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Spiders (Araneae) from six small islands in the middle Oslofjord, SE Norway

ERLING HAUGE AND LARS OVE HANSEN

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A list of 99 species of spiders taken on six small islands in the middle Oslofjord, SE-Norway, is presented. Tofteholmen, Ramvikholmen and Mølen are situated in eastern Buskerud, while Langøøya, Killingholmen and Kommersøya are situated in Vestfold. All the islands, except Mølen, are of Silurian origin. Several European species obviously have their north-western limits of distribution in this south-eastern area of Norway, where these islands are situated. This is briefly discussed and documented.

Five species are reported for the first time in Norway, *Philodromus rufus* Walckenaer, 1825, *Pardosa arenicola* (O. P.-Cambridge, 1875), *Theridium simile,* C. L. Koch, 1836, *Entelecara congenera* (O. P. Cambridge, 1879) and *Hypomma cornutum* (Blackwall, 1833).

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INTRODUCTION

Earlier studies have demonstrated that the Oslofjord region probably is the richest in Norway as far as insect species are concerned, and that also a large amount of so-called rare species are present in the area (e.g. Andersen & Fjeldså 1984, Aagaard & Hågvar 1987, Andersen & Søli 1988). Several insect species have only been found on islands in the area (Aarvik & Midtgaard 1986, Andersen & Hansen 1990, and there are some indications that a rich spider fauna is present here (Hauge & Midtgaard 1986, Hauge 1986).

Until recently these islands have been spared from severe human activity, but during the last two decades the pressure has increased considerably. Large areas are now used for shore residences, camping-grounds and other human activities, resulting in change and destruction of natural vegetation and unique habitats. The present paper is a result of a collecting program for insects and spiders in the area in 1987 (see Hansen 1989).

The sequence of the species in the systematic list is according to Hauge (1989) and the botanical names are according to Lid (1985).

STUDY AREA

The islands are situated in the middle Oslofjord (59° 30' N) (Fig. 1). In the following references the EIS-grid numbers are according to Økland (1977) and regional abbreviations are in accordance to Økland (1981):

Tofteholmen	BØ	Hurum:	EIS	19	UTM	32VNL8898
Ramvikholmen	BØ	Hurum:	EIS	19	UTM	32VNL8799
Mølen	BØ	Hurum:	EIS	19	UTM	32VNL8595
Langøya	VE	Våle:	EIS	19	UTM	32VNL7896
Killingholmen	VE	Sande:	EIS	19	UTM	32VNL7599
Kommersøya	VE	Sande:	EIS	19, 28	UTM	32VNL7499

The northern part of Kommersøya lies within EIS—grid no. 28, buut this study includes only EIS-grid no. 19.

Tofteholmen covers an area of 0.11 km². The distance to the mainland is approximately 2 km, and it is about 1 km to the nearest island. The rocks are Cambro-Silurian sediments and Permian eruptives (Brøgger 1929). The flora is very rich on the dry calcareous shore-meadows, and consists of herbs like *Geranium sanguineum, Galium* spp., and *Origanum vulgare* and scrubs like *Juniperus com-*

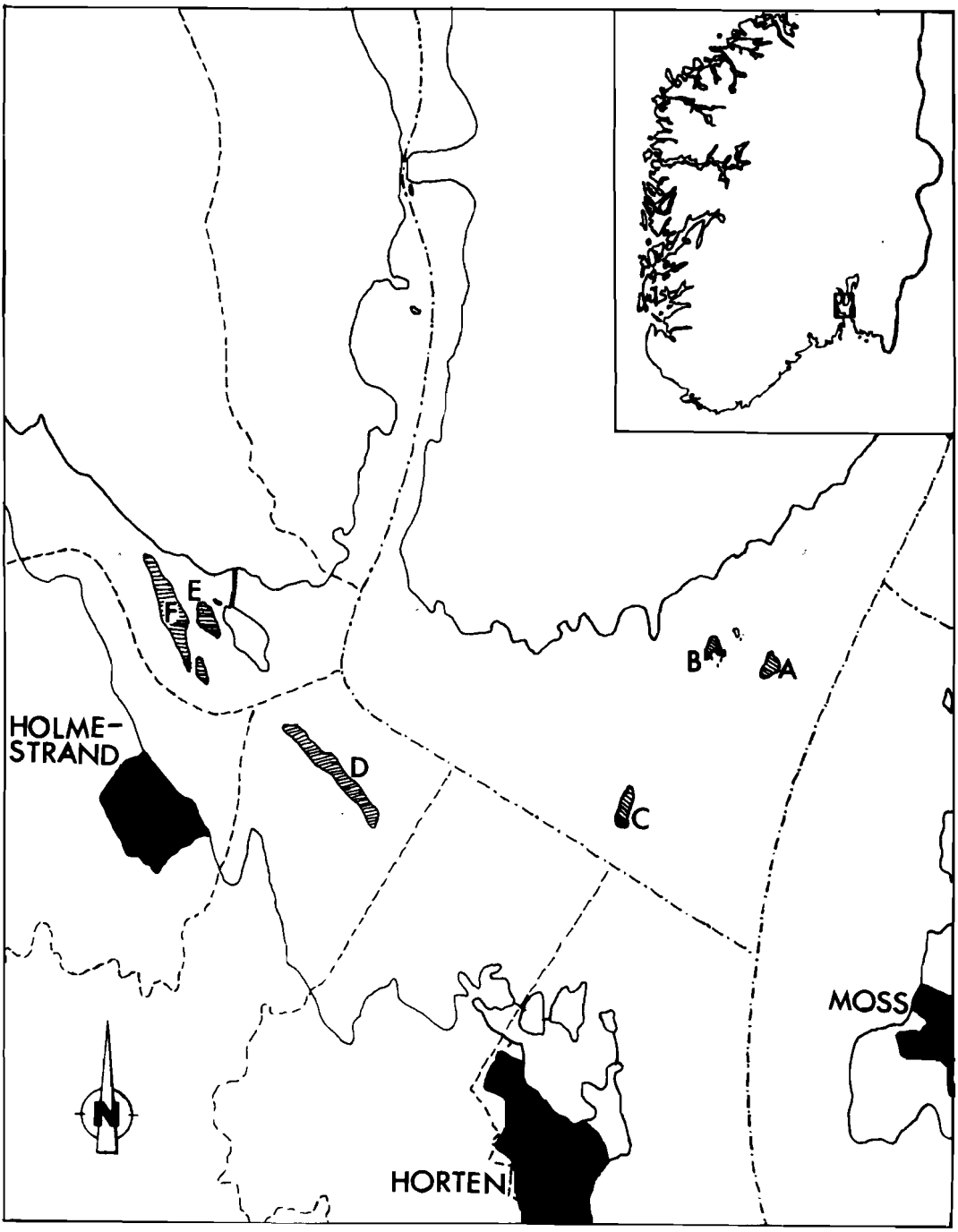

Fig. 1. The Oslofjord area, SE Norway, with the six islands: A: Tofteholmen, B: Ramvikholmen, C: Mølen, D: Langøya, E: Killingholmen and F: Kommersøya. Scale 1: 150 000.

munis, Ligustrim vulgare, Rosa spp., *Rubus* spp., *Prunus* spp., *Cotoneaster* spp. and *Crataegus* spp. The interior of the island is covered with old spruce forest *(Picea abies)* mixed with deciduous trees, particular lime *(Tilia cordata)*. For more details about the flora, see Dyring (1921) and Lid (1929).

Because of the rocky ground combined with wind exposure, taller spruces may die in dry summers. This gives the island a remarkable character, with many standing and fallen dead trees. The island has been protected by law since 1919 (for details see Hansen 1989).

Ramvikholmen covers about 0.10 km^2. The distance to the mainland is approximately 1.25 km. The geological origin and the vegetation are rather similar to Tofteholmen, but Ramvikholmen is more disturbed by human activity. Misteltoe *(Viscum album)* is present on both islands, but seems to be more abundant at Ramvikholmen. For details concerning the flora, see During 1921. The island is protected, but the regulation dates back to 1936 and needs revision (Hansen 1989).

Mølen covers approximately 0.25 km^2, and the distance to the mainland is approximately 3.5 km. The rocks are of Pre-Cambrian origin (Gleditsch 1948). However, the rich sea-shell mixed substratum gives rise to a very interesting flora, with a rich shrub and herb vegetation (Dyring 1921, Hagen 1950). Many of the same species occuring on Tofteholmen and Ramvikholmen and represented here. The interior of the island is covered with an old and dense lime forest mixed with elms *(Ulmus glabra)*. Some giant limes are very old reaching five meters in circumference (Hagen 1950). Most of the older limes are heavily attacked by misteltoe. Some specimens of *Prunus spinosa* and *Rhamnus cathartica* are several meters high with well developed trunks. The island has been protected since 1977 (Hansen 1989).

Langøya is situated about 2 km from the mainland. It is about 3.2 km long, and covers an area of about 1 km^2. The origin is Silurian limestone with a high fossil content. Limestone has been quarried on the island for more than 90 years, resulting in two big quarries covering about 60% of the total area of the island. Very little of the original forest is left. In the northern part there is a population of birches *(Betula verrucosa)*, mixed with other deciduous trees. Two small basiphiolus pine forests are present in the same area, where orchids (e.g. *Ophrys insectifera* and *Epipactis atrorubens)* are common. Most of the western shore consists of large open areas, covered with heaps of crushed limestone from the quarries. Calcareous meadows have been established here, with large populations of herbs (e.g. *Artemisia campestris, A. absinthium, Inula salisina, Melilotus* spp., *Centaureae* spp., *Caluna vulgaris, Origanum vulgare* and *G. sanguineum)*. The shrub vegetation is quite similar to that of Tofteholmen.

The northern part of the island, as well as a smaller part in the south and the easten shore are protected by law (Miljøverndepartementet 1985, Fylkesmannen i Vestfold 1989).

Killingholmen and **Kommersøya** are both of Silurian origin, built up of limestone with slate layers, but parts of Kommersøya consist of marble. Kommersøya covers about 0.7 km^2, and the highest point is about 60 m.a.s.l. Killingholmen covers about 0.1 km^2 with a large number of cabins. Both islands have dry calcareous meadows with remnants of basiphilous pine forest. Kommersøya has some old and dense deciduous and coniferous forest, in many places with dead and dying trees. In spite of quarrying and logging of marble at Kommersøya, the island elsewhere is still relatively undisturbed. Dyring (1921) has more details about the flora. Two small areas on each island are protected (Miljøverndepartementet 1985, Hansen 1989).

METHODS

Fifteen pitfall traps were placed on each island from primo June 1987 to medio November 1987 in a gradient from forest, to meadow and into the littoral zone, and a few also in fallen and stumps. Five traps on each island were supplied with baits (rotten meat, fish etc.). Some specimens were collected by sweep net, random hand collecting or light traps in the period from 1987, 1989 and 1990. All records are done by the second author (LOH). The material is deposited at the Zoological Museum, Bergen.

RESULTS

A total of 99 spider species were taken on these small Oslofjord islands (Table 1).

Table 1. Araneae species taken on six islands in the middle Oslofjord, SE Norway in 1987—90. New regional records are indicated with one asterisk (*) and new Norwegian records with two (**).

FAMILY / *species*	ISLAND						
	Tofte-holmen	Ramvik-holmen	Mølen	Lang-øya	Killing-holmen	Kommers-øya	
AMAUROBIIDAE							
Amaurobius fenestralis (Stroem, 1768)	—	Ra	Mø	La	—	—	—
DICTYNIDAE							
Dictyna arundinacea (Linnaeus, 1758)	—	—	—	La	—	Ko	—
D. latens (Fabricius, 1775)	—	—	—	—	—	Ko	—
D. pusilla Thorell, 1856	—	—	—	—	—	Ko	—
D. uncinata Thorell, 1856	—	—	—	La	—	—	—
SEGESTRIIDAE							
Segestria senoculata (Linnaeus, 1758)	—	Ra	Mø	La	—	—	—
GNAPHOSIDAE							
Drassyllus praeficus (L. Koch, 1867)	—	—	—	La	—	—	*
Gnaphosa bicolor (Hahn, 1831)	—	—	—	La	—	—	—
Haplodrassus signifer (C.L. Koch, 1839)	—	—	—	La	—	—	—
Micaria fulgens (Walckenaer, 1802)	—	—	Mø	—	—	—	*
M. nivosa L. Koch, 1866	—	—	—	La	—	—	*
Zelotes subterraneus (C.L. Koch, 1833)	—	—	—	La	—	—	—
CLUBIONIDAE							
Cheiracanthium onchognathum Thorell, 1871	—	—	—	La	—	Ko	*
Clubiona brevipes Blackwall, 1841	—	—	Mø	—	—	—	*
C. pallidula (Clerck, 1757)	—	—	Mø	La	—	—	—
C. terrestris Westring, 1862	—	—	Mø	—	Ki	—	—
LIOCRANIDAE							
Agroeca brunnea (Blackwall, 1833)	—	—	—	La	—	—	—
A. proxima (O.P.-Cambridge, 1871)	—	—	—	La	—	—	—
Phrurolithus festivus (C.L. Koch, 1835)	—	—	—	La	—	—	—
ANYPHAENIDAE							
Anyphaena accentuata (Walckenaer, 1802)	—	—	—	La	—	—	—
THOMISIDAE							
Misumena vatia (Clerck, 1757)	—	—	Mø	La	—	Ko	—
Oxyptila atomaria (Panzer, 1810)	—	—	Mø	La	—	—	—
O. praticola (C.L. Koch, 1837)	To	—	Mø	La	—	Ko	—
Xysticus cristatus (Clerck, 1757)	—	—	—	La	—	—	—
X. kochi Thorell, 1872	—	—	—	La	—	—	*
PHILODROMIDAE	—						
Philodromus aureolus (Clerck, 1757)	—	—	—	La	Ki	Ko	—
P. rufus Walckenaer 1825	—	—	Mø	—	—	—	**
Tibellus oblongus (Walckenaer, 1802)	—	—	—	La	Ki	—	—
SALTICIDAE							
Ballus depressus (Walckenaer, 1802)	—	—	—	La	—	—	*
Evarcha falcata (Clerck, 1757)	—	—	Mø	La	—	Ko	—
Heliophanus cupreus (Walckenaer, 1802)	—	—	Mø	—	—	—	—
LYCOSIDAE							
Acantholycosa lignaria (Clerck, 1757)	—	—	—	La	—	—	—
Alopecosa inquilina (Clerck, 1757)	—	—	—	La	—	—	—
Pardosa agricola (Thorell, 1856)	—	—	—	La	—	—	*
P. arenicola (O.P.-Cambridge, 1875)	—	—	Mø	—	—	—	**
P. lugubris (Walckenaer, 1802)	—	Ra	Mø	La	—	Ko	—
P. palustris (Linnaeus, 1758)	—	—	—	La	—	—	—
P. prativaga (L. Koch, 1870)	—	—	—	La	—	—	—
P. pullata (Clerck, 1757)	—	—	—	La	—	—	—
Trochosa ruricola (Degeer, 1778)	—	—	—	La	—	—	—
T. terricola Thorell, 1856	To	Ra	Mø	La	Ki	Ko	—
Xerolycosa nemoralis (Westring, 1861)	—	Ra	—	La	—	—	—
PISAURIDAE							
Pisaura mirabilis (Clerck, 1757)	—	—	—	La	—	—	—

TETRAGNATHIDAE							
Pachygnatha degeeri (Sundevall, 1830)	—	—	—	La	—	—	—
Tetragnatha extensa (Linnaeus, 1758)	—	—	Mø	La	—	Ko	—
METIDAE							
Meta menardi (Latreille, 1804)	—	—	—	La	—	—	—
Metellina mengei (Blackwall, 1869)	—	—	Mø	La	—	Ko	—
M. segmentata (Clerck, 1757)	—	—	—	La	—	—	—
THERIDIIDAE							
Anelosimus vittatus (C.L. Koch, 1836)	—	—	Mø	—	—	—	*
Dipoena tristis (Hahn, 1833)	—	—	—	—	—	KoR	*
Enoplognatha ovata (Clerk, 1757)	—	—	Mø	La	—	—	—
Episinus angulatus (Blackwall, 1836)	—	—	—	La	—	—	—
Euryopis flavomaculata (C.L. Kock, 1836)	—	—	—	La	—	—	—
Robertus lividus (Blackwall, 1836)	—	—	Mø	—	Ki	—	—
R. neglectus (O.P.-Cambridge, 1871)	—	—	—	—	—	Ko	—
Theridion bimaculatum (Linnaeus, 1767)	—	—	—	La	—	—	—
T. impressum L. Koch, 1881	—	—	—	LaR	—	—	—
T. pallens Blackwall, 1834	—	—	Mø	La	—	—	—
T. simile C.L. Koch 1836	—	—	Mø	La	—	—	**
T. sisyphium (Clerck, 1757)	—	—	Mø	La	—	—	—
ARANEIDAE							
Araneus diadematus Clerck, 1757	—	—	Mø	La	—	Ko	—
Araniella cucurbitina (Clerck, 1757)	—	—	—	—	—	Ko	—
Atea sturmi (Hahn, 1831)	—	—	—	—	—	Ko	—
Cyclosa conica (Pallas, 1772)	—	—	Mø	La	—	Ko	—
Larinoides patagiatus (Clerck, 1757)	—	—	Mø	—	—	—	*
Mangora acalypha (Walckenaer, 1802)	—	—	MøR	—	—	—	*
Nuctenea umbricata (Clerck, 1757)	—	—	Mø	—	—	—	—
LINYPHIIDAE							
Bathyphantes nigrinus (Westring, 1851)	—	—	Mø	—	—	Ko	—
B. setiger (F.O.P.-Cambridge, 1894)	—	—	Mø	—	—	—	—
Bolyphantes alticeps (Sundevall, 1832)	—	—	Mø	La	—	—	—
Centromerita bicolor (Blackwall, 1833)	—	—	—	La	—	—	—
Centromerus sylvaticus (Blackwall, 1841)	To	Ra	Mø	—	Ki	Ko	—
Diplocephalus cristatus (Blackwall, 1833)	—	—	—	La	—	—	—
D. latifrons (O.P.-Cambridge, 1863)	—	Ra	Mø	La	—	—	—
D. picinus (Blackwall, 1841)	—	—	Mø	—	—	Ko	—
Diplostyla concolor (Wider, 1834)	—	—	Mø	La	Ki	—	—
Dismodicus elevatus (C.L. Koch, 1838)	—	—	—	La	—	—	—
Entelecara congenera (O.P.-Cambridge, 1879)	—	—	—	La	—	—	**
Erigone dentipalpis (Wider, 1834)	—	—	—	La	—	—	—
Gongylidiellum murcidum Simon, 1884	—	—	—	La	—	—	—
Gongylidium rufipes (Sundevall, 1829)	—	—	Mø	—	Ki	—	—
Hypomma cornutum (Blackwall, 1833)	—	—	Mø	—	—	—	**
Labulla thoracica (Wider, 1834)	To	Ra	Mø	La	Ki	—	—
Lepthyphantes flavipes (Blackwall, 1854)	To	Ra	Mø	La	—	Ko	—
L. mengei Kulczynski, 1887	—	—	—	La	—	—	—
L. minutus (Blackwall, 1833)	—	—	Mø	—	—	—	—
L. tenebricola (Wider, 1834)	To	—	Mø	—	Ki	Ko	—
Linyphia triangularis (Clerk, 1757)	—	—	—	La	—	—	—
Macrargus rufus (Wider, 1834)	To	—	—	—	—	—	—
Micrargus subaequalis (Westring, 1851)	—	—	—	La	—	—	—
Microlinyphia pusilla (Sundevall, 1829)	—	—	Mø	—	Ki	Ko	—
Neriene clathrata (Sundevall, 1829)	—	—	Mø	—	—	—	—
N. montana (Clerck, 1757)	—	—	—	—	—	Ko	—
Oedothorax gibbosus (Blackwall, 1841)	—	—	—	La	—	—	—
Pelecopsis radicicola (L. Koch, 1875)	—	—	—	La	—	—	—
Stemohyphantes lineatus (Linnaeus, 1758)	—	—	—	La	—	—	—
Tapinopa longidens (Wider, 1834)	—	—	Mø	La	—	—	—
Tiso vagans (Blackwall, 1834)	—	—	Mø	—	—	—	—
Walckenaeria acuminata Blackwall, 1833	—	—	Mø	—	—	—	—

Seven of these were found on Tofteholmen, 9 on Ramvikholmen, 46 on Mølen, 68 on Landøya, 11 on Killingholmen and 25 on Kommersøya.

DISCUSSION

The 99 species comprises approximately 20% of the Norwegian total (536 species, see Hauge 1989). In the list, there is a good mixture of ground living species and species from the higher strata, which undoubtedly is due to the use of more than one sampling technique. The use of sweep nets has revealed species mainly from the families Metidae, Theridiidae and Araneidae, all relatively rare in pitfall collections. To some degree the diversity in the pitfall catches have been accommodated by placing the traps along vegetation gradients, although the number of traps within each habitat type perhaps are somewhat too small. The occurrence of species on each islands do not highlight the qualities between the islands, but rather the sampling effort executed on each island.

For several European spider species the south-eastern part of Norway, including the Oslofjord area and along the coast south to Kristiansand, seems to represent their north-western limit of distribution. This is probably due to the more continental climate in south-eastern areas compared to the mild and humid oceanic climate in the south-western and western areas. Several species in our list, together with species from Hauge & Midtgaard (1986), may be regarded as having this type of distribution.

Drassyllus praeficus, is previously only known from Østfold (Ø) and the coast of Grimstad (outer Aust-Agder) (AAY). *Cheiracanthium onchognatum* is previously only recorded from the island Ostøya in Bærum near Oslo (Akershus) (AK), and seems to have a southerly distribution in Sweden (north to Södermanland) (Sdm.) (Tullgren 1946). *Clubiona brevipes* has a similar distribution in Sweden (north to Uppland) (Upl.), however, in contrast to *C. onchognathum,* it seems to have established also in Finland (Palmgren 1977). In Norway it is previously only reported from Vestfold (VE) and Østfold (Ø). *Xysticus kochi* has also a similar distribution in Sweden (Tullgren 1946), and a south-eastern in Finland (Palmgren 1950) where it is considered as rare. The only previous Norwegian record of *X. kochi* is from the outer areas of Aust-Agder (AAY) (Hauge 1989). Also *Oxyptila praticola* seems to have a similar distribution in Norway, but in contrast to the species mentioned above it is obviously more common and has a wider ecological range. *O. praticola* is also reported from the more inland areas such as Elverum (HES), Ringerike (BØ) and Bygland (AAI) (see Hauge 1989). This is also supported by its more northern extension in both Sweden (north to Västerbotten) (Vb.) (Tullgren 1946) and in Finland at least north to the Arctic Circle (Palmgren 1950). Also the salticid species *Ballus depressus,* previously recorded once from «around Oslo» (AK) (Collett 1875), seems here, together with the record from Uppland (Sweden) (Tullgren 1946), to be close to its «Ultimo Thule». Its absence from Finland (see the lists of Palmgren 1977) and its distribution in Britain (Locket & al. 1974, Map 152) probably gives some support to that.

Philodromus rufus seems to have a soutern distribution in Europe, and is not previously recorded from Norway or Finland, but in Sweden it is recorded in Skåne (Sk.) and O land (Öl.) (Palmgren 1977). According to Locket & Millidge (1951) it is rare on bushes and low herbage in wooded areas in southern England.

Pardosa agricola, previously known from central Norway, i.e. from about Trondheim (STI) and north to Finnmark (Tambs-Lyche 1940), was found on Landøya. *P. arenicola* is by Locket & al. (1974) regarded as a subspecies of *P. agricola,* but obviously with a quite different pattern of distribution and consequently with different ecological demands (see Locket & al. 1974, Map 176). The species was found on Mølen, and should be regarded as new to the Norwegian fauna.

T. terricola is the species of the genus which has the widest distribution in Norway, at least all over the southern parts of the country north to Steinkjer (inner Nord-Trøndelag) (NTI). In these areas it is locally very abundant, but never caught above the timber line. Some older records, however, indicate that also *T. ruricola* is distributed north to Trøndelag (Collett 1875, Storm 1898). It is also recorded from the inner parts of southern Norway (Hallingdal) (BV) (Strand 1899). Strand's material has not been available. Storm's material has been revised

by Tambs-Lyche (1942) who states that at least some females in the material belong to *T. ruricola.* The present author (E.H.) has seen specimens of *T. ruricola* only in our material and a few from Hvaler in Østfold (Ø). However, according to records from Sweden and Finland (Holm 1947 and Palmgren 1939) *P. ruricola* is distributed north to Dalarna (Dlr.) and Raahe (Om) south of Oulu, Palmgren (1950) reported most findings from the south-eastern areas of Finland. *T. terricola,* on the other hand, is in these countries distributed somewhat further north, to Ångermanland (Ång.) in Sweden and represented with a single record north of the Arctic Circle in Finland. Otherwise in Finland it shows a more south-eastern distribution. Its «commonness» and its locally high abundance in west Norwegian areas are well documented by Hauge (1976).

Entelecara congenera is not previously recorded in Norway. It is in Finland recorded north to Pisavarre national park, Ostrobottnia. In Sweden it is quite common and widespread north to Dalarne (Dlr.) (Tullgren 1955).

Hypomma cornutum is reported for the first in Norway. It shows a pattern of distribution with northern limits similar to many other species mentioned above or in the litterature. The species is widespread in Europe (Bonnet 1957), but obviously more scattered in occurrence in its northern areas. These areas include the northern/north-western parts of the British Isles, even though it has reached the Scottish Highland (Locket & al. 1974, Map 382). There are a few scattered records in Sweden, reaching north to Stockholm (Upl.) (Tullgren 1955). The few Finnish records are mostly from the south-western parts, apart from the one from Lappajärvi in Ostrobottnia (Palmgren 1976). The species was found on Mølen both in 1987 and 1990 and seems to be well established there.

Dipoena tristis is previously only recorded from Oslo (AK) in Norway. The three theridiid species *Anelosimus vittatus, Enoplognatha ovata* and *Theridion impressum,* the wheel spinner *Mangora acalypha* and the linyphiid species *Micrargus subaequalis* have previously been found a few times in Norway and only in these south-eastern areas, i.e. inner Oslofjord south to Østfold (Ø) and Vestfold (VE), a couple of them also near Kristiansand (VAY) (see Hauge 1989). *Theridion simile* was sweep netted both on Mølen and Langøya. The species seems to have a southern distribution and is previously not recorded from Norway or Sweden. In Finland it is only recorded from the southwestern areas (Palmgren 1974). The species is found on the British Isles, though not commonly: on brushes and low plants in southern England, as well as in Yorkshire, Scotland and Eire (Locket et Millidge 1953).

Considering that these islands contain more than 20% of our known species of spiders, that several southern or southeastern distributed species have their northern limits here, and that five species are in Norway only found here, these islands should from a national point of view be considered as unique. Even though parts of the islands are protected, the human impact is now so intense that the need for further protection is urgent to avoid damage of this particular fauna.

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REFERENCES

Aasgaard, K. & Hågvar, S. 1987. Sjeldne insektarter i Norge. 1. *Økoforsk utredning 1987: 6.* 81 pp.

Aarvik, L. & Midtgaard, F. 1986. Records of Lepidoptera from Håøya and Ostøya in inner Oslofjord. *Fauna norv. Ser. B. 33:* 47—53.

Andersen, T. og Fjeldså, A. 1984. Sommerfugler (Lepidoptera) i åpent kystlandskap på Sandøy, Hvasser og sydenden av Tjøme. *Miljøverndepartementet. Rapport T-5 76:* 35—96.

Andersen, T. & Hansen, L. O. 1990. Caddisflies (Trichoptera) from five small islands in the middle Oslofjord, SE Norway. *Fauna norv. Ser. B.* 00: xx—xx.

Andersen, T. & Søli, G. E. E. 1988. Sjeldne og truede sommerfugler i Vestfolds kystområder. *Økoforsk rapport 1988: 17.* 129 pp.

Bonnet, P. 1957. *Bibliographia Araneorum II (3):* 1927—3026.

Brøgger, W. C. 1929. Tofteholmens geologi. p. 475—484 *in* Resvoll-Holmsen, H. Tofteholmen i Hurum. *Norsk Geogr. Tidsskr. II (8):* 473—510.

Collett, R. 1875. Oversigt af Norges Araneida I. *Forh. Vidensk. Selsk. Christ. 1875:* 255—259.

Dyring, J. 1921. Holmestrandsfjordens fanerogamer og karkryptogamer. *Nyt mag. f. Naturv. 59:* 45—184.

Fylkesmannen i Vestfold, Miljøvernavd. 1989. *Flerbruksplan for Langøya, Våle kommune.* 52 pp.

Gleditsch, Chr. C. 1948. Mølen en pre-kambrisk øy i ytre Oslofjord (Hurum). *Naturen 72 (1):* 10—24.

Hagen, A. 1950. *Mølens flora.* Landsforbundet for naturfredninger i Norge. 69 pp.

Hansen, L. O. 1989. *Insektinventeringen på fredede og verneverdige øyer i midtre Oslofjord.* Norsk Entomologisk Forening avd. Drammen, Drammen. 59 pp.

Hauge, E. 1976. Spiders (Araneae) of a West Norwegian *Calluna* heath. *Lindåsprosjektet, Rapp. 20:* 1—98.

Hauge, E. 1986. Spiders (Araneae) from Vestfold, South-East Norway. *Fauna norv. Ser. B. 33:* 104—105.

Hauge, E. 1989. An annotated check-list of Norwegian spiders (Araneae). *Insecta norv. 4.* 40 pp.

Hauge, E. & Midtgaard, F. 1986. Spiders (Araneae) in Malaise trap from two islands in the Oslofjord, Norway. *Fauna norv. Ser. B 33:* 98—102.

Holm, Å. 1947. Fam. 8—10. Oxyopidae, Lycosidae och Pisauridae. In: *Svensk Spindelfauna 3.* Entomologiska Föreningen, Stockholm. 48 pp.

Lid, J. 1929. Tofteholmens plantevekst. I. p. 485—491 *in* Resvoll-Holmsen, H. Tofteholmen i Hurum. *Norsk Geogr. Tidsskr. II (8):* 473—510.

Lid, J. 1985. *Norsk og svensk flora.* Det norske Samlaget, Oslo. 837 pp.

Locket, G. H., Millidge, A. F. & Merrett, P. 1951. *British Spiders I.* Ray Society, London. 310 pp.

Locket, G. H. & Millidge, A. F. 1953. *British Spiders II.* Ray Society, London. 449 pp.

Locket, g. H., Millidge, A. F. & Merrett, P. 1974. *British Spiders III.* Ray Society, London. 314 pp.

Miljøverndepartementet. 1985. *Utkast til verneplan for fossilforekomster i Oslofeltet.* Oslo. 165 pp.

Økland, J. 1977. Litt om biogeografiske metoder, og noen nye data om utbredelse av stavtege, *Ranatra linearia, og vannskorpion, Nepa cinerea,* i Norge. *Fauna 30:* 145—167.

Økland, K. A. 1981. Inndeling av Norge ved biogeografiske oppgaver — et revidert Strand-system. *Fauna 34:* 167—178.

Palmgren, P. 1939. Die Spinnenfauna Finnlands. I. Lycosidae. *Acta Zool. Fenn. 25:* 1—86.

Palmgren, P. 1950. Die Spinnenfauna Finnlands und Ostfennoskandiens. III. *Acta Zool. Fenn. 62:* 1—43.

Palmgren, P. 1974. Die Spinnenfauna Finnlands und Ostfennoskandiens. V. Theridiidae und Nesticidae. *Fauna Fennica 26:* 1—54.

Palmgren, P. 1976. Die Spinnenfauna Finnlands und Ostfennoskandiens. VII. Linyphiidae 2. *Fauna Fennica 29:* 1—126.

Palmgren, P. 1977. Die Spinnenfauna Finnlands und Ostfennoskandiens. VIII. *Fauna Fennica 30:* 1—50.

Storm, V. 1898. Iagttagelser over Arachnider i Throndhjems omegn. *K. norske Vidensk selsk. Skr. 1898 (7):* 1—10.

Strand, E. 1899. Araneae Hallingdaliae. *Arch. Math. Naturv. 21 (6):* 1—23.

Tambs-Lyche, H. 1940. Die Norwegische der Gattung *Pardosa* Koch. *Avh. norske Vidensk. akad. Oslo 1939 (6):* 1—59.

Tambs-Lyche, H. 1942. Notes on Norwegian spiders. *Norsk ent. tidsskr. 6:* 107—114.

Tullgren, A. 1944. *Svensk Spindelfauna 3. Fam. 1–4 Salticidae, Thomisidae, Philodromidae och Eusparrassidae.* Entomologiska föreningen, Stockholm. 138 pp.

Tullgren, A. 1946. *Svensk Spindelfauna 3. Fam. 5–7. Clubionidae, Zoridae och Gnaphosidae.* Entomologiska föreningen, Stockholm. 141 pp.

Tullgren, A. 1955. Zur Kenntnis Schwedischer Erigoniden. *Arkiv f. Zool. 7 (20):* 295—389.

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Larva and biology of *Anabolia concentrica* (Zetterstedt, 1840) and comments on other Fennoscandian *Anabolia* spp. (Trichoptera, Limnephilidae)

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Solem, J. O. & Johansson, A. 1991: Larva and biology of *Anabolia concentrica* (Zetterstedt, 1840), and comments on other Fennoscandian *Anabolia* spp. (Trichoptera, Limnephilidae). *Fauna norv. Ser. B 38:* 53—63.

The larva of *Anabolia concentrica* is described and a key to the Fennoscandian *Anabolia* spp. is suggested. The population of *A. concentrica* in the Vargbäcken, 25 km NW of Vindeln (64° 25' N, 19° 30' E) in Västerbotten province, North Sweden, studied in 1986/87 had a one-year life cycle. Adults appeared in August and September. First instar larvae were found in the following May. It is not known if overwintering was in the egg stage or as first instar larvae, but virtually no growth took place during winter. Larvae grew throughout summer and in July only the fifth instar was collected. There were five larval instars. Larvae may have to cope with irregular drought periods during growth. The larvae are shredders, but gut contents consist of fresh plants, stems and leaves of e.g. *Sphagnum balticum* and *Carex* sp., hyphae of fungi, diatoms *(Tabelaria* and *Achnantes),* filamentous green algae *(Microspora)* and a few fragments of invertebrates (e.g. legs of caddis larvae), and also detritus. We conclude that the larvae are opportunists and generalistic feeders.

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INTRODUCTION

There are different opinions on the number of European species in the genus *Anabolia.* Malicky (1983) included six species: *brevipennis* Curtis, *concentrica* Zetterstedt, *furcata* Brauer, *laevis* Zetterstedt, *lombarda* Ris, and *nervosa* Curtis. The species *brevipennis* is also referred to the genus *Phaecopteryx* (e.g. Botosaneanu and Malicky 1978, Andersen & Wiberg-larsen 1987). If *brevipennis* Curtis is included in *Phaecopteryx* we have four species in Scandinavia in the genus *Anabolia,* and these are *concentrica, furcata, laevis* and *nervosa.* The larvae of *A. nervosa* and *A. laevis* have been dealt with by Ulmer (1909) and Espen-Petersen (1916), and *A. nervosa, A. furcata* and *A. laevis* by Lepneva (1966). Waringer (1986) gave information to separate the larvae of *A. furcata* and *A. nervosa.* The larva of *A. nervosa* is also described by Nielsen (1942) and is included in the key to British limnephilid larvae by Hiley (1976). However, we have not found any information in the literature on the larvae of *A. concentrica.*

Therefore, the objectives of this paper are to describe the larva of *A. concentrica,* to give some bionomics of the species, and to suggest a key to the Scandinavian species of *Anabolia.*

STUDY AREA

Anabolia concentrica was studied in the Vargbäcken, 25 km NNW Vindeln (64°25'N, 19°30'E) in Västerbotten province, North Sweden. The stream flows in a valley surrounded by sandy heathland covered with pine *(Pinus sylvestris)* forest.

The stream plains were earlier used for hay-making, and thus kept open. The stream is 0.4—1.0 m wide and only about 300 m long. It originates from small bogs (250 m a.s.l.) and merges with other permanent streams before it empties into the small lake Lill-Gladatjärnen (205 m a.s.l.).

The stream is ice-covered from November to April and probably freezes to the bottom in winter. In early May 1987 the water flow was 0.18 $m^3 s^{-1}$, and in mid-August it had decrea-

Table 1. Water temperatures measured on dates of larval collecting in 1987 in Vargbäcken stream, Västerbotten province, North Sweden.

May			June			July			Aug				Sept			Oct	
10	19	28	6	15	24	4	14	24	2	10	20	30	10	20	30	12	24
0.5	1.6	1.6	2.3	6.6	7.4	6.8	8.8	10.7	9.3	7.5	9.4	5.6	7.8	4.4	2.6	6.5	3.7

sed to 0.02 m^3 s^{-1}. During dry summers the stream is periodically dry, but the frequency and length of the droughts are not known. During the rainy summer of 1987 the stream had a continuous flow with a water depth 40—50 cm and maximum water temperature of 10.7°C. Water temperature in the stream on the sampling days are given in Table 1, and we conclude that it is a cold water stream.

The stream bed consists of sand and fine gravel, and the stream margins have discontinuous stands of *Sphagnum* and *Carex*. One identified *Sphagnum* is *S. balticum* (Russ.) C. Jens. which indicates that the conditions in the surroundings are ombrotrophic and poor minerotrophic.

MATERIAL AND METHODS

About every ten days from 1 May to 24 October 1987 five handnet samples were taken in the Vargbäcken, and this covered the ice and snow-free period at the collecting site. At each sample a triangular handnet (maximum width 0.28 m, mesh size 0.6 mm) was used intensively along 0.5 m of the stream margin for 30 seconds, with a simultaneous stirring up of the bottom with the foot. Samples were sorted fresh and larvae were transferred to 70% ethanol. The samples were spread out along a 50 m long section of the stream. At each sampling water temperature and water depth were measured. We collected 63 first, 63 second, 62 third, 43 fourth and 42 fifth instar larvae.

The flight period of *Anabolia concentrica* was recorded with a Malaise trap placed across the stream. The trap was operated from 19 May to 24 October and the collecting jars were emptied every ten days.

To associate larvae and pupae with adults, larvae of *A. concentrica* were collected on 4 July and placed individually in small aquaria for hatching. Ten pupae were collected on 25 July, and laid on *Sphagnum*-moss in a small terrarium. The moss ensured stable moist air in the terrarium. Both larvae and pupae were kept in an unheated room. These rearings gave us the opportunity to associate larval sclerites left in the pupal case with adults, and also to compare with larvae collected in the field. The metamorphotype technique (Milne 1938) is quite effective in associating larvae and adult stages of caddis fly species that retain sclerotized larval parts in their case.

Larval head widths and lengths of 76 food items in the gut were measured to the nearest 0.01 mm under a binocular microscope. Individual head width was used to identify the various larval instars and the length of food items to estimate average size of the plants pieces eaten. Gut contents of five larvae were examined.

For character diagnostics we have examined larvae of *A. furcata* collected in Austria and *A. nervosa* from Austria and Britain.

We have tried to obtain larvae of *A. laevis,* but without success.

Separation of *Anabolia* from other Trichoptera larvae

The separation of *Anabolia* from other limnephilid genera may be done using Hiley (1976) and Wiggins (1977). However, we must admit that we have had some difficulties with Hiley's key.

Comments on the distribution of *Anabolia* spp.

Knowledge of the distribution of the *Anabolia* spp. in Fennoscandia may also help in larval identification. All four species occur in Sweden, but *A. furcata* is recorded only from south Sweden. *A. furcata* is not recorded in Finland and Norway; these two countries have only *nervosa, laevis* and *concentrica* (Svensson & Tjeder 1975, Andersen & Wiberg-Larsen 1987). In Scandinavia *concentrica* must be regarded as a northern species, and probably *laevis* also. *A. nervosa* is recorded all over the countries.

Our own notes on the occurrence in Scandinavia is that *Anabolia* spp. are rather rare, but may be locally common. This also coincides with the information given by Nybom (1960) for their occurrence in Finland.

The distribution of *Anabolia* spp. elsewhere in Europe shows that *nervosa* is recorded from the British Isles and Spain and eastwards. *A. furcata* is distributed from the Alps and eastwards to Siberia, and *A. concentrica* is known only from eastern Europe (Botosaneanu & Malicky 1978).

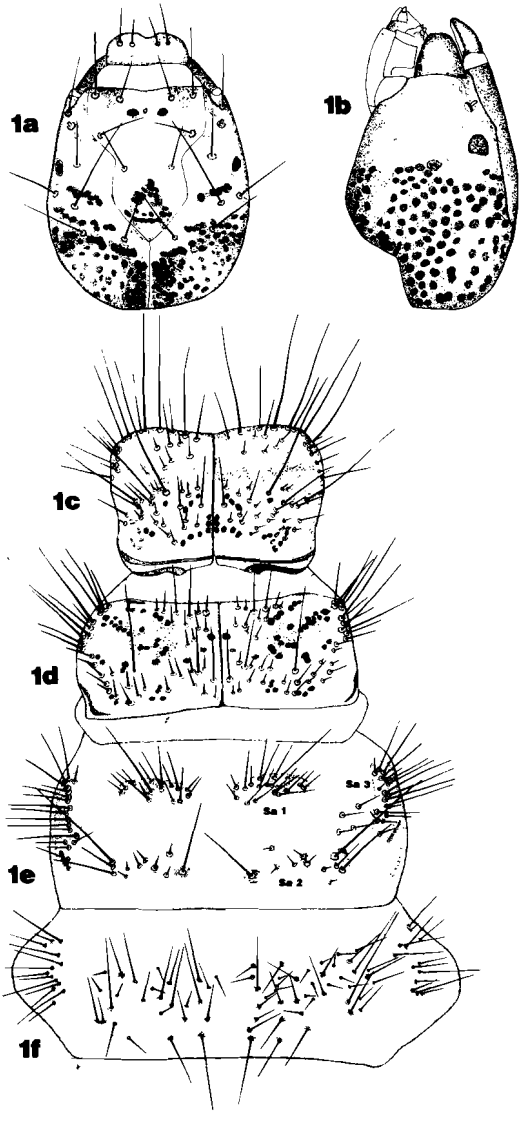

Fig. 1. Head, dorsal view (1a), and lateral view (1b), pronotum (1c), mesonotum (1d), metanotum (e) and dorsum (1f) of *Anabolia concentrica*. Sa 1, Sa 2 and Sa 3 = Setal areas 1, 2 and 3.

RESULTS

Description of 4th and 5th instar larva of *A. concentrica*

We concentrate here on the description of 4th and 5th larval instars, as younger larvae are difficult to identify. Larval instars may be identified by the head width and after Silfenius (1902) by using the number of gill filaments (3 filament gills = 4th and 5th instar, 2 = 3rd, 1 = 2nd, and 0 = 1st).

Dorsum of head with numerous dark brown spots (Fig. 1a, b). The distinct and prominent spots of *A. concentrica* are confined to the posterior part of the head, and are present on dorsal, lateral and ventral sides. Head appears relatively uniform brown.

Mandibles each with a brush of long setae and five teeth. Labrum sclerotized and with a row of four long setae on dorsal side and anterior to those two small setae.

Pronotum uniformly coloured, or the posterior part slightly darker than the anterior (Fig. 1c); a furrow divides the pronotum into an anterior part (1/3 of the length) and a posterior part. At the anterolateral corner of the pronotum is a patch of short and stout spines (Fig. 6). Prosternal horn present and long. Mesonotum with two large sclerites which are relatively uniformly brown (Fig. 1d). On metanotum three setal areas (sal, sa2 and sa3) on each side, setae of sal and sa3 appear from one sclerite, while sa2 has one large and several small sclerites (Fig. 1e).

Primary ventral setae of first femur both yellow. The femora of second and third legs bear only two major black setae on the ventral edge. Additional setae present on anterior and posterior faces of all three pairs of legs. Inner trochanter of first leg has 9—10 setae; that of second leg 5—7 setae and trochanter of third leg 4—7 setae (Fig. 2a, b, c).

First abdominal segment with ventral, lateral and dorsal humps. The dorsal hump may on some specimens be difficult to distinguish. The number of setae at the dorsal hump very variable (Fig. 1f). Setae on the ventral hump in a continuous band or appear from two blotches. Dorsal gills present on segments 2—8, dorsolateral gills on 2—5 or 6; ventrolateral gills on 2—6 or 7; and ventral gills on

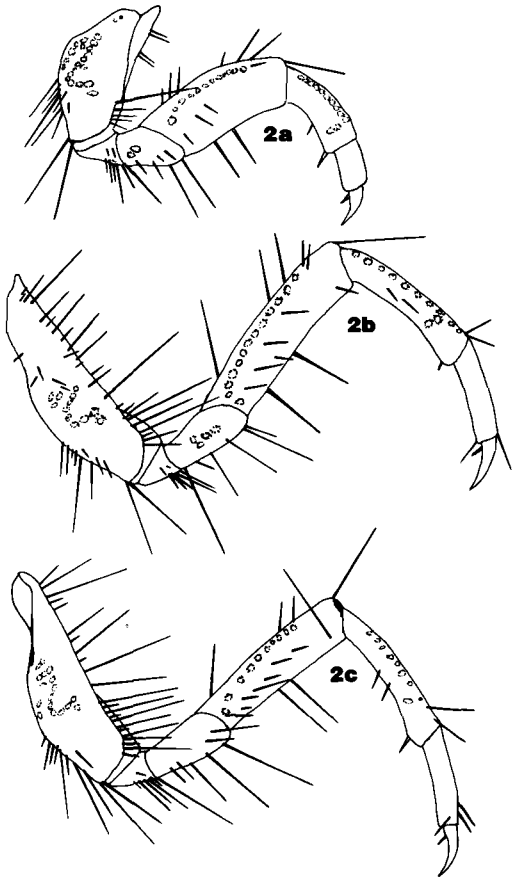

Fig. 2. Legs of *Anabolia concentrica*. 2a = first leg, 2b = second leg and 2c = third leg.

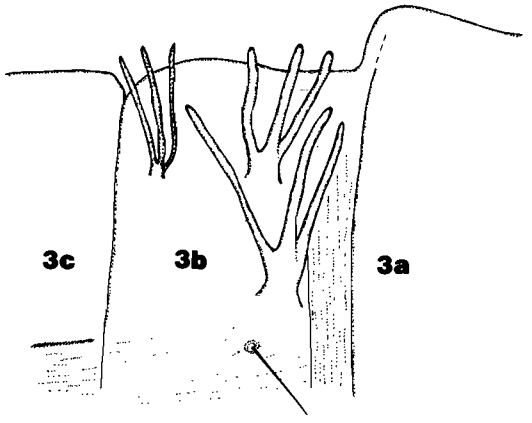

Fig. 3. Dorso-lateral view of abdominal segment 1 (3a), abdominal segment 2 with gills drawn (3b) and segment 3 (3c) of *Anabolia concentrica*. Two dorsal gills and one dorsolateral.

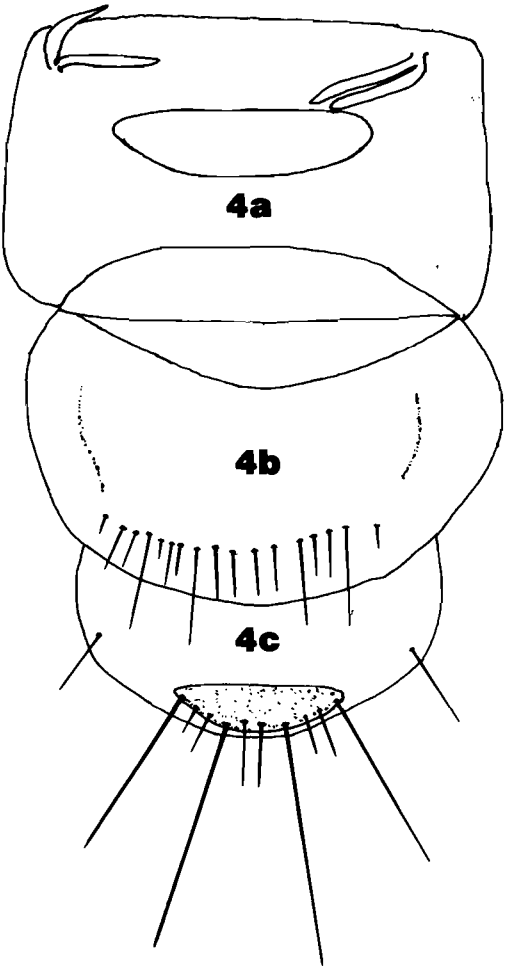

Fig. 4. Dorsum (4a), 8 (4b) and 9 (4c) of abdomen of *Anabolia concentrica*. Chloride epithelia indicated on 7, the continuous row of setae on 8 and sclerite on 9.

2—8. Each set of gills consists of 1—3 filaments (Fig. 3, Table 2). Dorsal and ventral chloride epithelia on segments 3—7 (Fig. 4a). Lateral fringe on 3—8. Dorsum 8 with a continuous row of setae (Fig. 4b). Dorsum 9 bears a sclerite (Fig. 4c). Anal claw with only one additional claw.

Larval instars were identified from maximum head width. The frequency distribution of larval head width (Fig. 5) shows that *A. concentrica* has five larval instars. Mean head width together with one SD is presented for each instar in Table 3. The factor of increase per moult was 1.3—1.4. Fifth instar larvae are 22—23 mm long.

Table 2. Gills of *Anabolia concentrica*, fifth instar larva.

Segment		Dorsal	Dorso-lateral	Ventro-lateral	Ventral
2	Anterior	3	3	0	3
	Posterior	3	0	3	3
3	Anterior	3	3	0	3
	Posterior	3	0	2	3
4	Anterior	3	2	0	3
	Posterior	3	0	2	3
5	Anterior	3	1	0	2
	Posterior	3	0	0	2
6	Anterior	2	0	0	2
	Posterior	2 (1)	0	0	2
7	Anterior	2	0	0	2
	Posterior	2	0	0	2
8	Anterior				
	Posterior				

Table 3. Mean of head width of larvae of *Anabolia concentrica* with one standard deviation (SD), factor of increase per moult (FI) and number of larvae measured.

Instar	1	2	3	4	5
x mm	0.53	0.74	1.04	1.43	1.86
SD	0.02	0.03	0.05	0.07	0.06
FI		1.4	1.4	1.4	1.3
N	63	56	56	47	40

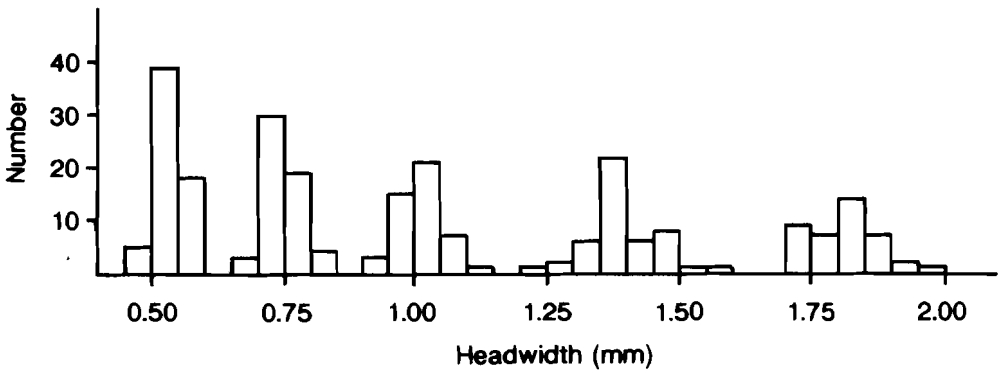

Fig. 5. Histogram of head-width measurements of larval instars 1—5 of *Anabolia concentrica*.

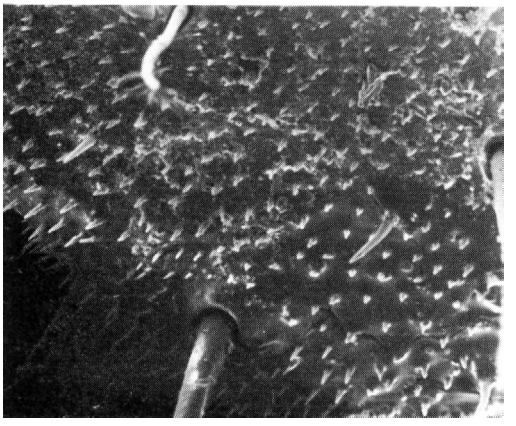

Fig. 6. SEM-photo of small, stout spines on anterolateral corner of pronotum of *Anabolia concentrica*. Horizontal bar 0,01 mm. Photo: K. Evjen, Dept. of Botany, Univ. of Trondheim.

Larval and pupal cases

Larval cases were constructed mostly of plant material, but sand grains may be included (Fig. 7a—d). One or more long sticks may be attached to the case. Posterior opening is irregularly formed. Anterior end has a dorsal hood. Larval cases are slightly curved when viewed laterally. (This is not seen in Fig. 7 because they are viewed dorsally). Immature larvae were mostly collected on the steep stream margins. Fifth instar cases are 22—23 mm long.

The pupal cases we collected were all made of sand grains (Fig. 7e), and none were curved.

Phenology

The seasonal distribution of adults and larval instars 1 to 5 is shown in Fig. 8. Adults were present in August and September, when oviposition must also occur. Totals of 63, 63, 62, 43 and 42 specimens of larval instars 1 to 5 were collected. First instar larvae were collected from 1 May. At this time the stream bottom was still covered with ice, and the melt-water was flowing over the ice. This indicates that eggs were deposited in the vegetation at the stream margins in the previous September.

Second instar larvae were first found on 19 May. The third instar occurred from 16 June, the fourth from 24 June, and the fifth instar from 4 July to 2 August.

Adults were recorded in the Malaise trap from 23 August to 21 September. A total of 27 males and 2 females were caught. In rearing experiments adults emerged from 11 August to 7 September, and the pupal period lasted 23—29 days.

Between 8 and 22 August seven adults emerged from the ten pupae placed in the terrarium. The number of adults caught in the Malaise trap and from indoor rearings are shown in Fig. 8. The life cycle of *A. concentrica* is univoltine.

Food

The gut content of the larvae examined varied considerably from specimen to specimen, and by eye it was obvious that the major items eaten were different from specimen to specimen. This indicates that the larvae are

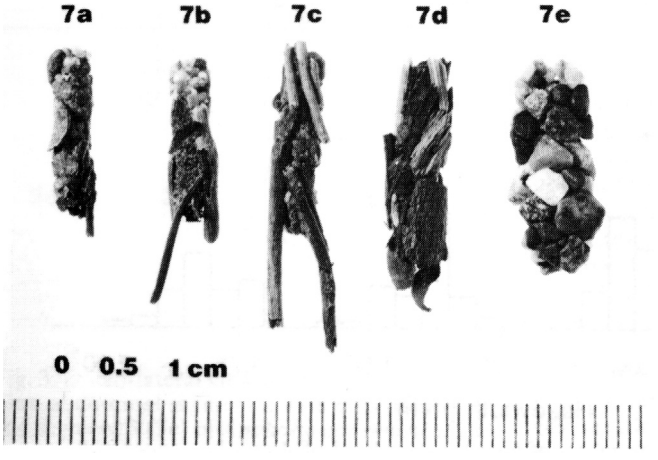

Fig. 7. Larval cases (7a—d) and pupal case (7e) of *Anabolia concentrica*.

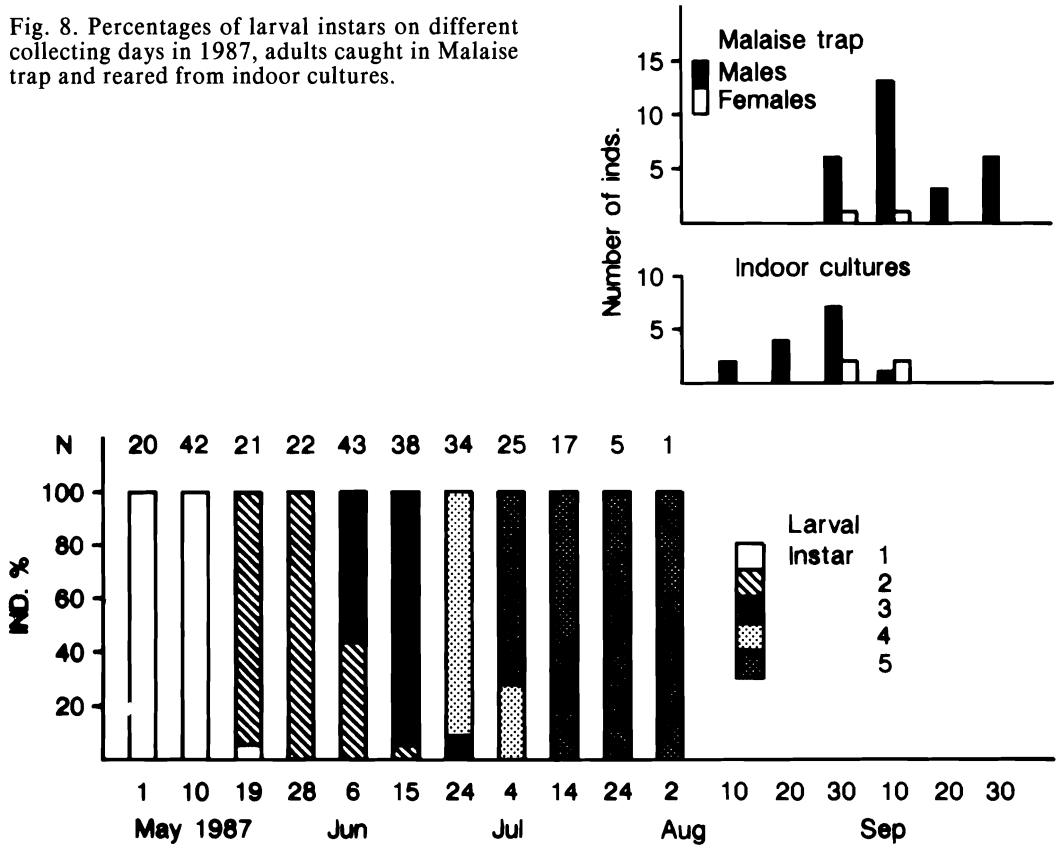

Fig. 8. Percentages of larval instars on different collecting days in 1987, adults caught in Malaise trap and reared from indoor cultures.

opportunistic in feeding behaviour. In five fifth instar larvae we recognized the following items in the gut content: vascular plants: especially fragments of *Carex* sp.; mosses: *Sphagnum balticum* (Russ.) C. Jens. and *Drepanocladus* sp.; algae (diatoms): *Tabelaria* sp., *Achnantes* sp.; algae (green filamentous): *Microspora* sp.; fungi: hyphae of basidiomycetes and of more primitive lines; a few fragments of sclerotized parts of insects (e.g. parts of legs etc. of Trichoptera), and some unrecognizable items that may be detritus. The gut content of one larva contained about 50% *Sphagnum balticum* (Russ.) C. Jens. and 50% *Carex* sp., and a few fragments of *Drepanocladus* sp. This examination revealed that the larva had been feeding at one time on *S. balticum* only, and at another time on *Carex* sp. only.

When feeding on *S. balticum* the larva had eaten both the leaves and stem. The leaves had either been cut in several parts or had been swallowed whole. The stem of *S. balticum* was cut in thin slices. The pieces of *Carex* examined, were stem or leaves, and small pieces of these had been eaten; the stem or leaf had not been cut through.

The size of the items found in the gut were 0.2—2.6 mm in length. However, the mean length was 0.7 mm with one SD = 0.3 mm. *A. concentrica* is a typical shredder, a herbivore and an opportunist/general feeder.

Suggested key to the fourth and fifth larval instars of *Anabolia* spp.

1. Setae present on inner trochanter of all three pairs of legs. Dark spots on head and thorax do not coalesce into irregular blotches (Fig. 1a—c). Spines in sa2 position on metanotum appearing from one large and several small clerites (Fig. 1d). Presegmental dorsolateral gills consisting of two of three filaments present on the second abdominal segment (Fig. 3) ..... *A. concentrica*

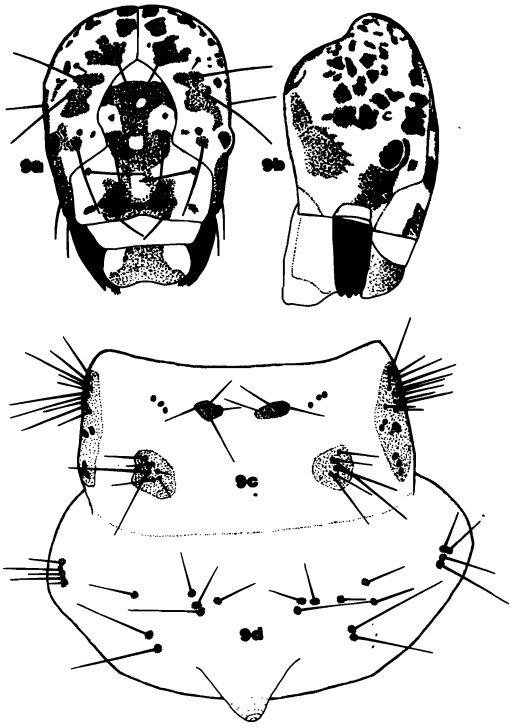

Fig. 9. Frontal (9a) and lateral view (9b) of head, metanotum (9c) and dorsum 1 (9d) of abdomen of *Anabolia nervosa.*

— Setae absent on inner trochanter. (From the Figures 422 and 423 in Lepneva (1966) *A. laevis (=soror=sororcula)* will also key out here) 2

2. Presegmental dorsolateral gills on second abdominal segment absent. Dark spots on head and thorax coalesce into irregular blotches, especially on the frontoclypeal apotome (Fig. 9a, b). Setae in sa2 position on metanotum make one distinct group and appear from one sclerite (Fig. 9c). ..... *A. nervosa*

— Presegmental dorsolateral gills on second abdominal segment present (Fig. 3). Head and thorax markings very distinct and the dark spots coalescing, especially on the frontoclypeal apotome, into irregular blotches (as shown in Fig. 9a, b). Setae in sa2 position on metanotum make one distinct group and appear from one sclerite. (Fig. 10) .... *A. furcata*

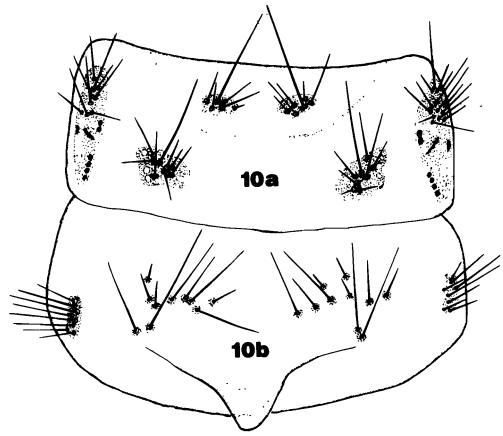

Fig. 10. Metanotum (10a) and dorsum 1 (10b) of abdomen of *Anabolia furcata.*

DISCUSSION

Comments on morphology

The dark brown spots on dorsum of the head do not coalesce into large and diffuse blotches which seem to be normal for *furcata,* and *nervosa,* and probably also for *laevis* (See figs 1a,, b and 9 a, b for this conspicuous difference). The larva of *A. sororcula,* which is a synonym of *A. laevis,* is described and figured in Silfvenius (1902), Ulmer (1909), Espen-Petersen (1916) and Lepneva (1966). Their drawings of the frontoclypeus or frontoclypeal apotome of *A. sororcula/A. laevis/A. soror* show clearly that *A. laevis* has a head pattern similar to *A. nervosa* and *A. furcata* and therefore any confusion with *A. concentrica* larvae should easily be avoided. The greatest risk for confusion and misidentification of *A. laevis* larvae will be with those of *A. nervosa* and *A. furcata.*

In North America (Wiggins 1977) the coalescence of spots in *Anabolia* appears to be diagnostic for the genus, but now knowing the larvae of *A. concentrica,* this does not appear to be the case for European species of *Anabolia.*

The stout spines on the anterolateral corner of the pronotum are probably a diagnostic character for larvae of *Anabolia.*

Larval and pupal cases

The change from a case built of plant material to one of sand grains occurs just prior to

pupation, and is a sudden event. We collected larvae every 10th day and of 45 5th instar larvae, only 5 cases had a few sand grains and 4 had completed the circle of the anterior opening using sand grains as material. None of the cases with larvae had more than 1/5 of the total case made of sand grains.

Pupae were collected from the stream bed, and they were just lying on the stream bed without anchorage to the substrate. The use of plant material in larval cases may serve two purposes; one as a good camouflage of the larvae when climbing on the steep margins of the stream and secondly the case is much lighter in weight than a case made of sand grains, and thus the larvae will use less energy when moving around in search for food. The pupal case of sand grains may also serve several purposes; one is camouflage, a second is mechanical protection against predators and a third is that the pupa gains advantage from a heavy case as it lies without anchorage to the substrate on the stream bed. A heavy case of sand grains is much less likely to be swept away with the current than a case of plant material. However, the larva must use energy in changing the case from plant to sand, but this must be less important than the advantage gained by the change in material.

Larval habitat

During spring, summer and autumn 1987 the Vargbäcken had a permanent flow of water, but in other years irregular periods of drought, or periods with no water flow have been observed. We do not know the length of these periods, but such events are interesting when considering the life cycle of *A. concentrica.* The drought periods occur during the larval growth period and must exert great pressure on the larvae. *S. balticum* which is present has strong demands on the environment, and from those we can learn much about the conditions prevailing in the habitat during drought periods.

S. balticum indicates that the ground water table is present and very near the ground surface bordering the stream all the time. *S. balticum* is a species that requires wet conditions to grow (Flatberg 1988, Moen 1985). Even though there is no flow of water in the stream, the steep margins will be moist enough for the larvae of *concentrica* to survive. The stream channel is relatively deep and the margins steep and this will also help in creating a damp habitat even when there is no water flow. For short time periods the larvae can obviously live in a moist, terrestrial habitat. The larvae may probably also bore holes in the wet ground to survive. However, a period of drought imposes conditions so demanding for aquatic animals that only a small minority of species have become adapted (Wiggins et al. 1980). This is reflected also by the caddis fly fauna in Vargbäcken, where we have found only three more species, *Limnephilus coenosus, Micropterna sequax* and *Ironoquia dubia.* North American species in these genera are found to inhabit temporary pools (Wiggins et al. 1980), and *L. coenosus* has been collected from habitats very similar to Vargbäcken at Dovrefjell, Norway (J.O.S. unpubl. data). It is a striking feature that no *Potamophylax* or *Halesus* spp. inhabit Vargbäcken. Both these genera are very abundant 5 km downstream, but obviously species in these two genera, which are very common in Scandinavia, cannot cope with the conditions present in Vargbäcken. The presence of *A. concentrica* (and a few other caddis species) in Vargbäcken and not in habitats with many species, may indicate low competitive ability.

A. concentrica has several of the features Williams (1987) listed for r — selected species, e.g. typically found in unstable habitats, poor competitive ability, short life span and opportunist/general feeding.

Phylogenetic and evolutionary comments

Aquatic insects were derived from terrestrial ancestors (Ross 1965, Wiggins et al. 1980). The most primitive of Trichoptera occur in cool running waters (Ross 1965). This view has been questioned by Weaver & Morse (1986), who suggest that the most primitive of Trichoptera inhabited humus and detrital mats near the shores of lentic or lotic depositional habitats. From these original habitats caddis flies have invaded lotic and lentic waters. The majority of caddis fly species live in permanent water, and the small number of species that exploit temporary pools and streams appear to have evolved from lineages in permanent waters (Wiggins et al. 1980); we agree with this view. The life cycle of *A. concentrica,* which is adapted to partly temporary streams, is therefore derived.

Phenology

At Vargbäcken *A. concentrica* either spend winter as egg or as the first larval instar. Our study did not reveal whether *A. concentrica* have a true diapause during winter, or if growth is only retarded because of low temperature. The stream was totally frozen in the winter 1986/87. If there is not a true diapause, development is, however, strongly retarded during winter. It may be that the eggs develop normally in autumn and that the first instar larvae spend the winter in the gelatinous matrix and hatch in spring as do several other caddis species (Wiggins 1973, Solem 1983). Otherwise, the eggs laid in autumn develop only a little before subzero temperatures from November to April stop development. These are the conditions that prevail for populations of *Chaetopteryx villosa* in the Dovrefjell mountains (Andersen 1984).

A summer diapause in the 5th larval instar is known for *Anabolia furcata,* which has a univoltine life cycle in Czechoslovakia (Novak 1960).

Hanna (1957) studied the growth of *A. nervosa* which is also univoltine, but did not find a summer diapause; adults occurred in October and small (first instar?) larvae were found in November, and there was virtually no growth in the population studied from November to March. In December, January and February Hanna did not find any larvae, and considered that the larvae had migrated to deeper water. Could it be that the larvae were in a diapause? No diapause is known in Nearctic species of *Anabolia* (Wiggins 1977).

The study of the growth of *A. nervosa* by Hanna (1957) was done near Manchester, England. In Fennoscandia *A. concentrica, A. laevis* and *A. nervosa* have closely similar flight periods, August-September (Nybom 1960, this study, unpubl. data J.O.S.). The life cycle of *A. laevis* is to our knowledge not known. Judging from the data of Hanna (1957) and the present study, the life cycles of *A. nervosa* and *A. concentrica* seem fairly similar and differ from that of *A. furcata.* This difference in life cycles may be an important factor concerning the distribution range of *Anabolia* species. The summer diapause in *A. furcata* may be the key factor for a more southern distribution of *A. furcata* than for *A. concentrica, A. nervosa* and perhaps also *A. laevis.* At northern latitudes where there is a long winter and also normally a halt in growth, either because of a diapause or retarded growth caused by low temperature, the larvae need the whole short summer for growth and metamorphosis so that the adults can complete the reproduction cycle in autumn.

Food

There is not much information on the food of *Anabolia* spp. in the literature, but Silfenius (1907) and Nielsen (1942) mentioned filamentous algae and diatoms eaten by *A. laevis* and *A. nervosa,* respectively. The food of *A. concentrica* thus seems to be different from that of *A. nervosa* and *A. laevis.* We have no information on the food requirements of *A. furcata.* However, gut contents of the North American *A. bimaculata* were largely pieces of vascular plant tissue (Wiggins 1977).

It is postulated that there is a size difference in the food items of shredders and collectors (Cummins 1978). In general, the items swallowed by shredders are larger than 1 mm, and those swallowed by collectors are less than 1 mm. *A. concentrica* is an exception to this generalization.

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REFERENCES

Andersen, J. S. 1984. *Biologi og livssyklus til Chaetopteryx villosa (Fabricius) (Trichoptera, Limnephilidae) i og ved Blesbekken og Raubekken, Kongsvoll, Oppdal.* Unpubl. cand. real. thesis at the University of Trondheim.

Andersen, T. & Wiberg-Larsen, P. 1987. Revised check-list of NW European Trichoptera. *Ent. Scand 18:* 165—184.

Botosaneanu, L. & Malicky, H. 1978. Trichoptera in J. Illies (Ed.) *Linmofauna Europeae.* G. Fischer Verlag.

Cummins, K. 1978. Ecology and distribution of aquatic insects. Pp. 29—31 in Merritt, R. W. & Cummins, K. W. (eds.) *An introduction to the aquatic insects of North America.* Kendall & Hunt Publ.

Espen-Petersen, P. 1916. Vaarfluer. *Danmarks fauna.* G.E.C. Gads forlag.

Flatberg, K. 1988. Taxonomy of *Sphagnum annulatum* and related species. *Ann. bot. Fennici 25:* 303—350.

Hanna, H. M. 1957. A study of the growth and feeding habits of the larvae of four species of caddis flies. *Proc. R. Ent. Soc. Lond. (A) 32:* 139—146.

Hiley, P. D. 1976. The identification of British limnephilid larvae (Trichoptera). *Syst. Ent. 1:* 147—167.

Lepneva, S. G. 1966. Larvae and pupae of Integripalpia, Trichoptera. *Fauna of the U.S.S.R. new Ser. 9:* 1—560. (English translation, Jerusalem 1971)

Malicky, H. 1983. Atlas of European Trichoptera. *Series Entomologica 24.* W. Junk Publ.

Milne, M. J. 1938. The metamorphotype method in Trichoptera. *N. Y. ent. Soc. Jour. 46:* 435—437.

Moen, A. 1985. Classification of mires for conservation purposes in Norway. *Aquilo Ser. Bot. 21:* 95—100.

Nielsen, A. 1942. Über die Entwicklung und Biologie der Trichopteren. *Arch. Hydrobiol., Suppl. XVII.*

Novak, K. 1960. Entwicklung und Diapause der Köcherfliegenlarven *Anabolia furcata* Br. (Trichopt.). *Cas. Cs. Spol. Ent. 57:* 507—212.

Nybom, O. 1960. List of Finnish Trichoptera. *Fauna Fenn. 6:* 1—56.

Ross, H. H. 1956. *Evolution and classification of the mountain caddisflies.* The Univ. of Illinois Press, Urbana. 211 pp.

Silfvenius, A. J. 1902. Über die Metamorphose einiger Phryganeiden und Limnophiliden. *Acta Soc. Fauna Flora Fenn. 21:* 1—102 (+ 2 Taf.)

Siltala, A. J. 1907. Über die Nahrung der Trichopteren. *Acta Soc. Fauna Flora Fenn. 29:* 1—34.

Solem, J. O. 1983. Larval and pupal descriptions of *Asynarchus contumax* McLachlan, 1880 and *A. lapponicus* Zetterstedt, 1840, with notes on bionomics in Centr. Norway (Trichoptera: Limnephilidae). *Ent. Scand. 14:* 439—451.

Svensson, B. & Tjeder, T. 1975. Check-list of the Trichoptera of North-Western Europe. *Ent. Scand. 6:* 261—274.

Ulmer, G. 1909. Trichoptera. *Die Süsswasserfauna Deutschlands.*

Waringer, J. A. 1986. A character separating the larvae of *Anabolia furcata* Brauer, 1857 and *Anabolia nervosa* Curtis, 1834 (Trichoptera: Limnephilidae). *Zool. Anz. 216:* 123—127.

Weaver, J. S. III and Morse, J. C. 1986. Evolution of feeding and case-making behaviour in Trichoptera. *Am. Benthol. Soc. 5:* 150—158.

Wiggins, G. B. 1973. A contribution to the biology of caddisflies (Trichoptera) in temporary pools. *Life Sci. Contr., R. Ont. Mus. 88:* 1—28.

Wiggins, G. B. 1977. *Larvae of the North American Caddisfly Genera (Trichoptera).* Univ. of Toronto Press.

Wiggins, G. B., Mackay, R. J. & Smith, I. M. 1980. Evolutionary and ecological strategies of animals in annual temporary pools. *Arch. Hydrobiol. Suppl. 58:* 97—206.

Williams, D. D. 1987. *The ecology of temporary waters.* Croom & Helm, London/Timber Press, Portland, Oregon. 205 pp.

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Short communications

GLOSSOSOMA CONFORMIS NEBOISS 1963, (TRICHOPTERA, GLOSSOSOMATIDAE) NEW TO NORWAY AND SCANDINAVIA

JOHN O. SOLEM

Glossosoma conformis Neboiss, 1963, is reported from HEN, Storelvdal: Atna river at Solbakken. This is also the first report of the species from Scandinavia. *G. conformis* is on the wings in late June and early July.

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Malaise trap samples at HEN, Storelvdal: Atna river at Solbakken (61°45'N, 10°45'E and 380 m elevation) in 1986 and 1987 gave 21 females and 30 males of *Glossosoma conformis.* According to Andersen and Wiberg-Larsen (1987) these are also the first records of *G. conformis* in Scandinavia. The collecting site is in the northern boreal coniferous zone. Water temperatures in the Atna river at Solbakken may reach about 20°C during summertime.

Table 1. Number of *Glossosoma conformis* caught in weekly Malaise trap samples in 1986 and 1987.

	18 June	25 June	2 July	8 July
1986	3	28	13	1
1987			2	4

At Solbakken *G. conformis* are on the wings early in the warm season (Tab. 1). On 18 June 1986 only 3 caddis fly species, *Apatania wallengreni, Glossosoma intermedia* and *G. conformis* were caught in the Malaise trap here. Other early warm season species, *Ecclisopteryx dalecarlica* and *Philopotamus montanus* appeared one or two weeks later. A total of 25 spp. of Trichoptera was collected in the Malaise trap at the site Solbakken during the summers 1986 and 1987.

G. conformis is earlier known from Great Britain and a wide area on the European continent (Botosaneany & Malicky 1978).

G. intermedia is new to the southern part of Norway.

REFERENCES

Andersen, T. & Wiberg-Larsen, P. 1987. Revised check-list of NW European Trichoptera. *Ent. scand. 18:* 165—184.

Botosaneanu, L. & Malicky, H. 1978. Trichoptera pp. 333—359 in Illies, J. (Ed.) *Limnofauna Europeae.* G. Fischer Verlag, Swets & Zeitlinger B. V.

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Carabidae and Staphylinidae (Col.) frequently found in Norwegian agricultural fields. New data and review

ARILD ANDERSEN

Andersen, A. 1991. Carabidae and Staphylinidae (Col.) frequently found in Norwegian agricultural fields. New data and review. *Fauna norv. Ser. B 38:* 65—76.

The carabid and staphylinid species most frequently caught during pitfall surveys in Norwegian agricultural fields 1975—1989 are reviewed. A total of 52.000 carabids belonging to 113 species and 108.000 staphylinids belonging to 226 species are included. Norway is divided into three separately treated geographical districts: east, west and middle Norway (northern Norway is not included). Carabids were surveyed in 47 localities and staphylinids in 39. The most frequently caught carabid and staphylinid genera are discussed separately. Overall, the most frequent carabid species were *Clivina fossor* (L.), *Bembidion lampros* (Herbst), *Loricera pilicornis* (Fabricius), *Patrobus atrorufus* (Ström), *Pterostichus melanarius* (Illiger), *Calathus melanocephalus* (L.) and *B. quadrimaculatum* (L.). The most frequent staphylinid species were *Aloconota gregaria* (Erichson), *Anotylus rugosus* (Fabricius), *Atheta fungi* (Gravenhorst), *Amischa analis* (Gravenhorst), *Tachinus signatus* (Gravenhorst) and *Philonthus cognatus* Stephens. The frequency of the species varied greatly between geographical districts.

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INTRODUCTION

Many carabid and staphylinid species are important predators of insects in agricultural fields (e.g. Good & Giller 1988, Luff 1989). For this reason the carabid and staphylinid fauna in many Norwegian fields have been surveyed for one or more of the last 15 years (since 1975). Some of the investigations have been published in entomological journals (Andersen 1982, 1985a), or written as theses at universities (Semb 1982, Østrem 1982, Abrahamsen 1983, Kjæraas & Svagård 1983, Waage 1984), but many surveys, mainly those carried out after 1985, are still unpublished. The aim of this presentation is to summarize our present knowledge, both published and unpublished, concerning the composition of the carabid and staphylinid fauna of agricultural fields in different parts of Norway.

In northern Norway, the carabid and staphylinid fauna have been sampled in only two localities in Troms county, one of which was published by Andersen (1985a). Because of the small number of localities from a restricted part of the district, the agricultural fauna of northern Norway is not included in the prestent paper.

During the investigations, a number of species have been found in new districts. These data will be published separately.

LOCALITIES

Fig. 1 gives the position of the 47 localities where the carabid fauna and 39 localities where the staphylinid fauna have been investigated. Norway is divided into three geographical districts: East (E), West (W) and Middle (M) Norway. E includes the counties of Østfold, Akershus, Hedmark, Oppland, Buskerud, Vestfold, Telemark, Aust-Agder and Vest-Agder, W includes Rogaland, Hordaland and Sogn og Fjordane, and M includes Møre og Romsdal, Sør-Trøndelag and Nord-Trøndelag. A locality is defined as one or more fields situated at the same farm and investigated for at least one year.

Spring barley (31% of the fields) and different Brassica crops (29%) are the most common crops in the surveys, followed by carrots (14%), potatoes (9%), other vegetables (9%), strawberries (7%) and grass (1%). The eight localities in W where staphylinids were not identified, include all of the strawberry localities.

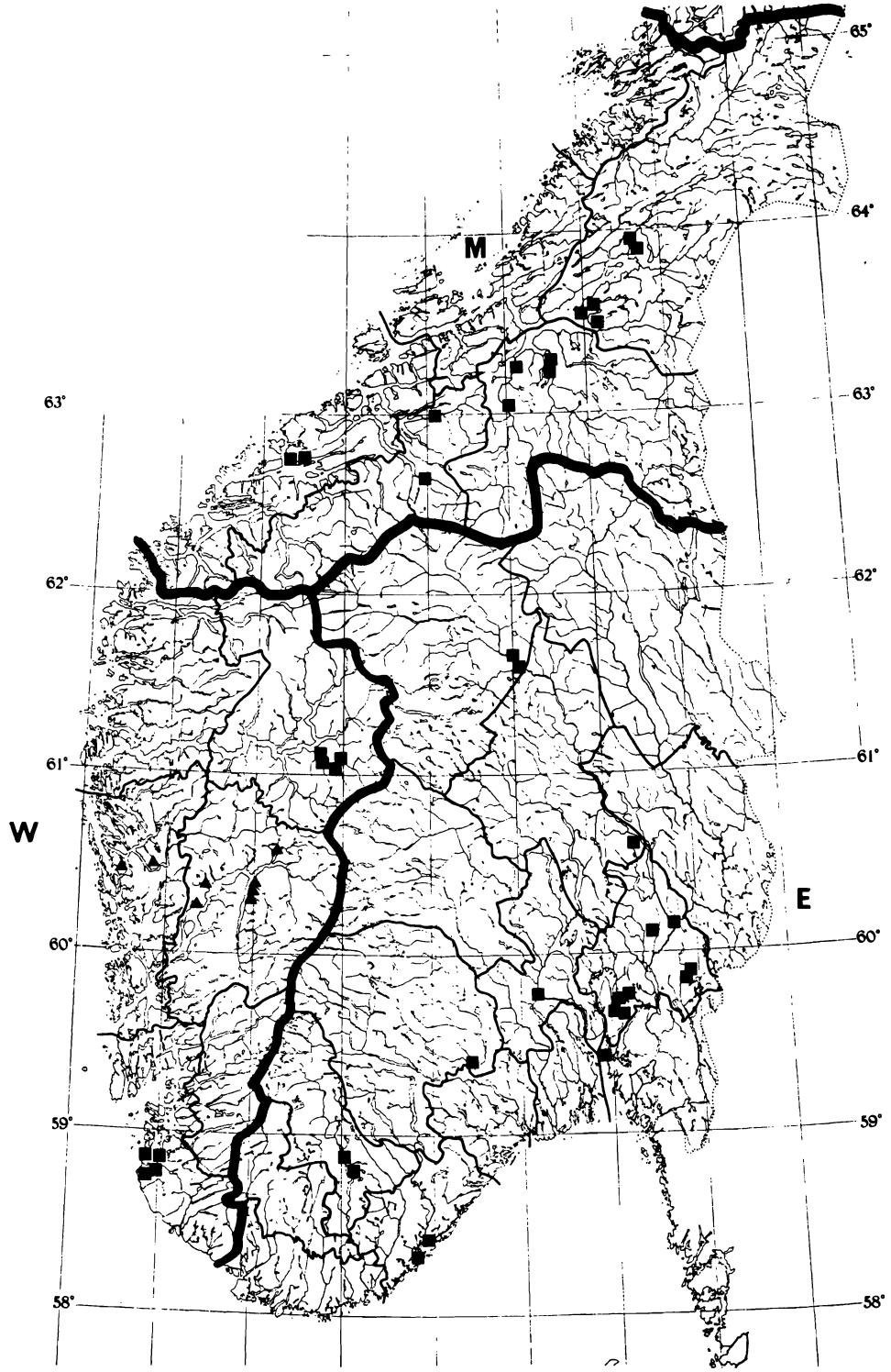

Fig. 1. Localities where pitfall surveys were done in agricultural fields. ■ = Carabids and staphylinids identified. ▲ = Only carbids identified. E = eastern, W = western, M = middle Norway.

Table 1. The 30 most frequent carabid species occurring in Norwegian agricultural fields: number of localities and sum of scores (scored in each locality according to their ranking where 10 = first, 9 = second, . . ., 1 = tenth). E = eastern, W = western, M = middle Norway, as in Fig. 1.

	Scores				Occurrences			
Species	E	W	M	Total	E	W	M	Total
Clivina fossor (L.)	18	15	13	46	118	65	107	290
Bembidion lampros (Herbst)	16	14	4	34	114	80	17	211
Loricera pilicornis (Fabricius)	18	15	11	44	54	67	82	203
Patrobus atrorufus (Ström)	12	14	9	35	32	98	60	190
Pterostichus melanarius (Illiger)	16	9	3	28	94	56	24	174
Calathus melanocephalus (L.)	17	11	9	37	69	51	43	163
Bembidion quadrimaculatum (L.)	18	0	6	24	125	0	37	162
Trechus secalis (Paykull)	17	13	8	38	64	55	20	139
Bembidion bruxellense Wesmaël	8	8	12	28	5	39	77	121
Pterostichus niger (Schaller)	13	13	10	36	30	38	38	106
Harpalus rufipes (Degeer)	16	12	3	31	54	27	3	84
Trechus quadristriatus (Schrank)	10	4	0	14	59	20	0	79
Bembidion lunatum (Duftschmid)	0	0	10	10	0	0	60	60
Agonum muelleri (Herbst)	16	8	2	26	35	17	7	59
Nebria brevicollis (Fabricius)	3	8	0	11	0	59	0	59
Elaphrus riparius (L.)	3	4	4	11	3	23	19	45
Nebria rufescens (Ström)	1	6	5	12	0	27	15	42
Amara bifrons (Gyllenhal)	12	8	4	24	21	1	18	40
Calathus erratus (Sahlberg)	7	4	1	12	12	17	9	38
Synuchus vivalis (Illiger)	10	9	3	22	2	22	7	31
Bembidion guttula (Fabricius)	12	0	0	12	30	0	0	30
B. tetracolum Say	2	7	4	13	0	23	6	29
Harpalus affinis (Schrank)	15	5	1	21	25	3	0	28
Calathus fuscipes (Goeze)	6	6	3	15	0	17	11	28
Trechus micros (Herbst)	8	0	3	11	15	0	13	28
Amara apricaria (Paykull)	10	8	3	21	13	6	3	22
Pterostichus oblongo-punctatus (Fabricius)	6	4	6	16	1	10	10	21
Amara fulva Müller	8	3	0	11	12	7	0	19
Bembidion femoratum Sturm	0	4	1	5	0	13	2	15

The most common soil type is sand (18 localities), followed by clay (13), peat (6), silt (5) and moraine (5). The eight localities in W where staphylinids were not identified are 6 on sand, 1 on clay and 1 on peat soil.

MATERIAL AND METHODS

Pitfall traps of varying size were used in all fields. They were filled with water and a little detergent, or filled with a 4% aqueous solution of formaldehyde. Trapping periods varied between fields, but normally the traps were put up shortly before sowing or planting in May-June and emptied regularly until shortly before harvest in August-September. Of the total number of trap days, 8.9% were in May, 26.3% in June, 28.3% in July, 22.9% in August, 12.5% in September and 1.1% in October.

Pitfall traps measure activity density. It is dependent not only on the population density of the species, but also its activity on the ground (Thiele 1977). As pitfall traps is the only method used in the surveys, all results in the present paper is concerned with the activity density of species.

The material consists of 52.000 carabids belonging to at least 113 spp., of which 16.000 are unpublished material and 13.000 are reported only in university theses. The staphylinids consist of 108.000 specimens belonging to at least 226 spp., of which 42.000 are unpublished material and 14.000 are reported only in university theses. The nomenclature follows Silfverberg (1979) with later corrections by Bistrøm & Silfverberg (1983, 1985, 1988).

RESULTS AND DISCUSSION

Family Carabidae

Table 1 shows two types of ranking for the 30 most frequent carabid species from the 47 localities. Table 2 shows the number of species caught of each carabid genus with five Norwegian species, or more, that were present in the surveys. Most of the species in Table 1 and genera in Table 2 are treated separately in the following. Unless otherwise indicated, ecology of the species is according to Lindroth (1985—86), and their frequency in other European fields is according to Thiele (1977) and Luff (1989). It should be noted that 5 of the localities in this investigation are included in Luff's (1989) report, where they make up slightly less than 10% of the material. For geographical districts the abbreviations from Fig. 1 are used.

Agonum. A genus with many hygrophilous species, and relatively few of the Norwegian species (32%) were caught in agricultural fields (Table 2). *Agonum* species rarely appeared in fields in M. *A. muelleri* (Herbst) was the most frequent species, appearing in most fields in E, less frequently in W, and rarely in M (Table 1). *A. dorsale* (Pontoppidan), a rather new element in the Norwegian fauna (Andersen 1985b), was caught quite often in E south of Oslo, but otherwise not found. Both species are frequent in other European fields. Five more species were caught in Norwegian agricultural fields, but normally in low numbers.

Amara. A genus with many xerophilous species preferring open areas, and 59% of the Norwegian species were caught in the fields (Table 2). However, none of the species were among the ten most frequent species in Norwegian fields (Table 1). The same situation has been observed in fields in other European countries. *A. bifrons* (Gyllenhal) and *A. apricaria* (Paykull) were the most frequent species, present in many fields in E and W, but rarely caught in M (Table 1). According to Thiele (1977), *A. bifrons* is infrequent in European fields except in eastern Europe, but it has often been caught in fields in Denmark (Lyngbye & Nielsen) and southern Finland (Varis et al. 1984). *A. fulva* Müller was found only in E and southern W (Table 1), mainly on sandy soils (Table 1). *A. ingenua* (Duftschmid) was caught in some fields, which had soil with a high content of peat. *A. plebeja* (Gyllenhal) appeared more often on sandy than on clayish soils. *A. familiaris* (Duftschmid), the most frequent *Amara* species in European fields, was caught in only 12 localities, and never in high numbers. Many *Amara* species were caught in low numbers in a few fields.

Bembidion. The genus contains many hygrophilous species, and only 26% of the Norwegian species were caught in the present study (Table 2). However, several of the 13 species caught were frequent in Norwegian fields (Table 1). *Bembidion* species seem to

Table 2. The number of carabid species in each genus caught in pitfall surveys in agricultural fields. Only genera with five Norwegian species or more are included.

Genus	Number of species caught in the surveys	Percent of registered Norwegian species
Calathus Bonelli	5	83
Notiophilus Dumeril	5	83
Pterostichus Bonelli	11	78
Trechus Clairville	5	63
Nebria Latreille	3	60
Amara Bonelli	22	59
Harpalus Latreille	8	53
Carabus L.	7	44
Dromius Bonelli	3	38
Agonum Bonelli	7	32
Dyschirius Bonelli	3	27
Bembidion Latreille	12	26

be more dominating in pitfall trap catches in Norwegian agricultural fields (7 species among the 30 most frequent, Table 1) than in other European countries (3 species among the 30 most frequent, Thiele 1977). *B. lampros* (Herbst) was very frequent on moraine and sandy soils in E and W, but less so in M. Lindroth (1985—86) also reports it mainly from sandy soils. *B. quadrimaculatum* (L.), a species often caught in agricultural fields in Sweden (Ekbom & Wiktelius 1985) and southern Finland (Varis et al. 1984), was frequent in E (in fact more so than *B. lampros)* and M, but absent in W (see also Lindroth 1985—86). *B. bruxellense* Wesmaël was very frequent in M, but less so in W, and rarely caught in E. It was caught on all kinds of soils, as reported also by Lindroth (1985—86). It has been caught in Finnish fields (Varis et al. 1984). *B. lunatum* (Duftschmid) was frequent in M, especially on sandy soils, but not caught in the other districts. Lindroth (1985—86) claims it to be found mainly on clayish and silty soils. *B. guttula* (Fabricius) was present in many fields in E, but not caught in the other districts (see also Lindroth 1985—86). It has been reported from some Swedish (Ekbom & Wiktelius 1985) and Finnish fields (Varis et al. 1984).

Calathus. A genus with xerophilous species preferring open areas, and a high proportion (83%) of the Norwegian species were caught (Table 2). *C. melanocephalus* (L.) was the most frequent species, often caught in fields, especially on moraine and silty soils, in all three geographical districts (Table 1). Lindroth (1985—86) reported it as eurotyp, but preferring sandy soils. It has often been caught in fields in Denmark and southern Finland (Scheller 1984, Varis et al. 1984), but it is less frequent in the rest of Europe. *C. erratus* (Sahlberg) and *C. fuscipes* (Goeze) were present in some fields in E, W and M (Table 1).

Carabus. A moderate percentage (44%, Table 2) of the Norwegian species was trapped, and none of them were among the 30 most frequent ones. This is in line with that reported from other European fields by Luff (1989), but Thiele (1977) reported three *Carabus* species among the 30 most frequent. *C. nemoralis* Müller was the most frequent species in the genus, caught in low numbers in less, than half of the fields in E, W and M north to Trondheim.

Clivina fossor (L.) was the most frequent carabid species, present in almost every field investigated (Table 1). Lindroth (1985—86) also reported the species as very eurotypic. It is more often caught in Norway and southern finland (Varis et al. 1984) than in the rest of Europe.

Dyschirius. A genus with species mainly found near water. Only three species were caught (Table 2), and none of them were among the 30 most frequent species. *D. globosus* (Herbst) was the only species found in several (11) fields in all three geographical districts. It was rarely caught in Swedish (e.g. Nedstam & Jonasson 1975) and Finnish fields (Varis et al. 1984), but Thiele (1977) reported it as more frequent in fields in other European countries.

Elaphrus. A genus with hygrophilous species. Only two species were caught, and *E. riparius* (L.) was the only frequent one. It appeared in some fields in all three geographical districts (least so in E, Table 1), mainly in fields near rivers. It is rare in fields in other European countries.

Harpalus. A genus with many xerophilous species appearing in open areas. Fifty-three percent (53%) of the Norwegian species were caught (Table 2). The rather moderate percentage may be explained by the fact that many *Harpalus* species are rare in Norway. *H. rufipes* (Degeer) was the most frequently caught species in the genus, present in many fields in E and W, but rarely caught in M (Table 1). *H. affinis* (Schrank) was often caught in E, less so in W and rare in M (Table 1). Both species are frequent in the rest of Europe. *H. latus* (L.) was caught in 17 Norwegian fields, but always in low numbers. It is rare in fields in other European countries.

Loricera pilicornis (Fabricius) was caught in most fields in all three geographical districts (Table 1). It is less frequent in other European fields.

Nebria. Three species (60% of the Norwegian species) were caught (Table 2). *N. brevicollis* (Fabricius) was the most frequent one. It was often caught in southern W, bur rare in E and absent in northern W and M (Table 1). It is rare in European fields, but Roesgaard & Lindhardt (1979) and Lyngbye & Nielsen (1980) found it dominant in Danish fields, and Hossfeld (1963) reported it from Germany. *N. rufescens* (Stroöm) seems to replace *N. brevicollis* in northern W and in M (Table 1).

Notiophilus. A genus with many species that prefer open areas of varying humidity. A high percentage (83%) of the Norwegian species was caught (Table 2), but none of the species were among the 30 most frequent ones. This is in line with the situation in the rest of Europe. *N. biguttatus* (Fabricius) was the most frequent species in Norwegian fields. It was caught in nine fields in all three geographical districts, but normally in low numbers.

Patrobus. A genus with hygrophilous species, of which two species were caught. *P. atrorufus* (Ström) was present in most fields in W, especially on soils rich in humus, but less frequent in M and E (Table 1). Also Lindroth (1985—86) claimed it to occur mainly on mullrich soils. It is frequent also in Swedish (Ekbom & Wiktelius 1985) and Finnish fields (Varis et al. 1984), but rare in the rest of Europe.

Pterostichus. The high percentage of the Norwegian species caught (78%, Table 2) may indicate that the genus as a whole accepts more open and dry habitats than previously reported. Two species were among the 30 most frequent ones (Table 1), but the genus is even more dominating in other European fields (6 species among the 30 most frequent, Thiele 1977). *P. melanarius* (Illiger) was present in most fields in E and southern W, especially on moraine and clayish soils, but rarely caught in northern W and M (Table 1). Lindroth (1985—86) also reported it to avoid soils containing too much sand. It is more frequent in the rest of Europe. *P. niger* (Schaller) was more frequent than *P.*

melanarius in M, otherwise less so (Table 1). *P. cupreus* (L.), which is often caught in fields in other European countries, was caught only in low numbers in 7 fields in E.

Synuchus vivalis (Illiger) was quite frequent in Norwegian fields (Table 1), as in the rest of Europe. It was caught in many fields in E and W, and some in M (Table 1).

Trechus. A genus with species said to prefer shady, moderately wet areas. A rather high proportion (63%) of the Norwegian species were caught (Table 2), and several of them in many fields (Table 1). *T. secalis* (Paykull) was the most frequent species in the genus, present in many fields in all three geographical districts, especially on clayish soils (see also Lindroth 1985—86). *T. quadristriatus* (Schrank) was frequent in fields, mainly on clayish soils, in E and southern W, but otherwise absent. Both species have often been caught in European fields, but *T. secalis* is obviously more frequent in northern countries (see also Varis et al. 1984, Ekbom & Wiktelius 1985). *T. micros* (Herbst) and *T. discus* (Fabricius) were quite frequently caught in E, but absent in W, and *T. micros* was also caught in some fields in M (Table 1). According to Lindroth (1985—86) they are always found near fresh water, but the present investigation shows them to accept more dry areas then previously reported. Both species have been caught in varying numbers in Swedish (Ekbom & Wiktelius 1985) and Finnish fields (Varis et al. 1984), otherwise they are rarely reported from European agricultural fields (but see Hossfeld 1963).

Family Staphylinidae

Table 3 shows the 30 most frequent staphylinid species from the 39 localities. Table 4 shows the number of species caught in each staphylinid genus with ten Norwegian species or more that were present in the surveys. Most of the species in Table 3 and genera in Table 4 are treated separately in the following. Unless otherwise indicated, ecology of the species are according to Palm (1948—72), and the frequency in other fields in Northern Europe is according to Good & Giller (1988).

Acrotona. Only 30% of the Norwegian species were caught in fields (Table 4), and none of them were among the 30 most frequent. *A. aterrima* (Gravenhorst) was caught in 17 fields in all three geographical districts (least caught in M), but always in low numbers. It has been reported from fields in other European countries (Topp & Trittelvitz 1980).

Aleochara. A rather moderate proportion (38%) of the Norwegian species was caught in fields, and two species were among the 30 most frequent ones (Table 3). *A. brevipennis* Gravenhorst was present in many fields in E and M, but rarely caught in W. *A. bipustulata* (L.) appeared in all three geographical districts, but it was frequent only in E. Both species have been reported from some fields in other European countries.

Aloconota gregaria (Erichson) seems to be one of the most frequent staphylinid species in Norwegian agricultural fields. It was very eurotypic, caught in almost every investigated field except in northern W (Table 3). It has been caught also in other European fields (e.g. Geiler 1959/60, Roesgaard & Lindhardt 1979).

Amischa. This genus was also very frequent, especially on moraine and clayish soils. Like *Aloconota gregaria* it was least numerous in norhtern W, but also less frequent in M (Table 3). Most of the material was identified as *A. analis* (Gravenhorst), but in material collected from agricultural fields in Ås, Akershus in 1990 and identified according to Muona (1990), both *A. analis* and *A. nigrofusca* (Stephens) were found (unpublished data). Thus, the whole material must be chequed if the two species are to be separated. *A. analis* has often been reported from fields in other European countries (e.g. Geiler 1959/60, Topp & Trittelvitz 1980).

Anotylus. The genus contains rather hygrophilous species. Only 27% of the Norwegian species were caught (Table 4). *A. rugosus* (Fabricius) was one of the most frequent staphylinid species in all three geographical districts (Table 3). It was also very frequent in fields in other European countries.

Arpedium quadrum (Gravenhorst) appeared in several fields in E and some fields in M, but was absent from W (Table 3). It had not been reported from fields in other European countries.

Table 3. The 30 most frequent staphylinid species occurring in Norwegian agricultural fields: number of localities and sum of scores (scored in each locality according to their ranking where 10 = first, 9 = second, . . ., 1 = tenth). E = eastern, W = western, M = middle Norway, as in Fig. 1.

	Occurrences				Scores			
Species	E	W	M	Total	E	W	M	Total
Aloconota gregaria (Erichson)	18	4	13	35	169	40	84	293
Anotylus rugosus (Fabricius)	17	8	13	38	98	45	96	239
Atheta fungi (Gravenhorst)	14	8	10	32	72	65	57	194
Amischa analis (Gravenhorst)/								
A. nigrofusca (Stephens)	18	8	9	35	99	33	23	155
Tachinus signatus (Gravenhorst)	16	8	10	34	65	11	72	148
Philonthus cognatus Stephens	14	8	9	31	61	20	54	135
Tachyporus chrysomelinus (L.)/								
T. dispar (Paykull)	16	8	10	34	41	29	17	87
Aleochara brevipennis Gravenhorst	14	1	7	22	49	0	33	82
Oxypoda exoleta Erichson	10	8	4	22	30	39	0	69
Atheta elongatula (Gravenhorst)	6	8	10	24	1	33	34	68
Philonthus laminatus (Creutzer)	9	6	8	23	12	13	40	65
Tachyporus obtusus (L.)	15	8	8	31	32	13	14	59
Philonthus carbonarius								
(Gravenhorst)	14	8	8	30	13	12	22	47
Stenus biguttatus (L.)	12	0	2	14	29	0	9	38
Gyrohypnus scoticus (Joy)	14	6	6	26	16	10	10	36
Arpedium quadrum (Gravenhorst)	10	0	3	13	21	0	8	29
Lathrobium fulvipenne Gravenhorst	13	7	4	24	21	0	7	28
Aleochara bipustulata (L.)	12	5	4	21	28	0	0	28
Mycetoporus longulus Mannerheim/								
M. ruficornis Kraatz	5	5	1	11	16	8	0	24
Dinaraea angustula (Gyllenhal)	8	5	3	16	8	1	14	23
Philonthus subvirescens Thomson	2	2	4	8	0	0	18	18
Lathrobium geminum Kraatz	9	3	6	18	15	0	2	17
Atheta palustris (Kiesenwetter)	6	5	2	13	5	10	2	17
Atheta orphana (Erichson)	1	4	1	6	0	13	3	16
Tachyporus hypnorum (Fabricius)	12	4	1	17	14	1	0	15
Mycetoporus lepidus (Gravenhorst)	7	2	2	11	14	0	0	14
Tachinus corticinus Gravenhorst	5	4	7	16	0	8	5	13
T. marginatus Gyllenhal	3	3	1	7	2	11	0	13
Philonthus pachycephalus Nordmann	4	6	2	12	0	10	0	10
P. decorus (Gravenhorst)	6	6	6	18	0	0	9	9

Table 4. The number of staphylinid species in each genus caught in pitfall surveys in agricultural fields. Only genera with ten Norwegian species or more are included.

Genus	Number of species caught in the surveys	Percent of registered Norwegian species
Philonthus Curtis	28	64
Lathrobium Gravenhorst	8	53
Tachyporus Gravenhorst	9	50
Tachinus Gravenhorst	7	50
Gabrius Stephens	4	40
Aleochara Gravenhorst	10	38
Mycetoporus Mannerheim	9	38
Omalium Gravenhorst	4	33
Acrotona Thomson	3	30
Oxypoda Mannerheim	10	29
Anotylus Thomson	3	27
Quedius Stephens	8	25
Atheta Thomson	29	21
Stenus Latreille	14	21
Carpelimus Kirby	2	13
Hapalarea Thomson	1	8
Gyrophaena Mannerheim	1	6
Bledius Samouelle	1	5

Atheta. Many species (29) were caught in agricultural fields, but this is only 21% of the Norwegian *Atheta* fauna (Table 4). Four species were among the 30 most frequent (Table 3). *A. fungi* (Gravenhorst) was present in many fields in all three geographical districts, possible least so on clayish soils. *A. fungi* is also frequent in fields in other European countries. *A. elongatula* (Gravenhorst) was caught in most fields in W and M, but rarely present and never numerous in E. It has rarely been reported from agricultural fields in other European countries (Geiler 1959/60).

Dinaraea angustula (Gyllenhal) appeared in less than half of the fields in all three geographical districts, normally in low numbers (Table 3). It was frequent in fields in other European countries (e.g. Geiler 1959/60, Roesgaard & Lindhardt 1979).

Gabrius. A genus with more or less hygrophi-

lous species. Four species were caught, which is a moderate proportion (40%) of the Norwegian species (Table 4). None of the species were frequent in fields, but *G. pennatus* Sharp and *G. velox* Sharp were caught in several fields in E, while *G. subnigritulus* (Reitter) was caught in most fields in W and in some fields in E and M. *G. subnigritulus* has been recorded from fields in other European countries (Geiler 1959/60).

Gyrohypnus scoticus (Joy) was a quite frequent species in all three geographical districts (Table 3). It has been reported from fields in some European countries (e.g. Geiler 1959/60).

Lathrobium. Eight species were caught in agricultural fields, which is a high proportion (53%) of the Norwegian *Lathrobium* fauna (Table 4). This may indicate that the genus accepts a wider range of habitats than previously reported. *L. fulvipenne* Gravenhorst and *L. geminum* Kraatz, the two most frequent species, were caught in many fields in all three geographical districts, but normally in low numbers (Table 3). Only *L. fulvipenne* has been reported as frequent in fields in other European countries.

Mycetoporus. A genus containing mostly hygrophilous species. Nine species were caught in fields, which is a moderate proportion (38%) of the Norwegian species (Table 4). *M. longulus* Mannerheim/*M. ruficornis* Kraatz (not separated) were the most frequent species, caught in low numbers in several fields in E and W, but rarely in M (Table 3). *M. lepidus* (Gravenhorst) was caught mainly in E, but rarely also in W and M (Table 3). *M. longulus* and *M. lepidus* have been reported from field in other European countries by Geiler (1959/60).

Omalium. Four species were caught, which make up a moderate amount (33%) of the Norwegian species (Table 4). All of them appeared infrequent and in low numbers. The genus is often caught in field in other European countries.

Oxypoda. Ten species were caught, but this is only 29% of the Norwegian species (Table 4). *O. exoleta* Erichson was the most frequent species, particularly in W (Table 3). The species has been reported from European fields (e.g. Pietraszko & Clercq 1983). *O. umbrata* (Gyllenhal) was also caught in many fields (16), but always in low numbers. This species has rarely been reported from fields in other European coountries (Geiler 1959/60).

Philonthus. A total of 28 species were caught, which makes up 64% of the Norwegian *Philonthus* species (Table 4). Six species were among the 30 most frequent (Table 3), and consequently *Philonthus* is a very dominating genus in Norwegian agricultural fields. It is also frequent in fields in other European countries. *P. cognatus* Stephens was the most frequent species, caught in most fields in all three geographical districts (Table 3), but least so on moraine and sandy soils. *P. laminatus* (Creutzer) was also caught in many fields, especially on soils rich in humus, but least so in E (Table 3). *P. carbonarius* (Gravenhorst) was caught in most fields in all three geographical districts, but often in low numbers (Table 3). The three above mentioned species are the most frequent ones also in the rest of Europe. In addition, several species were caught in lower numbers in a rather high number of Norwegian fields: *P. decorus* (Gravenhorst) (18 fields), *P. ochropus* (Gravenhorst) (18), *P. atratus* (Gravenhorst) (12, mainly E), *P. pachycephalus* Nordmann (12) and *P. varians* (Paykull) (12).

Quedius. Eight species were caught, which is only 25% of the Norwegian species (Table 4). Also, none of the species were among the 30 most frequent, and consequently the genus is not important in Norwegian agricultural fields. This is in strong contrast to the related genus *Philonthus,* but in line with the situation in the rest of Europe. *Q. molochinus* (Gravenhorst) was the most frequent species, caught in low numbers in 10 fields in all three geographical districts.

Stenus. A genus with mainly hygrophilous species occurring near water. Only 21% of the Norwegian species were caught (Table 4), and only *S. biguttatus* (L.) was among the 30 most frequent ones (Table 3). It was caught quite frequently in E, rarely in M, and not caught in W. The species has also been caught in fields in other European countries.

Tachinus. A genus with mostly hygrophilous species. A large proportion (50%) of the Norwegian species were caught (Table 4),

and three species were among the 30 most frequent (Table 3). However, *T. signatus* (Gravenhorst) was the only species caught in most fields in all three geographical districts (Table 3), least so on clayish soils. It is also frequent in fields in other European countries.

Tachyporus. As was the case for the related genus *Tachinus,* 50% of the Norwegian species were caught in agricultural fields (Table 4), and at least three species were among the 30 most frequent ones (Table 3). *T. chrysomelinus* (L.)/*T. dispar* (Paykull) (not separated) were frequently caught in all three geographical districts. In agricultural fields investigated in Ås, Akershus in 1989—90, the two species were separated, and then *T. chrysomelinus* was much more numerous than *T. dispar* (unpublished data). *T. obtusus* (L.) was also caught in many fields in all three geographical districts. *T. hypnorum* (Fabricius) was less frequent, and only caught in E and southern W. *T. hypnorum* is the most frequently reported *Tachyporus* species from fields in other European countries (e.g. Roesgaard & Lindhardt 1979).

I conclusion, the carabid species *C. fossor* and *L. pilicornis,* and the staphylinid species *A. gregaria, A. rugosus* and *A. fungi* were the most eurotypic and frequently caught species in all three geographical districts (Table 1 and 3). In addition, characteristic species were in eastern Norway the carabids *B. quadrimaculatum* and *B. lampros* and the staphylinids *A. analis, T. signatus* and *P. cognatus,* in western Norway the carabids *B. lampros* and *P. atrorufus* and the staphylinids *O. exoleta, A. analis* and *A. elongatula,* and in middle Norway the carabids *B. bruxellense, B. lunatum* and *P. atrorufus* and the staphylinids *T. signatus, P. cognatus* and *P. laminatus* (Table 1 and 3).

There is little clear relationship between the most frequently caught species and crop type. This was noted also by Luff (1989). Concerning preferred soil types, this had been noted under the single species.

Carabids and staphylinids act as important natural enemies of many pest insects in agricultural fields (e.g. Good & Giller 1988, Luff 1989). The present paper gives basic data on which species are present where in Norwegian agricultural fields. For staphylinids, large areas in western Norway have not been surveyed, and for both beetle families more data is needed from northern Norway.

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REFERENCES

Abrahamsen, R. A. 1983. *Løpebille- og kortvingefaunaen (Col., Carabidae og Staphylinidae) i gulrotåkre og utvalgte arters predasjonsevne på egg av gulrotflue,* Psila rosae, *(Fabr.) (Dipt. Psilidae).* Thesis (cand. real), University of Oslo (unpublished), 142 pp.

Andersen, A. 1982. Carabidae and Staphylinidae (Col.) in swede and cauliflower fields in southeastern Norway. *Fauna norvegica Ser. B 29:* 49—61.

Andersen, A. 1985a. Carabidae and Staphylinidae (Col.) in swede and carrot fields in northern and south-western Norway. *Fauna norvegica Ser. B 32:* 12—27.

Andersen, A. 1985b. *Agonum dorsale* (Pontoppidan) (Col., Carabidae), an expanding species in Norway. *Fauna norvegica Ser. B 32:* 52—57.

Biström, O. & Silfverberg, H. 1983. Additions and corrections to Enumeratio Coleopterorum Fennoscandiae et Daniae. *Notulae Entomol. 63:* 1—9.

Biström, O. & Silfverberg, H. 1985. Additions and corrections to Enumeratio Coleopterorum Fennoscandiae et Daniae. 2. *Notulae Entomol. 65:* 143—154.

Biström, O. & Silfverberg, H. 1988. Additions and corrections to Enumeratio Coleopterorum Fennoscandiae et Daniae. 3. *Notulae Entomol. 68:* 49—60.

Ekbom, B. S. & Wiktelius, S. 1985. Polyphagous arthropod predators in cereal crops in central Sweden, 1979—1982. *Z. ang. Ent. 99:* 433—442.

Geiler, H. 1959/60. Zur Staphylinidenfauna der mitteldeutschen Agrarlandschaft. *Wiss. Z. Karl-Marx-Univ. Lpz. 9:* 587—594.

Good, J. A. & Giller, P. S. 1988. A contribution to a check-list of Staphylinidae (Coleoptera) of potential importance in the integrated protection of cereal and grass crops, pp 81—98 in: Cavalloro, R. and Sunderland, K. D. (eds.) *Integrated crop protection in cereals.* Proceedings of a meeting of the EC Experts' Group, Littlehampton Nov. 1986.

Hossfeld, R. 1963. Synøkologischer Vergleich der Fauna von Winter- und Sommerrapsfeldern. *Z. ang. Ent. 52:* 209—254.

Kjæraas, P. O. & Svagård, U. 1983. *Effekten av samplanting mellom gulrot og løk på gulrotflue* (Psila rosae *Fabricius).* Thesis (hovedoppgave), Agricultural University of Norway (unpublished), 145 pp.

Lindroth, C. H. (†) 1985—86. The Carabidae (Coleoptera) of Fennescandia and Denmark. *Fauna ent. scand. 15:* 1—497.

Luff, M. L. 1989. Biology of polyphagous ground beetles in agriculture, pp 209—250 in: Russel, G. E. (ed.) *Biology and population dynamics of invertebrate crop pests.* Intercept Ltd., Andover.

Lyngbye, J. E. & Nielsen, H. B. 1980. The spatial distribution of carabids (Coleoptera: Carabidae) in relation to a shelterbelt. *Ent. Meddr 48:* 133—140.

Muona, J. 1990. The fennoscandian and danish species of the genus Amischa Thomson (Coleoptera, Staphylinidae). *Ent. Tidsskr. 111:* 17—24.

Nedstam, B. & Jonasson, T. 1974. Förekomst av jordlöpare och kortvingar i några skånska kålodlingar. *Växtskyddsnotiser 38:* 79—84.

Palm, T. 1948. Skalbaggar. Coleoptera. Kortvingar: Fam. Staphylinidae. Underfam. Micropeplinae, Phloeocharinae, Olisthaerinae, Proteininae, Omaliinae. *Svensk Insektfauna 9 (1):* 1—133.

Palm, T. 1961. Skalbaggar. Coleoptera. Kortvingar: Fam. Staphylinidae. Underfam. Oxytelinae, Oxyporinae, Steninae, Euaesthetinae. *Svensk Insektfauna 9 (2):* 1—126.

Palm, T. 1963. Skalbaggar. Coleoptera. Kortvingar: Fam. Staphylinidae. Underfam. Paederinae, Staphylininae. *Svensk Insektfauna 9 (3):* 1—168.

Palm, T. 1966. Skalbaggar. Coleoptera. Kortvingar: Fam. Staphylinidae. Underfam. Habrocerinae, Trichophyinae, Tachyporinae. *Svensk Insektfauna 9 (4):* 1—93.

Palm, T. 1968—72. Skalbaggar. Coleoptera. Kortvingar: Fam. Staphylinidae. Underfam. Aleocharinae. *Svensk Insektfauna 9 (5-7):* 1—467 + VII plates.

Pietraszko, R. & de Clercq, R. 1983. Distribution and occurence of Staphylinidae in arable land in Belgium. *Med. Fac. Landbouww. Rijksuniv. Gent 48:* 441—455.

Roesgaard, H. & Lindhardt, K. 1979. The effect of straw burning on predaceous arthropods of the soil surface. *Tidsskr. Planteavl 83:* 305—323.

Scheller, H. V. 1984. Pitfall trapping as the basis for studying ground beetle *(Carabidae)* predation in spring barley. *Tidsskr. Planteavl 88:* 317—324.

Semb, C. E. 1982. *Samplanting. Repellerende stoffer fra løk og naturlige nyttedyr i kontroll av gulrotflue* (Psila rosae *Fabricius).* Thesis (hovedoppgave), Agricultural University of Norway (unpublished), 99 pp.

Silfverberg, H. (ed.) 1979. *Enumeratio Coleopterorum Fennoscandiae et Daniae.* Helsingfors Entom. Bytesförening, Helsingfors. VI + 79 pp.

Thiele, H.-U. 1977. Carabid beetles in their environments. *Zoophysiology and Ecology 10:* 369 pp.

Topp, W. & Trittelvitz, W. 1980. Verteilung und Ausbreitung der epigäischen Arthropoden in der Agrarlandschaft. II. Staphylinoidea. *Anz. Schädlingsk. 53:* 33—36.

Varis, A.-L., Holopainen, J. K. & Koponen, M. 1984. Abundance and seasonal occurrence of adult Carabidae (Coleoptera) in cabbage, sugar beet and timothy fields in southern Finland. *Z. ang. Ent. 98:* 62—73.

Waage, B. E. 1984. *Phenology and species assemblages of carabids (Col., Carabidae) in strawberry fields and surrounding habitats in western Norway.* Thesis (cand. scient), University of Bergen (unpublished), 56 pp.

Østrem, L. A. 1982. *Samplanting. Repellerande stodd frå bete og naturlege nyttedyr i kontroll av stor og lita kålflue* (Hylemyia floralis *Fallen og* Hylemyia brassicae *Bouche).* Thesis (hovedoppgave), Agricultural University of Norway (unpublished), 119 pp.

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A survey of the family Micropezidae in Norway

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The fly family Micropezidae in Norway includes the following species: *Micropeza corrigiolata*(L.) *Compsobata cibaria* (L.), *C. commutata* Czerny, *Neria ephippium* (Fabricius), *N. nigricornis* (Zetterstedt) and *Calobata petronella* (L.).

An illustrated key to the adults of Norwegian species is presented, and distributional maps are provided. Notes are made on flight periods and habitat selection. Two species, *Neria ephippium* (Fabricius, 1794) and *N. nigricornis* (Zetterstedt 1838), are reported new to the Norwegian fauna.

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INTRODUCTION

Siebke (1877) published the last check-list covering all records of Norwegian Diptera. Some fly families and lesser systematic fly groups have been surveyed since his time, but still there are several Diptera families which have not been subject to any surveys in recent time. Among these are the Micropezidae, a fly family with comparatively few species of which only forty are known from the Palaearctic (Soós & Papp 1984). McAlpine et al. (1981) place the family together with Neriidae and Cypselosomatidae in the superfamily Nerioidea. Only Micropezidae among these three families occurs in Europe.

Zetterstedt (1838) was the first to record Micropezidae from Norway when he recorded species of *Calobata* from different localities in Northern Trøndelag, Nordland and Finnmark province. We have not seen any of Zetterstedt's material, most of which must be considered lost. Dr. H. Andersson, Lund has informed us that only one Micropezidae, a male *Compsobata commutata* Czerny, exists in the Zetterstedt's collection in Lund. Thus the remaining localities mentioned above cannot be verified. Some of the material mentioned in Siebke's list (1877) is today missing in the collections in Zoological Museum, University of Oslo. Unverified records are not included in our material.

One later report on Norwegian insects also include Micropezidae (Bidenkap, 1900). Storm (1891, 1907) published records of *Compsobata cibaria* (L.) and *Calobata petronella* (L.) from near Trondheim. Storm's collections are mostly destroyed and his records must be left without consideration. Strand (1903) also published records which also are left out.

We have not followed the nomenclature used by Soós & Papp (1984). Andersson (1989) made a revision of important material from Fennoscandia which makes alterations in the nomenclature used by Soós & Papp, and we therefore follow Andersson. His work is important for future investigations on this family in Fennoscandia and Denmark. Merritt & Peterson (1976) made a survey of the Micropezidae of Canada and Alaska. They list five genera and three subfamilies. The same subfamilies are also found in Scandinavia, but none of the sixteen species.

Distribution in the USSR can be checked in Ozerov (1987).

MATERIAL AND METHODS

Material in the following museums have been revised: Zoological Museum, University of Oslo (ZMO), Zoological Museum, University of Bergen (ZMB), The Museum, The University of Trondheim (UNIT-museet), Tromsø Museum University of Tromsø (TM) and the Museum of Zoology, Amsterdam. Norwegian material deposited in Museum of Zoology and Entomology, University of Lund (Lund Museum) is included in the loca-

lity lists, after informations given by Hugo Andersson. The specimens in Lund are not added to the number of specimens revised by the authors. We have also included material from the private collections of Knut Rognes, Stavanger and Terje Jonassen, Sjernarøy and one of the authors (TRN). Fred Midtgaard, Norwegian Forest Research Institute, made collections with Malaisetraps in the summers 1984, -85 and -86; Micropezidae was partly sorted out is now deposited in ZMB and included in the survey.

The geographic provinces follow the revised Strand system (Økland 1981). EIS square numbers are noted as well as UTM (grid zone 32) when available.

For older material we assume that collection has mostly been done with an insect net. Collection with Malaisetraps is noted as MF.

Family Micropezidae

The Micropezidae have mostly rounded heads, in some species the face is snout-like. They are longbodied, slender flies with long legs, hence the name «Stiltflies» or «Longlegged flies», — in Norwegian «Styltefluer».

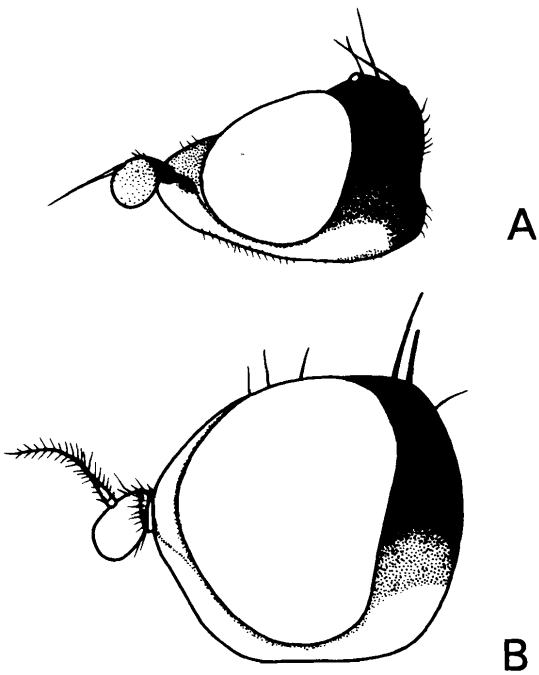


Fig. 1. Heads seen in profile: A. *Micropeza corrigiolata* (L. 1767); B. *Compsobata commutata* Czerny, 1930.

The head lacks ocellar bristles. Scutellum bears one pair of bristles. The wings are well developed, but rather short in some species; mostly hyaline, but banded in some species. Radius (R_{4+5}) and Media (M) converge strongly towards the apex, the anal cell is not convex apically. On account of the slender bodies and the long legs the Micropezidae may superficiously look like Tanypezidae. In the Micropezidae, however, the tarsi of third legs are much shorter than the tibia; they are longer than tibia in Tanypezidae.

The male genitalia usually offer good species characters. The females have an ovipositor with few species distinctions.

Key to subfamilies

1. The head and face longish, snout-like, fig. 1A. Colour of head and body mainly black, with some yellow markings on the head. The wings short, fig. 2. No cross-rib between 2. basal-cell (2BC) and the discal-cell (DC). The males lack pregenital lobes ..... Sub.fam. Micropezinae, Genus. *Micropeza*

— Head not snout-like, more rounded fig. 1B. Colour of head and body more or less greyish-brown, sometimes blackish. Wings fairly long, a crossrib is present between 2BC and DC. Males with pregenital lobes ... 2.

2. Postvertical (PVB) bristles present. Head and body blackish. The wings with a dark cross-band. Body-length 8—9 mm ..... sub.fam. Taeniapterinae.

Genus *Raineria* (One species: *Raineria calceata* (Fallén, 1820). A rare species in Scandinavia, recorded from southern Sweden and Denmark).

Postvertical (PVB) bristles lacking. Head and body brown or greyish-brown. Wings hyaline. Body-length 4—8 mm ..... Sub.fam Calobatinae, genera *Calobata, Cnodacophora, Compsobata* and *Neria.*

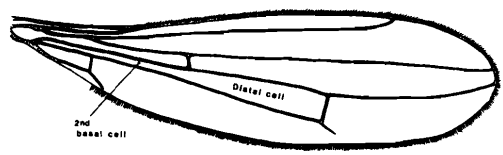
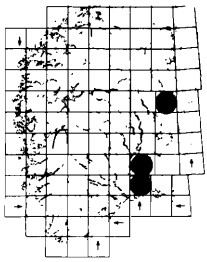


Fig. 2. Wing of *Micropeza corrigiolata* (L. 1767).

EIS - maps showing the distribution of the following species:



1

Micropeza corrigiolata (L. 1767)

Sub.fam. Micropezinae

Genus *Micropeza* Meigen, 1803 (Syn. *Tylus* Meigen, 1800)

Key to species

1. Vertex and occiput black, buccae whitish-yellow. Body black. Body-length 5—6 mm ..... *M. corrigiolata* (L. 1767)

2. Vertex and occiput yellow with black streaks and spots. Body mostly black, but thorax on each side with a yellow lateral stripe and also some yellow markings on the lower lateral plates of thorax. Body-length 6—8,5 mm .... *M. lateralis* Meigen, 1826

(A rare species not known from Fennoscandia, only in Denmark (Lyneborg, 1962)).

Micropeza corrigiolata (L. 1767)
M. corrigiolata was first published from Norway by Siebke (1877), from Grundset near Elverum, Hedmark province. The Norwegian distribution on map 1.

Material examined: 11 ♂♂, 13 ♀♀ + 1 specimen without abdomen.

Ak, Oslo: Hovedøya 29 June 1981 2 ♂♂ 2 ♀♀ in *Phragmites australis,* ZMB. HES, Elverum: Grundset, 1 ♀ 1 specimen ZMO. VE, Tjøme: Kjære, 14 July 1969 1 ♀ VNL 8052 in *Phragmites australis,* ZMB; Kolabekkilen, VLN 807513 24 July 1982 1 ♀ in *Phragmites australis,* ZMB; Mostranda, VNL 800496 22 July 1982 1 ♀, 8 July 1983 2 ♀♀, 20 July 1983 1 ♂, 30 June 1985 1 ♀, 6 July 1985 1 ♀, 15 July 1986 3 ♂♂ 1 ♀, ZMB; Sunnane, VNL 806595 3 July 1983 1 ♂ 1 ♀ in *Phragmites australis,* ZMB; Treidene, VNL 803499 5 July 1984 1 ♂, ZMB. TEY, Porsgrunn: Brevik, Sandøy, July 1986 3 ♂♂ 1 ♀ in *Scirpus tabernaemontani,* ZMB.

M. corrigiolata is new to AK, VE and TEY. The distribution seems restricted to south-eastern Norway. The species is reported from southern Sweden north to approximately 60° N (Andersson, 1989). Ringdahl (1960) regards *M. corrigiolata* as a southern species in Sweden. *M. corrigiolata* is recorded from Finland (Hackman, 1980), and Lyneborg (1962) reports it as uncommon, but widespread in Denmark.

The recent records from Norway are all, except one, localities in common reed, *Phragmites australis* Trin. The exception is a locality with *Scirpus tabernaemontani,* but this plant grows in very wet habitats like the reed. Some localities are brackish water. Collecting in large stands of reed is difficult, and this may partly account for the rarity of this species. Specimens have been collected from late June and throughout July, which probably may be the flight period of this species in southern Norway.

Sub.fam. Calobatinae

The following key to the different genera is simplified and should only be used for material found in Fennoscandia and Denmark. Males of the different genera have characteristic genitalia, but the key mentions only characters found in both sexes. For detailed description of genitalia see Lyneborg (1962) and Andersson (1989). Some species are best separated on the presence or absence of pruinosity on the head and mesonotum. Such pruinosity, however, can only be seen on dry material. Specimens kept in alcohol must be dried for some minutes to allow eventual pruinosity to appear.

Key to genera

1. Long mouthpalps, approximately four times longer than broad, reaching the front part of mouth (clypeus). Subcostal (SC) and Radius (R1) strike costa at least at a distance as long as the posterior cross-vein, Fig. 3A ..... 3.

— Short mouthpalps, at most twice longer than broad, not reaching the first part of the

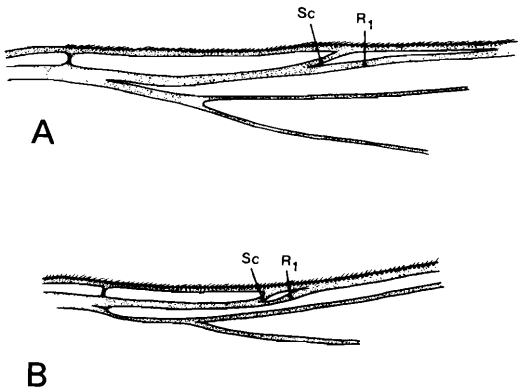


Fig. 3. Part of wing: A-Genus *Calobata;* B-Genus *Compsobata.*

oral opening. SC adn R1 strikes costa close together ..... 2.

2. Mesonotum partly shiny without pruinosity ..... Gen. *Neria*
— Mesonotum covered with pruinosity, not shiny. ..... Gen. *Compsobata*

3. Mesonotum partly without pruinosity, shining. Usually one pair of dorsocentral bristles (DB) ..... Genus *Cnodacophora* (One species *Cnodacophora stylifera* (Loew, 1870) is recorded from Northern Sweden)
— Mesonotum not shining. Usually two pairs of (DB) ..... Genus *Calobata*

Genus *Compsobata* Czerny, 1930

Key to species

1. Arista all yellow. Upper part of vertex and area around the ocellar triangle is black. The pregenital lobe in the male is slender at base (fig. 4A). Female ovipositor with a transverse row of long, whitish bristles at ventral end. Body-length 5—7,5 mm .... *C. commutata* Czerny, 1930

— Arista black at base. Upper part of vertex reddish brown, the reddish brown colour continues in an area up to both sides of the ocellar triangle. Male pregenital lobes broad at base (fig. 4B). Female ovipositor without a transverse row of bristles at the ventral end. Body-length as in *commutata* .. *C. cibaria* (L. 1761).

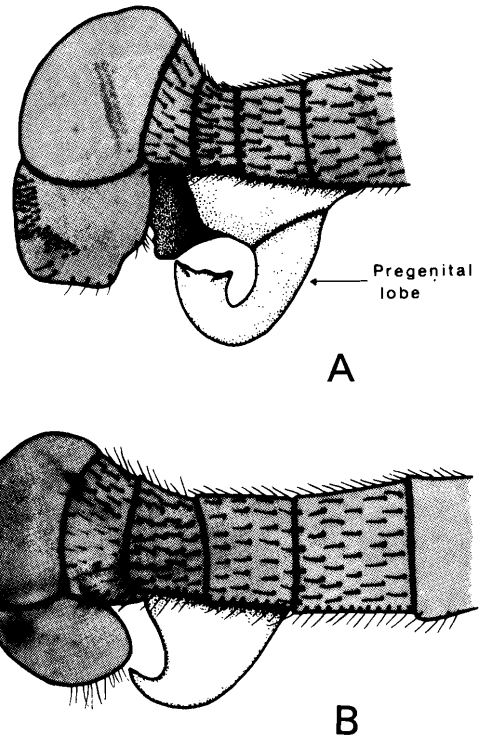
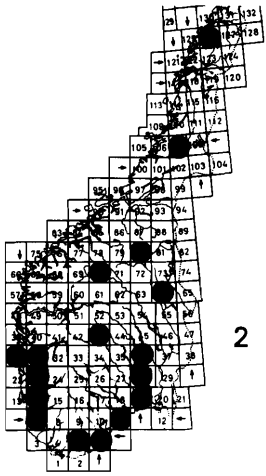


Fig. 4. Tip of abdomen in males of: A - *Compsobata commutata* Czerny, 1930; B - *Compsobata cibaria* (L. 1761).

Compsobata cibaria (L. 1761)
C. cibaria was first recorded by Siebke (1877) from several localities in southern Norway. Parts of Siebke's material are today not present in the collections of ZMO, viz.: VE: Stavern and HEN: Stor-Elvdal and Tyldal. The Norwegian distribution om map 2.

Material revised: 56 ♂♂ 156 ♀♀
Ø, Moss: Jeløy Ahlbybukt 17 July 1986 1 ♀, ZMB. AK, Oslo: Skøyen 22 June 1851 1 ♀, ZMO 11860; Tøyen 20 June 1849 1 ♂, ZMO 11857, 1 ♂, TM. (The male in TM was probably published by Siebke (1877) and later made a gift to this museum); Frogner 1 ♂, ZMO 11586; Oslo 1 ♀, ZMO 11849; Frogn: Håøya MF 19 May—3 June 1984 1 ♀, 3—16 June 1984 1 ♂, 27 June—22 July 1984 1♀, ZMB Bærum: Østøya MF A 3 ♂♂ 7 ♀♀ 1984, MF B 1 ♂ 2 ♀♀ 1984, MF C 6 ♂♂ 9 ♀♀ 1984, ZMB. HEN, Åmot: Åmot 1 ♀, ZMO 11859; Tynset: N. of Kvikne 22 June 1967 1 ♀, ZMB. ON, Lesja: Lora VMP 827915—17, 29 July 1974 1 ♀, ZMB. BØ, Ringerike: Hønefoss 1



2

Compsobata cibaria (L. 1761)

♂, ZMO 11858. Hurum: Tofte MF 18 May—2 June 1985 2 ♂♂ 24 ♀♀, 2—17 June 1985 11 ♂♂ 45 ♀♀, 17 June—17 July 1985 11 ♂♂ 21 ♀♀, ZMB. BV, Hol: Geilo 15 June 1971 1 ♂, TRN pers.coll.; Gol: Engene MF 18 June—5 July 1982 2 ♂♂ 4 ♀♀, 5—21 July 1982 1 ♀, ZMB. VE, Sandefjord: Sørbyøya 22 June 1984 1 ♀, ZMB; Sørpynten 22 June 1984 1 ♀, ZMB; Sem: Karlsvik 26 May 1985 1 ♂ 4 ♀♀, ZMB; Stokke: Gjennestad 7 July 1983 1 ♂, ZMB; Tjøme: Mostranda 1 June 1967 1 ♂, ZMB; Tjøme 19 July 1981 1 ♀, ZMB. TEY, Bamble: Vold, Herre 13 June 1983 1 ♀, ZMB. AAY, Tromøy: NNV off Tromøy church 22 May 1983 2 ♀♀, ZMB; Tromøy 30 May 1981 1 ♀, ZMB. VAY, Marnardal: Laudal, Sveindal MF 12 June—27 July 1983 3 ♀♀, ZMB. RY, Time: Njå 11 June 1982 1 ♂, ZMB; Gjesdal: Edland 13 June 1982 1 ♂, ZMB; Ålgård 7 June 1983 2 ♀♀, ZMB; Finnøy: Kyrkøy, 15 July 1987 1 ♂, 17 July 1987 1 ♀, ZMB. HOY, Bergen (Fana): Store Milde 24 July 1983 1 ♂, ZMB; Os: Drange MF, 5—14 June 1988 3 ♂♂ 2 ♀♀, 14—26 June 1988 1 ♀, 26 June—16 July 1988 1 ♂, ZMB. HOI, Etne: near Nordelvi VLM 300185 26 June 1985 1 ♀, ZMB; Kvinherad: Rosendal 1—2 June 1982 1 ♀, ZMB. NTI, Høylandet: Skiftesåa June 1987 1 ♂ 3 ♀♀ UNIT-museet; Tverråa June—July 1987 2 ♂♂ 9 ♀♀ UNIT-museet. NSI, Beiarn: Kvæl 19 July 1981 1 ♀, ZMB. Unverified records viz. Siebke (1877): VE, Stavern and Tønsberg, HEN, Storelvdal and Tyldal.

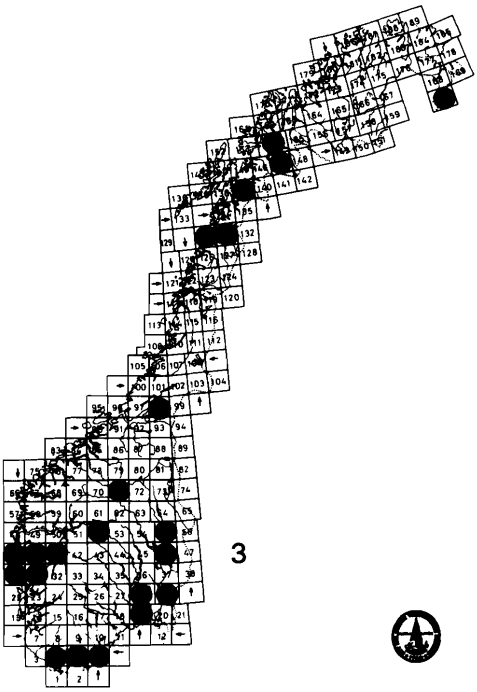
C. cibaria is not rare in southern Norway. North of Dovre there are three localities, Beiarn in Nordland the northernmost. There are also some unverified records from Northern Trøndelag in Zetterstedt (1838). Storm (1891, 1907) has records from Southern Trøndelag and Strand (1903) from Nordland, but this material does not longer exist.

Material from three Malaisetraps on Ostøya island, Bærum throughout the summer 1984 yielded 10 males and 18 females and one Malaisetrap at Tofte in Hurum (BØ) as many as 24 males and 90 females, actually a large part of the total material of *C. cibaria.* Thus Malaise traps are effective to collect this species, but the results vary with the habitat. The first specimens were caught between May 18th and June 2nd, the last in the period ending July 17th. Traps were operated throughout September. The flight period is probably June-July in southern Norway. Specimens with ptinial bladder extruded were caught 3 June.

Detailed descriptions of the habitats around the Malaisetraps at Ostøya and Håøya have been given by Greve & Midtgaard (1986). Since at least the habitats at Ostøya varies, *C. cibaria* can adapt to different habitats. The locality at Hurum., Tofte was a decidious forest with a wide diversity of trees and bushes.

Compsobata commutata (Czerny, 1930)
(Syn. *Calobata cothurnata* auct., not Panzer, 1798)
The Norwegian distribution on map 3.

Material examined: 37 ♂♂, 60 ♀♀
AK, Oslo: «Punsjebollen» 1 ♀, ZMO 11867; Oslo 1 ♀ 2 ♀♀, ZMO 11847 1 ♂, 11848, 11851 2 ♀♀; Tøyen 1 ♂, ZMO 11846; Nordstrand, Kastellet 18 July 1871 1 ♀, ZMO 11850; AK, Ås: Nesset 2 June 1983 1 ♀, TRN pers.coll.; Bærum: Ostøya 31 May 1984 1 ♀, MF A 1 ♂4 ♀♀ 1984 MF C 3 ♂♂6 ♀♀ 1984 ZMB; Enebakk: Enebakk 1 ♂ 1 ♀, ZMO 11871. Nannestad: Tømte 20 June 1985 1 ♀ ZMB. Revised from *C. petronella* (Siebke, 1877) HES, Elverum: Grundset 1 ♀, ZMO 11854; Stange: Tangen 5 June 1984 1 ♀, ZMB. Revised from *C. petronella* ON, Sel: Laurgård 1 ♂, ZMO 11845; Vang: Vang 1 ♂, ZMO 11852. BØ, Røyken: Røyken 1 ♂, ZMO 11853. BV, Gol: Engene MF 5—21 July 1982 1 ♂ 1 ♀, ZMB. VE, Borre: Borrevann 13 June 1965 1 ♂, ZMB. AAY, Grim-



Compsobata commutata Czerny, 1930

stad: Landvik, Skiftenes VMK 702747 25 May 1971 1 ♂, 29 May 1981 1 ♀, ZMB. VAY, Flekkefjord: Hidra, Dragøy MF 20 July 1981 1 ♀, 3—5 July 1982 2 ♀♀, 14—17 July 1982 3 ♀♀, ZMB; Gausdal, Store Eikås MF 21 June—6 July 1982 3 ♀♀, 6—15 July 1982 2 ♀♀, 15—22 July 1982 1 ♀, ZMB; Marnardal: Laudal, Sveindal MF 12 June—27 July 1983 1 ♂ 3 ♀♀, ZMB. HOY, Bergen (Fana): Mildevann 1 June 1980 2 ♂♂, ZMB; Tveiteråsen 3 June 1942 1 ♂, ZMB; HOY, Myravann 8 June 1983 1 ♀, ZMB; HOY, Bergen: Kristianborgvann 8 June 1986 4 ♂♂ 4 ♀♀, ZMB; HOY, Bergen (Åsane): Åstveit 16 June 1966 1 ♀, ZMB; HOY, Bergen (Åsane): Åstveit at Golf course, 25 June 1966 1 ♂, ZMB; Os: Røykenesvann 19 June 1983 1 ♂, ZMB; Osterøy: Fitjarhellen EIS 25 June 1982 1 ♀, ZMB; Osterøy: Kleppevann 25 June 1982 1 ♀, ZMB. HOI, Granvin: Seim 1 June 1936 1 ♂, ZMB. Revised from *C. cibaria* HOI, Kvam: Tangerås 7 July 1874 1 ♀, ZMO 11861. NTI, Verdal: Garnes 30 June—13 July 1840 1 ♂, Museum of Zoology and Entomology, Lund. NTI, Høylandet: Skiftesåa July 1987 2 ♂♂ 5 ♀♀ UNIT-museet; Tverråa July 1987 2 ♂♂ 3 ♀♀ UNIT-museet. NSY, Bodø: Kronli, Falkflaug 15 July 1981 1 ♂, ZMB; Urskar gård 8 Aug. 1982 1 ♂, ZMB. NNØ, Sørfold: Røsvik 17 Aug. 1923 1 ♀, TM 27 June 1956 10 Museum of Zoology and Entomology, Lund. NNØ, Evenes: at Evenes airport 5 July 1983 1 ♂, TRN pers.coll., 22 June 1984 1 ♂ 1 ♀, ZMB. TRI, Målselv: Frihetsli 12 July 1942 1 ♀, TM; Bjerkeng 29 July 1885 1 ♂, TM; Balsfjord: Balsfjord 28 June 1895 1 ♂, TM. FØ, Sør-Varanger: Svanvik, Mellesmo MF 20 June—4 Aug 1986 2 ♂♂ 2 ♀♀, ZMB.

C. commutata seems to be fairly common in southern Norway and there are several records from all provinces in northern Norway also.

The flight period in southern Norway seems to be from May to late June/early July. In Northern Norway records are from late June, July and August. The flight period in northern Norway seems delayed as only one record is as early as late June.

Compared with *cibaria* and *petronella, commutata* does not occur in great numbers even when Malaisetraps are used. For information on the habitats at Ostøya, see Greve & Midtgaard (1986).

Genus *Neria*

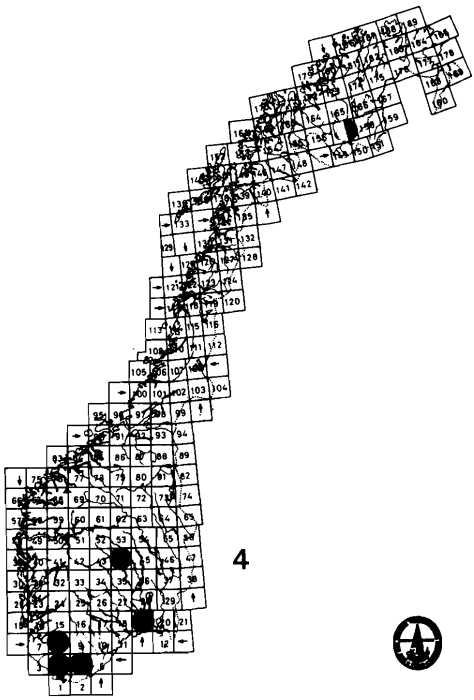
Key to species

Thorax red-brown, shining. Small species with short wings. Body-length 4—5 mg wings shorter ..... *Neria ephippium* (Fabricius)

— Thorax black and shining above, but covered with pruinosity at the sides. Wings longer. Body-length 5—7 mm ..... *Neria nigricornis* (Zetterstedt)

Neria ephippium (Fabricius, 1794)
The species is here recorded new to Norway. The Norwegian distribution on map 4.

Material examined: 4 ♂♂, 5 ♀♀
Neria ephippium (Fabricius, 1794)
BV, Gol: Engene MF 18 June—5 July 1982 1 ♂, 5—21 July 1982 3 ♀♀, ZMB. VE, Tjøme: Kjære 1965 1 ♀, ZMB. VAY, Flekkefjord: Hidra, Osmundstø MF 21 June—3 July 1982 1 ♂, ZMB; Marnardal: Laudal, Sveindal MF 12 June—27 July 1983 1 ♀, ZMB. RI, Forsand: Helmikstøl 4 June 1985 1 ♂, 19 June 1985 1 ♂, ZMB.



Neria ephippium (Fabricius, 1794) = closed circles;

Neria nigricornis (Zetterstedt, 1838) = half circle

N. ephippium seems to be rare in Norway. Two localities are from coastal areas, the other three are inland, all from southern parts of the country. In Denmark Lyneborg (1962) term the species as uncommon. Andersson (1989) reports it from Sweden north till around 59° N.

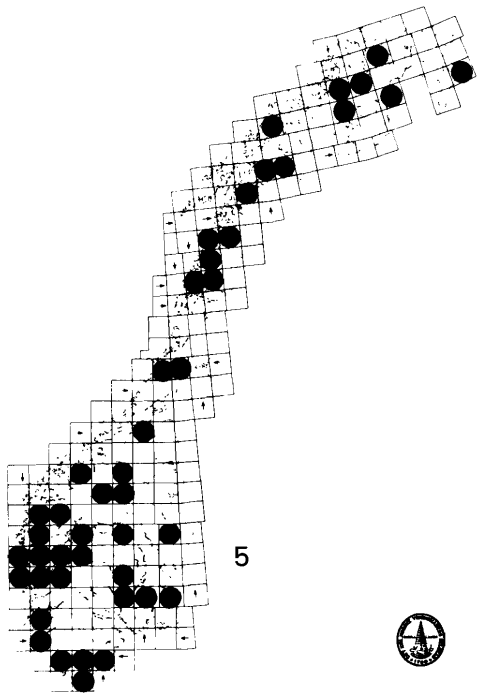
Collin (1945) records *N. ephippium* from damp localities in marshy places. Records date from last part of June and possibly early July. The Osmundstø locality was a flowering meadow close to sea, Engene a meadow close to a river.

Neria nigricornis (Zetterstedt, 1838)
New to Norway. Norwegian distribution on map 4.

One record:
FI, Kautokeino: Avzi MF 25—26 July 1986 1 ♀, ZMB.
Andersson (1989) reports *N. nigricornis* from Sweden, Finland and the USSR. The single Norwegian record fits well with the other records from Fennoscandia. The species is probably rare in Norway.

The habitat at Avzi was flowering meadows with many different species of flowers and the Malaisetrap was placed close to a river.

Genus *Calobata*
Calobata petronella (L. 1758)
Material examined. 289 ♂♂, 624 ♀♀ and 6 specimens without abdomen. The Norwegian distribution on map. 5.
AK, Oslo: Oslo 2 ♂♂, ZMO 11866, 11872; 1 ♂, TM; Juliushaugen 14 July 1846 1 ♀, ZMO 11868, 27 June 1850 1 ♀, ZMO 11865; Tøyen 28 July 1845 1 ♂, ZMO 11864; Frogn: Håøya MF A 3—16 June 1984 6 ♂♂ 9 ♀♀, 16—27 June 1984 1 ♂ 2 ♀♀, 27 June—22 July 1984 2 ♂♂ 3 ♀♀, 22 July—18 Aug. 1984 1 ♂ 1 ♀, ZMB; Bærum: Ostøya MF B 4 ♂♂ 5 ♀♀ ZMB; Enebakk: Enebakk 1 ♂, ZMO 11870. HES, Elverum: Grundset ?, July 1871 1 ♂, ZMO 11862 (The locality uncertain, the label *might* be Grundset). This locality is not mapped. HEN, Åmot: Rena 17 July 1987 3 ♀♀, ZMB. OS, Gausdal: 2.5 km W of Svatsum 14 July 1982 ♀, ZMB. ON, Dovre: Toftemo 6 Aug. 1873 1 ♂, ZMO



Calobata petronella (L. 1758)

11863; Lesja: Lora VMP 827915—17 29 July 1974 1 ♂, ZMB; Våga: Vågamo 11 July 1953 1 specimen, ZMO. BØ, Kongsberg: Kapermoen 18 June 1983 1 ♂, ZMB; Hurum: Tofte MF 18 May—2 June 1985 1 ♀, 2—17 June 1985 7 ♂♂ 13 ♀♀, 17 June—17 July 1985 86 ♂♂ 289 ♀♀, 17 July—8 Aug. 1985 1 ♂ 25 ♀♀, 8 Aug.—1 Sept. 1985 6 ♀♀, ZMB; Rollag: Rollag 12 July 1984 1 ♀, ZMB. BV, Hol: Haugastøl 16 July 1974 1 ♀, ZMB. AAY, Birkenes: Sennumstad 26 June—6 Aug. 1986 1 specimen, ZMB; Iveland: Grosås MF 6—22 July 1982 1 ♀, ZMB. VAY, Kristiansand: Oddernes 18 June 1967 1 ♀, ZMB; Mandal: near road to Valand MF, 11—28 Aug. 1982 1 ♀, ZMB; Flekkefjord: Hidra, Osmundstø MF 21 June—3 July 1982 4 ♀♀, -ZMB; Marnardal: Laudal, Sveindal MF 12 June—27 July 1983 1 ♂, ZMB, RY, Sandnes: Skeiane 28 June 1963 1 ♀, ZMB; Stavanger: Sunde 26 June 1981 1 ♀, 4 June 1982 3 ♀♀, ZMB; Finnøy: Kyrkøy 13 July 1987 1 ♂, ZMB; Rennesøy: Vikevåg 6 June 1981 1 ♀, ZMB; Tysvær: Kårstø 13 July 1981 1 ♂, ZMB. RI, Forsand: Forsand 24 June 1945 1 ♀, ZMB; Songesand, near school 18 July 1984 1 ♂, ZMB; Hjelmeland: Eiane 8 June 1983 1 ♀, ZMB; Jøsneset, Fosså MF 13—20 June 1982 1 ♂, 20 June—11 July 1982 2 ♂♂, ZMB. HOY, Bergen: Bergen 7 June 1966 1 ♀, ZMB; Muséhagen 1 June 1973 1 ♂, ZMB; (Fana): Fana 19 June 1985 1 ♂, ZMB; Hauglandsdalen near Fjelltveit 3 June 1983 4 ♂♂ 13 ♀♀, ZMB; Myravann 8 June 1983 4 ♂♂ 1 ♀, ZMB; Storetvedt 27 June 1982 1 ♀, ZMB; Strømme 22 June 1986 1 ♀, ZMB; (Laksevåg): Melkeplassen 4 July 1981 1 ♂ 1 ♀, ZMB; (Åsane): Vikaleitet at Teigland 29 June 1983 1 ♀, ZMB; Vollane 17 June 1983 1 ♂ 2 ♀♀, ZMB; Os: Drange MF 5—14 June 1988 1 ♂ 1 ♀; 14—26 June 1988 4 ♂♂ 3 ♀♀, 26 June—16 July 1988 2 ♂♂ 4 ♀♀, ZMB; Fjell: Sæle MF 30 May—16 June 1982 2 ♀♀, ZMB; Askøy: Herdla May 1937 1 ♂, June—July 1938 1 ♂, ZMB; Kleppestø 20 June 1985 1 ♂, ZMB; Vaksdal: Eidslandet 15 June 1968 1 ♂ 1 ♀, ZMB; Ekse 27 June 1967 2 ♀♀, ZMB; Osterøy: Kleppe 16 June 1986 1 ♂, 28 June 1988 1 ♂ ZMB; Kleppevann 25 June 1982 2 ♂♂ 4 ♀♀, 16 June 1986 1 ♂, ZMB; Skaftå MF 28 May—13 June 1982 1 ♀, ZMB. HOI, Kvinherad: Lio 2 June 1966 1 ♀, ZMB; Kvinherad: Rosendal, Baroniet 28 May 1968 1 ♂, ZMB; Skåla 13 June 1965 1 ♀, ZMB; Rosendal 1—2 June 1982 2 ♀♀, ZMB; Odda: Solfonn hotel 13 June 1976 1 ♀, ZMB; Ullensvang: Djønno 5—26 June 1984 1 ♂ 2 ♀♀, ZMB; Eidfjord: Hjølmo 17 July 1967 1 ♀, ZMB; Viveli 27 July 1967 1 ♀, 28 July 1967 1 ♀, ZMB; Ulvik: Hallanger 28 May—16 June 1982 MF 45 ♂♂ 109 ♀♀ 1 specimen, ZMB; Voss: Solbakken VLN 864317 MF 8 June—13 July 1985 13 ♂♂ 7 ♀♀, 13 July—3 Aug. 10 ♂♂ 1 ♀, 29 June—6 Aug. 1986 16 ♂♂ 3 ♀♀, ZMB; Kårdal 13 July 1985 1 ♀, ZMB. SFY, Gulen: Brekkestranda 30 June 1983 1 ♀, ZMB; Jølster: Skei 3 July 1942 1 ♂, ZMB; Solheim VLP 513243 5 July 1983 3 ♂♂, ZMB; Naustdal: Naustdal 28 May—3 July 1986 3 ♂♂ 6 ♀♀, 3 July—28 July 1986 MF 2 ♂♂ 1 ♀, ZMB; Førde: Rotenes 2 July 1983 1 ♀, ZMB. SFI, Årdal: Øvre Årdal 1 July 1938 1 ♀, ZMB. MRY, Vestnes: Vestnes 1 ♀, ZMO 11869. MRI, Rauma: Åndalsnes 2 July 1971 1 ♀, Mus.Amsterdam. STI, Trondheim: Leirbru July 1987 2 ♂♂ 1 ♀, ZMB; Oppdal: Kongsvoll, Blesbekken VNQ 323072 11 Aug. 1981 1 ♀, UNIT-museet; Kongsvoll, Gåvålibekken MF 27 July—3 Aug. 1982 2 ♀♀, UNIT-museet, Kongsvoll, Raubekken VNQ 315082 MF 24—31 July 1980 1 ♀, UNIT-museet. NTY, Namsos: Namsos 16 July 1946 1 ♀, TM. NTI, Høylandet: Skiftesåa June—July 1987 1 ♀, UNIT-museet; Tverråa June—July 1987 6 ♂♂ 17 ♀♀, UNIT-museet. NSY, Bodø: Hjartøy July 1977 1 ♀, ZMB; Valnes, Skålmoen 27 July 1987 1 ♀, ZMB. NSI, Saltdal: Rognan July 1988 2 ♀♀, ZMB; Rana: Berget 3 Aug. 1947 1 ♀, TM; Granhei MF 29 June—27 July 1986 2 ♀♀, ZMB; Mo 25 June 1956 10 ♂♂ 4 ♀♀, Lund Museum; Beiarn: Moljord 6 Aug. 1972 1 ♀, ZMB. NNØ, Sørfold: Røsvik 3 July 1923 1 ♀, 15 July 1923 1 ♀, 16 July 1923 1 ♂, 16 Aug. 1923 2 ♂♂, TM; Evenes: near Evenes airport 22 June 1984 1 ♀, ZMB; Narvik: Narvik 27 June 1947 8 ♂♂ 5 ♀♀, Lund Museum. TRY, Tromsø: Tromsø 2 Aug. 1897 1 ♀, 27 July 1924 1 ♀, 19 May 1944 1 ♀ TM, 20 July 1947 1 ♀, 25 July 1947 1 ♀, Lund Museum. TRI, Bardu: Sætermoen 25—28 June 1981 1 ♀, ZMB; Målselv: Frihetsli 31 July 1922 1 ♂, TM; Dividalen, Høgskardhus MF 18—19 July 1987 1 ♀, ZMB, Moen 166 June 1986 1 ♂, TM. FV, Alta: Gargia 1 July 1979 1 ♀ ZMB; 22 June 1986 1 ♂, TM; Kautokeino: Suolovuobme 24 June 1984 1 ♂ 1 ♀, ZMB; Karasjok: Karasjok 15 July 1947 1 ♂, ZMB,. FN, Porsanger: Banak 12 July 1947 three specimens, Lund Museum; Børselvfjellet 21 June 1986 4 ♀♀, TN; Børselv 11 July 1947 1 ♀, Lund Museum; Lakselv 5 July

1956 1 ♀, Lund Museum; Skoganvarre 11 July 1947 1 ♀, Lund Museum; Lebesby: Adamsfjord 5 July 1956 1 ♂, Lund Museum. FØ, Sør-Varanger: Pasvik 17 July 1969 2 ♂♂, ZMB; Svanvik, Mellesmo MF 20 June—4 Aug. 1986 4 ♂♂ 4 ♀♀, ZMB, Svanhord MF 4 Aug.—1 Sept. 1986 2 ♂♂ 2 ♀♀, ZMB.

Calobata petronella was first recorded from Norway by Zetterstedt (1838) from Suulstua, Northern Trøndelag province. It is distributed all over the country and is by far the most common species among the Norwegian Microzedidae. Storm (1907) recorded *C. petronella* from several localities in Southern Trøndelag and likewise Zetterstedt (1838) from Northern Trøndelag, but the records are not included here since the material is lost.

C. petronella is found in the lower alpine zones in Norway, but rarely. Malaisetraps situated at Blesbekken, Kongsvoll, Southern Trøndelag collected a few specimens at 1000 m a.s.l. (Greve, Solem & Bretten, 1987), and in the IBP project on Hardangervidda (Fjellberg, 1972) *C. petronella* was collected up to 990 m a.s.l. at Haugestøl.

From mountainous birch forests there are several records,, and a Malaisetrap situated at 670 m a.s.l. at Mjølfjell, Voss caught as many as 39 males and 11 females during the 1985 season, from 8 June till 3 August.

Lobanov (1960) reports flight to take place in NW USSR in June and July. This fits in fairly well with material from southern Norway where specimens have been caught from late May till early August. Material from the northern provinces viz. Troms and Finmark as well as from the upper sub-alpine birch forests in southern Norway indicates a somewhat postponed flight period, a phenomenon often noticed among different insects groups (Brinck, 1948). Nearly all records from these areas are from July and August. There also seems to be a longer flight period for the females than the males. The Malaise-trap in Tofte, Hurum, (BØ) collected only 1 male in the period 17 July—8 August compared to 25 females, and no male and 6 females in the following period 8 August—12 September. The trap was closed at the end of September. The first female appeared in the period 18 May—27 June, the first male 2—17 June.

Lobanov (1960) gives the habitats for the larvae as manure, refuse and dung. Rotten grass probably attracted some of the many specimens, seventeen of which were collec-

Table 1. Malaise trap catches on AK, Bærum: Ostøya and Bø, Hurum: Tofte in southeastern Norway.

Ostøya/periods / Species	MF-traps	14-28 April	28 April-12 May	12-30 May	30 May-10 June	10 June-1 July	1-24 July	24 July-12 Aug.	12 Aug.-1 Sept.	1-23 Sept.
Compsobata cibaria	A	-	-	-	1♂ 4♀♀	1♂ 2♀♀	-	1♂ 1♀	-	-
	B	-	-	-	2♀♀	1♂	-	-	-	
	C	-	-	1♀	1♂ 4♀♀	2♂♂ 1♀	3♂♂3♀♀	-	-	-
Compsobata commutata	A	-	-	-	1♂ 3♀♀	-	1♀	-	-	-
	B	-	-	-	-	-	-	-	-	
	C	-	-	-	1♂ 2♀♀	2♂♂ 4♀♀	-	-	-	-
Calobata petronella	A	-	-	-	-	-	-	-	-	-
	B	-	-	-	3♂♂ 3♀♀	1♂ 1♀	1♀	-	-	
	C	-	-	-	-	-	-	-	-	

Tofte/periods / Species	MF-traps		13-18 May	18 May-2 June	2-17 June	17 June-17 July		17 July-8 Aug.		
Compsobata cibaria			-	2♂♂ 24♀♀	11♂♂ 45♀♀	11♂♂ 21♀♀		-	-	
Calobata petronella			-	1♀	7♂♂ 13♀♀	86♂♂ 289♀♀		1♂ 25♀♀	6♀♀	

[-] = Open trap - no catches.

▨ = Trap not operating.

ted at Fjelltveit, Hauglandsdalen (HOY) while they were walking on and among a heap of rotten grass. Several pairs were in copulation. Some of the Malaise-traps used yielded large percentage of the total material: The trap at Hurum a total of 428 specimens in 1985, the trap at Hallanger 155 specimens, accounting for 47% and 16.9% of the total material respectively.

C. petronella was caught together with other *Micropezidae* species at the Håøya and Ostøya islands, Table 1. Specimens are often found on bushes and small trees bordering mostly decidiuos forest. Some have been netted on meadows, some bordering damp places, ditches, near lakes etc. For descriptions of habitats in sub-alpine areas see Greve, Solem and Bretten (1987).

Cnodacophora stylifera (Loew, 1870)

C. stylifera is hitherto not recorded from Norway. It was first published from Sweden by Ringdahl (1951) and according to Andersson (1989) Abisko in Torne Lappmark is still the only area of Fennoscandia and Denmark where this species has been found.

In our key *C. stylifera* is an alternative to the genus *Calobata* with *C. petronella.* Compared to that species, *stylifera* is smaller, bodylength 4.5—6 mm. The all over colour is very dark compared to *C. petronella,* the mesonotum is in most parts shining black with bands of silvery pruinosity. The males lack the appendages which *C. petronella* males have on the 3. and 4. sternites, and the hooks on the 5. sternites are longer than in *C. petronella.*

DISCUSSION

Andersson (1989) reports eight species from Sweden. Of these we found six species in the Norwegian material of *Micropezidae. Rainieria calceata* is a very rare species both in Sweden and Denmark with a southern distribution in Fennescandia and is therefore not to be expected in Norway, with a possible exception for the Oslofjord area. In Scandinavia *Cnodacophora stylifera* has been recorded from Abisko, Sweden only. Since Abisko is not too far from the Norwegian border this species can perhaps be present in Northern Norway. *Micropeza lateralis,* in Fennoscandia and Denmark only recorded from Denmark (Lyneborg, 1962), is not likely to be found up in Norway.

Out of the six species of *Micropezidae,* two are southern in their distribution, *Micropeza corrigiolata* found only in the south-east and *Neria ephippium* in southern Norway to around 60°N. The two *Compsobata* species are widely distribution in the country. However, *C. commutata* is represented in all the three northern province while *C. cibaria* has only been recorded once from Nordland. By far the most common and widespread species is *Calobata petronella.* It has been found as far north as 70° N and is also the only species found in the lower alpine zones. Single specimens have been found rarely up to around 1000 m a.s.l. in the Kongsvoll area, Dovre, (Greve, Solem & Bretten, 1987) and from similar altitudes on Hardangervidda. In subalpine birch forest, however, the species occurs more frequently. At 670 m a.s.l. at Voss, Mjølfjell, 40 specimens were caught in a Malaisetrap during the summer 1985.

Malaise-traps are clearly very efficient for collecting some Micropezidae species. *Calobata petronella* and *Compsobata cibaria* were commonly found in Malaise-traps while *Compsobata commutata* was more poorly represented. Two Malaise-traps alone collected a large percentage of the total *cibaria* material. 47% of the material of *C. petronella* was collected in one Malaise-trap at Tofte, Hurum.

For some of the species the material yields information on habitat selection. *M. corrigiolata* has mostly been collected in stands of common reed *Phragmites australis,* on one occasion in *Scirpus tabernaemontani,* another grass growing in damp places.

Compsobata cibaria, C. commutata and *Calobata petronella* have been collected from a wide variety of habitats, but *C. petronella* only has been found above the tree borderline, in the low alpine zone.

On a few occasions, some of the three species have been collected together. On Ostøya island, Bærum, three Malaise-traps were operated summer 1984 in three different habitats, see Greve & Midtgaard (1986). *Compsobata cibaria* was collected in all three traps A, B & C; *Calobata petronella* in B and *Compsobata commutata* in A and C. Traps A and B were placed in similar surroundings viz. open, decidious forest, C in a wet forest dominated by *Alnus glutinosa.* Table 1 shows the number of specimens collected here and

also the results from a fourth Malaise-trap operated in a rich decidous forest at Tofte, Hurum in 1985. The figures also illustrate the flight periods of the three species in southern Norway.

The material of *Compsobata commutata* from northern areas is small. The first date of observation is 20 June compared to 25 May in southern Norway. The latest observations are from August, compared to July in southern Norway. For *C. petronella* there is a similar delay of flight period, and also specimens caught in low alpine areas are flying in July/-August.

In the lowlands of southern Norway *Calobata petronella* and *Compsobata cibaria* occur in large populations in suitable areas, Table 1. *Compsobata commutata* is different in this respect. The highest number caught in one locality was eight specimens netted near the Kristianborg lake, Bergen. It rarely occurs in Malaise-traps, which collect large number of specimens of both *C. petronella* and *C. cibaria.*

Several pairs of *C. petronella* in copula were observed in Hauglandsdalen near Bergen on a dung of partly rotten grass. It should therefore be reason to believe that such substrate is suitable for eggs and larvae.

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REFERENCES

Andersson, H. 1989. Taxonomic notes on Fennoscandian Micropezidae (Diptera). *Notul. ent. 69,* 153—162.

Bidenkap, O. 1901. Foreløbig oversigt over de i det arktiske Norge hidtil bemærkede Diptera Brachycera. *Tromsø Mus. Aarsh. 19,* 147—150.

Brinck, 1949. Studies on Swedish stonesflies (Plecoptera). *Opusc. ent. Suppl. 11,* 250 pp.

Collin, J. L. 1945. British Micropezidae (Diptera). *Ent. rec. 57,* 115—119.

Fjellberg, A. 1972. Coleoptera from Hardangervidda. *Fauna of the Hardangervidda. 1,* Universitetsforlaget. Bergen - Oslo - Tromsø, 74 pp.

Greve, L. & F. Midtgaard, 1986. The Clusiidae (Diptera) from the islands Håøya and Ostøya in the Oslofjord and a survey of the family in Norway. *Fauna norv. Ser. B. 33,* 86—92.

Greve, L.; Solem, J. O. & Bretten, S. 1987. Bibionidae, Xylophagidae, Rhagionidae, Psilidae, Micropezidae, Clusiidae and Piophilidae (Diptera) from the Dovrefjell National Park, South Norway. *Fauna norv. Ser. B. 34,* 75—79.

Hackman, W. 1980. A check list of the Finnish Diptera II. Cyclorrhapha. *Notul. ent. 60,* 117—162.

Lobanov, A. M. 1960. Contribution to the biology and ecology of *Trepidaria petronella L. (Dipt. Tylidae). Zool. Zh. 39,* 888—892.

Lyneborg, L. 1962. Danske acalyptrate fluer. 1. *Ent. Meddr. 31.,* 249—264.

McAlpine, J. F. et al., 1981. *A manual of Nearctic Diptera 1,* 674 pp.

Merritt, R. W. & Peterson, B. W. 1976. A synopsis of Micropezidae (Diptera) of Canada and Alaska, with the descriptions of four new species. *Can. J. Zool. 54,* 1488—1506.

Ozerov, A. L. 1987. Dipterans of the subfamily Calobatinae (Diptera, Micropezidae) in the fauna of the USSR. (In russian). *Zool. Zh. 66,* 549—556.

Ringdahl, O. 1951. Flugor från Lapplands, Jämtlands och Härjedalens fjälltrakter (Diptera Brachycera). *Opusc. ent. 16,* 113—186.

- 1960. Flugfaunaen på Kullaberg och Hallands Väderö. *Kullabergs Natur 2,* 1—40.

Siebke, H. 1877. *Enumeratio Insectorum Norvegicorum. Fasciculum IV. Catalogum Dipterorum Continentem.* A. W. Brøgger, Christiania, 255 pp.

Soós, A. & Papp, L. 1984. *Catalogue of Palaearctic Diptera./Micropezidae - Agromyzidae. 9.* Akademiai Kiado, Budapest & Elsevier, Amsterdam-Oxford-New York-Tokyo, 460 pp.

Storm, V. 1891. Diptera brachycera quæ observavit determinavitque. *K. norske Vidensk. Selsk. Skr. 1891,* 283—313.

— 1907. Supplerende iakttagelser over Insecta Diptera ved Trondhjem. *K. norske Vidensk. Selsk. Skr. 1907 (5),* 1—11.

Strand, E. 1903. Norske lokaliteter for Diptera. *Christiania Vidensk. Selsk. Forh. 1900 (3),* 1—11.

Zetterstedt, J. W. 1838. *Insecta Lapponica. III,* Lipsiae, 485—868.

Økland, K. A. 1981. Inndeling av Norge til bruk ved biogeografiske oppgaver — et revidert Strand-system. *Fauna Oslo 34,* 167—178.

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Short communications

PHERBELLIA SCUTELLARIS (ROSER, 1840) (DIPTERA, SCIOMYZIDAE) NEW TO NORWAY

LITA GREVE

Pherbellia scutellaris (Roser, 1840) is reported for the first time from Norway. A male was netted on the SE part of the small island Ånuglo in the Hardangerfjord, Hordaland (HOY Tysnes) on 9 June 1990.

Lita Greve, Zoological Museum, University of Bergen, Muséplass 3, N-5007 Bergen, Norway.

A total of 83 species of Sciomyzidae, Diptera have hitherto been recorded from Fennoscandia and Denmark. *Pherbellia scutellaris* (Roser, 1840) belongs to the subfamily Sciomyzinae. The genus *Pherbellia* numbers twentytwo species in Fennoscandia and Denmark. This number, however, represents only a fraction of the total number of species in the genus *Pherbellia* which is recorded from every zoogeographic region. Hitherto thirteen *Pherbellia* species have been recorded from Norway.

On 9. June 1990 one male *Pherbellia scutellaris* was netted on the small island Ånuglo which is situated in the outer parts of the Hardangerfjord. The island consists of metamorphosed sedimentary rocks with phyllite. Thus Ånuglo has a rich flora with elements which in Norway are only found in the outer parts of western Norway. The locality can be described as a deciduous forest with some *Pinus silvestris* and is situated on the SE part of the island near to Vedavika. *P. scutellaris* is the 52.th species of Sciomyzidae recorded from Norway.

According to Rozkošný (1984) *P. scutellaris* has earlier often been confused with other *Pherbellia* species, among the Fennoscandian and Danish species *P. rozkosnyi* Verbeke, 1967 and *P. sordida* (Hendel, 1902). Knutson & Berg (1971) refer to *P. scutellaris,* but their material is *P. rozkosnyi* (Rozkošný, 1984).

P. sordida has hitherto not been recorded from Norway. In Fennoscandia and Denmark this species is recorded only from the south. *P. sordida* has, however, been recorded from Arkhangelsk according to Rozkošný (1984).

P. rozkosnyi was reported new to Norway (Greve & Rozkošný, 1981) from HOI. Rozkosný (1984) reports it from AK, BV and HOI including the material mentioned by Knutson & Berg (1971). Greve & Økland (1989) include material from HOY. New material of *P. rozkosnyi* in Zoological Museum, University of Bergen: HES Ringsaker, Helgøya, Eiksåsen EIS Sept. 1990 3 males; HOY Os, Gåssand, Raudli EIS 31 12—26 July 1990 1 male, 23 August—6 Sept. 1990 1 male; NTI Stjørdal, Vikan EIS 92 28 June—14 July 1990 1 male, 14 July—20 August 1990 7 males. All material was collected in Malaise-traps. Only *P. rozkosnyi* males are recorded here since females cannot be determined with certainty.

Judged from the number of records of *P. rozkosnyi* this species seems not to be very rare in Norway, while the nearest record of *P. scutellaris* is in Skåne, southernmost Sweden. *P. scutellaris* is also known from Scotland.

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REFERENCES

Greve, L. & Rozkošný, R. 1981. Three species of Sciomyzidae (Dipt.) new to Norway, with a note on *Ectinocera borealis* Zetterstedt 1838. *Fauna norv. Ser. B. 28,* 100—101.

Greve, L. & Økland, B. 1989. New records of Norwegian Sciomyzidae (Diptera). *Fauna norv. Ser. B. 36,* 133—137.

Knutson, L. V. & Berg., C. O. 1971. The malacophagous flies of Norway (Diptera, Sciomyzidae). *Norsk ent. Tidsskr. 18,* 119—124.

Rozkošný, R. 1984. The Sciomyzidae (Diptera) of Fennoscandia and Denmark. *Fauna ent. Scand. 14,* 1—224.

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MORDELLISTENULA PERRISI (MULSANT, 1856) (COL., MORDELLIDAE) NY ART FOR NORGE

STIG OTTO HANSEN

Mordellistenula perrisi (Mulsant. 1856) (Mordellidae) is reported new to Norway from Laget, Tvedestrand,; Aust-Agder county (AAY), EIS 11 (Lindroth C. H. (ed) 1960) (Silverberg H. 1979). One specimen was collected on a flower June 16th 1987.

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Under slaghoving etter biller fant jeg 16. juni 1987 et eksemplar av *Mordellistenula perrisi* på blomst. Eksemplaret ble funnet i vestvendt, tørr skråning.

Arten er kjent fra Syd-Sverige (SK., BL., SM., ØL., og GOTL.) og Danmark (J, Ø.), hvor den blir funnet på solrike, varme, tørre biotoper gjerne der hvor det er gruset eller sandet jordsmonn på blomster. Særlig Jasion montane og Hieracium er atraktive for denne blomstersøkende arten (Hansen V. 1973).

LITTERATUR

Hansen, V. 1973. Biller XII. Heteromerer. Danmarks Fauna 50, -I-307.

Lindroth, C. H. (ed) 1960. Catalogus Coleopteroum. Fennoscandiae et Daniae. Entomologiska Sallskapet, Lund.

Silverberg, H. (Red.Cur) 1979. Enumeratio Coleopterorum Fennoscandae et Daniae. Helsingfors Entomologiska Bytesförening, Helsingfor.

DREPANA CULTRARIA (FABRICIUS, 1775) (LEP., DREPANIDAE) A NEW AND PROBABLY THREATENED HOOK TIP IN NORWAY

LARS OVE HANSEN & ANDERS DAHL

Hansen, L. O. & Dahl, A. 1991. *Drepana cultraria* (Fabricius, 1775) (Lep., Drepanidae) a new and probably threatened Hook-tip in Norway. *Fauna norv. Ser. B. 38:* xx—xx.

The Barred Hook-tip *Drepana cultraria* is reported new to Norway. One male was captured in a light trap at Gokstad, Sandefjord, Vestfold (VE), 25 July 1989 (EIS 19). Remarks on ecology and distribution are given. Considering the small amount of old and dense oak and beech forest left in Norway, together with the fact that *D. cultraria* has its northernmost distribution here, the species must be considered as threatened in Norway.

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One male of the Barred Hook-tip (*Drepana cultraria)* was captured in a light trap at Gokstad, Sandefjord, Vestfold (VE), EIS 19, 25 July 1989 (Leg.: Anders Dahl). The species has not previously been recorded in Norway, and the total number of Norwegian hook tips (Drepaninae) is now seven.

The light trap was operated in an area with quite dense and old oak forest (*Quercus* sp.), but beech (*Fagus sylvatica*) is also present in the area. Skou (1984) mentions only beech as larval foodplant, but it is most likely that other deciduous trees, as oak, are accepted. The data of capture may indicate that the species is bivoltine in Norway, as in Denmark and Sweden (Skou 1984), with one flight period from the middle of May to the middle of June and a second flight period from the end of July to the end of August.

Svensson et al. (1987) report *D. cultraria* from seven south-Swedish regions, northernmost Bohuslän (Bo) and Dalsland (Ds). The Norwegian record is at the same latitude as the northernmost Swedish records. In Denmark *D. cultraria* is recorded from all regions (Schnack 1985), but it seems to be absent from Finland and the Baltic countries. Furthermore it is recorded from Poland, Germany, The Netherlands and Gr.Britain, but not Eire (Skou 1984). This indicates a southerly distribution, forming its northern range in Norway and Sweden.

D. cultraria is not known to migrate, so the species must be considered as resident in the area. Considering the small amount of old and dense oak and beech forest left in Norway, together with the fact that *D. cultraria* has its northernmost extension here, the species must be considered as threatened in Norway until further notice.

ACKNOWLEDGEMENTS

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REFERENCES

Skou, P. 1984. Nordens Målere. *Danmarks Dyreliv Bind 2.* Copenhagen. 332 pp.

Schnack, K. 1985. Catalogue of the Lepidoptera of Denmark. *Ent. Meddl. 52 (2/3).* Copenhagen. 163 pp.

Svensson, L., Elmquist, H., Gustafsson, B. (ed.), Hellberg, H., Imby, L. & Palmqvist, G. 1987. *Kodlista L1. Catalogus Lepidopterorum Sueciae.* Stockholm.

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EUOPHRYS AEQUIPES (O. P. CAMBRIDGE, 1871) (ARANEAE, SALTICIDAE) NEW TO NORWAY

ELIN ALVSEIKE

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One male of *Euophrys aequipes* (O. P. Cambridge, 1871) was taken in southwestern Norway, RY: Sola, Vigdel, in a pitfall trap June 8—24, 1990. The outer parts of Vigdel are sand dunes with *Ammophila arenaria* and *Elymus arenarius*. The inner area is covered with mixed and very low vegetation. The specimen was taken in this duneheath on a sun-exposed slope dominated by lichens and *Empetrum nigrum*.

The species is widespread in Europe (Jones 1983). In western areas it is known from England north to Westmoorland, more common in the south than in the north, and from a few areas in Scotland (Locket & Millidge 1951, Jones 1983). In Sweden it is reported from the southern counties from Västergötland north to Uppland, as well as from the islands of Öland and Gotland (Tullgren 1946, Almquist 1973). In Denmark it has been recorded from a few coastal areas of Jutland and Zealand, but it is obviously rather uncommon (Brændegård 1966). According to Palmgren (1943), a few specimen has been taken in southern parts of Finland, north to Riistina. The habitat of *Euophrys aequipes* is sun exposed or sandy places (Locket & Millidge 1951).

REFERENCES

Almquist, S. 1973. Spider associations in coastal sand dunes. *Oikos 24 p.* 444—457.

Brændegård, J. 1966. Edderkopper eller spindlere II (Sparassidae, Philodromidae, Thomisidae, Salticidae, Oxyopidae). *Danmarks fauna 80,* 1—231 pp.

Jones, D. 1983. *A guide to spiders of Britain and Northern Europe.* The Hamlyn Publishing Group Ltd. London. 320 pp.

Locket, G. H. and Millidge, A. F. 1951. *British Spiders vol. 1* Ray Society, London, 310 pp.

Palmgren, P. 1943. Pisauridae, Oxyopidae, Salticidae, Clubionidae, Anyphaenidae, Sparassidae, Ctenidae, Drassidae. *Die Spinnenfauna Finnlands II,* 112 pp.

Tullgren, A. 1944. Salticidae, Thomisidae, Philodromidae, och Eusparassidae. *svensk Spindelfauna 3. Fam. 5–7.* Entomologiska Föreningen, Stockholm. 136 pp.

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Book reviews

ØKLAND, JAN, 1990.: Lakes and Snails; Environment and Gastropoda in 1500 Norwegian lakes, ponds and rivers. Innbundet 516 pp., 316 figurer og 102 tabeller. Universal book services/dr. W. Backhuys. Oegstgeest, The Netherlands. Pris: Gld. 180.-/US dollar 95.-. ISBN 90-73348-02-1.

Det er kommet et praktverk om sjøer og deres sneglefauna i Norge. Hva har så et verk som behandler snegler noe i et entomologisk tidsskrift å gjøre? Til dette er å svare at boken inneholder så mange opplysninger som også en ferskvannsentomolog vil ha nytte av at det på den bakgrunn er helt relevant at boken blir omtalt i Fauna norv. Ser. B.

Monografien, for det er en monografi, er skrevet på engelsk og er inndelt i 14 kapitler; 1. Introduction, 2. Principles and methods, 3. Material, 4. Freshwater environment of Norway, 5. Relationships among main environmental parameters, 6. Snails in fresh water - a species approach, 7. Environment and species, 8. The snail fauna in lakes, ponds and other surface water types, 9. The snail fauna in different lake environments, 10. Lake types and snails - a study in cluster analyses, 11. Geographical distribution of freshwater snails in Norway, 12 General overview and discussion, 13. Summary and conclusions, 14. Primary Tables. Det er en overveldende informasjonsmengde som presenteres med data fra over 1000 norske innsjøer. Her er regionale forhold om geologi, klima, akvatisk makrovegetasjon, substrat, bølgenes påvirkning, pH, kalsium, magnesium, spesifikk ledningsevne, vannfarge og turbiditet, omtalt. Forsuring av vassdrag er også diskutert. Selv om det er sneglene alle de målte faktorer er sett i relasjon til, så har informasjonen i miljøkapitlene interesse for alle som arbeider i ferskvann. Det er samlet så mye grunnleggende data om norske vassdrag at monografien er et monument i ferskvannslitteraturen, og jeg anbefaler den til alle ferskvannsbiologer for å hente data/informasjon til undervisning og forskning.

John O. Solem

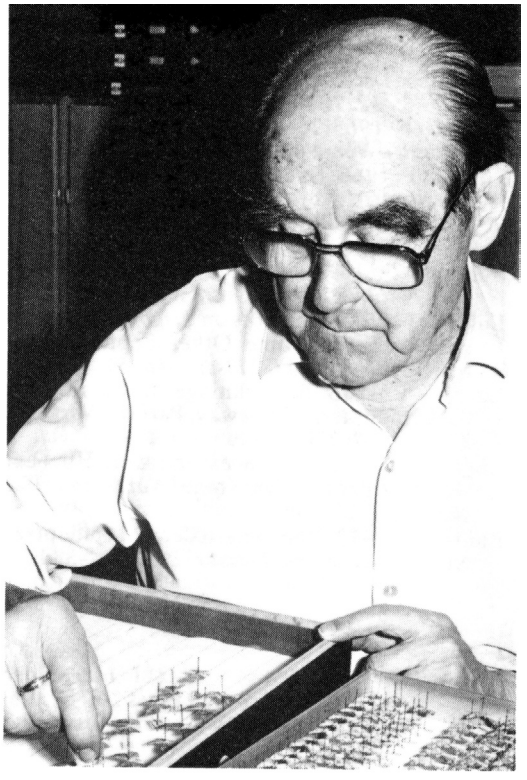
Carl Fredrik Lühr til minne

Carl Fredrik Lühr, æresmedlem av Norsk entomologisk forening fra 1979, er gått bort i en alder av 90 år. Han var en fargerik person, et godt menneske, entusiastisk, med sterke meninger og en person jeg var heldig å få kjenne. Han gjorde sterke inntrykk på medmennesker.

Entomologien kom han i kontakt med som 14-åring. Han var Oslogutt, men under et sommeropphold på Nesodden traff han den klassiske lepidopterolog Kari Haanshuus, og interessen for sommerfuglene ble vekt. Eksemplarer fra hans sommerfuglfangst på Nesodden i ungdomsårene sitter fremdeles i hans samling. Han meldte seg inn i Norsk entomologisk forening i 1922 og var medlem nr. 36.

Men entomologien måtte vike for andre interesser da Carl Fredrik Lühr i tyveårene reiste til Trondheim for å studere ved NTH. Han ble maskiningeniør i 1926, og var frem til det siste med i styre og stell i NTH's idrettslag og hyttekomité. Favorittsporten var en lang stund israce med automobil, en sport som aldri slapp ham. Etter studiene var Carl Fredrik Lühr i rutebilbransjen, i Troms, Oslo og til slutt som disponent ved Ottadalen kommunale billag, til han trakk seg i begynnelsen av 1970-årene. Carl Fredrik Lühr var i flere år borte fra entomologien, men i forbindelse med det 9. Nordiske Entomologmøte i Oslo i 1952, ble det organisert ekskursjon til hans distrikt, og interessen for sommerfuglene våknet på nytt. Siden da fikk entomologien en større og større plass som den kjære hobby den ble. Minst 50 000 sommerfugler havnet i hans rikholdige samling, hvor bare et dusin arter av «macros» manglet på en komplett Norgessamling. Samlingen er nå flyttet til Vitenskapsmuseet i Trondheim, og utgjør hovedstammen i sommerfuglsamlingen. Han hadde en forkjærlighet for nordnorske arter, og særlig Grønnåsen ved Gargia, Alta, var en avholdt lokalitet. Denne lokaliteten eller området arbeidet han for å få fredet.

Som den utadvendte person han var, hadde han en stor kontaktflate, både innenlands og utenlands. Carl Fredrik Lühr var styremedlem i Norsk entomologisk forening i 1959—1960 og kasserer i 1960 til 1966. Som tillitsmann i NEF i en mer «lukket» periode enn nå, tok han åpent og hjertelig i mot nye medlemmer. Carl Fredrik Lühr var også med på å



starte den europeiske sommerfuglforeningen «Societa Europaea Lepidopterologica» i 1976, og har deltatt på de fleste møter der, flere ganger som eneste nordmann. Han var en «institusjon» i Norsk entomologisk forening, med stor og ærlig entusiasme for sine hobbies, sommerfugler og frimerker.

Jeg lyser fred over Carl Fredrik Lühr's minne.

Litteraturliste

Lühr, C. F. 1959. En for Norge ny Geometridae (Lepidoptera). *Norsk ent. Tidsskr. 11:* 22..

Lühr, C. F. 1960. Fortegnelse over Macrolepidoptera fanget i Lom herred (On). *Norsk ent. Tidsskr. 11:* 112—116.

Lühr, C. F. 1960. *Archanara spaganii* Esp. (Lepidoptera, Noctuidae) ny for Norge. *Norsk ent. Tidsskr. 11:* 111.

Lühr, C. F. 1961. *Actebia fennica* Tausch. funnet igjen i Norge (Lepidoptera, Noctuidae). *Norsk ent. Tidsskr. 11:* 269.
Lühr. C. F. 1962. Tillegg til fortegnelse over Macrolepidoptera fanget i Lom herred (On). *Norsk ent. Tidsskr. 12:* 40.
Lühr, C. F. 1963. *Amphipyra lithoxyiea* F. ny for Norge (Lepidoptera, Noctuidae). *Norsk ent. Tidsskr. 12:* 126—127.
Lühr, C. F. 1965. Nye funn og finnesteder (Lepidoptera). *Norsk ent. Tidsskr. 12:* 100.
Lühr, C. F. 1966. Nye finnesteder for Noctuoidea. *Norsk ent. Tidsskr. 13:* 424.
Lühr, C. F. 1968. Nye funn av Lepidoptera i Norge. *Norsk ent. Tidsskr. 15:* 60.
Lühr, C. F. 1070. Nye funn av Lepidoptera i Norge. *Norsk ent. Tidsskr. 17:* 123—124.
Lühr, C. F. 1971. Remarks on *Trigonophora meticulosa* L. and Some Other Lepidoptera in Norway. *Norsk ent. Tidsskr. 18:* 51.
Lühr, C. F. 1973. Bemerkninger til Catalogue of the Lepidoptera of Norway, Part III. *Norsk ent. Tidsskr. 20:* 270—271.
Lühr, C. F. 1973. *Eupithecia irriguata* Hb. (Lep. Geometridae) ny for Norge. *Norsk ent. Tidsskr. 20:* 335—336.
Lühr, C. F. 1973. Nye finnesteder av Lepidoptera i Norge. *Norsk ent. Tidsskr. 20:* 333—334.
Lühr, C. F. 1975. Nye funn av Lepidoptera. *Norsk ent. Tidsskr. 22:* 164—165.
Lühr, C. F. 1976. Nye funn av Lepidoptera. *Norsk ent. Tidsskr. 23:* 205.
Lühr, C. F. 1980. Fra Societas Europaea Lepidopteralogica's kongress. *Insekt-nytt 5* (2): 34—35.
Lühr, C. F. 1981. *Anaitis efformata* Gn. ny for Norge. *Atalanta Norvegica 3:* 173—174.
Lühr, C. F. 1982. *Polia furca colletti* Sparre Schneider, en likeså vakker som sjelden norsk noctuide. *Lepidoptera 4* (3): 80.
Lühr, C. F. 1982. *Polis furca colletti* Sp. Sch. (Lepidoptera, fam. Noctuidae). *Insekt-Nytt 7* (3): 16—17.
Lühr, C. F. 1986. *Plebejus idas* L. ab. *juncta* Tutt. *Insekt-Nytt 11* (3): 12.
Lühr, C. F. 1986. Gynandromorph *Colias hecla* Lef. ssp. *Sulitelma* Aur. *Insekt-Nytt 11* (4): 5.
Lühr, C. F. & Hegvik, H. 1977. Macrolepidoptera fra en reise i Nord-Norge i august 1977. *Atalanta Norvegica 3:* 50—52.

John O. Solem

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