetes bidactylus* und *P. perforatus* von den schleswig-holsteinischen Küsten. (Acarina : Oribatei). — *Kieler Meeresforsch.*, **XI**, 2 : 231-234.
- THAMDRUP (H. M.), 1932. — Faunistische und ökologische Studien über dänische Oribatiden. — *Zool. Jahrb. Syst.*, **62** : 289-330.
- WEIGMANN (G.), 1967. — Faunistisch ökologische Bemerkungen über einige Oribatiden der Nordseeküste. — *Faun. — ökol. Mitt.*, **III** (3/4) : 173-178.
- , 1971. — Collembolen und Oribatiden in Salzwiesen der Ostseeküste und des Binnenlandes von Norddeutschland. (Insecta : Collembola — Acari : Oribatei). — *Faun. — ökol. Mitt.*, **4** (1) : 11-20.
- WEISS-FOGH (T.), 1948. — Ecological investigations on Mites and Collembolids in the soil. — *Natura Jutlandica*, **1** : 135-270.

---

#### INFORMATIONS

##### XV<sup>e</sup> CONGRÈS INTERNATIONAL D'ENTOMOLOGIE

Le quinzième Congrès International d'Entomologie se tiendra à Washington, D.C., U.S.A., du 19 au 27 août 1976.

Toute personne désirant recevoir des informations sur ce Congrès peut envoyer une carte postale avec son nom et son adresse écrits en majuscule à :

Dr. ERNEST C. BAY, Secretary General  
XV International Congress of Entomology  
P.O. Box 151  
College Park, Md.  
USA 20740