

# Studies on the Diptera Brachycera Fauna of the Sea Shores in North Norway

RICHARD DAHL

Per Eskilsgatan 28, Helsingborg, Sweden

**Abstract:** DAHL, R. 1968. Studies on the Diptera Brachycera Fauna of the Sea Shores in North Norway. *Norsk ent. Tidsskr.* 15, 19-27.

This paper is based upon the results of an entomological journey in North Norway in 1956, during which 315 species of Diptera Brachycera were collected. As the material comes mainly from sea shore localities, it is recorded with due regard to the ecological distribution of the most frequent species in the various distinct types of shore biotopes. A comparison of the ecological groups of Diptera Brachycera from North Norway and North America shows that of the 28 typical sea shore flies in North Norway, 17 are known from the coasts of North America.

## INTRODUCTION

During a journey in northern Norway in June-July 1956 I made intensive studies of Diptera Brachycera at different shore localities in North Norway, almost all of them on the Arctic Ocean shore. Almost all of the localities, in other words, are North of the Arctic Circle. The geographical divisions follow Strand (1943).

## DESCRIPTION OF THE BIOTOPES AND THEIR DIPTEROUS FAUNA

With regard to degree of exposition to the sea, inclination, soil properties etc., the shore biotopes may be divided into different types, all being suitable for an ecological study. Where the rock ground is solid or splintered in big blocks at the shore, there is seldom sufficient organic material to establish the basis for a stable coenose of Diptera. Only the *rock pool* biotope has been studied on these shores.

A much richer fauna is found on the shallow shores where the tide characterizes the coast and different types of organic material are deposited. Depending on its composition and the possible vegetation, three different biotopes have been studied: A. The most exposed where sand is the predominant component, the *sand*

*marsh*. B. The more protected, consisting of mainly organic and more fine-grained material, the *mud marsh*. C. The most protected, often situated at a higher level with a vegetation, forming a more or less close vegetation, the *grass marsh*. B and C are often well established at the estuaries of larger rivers, where the supply of organic substrate is good.

The exposed sand shore often has a mosaic from the dune heath vegetation at its higher levels. Therefore, attempts have been made to separate a *dune heath* biotope, which may be of interest with regard to the investigations made at the coasts of Finland (Krogerus 1932) and Sweden (Ardø 1957).

On several coast localities the zone directly above the tidal zone is a ground with closed vegetation of grass and herbs. I have defined two biotopes in this upper zone: The *grass meadow* and the *herb meadow*, both being more or less exposed to grazing. The last-named biotope is distinguished from the other meadow type by a predominance of insect-pollinated plants.

Though the investigations were restricted to coastal localities, some inland biotopes have also been studied for comparison. Thus collecting of Diptera was made on several sandy



Fig. 1. In many localities rock pools show a various degree of exposition to inundation by tides and storm waters, thus creating pools of different values of salinity. Rigidly bound to the biotope is *Hilara maura*, *Leptocera fontinalis*, *Hydrellia griseola*, *Scatella stagnalis* and *Ephydra* species (Fi: Talvik).

lake shores, almost all of them in the regio alpina. But little ecological information can be given from the few specimens collected. On the other hand, rich material has been collected in localities of the bog meadow biotope, which with its hygrophilous fauna may be used for comparison with the fauna of the saline sea shore.

#### The rock pool

The rock pool biotope (Fig. 1) belongs to the group of rather intensely studied biotopes in North Europe. There are various attempts to distinguish different types of rock pools (e.g. Lindberg 1944) but the few localities here studied imply only rocky basins with salt water, provided by sea at high-water level.

*Localities.* Nnø. Sørkil; TRi. Gratangen; Balsfjordbotn; Kvenangsbotn; Fi. Talvik; Fn. Ifjord (two localities); Vardø (two localities). 9 localities, 19 species, 42 specimens.

Most frequent species:

4 localities: *Hilara maura*, *Leptocera fontinalis*, *Hydrellia griseola*, *Scatella stagnalis*.

3 localities: *Ephydra alandica*.

2 localities: *Ephydra riparia*.

Thus the *Ephydra*-species show a low degree of constancy within this biotope in northern Norway as a contrast to corresponding localities in the south of Sweden (Dahl 1959).

A comparison with the results of Johnsen (1946), obtained from the study of rock pool on Bornholm, Denmark, shows that only two species are in common, *Ephydra riparia* and *Scatella stagnalis*, a fact mostly due to the poor investigation of Diptera Brachycera, only five species being recorded from this island.

#### The sand marsh

The exposed coastal low land with a sandy bottom material (Fig. 2) is of course difficult to distinguish both from other types of marshy shores and from sand shores not exposed to the tide. The organic material increases with the distance from the water, and also as the vegetation becomes more closed, beginning with single plants of *Carex goodenowii*, *Scirpus*



Fig. 2. In connexion with drier parts of the sand marsh biotope (with *Xiphandrium monotrichum*, *Hydrophorus norvegicus*, *Themira putris* and *Scatella quadrisetosa* as most prominent species) the dune heath forms a range of a mosaic character, consisting of association-fragments of *Honckenya peploides*, *Elymus arenarius* etc. with a diptera coenose dominated by *Hilara griseola*, *Scatella stagnalis* and *Nupedia dissecta* (TRi: Balsfjordbotn).

*rufus* and *pauciflorus* and *Festuca rubra*. Often *Elymus* and *Honckenya* form associations on dried parts of this shore type.

*Localities.* Nsi. Mo i Rana; Saltdal; TRi. Gratangen; Fv. Langfjord; Fn. Lakselv; Varangerbotn; Smalfjord. 7 localities, 40 species, 350 specimens.

Most frequent species:

6 localities: *Scatella stagnalis*, *S. quadrisetosa*.

4 localities: *Xiphandrium monotrichum*, *Hydrophorus norvegicus*, *Themira putris*.

3 localities: *Porphyros riparius*, *Hydrellia griseola*, *Scatophaga litorea*, *Collinellula lutosa*.

#### The dune heath

On many shores dry sand forms an intermediate zone between the moist biotopes near sea level and the meadows which often constitute the highest parts of a shore profile. Often the vegetation of this zone is of a type suggesting comparison with its counterpart on the shores of southern Fennoscandia. From this point of view every locality with a closed vegetation of *Elymus* and *Honckenya* has been studied and is here referred to the *dune heath* biotope (Fig. 2), a term not quite corresponding to the more limited concept used by Ardo (1957). This is a consequence of the indistinct zonation of the localities in northern Norway compared with those in southern Sweden. On the localities here studied, the zone is broken up into several plant associations, separated by open sand, all forming a mosaic, such as associations of *Festuca rubra* and *ovina*, *Poa pratensis*, *Asralagus alpinus*, *Lathyrus maritimus* etc., alternating with the vegetation of *Elymus* and *Honckenya*.

*Localities.* Nsi. Mo i Rana; TRi. Balsfjordbotn; Fn. Tana bru; Tanafjord; Tornvik; Vardø. 6 localities, 36 species, 146 specimens.

Most frequent species:

2 localities: *Hydrellia griseola*, *Scatella stagnalis*, *Nupedia dissecta*, *Acroptena nuda*, *Scatophaga litorea*, *S. stercoraria*.

Among the collected material the following species are mentioned by Ardo (1957) in his list of stenotope marine shore dune diptera in

southern Sweden: *Helina protuberans*, *Delia quadripila*, *Thoracochaeta zosterae*, *Scatophaga litorea*, *Fucellia fucorum*, *Spilogona contractifrons* (common at all moist places) and *Paragele cinerella*.

#### The mud marsh

The big content of organic material characterizing the mud marsh constitutes a biotope with a rich flora and fauna, among others *Scirpus uniglumis*, *Carex heleonastes* and *cane-scens*, and grasses such as *Festuca rubra* and *Agrostis stolonifera*. In some localities *Primula sibirica* is not rare.

*Localities.* TRi. Gratangen; Sørkil; Balsfjordbotn; Fi. Altafjordbotn (two localities); Fn. Storfjord, Lakselv. 7 localities, 33 species, 367 specimens.

Most frequent species:

All localities: *Scatella quadrisetosa*.

6 localities: *Porphyros riparia*.

5 localities: *Hydrophorus norvegicus*.

4 localities: *Hydrophorus praecox*, *Hilara griseola*, *Hydrellia griseola*.

In this biotope, species with a high degree of constancy had a high abundance too, especially *Scatella quadrisetosa*.

#### The grass marsh

The grass-dominated lowlands (Fig. 3) appearing on sheltered coasts seem to be morphologically closely related to the south-western Swedish coast meadows. The salt water support, however, is more regular, the spring tide playing a particularly important role in this respect. Climatic conditions prevent any direct comparisons between these two types of coastal meadows.

*Localities.* Mnø. Djupvik; Fn. Lakselv (two localities); Varangerbotn; Smalfjord; Bjørnnes. 6 localities, 48 species, 299 specimens.

Most frequent species:

4 localities: *Scellus spinimanus*, *Porphyros riparia*.

3 localities: *Hygroceleuthus latipennis*, *Schoenomyza litorella*, *Scatophaga litorea*, *S. stercoraria*, *Parallelomma fuscipes*.

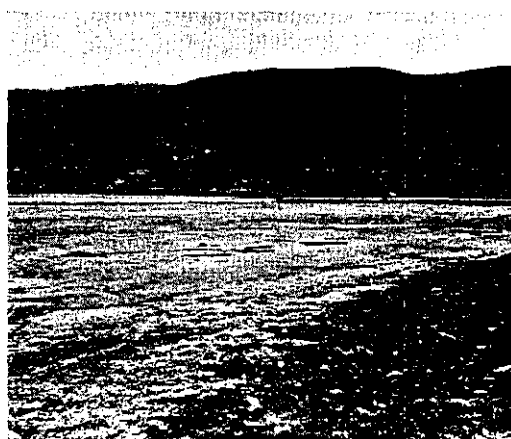


Fig. 3. On sheltered low land coasts the grass marsh - with *Scellus spinimanus* and *Porphyrus riparia* as the most interesting species - is the natural continuation at higher parts of the mud marsh, which has *Scatella quadrisetosa* as a very characteristic species in the diptera coenose. (Fn: Tanafjord)

Ringdahl (1959) gives a list of flies from coastal meadows. An attempt at a comparison with his records gives the following results:

A. Flies common in coastal meadows in both districts: *Hygroceleuthus latipennis*, *Porphyros riparia*, *Scatophaga litorea*, *Scatella stagnalis*.

B. Flies common in my northern localities, not listed by Ringdahl: *Scellus spinimanus*, *Scatella quadrisetosa*, *Parallelomma fuscipes*.

C. Flies common in the southern localities, not collected in this investigation: This applies to many flies e.g. the *Nemotelus*-species, characteristic of many coastal meadows in the south and like other *Stratiomyids* southern in distribution.

#### The grass meadow

The upper boundary of the true shore is often formed by grazing ground with a vegetation of *Poa pratensis*, *Festuca rubra*, *Aira caespitosa* and *Anthoxanthemum odoratum*. In addition, single herbs appear, such as *Ranunculus*-species, *Trollius europaeus* and *Achillea millefolium*. Thanks to the droppings of the grazing cattle, coprophilous Diptera have

good life conditions. Of the investigated localities, two are situated outside any shore zonation.

**Localities.** Nsi. Dunderland; Nnø. Djupvik; TRi. Gratangen (three localities); Sørkjøs; Kvenangsbotn; Fn. Lakselv (two localities); Tanafjord; Adamsfjord. 11 localities, 118 species, 281 specimens.

Most frequent species:

6 localities: *Melanostoma mellinum*.

5 localities: *Melanostoma scalare*, *Lasiops nigritellus*, *Hilara interstincta*, *H. maura*, *Bicellaria subpilosa*.

4 localities: *Fannia serena*, *Scatophaga suilla*, *Lasiops aculeipes*, *Cheilosia vernalis*, *Platychirus manicatus*.

3 localities: *Hilara griseola*, *Rhamphomyia albissima*, *Lycia laeta*, *Lauxania cylindricornis*, *Scatella stagnalis*, *Lasiops ater*, *Linnoctus*, *Okeniella caudata*, *Microprosopa pallicauda*, *Scatophaga stercoraria*, *Sepsis flavimana*, *Nemopoda* sp. (the three last-named being pronouncedly coprophilous).

#### The herb meadow

A distinction between the two meadow biotopes, the grass and the herb meadow, is naturally debatable, especially since abiotic factors do not show any important differences. The main reason for this distinction is the vegetation, which in the herb meadow, in contrast to the grass meadow, is dominated by 'insect-flowers', such as *Solidago virgaurea*, *Ranunculus*-species, *Trollius europaeus*, *Sausurea alpina*, *Veronica longifolia* and so on.

**Localities.** Nsi. Mo i Rana (several localities); Nnø. Røsvik; TRi. Gratangen (several localities); Målselv; TRy. Tromsø; Sandbukt; Fn. Tana bru (several localities). 13 localities, 116 species, 365 specimens.

Most frequent species:

6 localities: *Scatophaga suilla*, *Fannia serena*.

5 localities: *Melanostoma mellinum*.

4 localities: *Melanostoma scalare*, *Scatophaga stercoraria*, *Coelomyia spathulata*.

3 localities: *Platychirus peltatus*, *Hilara maura*,

*Sepsis flavimana*, *Scatophaga lutaria*, *Lasiops ater*.

Among species found on two localities the following may be mentioned: *Symphoromyia crassicornis*, *Porphyros riparia*, *Empis lucida*, *Nupedia dissecta*, and *Hydrophoria conica*.

A comparison between the two meadow biotopes shows a good agreement, the following species being common to both types:

*Platychirus peltatus*  
*P. manicatus*  
*Melanostoma mellinum*  
*M. scalare*  
*Scatophaga suilla*  
*S. stercoraria*  
*S. lutaria*  
*Lasiops ater*  
*L. nigrifolius*  
*L. aculeipes*  
*Lycia laeta*  
*Hilara maura*  
*Bicellaria subpilosa*  
*Fannia serena*

On the other hand the ecological distribution of other species calls for a distinction. The following species of more or less high constancy have been found in one of the two biotopes only:

The grass meadow...  
*Hilara intersticta*  
*Xiphandrium monotrichum*  
*Schoenomyza litorella*  
*Okeniella caudata*  
*Microprosopa pallicauda*  
*Lauxania cylindricornis*

The herb meadow  
*Coelomyia spathulata*  
*C. subpellucens*  
*Hydrophoria conica*  
*Nupedia dissecta*

The bog meadow

The bog meadow is different from other meadow types both with respect to vegetation

and to abiotic factors. It is often developed at a higher altitude, and also in the regio alpina. The annual temperature amplitude is larger, the humidity is higher, the substrate is poorer. Connexion with a shore zonation is uncommon. The vegetation is characterized by *Eriophorum*-species such as *angustifolium*, *vaginatum* and *scheuchzeri*, *Scirpus caespitosus*, *Betula nana*, *Andromeda polifolia*, *Rubus chamaemorus* and *Empetrum*-species etc.

*Localities.* Nsi. Fauske; Nnø. Kråkmø; Sørkil; TRI. Bardu; Sørkjøs; Fi. Kåfjord; Alta; Fn. Tanafjord; Vardø; Vicksa; Ifjord; Børselv. 12 localities, 67 species, 191 specimens.

Most frequent species:

7 localities: *Empis lucida*.  
 6 localities: *Rhamphomyia obscura*.  
 5 localities: *Hilara intersticta*.  
 4 localities: *Empis borealis*, *Renocera striata*, *Melanostoma mellinum*.  
 3 localities: *Neoascia dispar*, *Dolichopus maculipennis*, *D. stenhammari*, *Lispocephala erythrocerata*, *Spilogona macropyga*, *Nupedia dissecta*, *Scatophaga furcata*, *Okeniella caudata*, *Parallelomma fuscipes*.

#### Discussion

The constancy values give an estimation of the regularity of the appearance of a species within a coenose of a biotope. As a summary, Table I records all the biotopes and their most representative species mentioned above. This table may also form a basis for an estimation of the homogeneity of the biotopes selected as far as the Diptera coenoses are concerned. A high constancy value for a number of species is a sign of a homogenous coenose. Examples of these are found in the sand, mud and grass marsh biotopes. Of the remaining biotopes treated, the grass, herb and bog meadows and the rock pool have a fairly constant Diptera coenose, the dune heath less so.

I have stated that biotopes of a zonated shore type have a good Ephydrid coenose in contrast to biotopes of a mosaic or non-shore-bound type (Dahl 1959 p. 45). This statement

Table I. Ecological grouping of the dipterous sea shore fauna based upon the values of constancy (%)\*

	rock pool	sand marsh	dune heath	mud marsh	grass marsh	grass meadow	herb meadow	bog meadow
<b>Dolichopodidae</b>								
<i>Dolichopus maculipennis</i>								25
<i>D. stenhammari</i>								25
<i>Hygroceleuthus latipennis</i>					50			
<i>Hydrophorus norvegicus</i>		57		63				
<i>H. praecox</i>				50				
<i>Scellus spinimanus</i>					66			
<i>Porphyros riparia</i>		43		75	66			
<i>Xiphandrium monotrichum</i>		57						
<b>Empididae</b>								
<i>Empis borealis</i>								33
<i>E. lucida</i>								58
<i>Hilara griseola</i>				50		38		
<i>H. interstincta</i>				50				42
<i>H. maura</i>	57					63	38	
<i>Rhamphomyia albissima</i>						38		
<i>R. obscura</i>								50
<b>Syrphidae</b>								
<i>Cheilosia vernalis</i>						50		
<i>Platychirus manicatus</i>						50		
<i>P. peltatus</i>							38	
<i>Melanostoma mellinum</i>						75	63	33
<i>M. scalare</i>						63	50	
<i>Neocia dispar</i>								25
<b>Sepsidae</b>								
<i>Nemopoda pectinulata</i>						38		
<i>Themira putris</i>		57						
<i>Spes flavimana</i>						38	38	
<b>Sciomyzidae</b>								
<i>Renocera striata</i>								33

\*The number of samples in which a species has been found, divided by the total number of samples, multiplied by 100 and expressed as a percentage.

Table I. *Continued*

	rock pool	sand marsh	dune heath	mud marsh	grass marsh	grass meadow	herb meadow	bog meadow
<b>Ephydriidae</b>								
<i>Ephydra alandica</i>	43							
<i>Scatella quadrisetosa</i>		86		100				
<i>S. stagnalis</i>	57	86	33			38		
<i>Hydrellia griseola</i>	57	43	33	50				
<b>Sphaeroceridae</b>								
<i>Collinelluta lutosa</i>		43						
<i>Leptocera fontinalis</i>	57							
<b>Muscidae</b>								
<i>Lasiops ater</i>						38	38	25
<i>L. aculeipes</i>						50		
<i>L. innocuus</i>						38		
<i>Fannia serena</i>						50	75	
<i>Coelomyia spathulata</i>							50	
<i>Lispocephala erythrocerata</i>								25
<i>Schoenomyza litorella</i>					50			
<b>Anthomyiidae</b>								
<i>Acroptena nuda</i>			33					
<i>Nupedia dissecta</i>			33					25
<b>Scatophagidae</b>								
<i>Parallelomma fuscipes</i>					50			
<i>Okeniella caudata</i>						38		25
<i>Microprosopa pallicauda</i>						38		
<i>Scatophaga furcata</i>								25
<i>S. litorea</i>		43	33		50			
<i>S. lutaria</i>							38	
<i>S. stercoraria</i>			33		50	38	50	
<i>S. suilla</i>						50	75	

can be expanded to be applicable to the whole Diptera Brachycera coenoses as proved by the present investigations in North Norway.

The distribution of the large Diptera Brachycera families on the different biotopes is very marked. In Table I the species of a high constancy listed above form a basis for an evaluation of ecological distribution. The *Dolichopodids* and *Ephydriids* dominate in the shore biotopes, especially in the marsh types; the *Empidids* appear regularly in the grass meadow but are especially predominant in the bog meadow. The *Syrphids* are mainly confined to the grass and herb meadows, an ecological distribution that is also typical for the *Muscids*. The most eurytopic character, besides the *Ephydriids* *Hydrellia griseola* and *Scatella stagnalis*, is shown by the *Scatophagids*.

There is a remarkable distinction between the herb and grass meadow biotopes on one hand and all the rest on the other, the former being inhabited by a very large number of species, 116-118, the latter by only 19-67 species.

The most characteristic types of coastal biotopes, with their most prominent Diptera species, have been described. In comparison with South Scandinavia most species are in common. With regard to the composition of the coastal shore coenoses it is interesting to note how in these certain typical alpine species—often appearing in the bog meadow biotope—may be rather common, e.g. *Dolichopus maculipennis*, *D. stenhammari*, *Hydrophorus pilipes*, *Diaphorus nigricans*, and *Spilogona arenosa*.

This is a distribution tendency that is known in many other animal and plant groups (Lindroth 1931 p. 439), and can be explained by the similarities of some environmental factors within these separate biotopes, above all the dry substrate, a result either of sun exposition or of a high degree of salinity, or both. Of course, this tendency is most easy to study in localities situated at higher latitudes, where the shore biotopes are established in close connexion with alpine biotopes and not isolated by

the ecological barrier formed by a forest zone. From Iceland Lindroth (1931) gives many examples, both among plants and among Coleoptera, and from the same island, Tuxen et al. (1954, p. 152) mention *Fucomyia frigida* and *Scatophaga villipes*, both sea-shore species, as found on the central highland.

#### SOME REMARKS ON THE GEOGRAPHICAL DISTRIBUTION OF THE SHORE SPECIES

In my North Norwegian material of 315 species, 112 species are so far recorded as American. Of the typical shore flies collected in North Norway, the following ones are also known from North America:

*Hydrodromia stagnalis*  
*Hilara bistriata*  
*Porphyros crassipes*  
*Scellus spinimanus*  
*Themira putris*  
*Limosina crassimana*  
*Scatella paludum*  
*S. quadrisetosa*  
*Ephydra riparia*  
*Pelina aenescens*  
*Trichopalpus punctipes*  
*Ceratinostoma ostiorum*  
*Scatophaga litorea*  
*Spilogona aerea*  
*S. arenosa*  
*Lispe tentaculata*  
*Fucellia fucorum*

Thus of 28 species recorded as typical sea shore flies in North Norway, 17 are also known from the coasts of North America. Of these, two species are only recorded from the most northern shores of the continents, *Scatella quadrisetosa* and *Ceratinostoma ostiorum*. The European species not known from North America have a more southern tendency in their distribution and most of them are boreal species with only few arctic localities.

The majority of the typical sea shore species



have their distribution centre in the north of the Atlantic and neighbouring seas. As a matter of course this implies that the fauna of coast shore biotopes can be characterized as having one of the widest geographical distributions in the Arctic districts in comparison to the fauna of other biotopes. This fact can be a result of the distribution ecological factors favouring the dispersion of the shore species.

But more probably this large distribution area is caused by the better possibilities of survival during the Ice Ages that marked the shore species. At any rate the climatic conditions were somewhat better in the ice-free coastal belts with their higher humidity and moderate temperature. The retreating sea uncovered new land on the continental shelves and new shore biotopes were formed with the variation of the ice masses.

The composition of the diptera coenoses of the North Norwegian shore biotopes may be characterized as having two origins, one formed by species invading the localities from distribution centres in more south-easterly parts of the Eur-Asiatic land mass, the other represented by species regarded as Wurm-hibernating and colonizing these localities from any of the many refugial areas in the Arctic or Atlantic Oceans. Before a more valid decision can be made on which of these two groups a shore species belongs to, it will be necessary to get a better knowledge of the diptera fauna of other coast localities in the Arctic Ocean.

#### ACKNOWLEDGEMENTS

With some families I have had the help of specialists in the identification of the species. I am very grateful to the following scientists for their kind help: Fil. mag. S. Gaunitz, Växjö (Syrphidae: *Cheilosia*, *Chrysogaster*, *Melano-stoma*), Fil. lic. L. Hedström, Uppsala (some

Dolichopodidae specimens), Fil. dr. W. Hellén, Helsingfors (Syrphidae: *Cheilosia*), Docent W. Hackman, Helsingfors (Sphaeroceridae: *Limosina*), Prof. M. Hennig, Stuttgart (Sepsidae: 1 specimen), Prof. H. Kauri, Bergen (Tabanidae), Prof. R. Tuomikoski, Helsingfors (Empididae: *Bicellaria*, *Hilara*), Dr. R. Vockeroth, Ottawa (Scatophagidae).

Most thanks are due to my old friend and teacher, the late fil. dr. O. Ringdahl, who has helped me with the determination of some Dolichopodidae, Syrphidae, Muscidae and Anthomyiidae.

Thanks to the kindness of Dr. R. Vockeroth, Ottawa, some Canadian dipterologists—besides Dr. Vockeroth himself, Dr. J. G. Chillcott and Dr. G. E. Shewell—have gone through my species list, identifying all species known from North America.

#### REFERENCES

- ARDÖ, P. (1957) Studies in the Marine Shore Dune Ecosystem with special reference to the Dipterous Fauna. *Opusc. ent., Suppl. XIV*, (255 p.).
- DAHL, R. (1959) Studies on Scandinavian Ephydriidae (Diptera Brachycera). *Opusc. ent., Suppl. XV*, (224 p.).
- JOHNSON, P. (1946) The rock pools of Bornholm and their fauna. *Vidensk. Meddr. dansk naturh. Foren.* 109, 1-53.
- KROGERUS, R. (1932) Über die Ökologie und Verbreitung der Arthropoden der Treibsandgebiete an den Küsten Finnlands. *Acta zool. fenn.* 12, (308 p.).
- LINDBERG, H. (1944) Zur Kenntnis der Insektenfauna im Brackwasser des Baltischen Meeres. *Acta Soc. Sci. fenn. Comm. Biol.* X 9, (206 p.).
- LINDROTH, C. H. (1931) Die Insektenfauna Islands und ihre Probleme. *Zool. Bidr. Upps.* 13, 105-600.
- RINGDAHL, O. (1959) Flugor på strandängar i nord. västra Skåne. *Ent. Tidskr.* 80, 39-48.
- STRAND, A. (1943) Inndeling av Norge til bruk ved faunistiske oppgaver. *Norsk ent. Tidsskr.* 6, 208-224.
- TUXEN, S. L., NIELSEN, P. & RINGDAHL, O. (1954) Diptera I. *Zoology Iceland*, 3, (48a), 1-189.

Received 29 February 1968