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Carabidae and Staphylinidae (Col.) in swede and cauliflower fields in south-eastern Norway

ARILD ANDERSEN

Andersen. A. Carabidae and Staphylinidae (Col.) in swede and cauliflower fields in south-eastern Norway. *Fauna norv. Ser. B. 29,* 49—61.

During May—Oct. 1975—81 about 20 000 carabids and 48 000 staphylinids were caught in 12 swede and cauliflower fields at Jeløy (sand and gravel, moraine), Ås (clay) and Ski (clayish moraine). Carabids were most numerous in May—June (spring breeders) and Aug. (autumn breeders), while staphylinids were most numerous in May—July. The activity density for each species caught in each field is given, as well as the time for its maximum activity.

The three localities had a quite similar fauna, the Sørensen index of similarity for carabids being 44 for Jeløy—Ski, 62 for Jeløy—Ås and 86 for Ås—Ski. Among the 10 most numerous carabid species at each of the three localities, the following six were in common: *Bembidion lampros* (Herbst), *Calathus melanocephalus* (L.), *Bembidion quadrimaculatum* (L.), *Trechus quadristriatus* (Schrank), *Harpalus rufipes* (Degeer) and *Clivina fossor* (L.). The same holds for the following seven staphylinid species: *Aloconota gregaria* (Erichson), *Amischa analis* (Gravenhorst), *Aleochara bipustulata* (L.,), *Atheta fungi* (Gravenhorst), *Anotylus rugosus* (Fabricius), *Tachyporus hypnorum* (Fabricius) and *T. chrysomelinus* (L.).

The eight most numerous carabid and staphylinid species are discussed separately. Their seasonal changes during May—October are given in histograms and comments are given on their reproduction cyclus.

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INTRODUCTION

The carabids of common European crops have been quite thoroughly investigated (Thiele 1977). This is mainly due to their value as predators of several pest species. The staphylinids are less investigated, both because of their difficult taxonomy and because their importance as predators may be more doubtful (Geiler 1959/60, Pietraszko & Clercq 1978, Topp & Trittelvitz 1980).

The purpose of the present investigation was to collect information about the fauna of these beetles in some Norwegian fields as this was not previously done. It is part of a project evaluating the importance of the natural enemies of the turnip root fly *Delia floralis* (Fallén), a serious pest in several cruciferous crops.

Parts of the fields were treated with different insecticides. A discussion of the effects of the insecticide treatments on the beetles will, however, be given in a separate article.

LOCALITIES

The fields were located at Jeløy (near Moss) in Østfold county and Ås and Ski in Akershus county, all areas lying 25—50 km south of Oslo. The trapping was done at Jeløy in 1975—81 (except in 1977), at Ås in 1978—81 and at Ski in 1979—80.

At Jeløy the soil consisted of sand and gravel (moraine). This farm was situated close to the sea and the experimental field was each year a 0.6 ha swede field surrounded by potatoes, barley, meadow, gravel roads and mixed forests. Weeds were removed mechanically and by hand in June, but some occurred in late summer, especially *Stellaria media* (L.) and *Chenopodium album* L. The experimental fields, one each year, were situated in different parts of the farm, not more than 500 meters apart, the previous crop being either barley or meadow (not treated with insecticides). From 1978 on, the area was irrigated. Most of the field was treated with granules of either trichloronate, isofenphos or chlorfenvinphos at sowing in late May against root flies, but a small part of about 400 m^2 each year was kept untreated. This farm by the sea had a yearly mean temperature of 6.8°C, 1.3° higher than the other two localities, lying about 10 km in from the sea.

At Ås the soil consisted of clay. The experimental field was each year a 4 ha swede field surrounded by meadow, turnips, roads and

spruce forest. Weeds were removed mechanically and by hand in June, but in late summer, especially cruciferous weeds, *Elytrigia repens* (L.) and *Matricaria inodora* L. were abundant. As at Jeløy the experimental fields, one each year, were situated in different parts of the farm not more than 500 meters apart, except for the field in 1981, which was 1500 meters away from the other three. The previous crops had always been 2 years of meadow not treated with insecticides. Manure was used all years and at least one forth of the field was treated with granules of isofenphos or chlorfenvinphos at sowing in May against root flies. In addition fenitrothion was sprayed against flea beetles in May 1978 and 1979.

At Ski the soil consisted of clayish moraine. This experimental field was a 3 ha cauliflower field surrounded by barley, gravel roads and mixed forest. It was irrigated, and very little weeds occurred because of herbicide treatment. Half the field was sprayed with permethrin and half with bromophos against caterpillars, and in addition some parts along the edge were sprayed with fenitrothion against bugs. The soil used for growing the seedlings had been treated with isofenphos against root flies. The field had been used for cauliflower several years with heavy use of insecticides.

MATERIAL AND METHODS

Pitfall traps were used, consisting of two 95 mm deep plastic cups one inside the other and with an upper diameter of 66 mm. The cups were dug flush with the soil in a plant row and the inner cup was equipped with a handle. The trap was filled with 4% formalin and a little liquid detergent and protected from rain and birds by a 10 x 10 cm huntonite plate about 5 cm above the ground, supported by wire hoops. They were put up in early May to early June and taken down late Aug. to early Oct. About once a week the traps were emptied, and then only the inner cup was removed, leaving the other one to keep the soil in place. The number of traps varied between the fields, but normally about 50 were used per field. Traps were put up in straight lines, 5—25 meters apart, depending upon the size of the field, The trapping period in each of the 12 fields is shown in Fig. 1.

Pitfall traps measure activity density. It is dependent not only on the population density of a species, but also on its activity (Thiele 1977). In the present article mean number of specimens per 100 trap days during the trapping period is used to measure this activity density, trap days being the number of traps used multiplied by the number of days of capture. There are problems in comparing the activity density between fields and species because several factors varied, such as distance between the traps. Traps standing close together will overlap in their effective «catching-area», and thus catch less than traps farther apart. Since the trapping periods varied, this will also influence the catch of each species, especially those with maximum activity early or late in the year, as a varying part of its activity peak will fall inside the trapping period. I still find the mean number of specimens per 100 trap days the most useful tool to compare the activity density of the different species between fields and areas.

The total material consists of 20431 carabids of at least 74 species and 48373 staphylinids of at least 133 species. The nomenclature follows Silfverberg (1979), with names used in Lindroth (1960) with later corrections by Strand (1970 and 1977) in brackets. In 1975 and 1976 most of the *Atheta*- and *Oxypoda*-material was classified to species, later on this was done only with

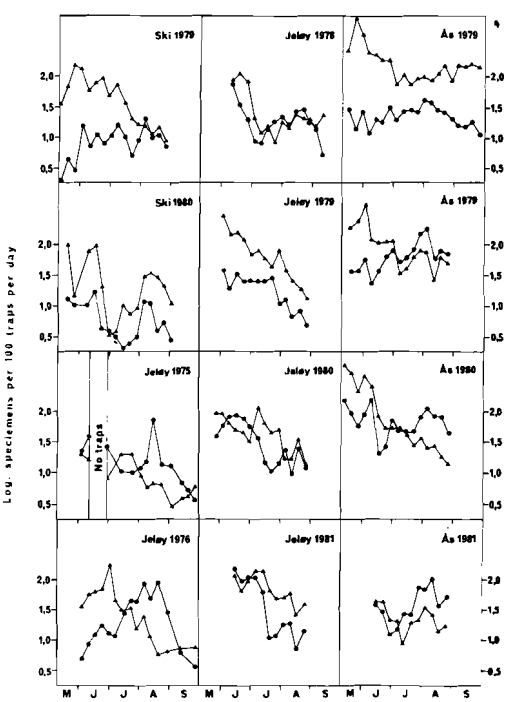

Fig. 1. Total activity density for carabids (●) and staphylinids (▲) in each of the 12 fields.

Table 1. Mean activity density, given in specimens per 100 trap days for carabids caught at Jeløy, Ås and Ski 1975—1981 togheter with their activity months. r ⩾ 0.1 specimens per 100 trap days. roman numbers = probably reproduction activity.
Latin numbers = trapping months.

	JELØY						ÅS				SKI		Activity
Species	1975	1976	1978	1979	1980	1981	1978	1979	1980	1981	1979	1980	months
Acupalpus meridianus (L.)	r												6
Agonum assimile (Paykull)					0.5	0.1							7-8
A. dorsale (Pontoppidan)	r			0.9	10.5	14.2							VI-VII
A. muelleri (Herbst)				r	r		0.1	r	r	0.1		r	V-VI
Amara aenea (Degeer)			r										6,8
A. apricaria (Paykull)	r	0.2	r	0.2	0.3	r	2.2	0.9	0.2	0.1	r	r	5-9
A. aulica (Panzer)	r	r	r		r		r	r	r	r	r	r	VII-VIII
A. bifrons (Gyllenhal)	0.5	3.0	1.1	0.5	r	0.2	1.2	2.2	5.0	0.5		r	VII-VIII
A. brunnea (Gyllenhal)		r											6
A. communis (Panzer)		r											6-7
A. consularis (Duftschmid)	r	r		r	r								6-9
A. eurynota (Panzer)	0.1	r		0.1			0.3	r			r		6-9
A. familiaris (Duftschmid)	r	r					r						5-9
A. fulva (Degeer)	0.6	0.3	0.1	1.5	r								VII-VIII
A. lunicollis Schiødte		r											6-7
A. municipalis (Duftschmid)							r						9
A. plebeja (Gyllenhal)		r	0.4		r	0.1	r	r		0.3			VI
A. praetermissa (Sahlberg)		r											7
A. sp.	r	r	0.2			r	r	r	r		r	r	-
Anisodactylus binotatus (Fabricius)											r		6
Asaphidion flavipes (L.)									r			r	5
Badister bullatus (Schrank) (=bipustulatus Fabricius)	r	r			r			r				r	5-7
Bembidion aeneum Germar							0.2	0.2	r		r	r	V
B. bruxellense Wesmaël							r				r		5-6
B. guttula (Fabricius)					0.1		2.1	3.7	1.2	r	r	r	V-VI
B. lampros (Herbst)	8.7	0.4	7.2	7.8	15.8	30.6	3.1	8.1	29.4	4.4	1.6	1.1	V-VI
B. properans (Stephens)												r	5
B. quadrimaculatum (L.)	0.3	0.2	1.7	2.2	0.7	1.2	4.8	7.3	7.5	0.3	0.4	1.3	V-VII
B. tetracolum Say	r												6
Calathus ambiguus (Paykull)		r											7
C. erratus (Sahlberg)	r	0.2	r	0.6	r				r	r	r	0.1	VII-VIII
C. fuscipes (Goeze)					r			r	r	r	r		7-8
C. melanocephalus (L.)	2.7	19.4	7.4	1.9	2.9	1.4	4.3	8.4	9.5	5.6	r	0.4	VII-VIII
C. micropterus (Duftschmid)	r					r				r		r	6-7
Carabus hortensis L.	0.4	r	0.4	r	r		r	r	r				8-9
C. nemoralis Müller		r	r		0.4				0.1			r	5-8
C. violaceus L.												r	7
Clivina fossor (L.)	0.7	0.6	0.1	1.3	3.5	2.4	2.9	2.0	1.9	0.4	0.1	0.2	V-VI
Cychrus caraboides (L.)					r								8
Cymindis macularis Fisher v. Waldheim				r									7
Dromius quadrimaculatus (L.)						r							8
D. notatus Stephens		r			r								7,9
Dyschirius globosus (Herbst)	0.1	r									r	r	5-6
Elaphrus riparius (L.)												r	5
Harpalus affinis (Schrank)	0.1	r	r	0.6	r	r	0.4	0.7	1.1	0.4	r	r	5-9
H. latus (L.)		r						r			r	r	5-7
H. quadripunctatus Dejean	r	r	r	r	r			r			r	r	6-8
H. rufibarbis (Fabricius) (=seladon Schauberger)	r	r	r		r		r	r					6-7
H. rufipes (Degeer)	1.1	1.7	2.6	1.3	0.6	1.7	2.7	1.9	2.4	1.1	0.4	0.2	VI-VIII
H. smaragdinus (Duftschmid)			r										6
H. tardus (Panzer)	r	r		0.1									6-7
Lebia chlorocephala Hoffmannsegg					r						r		6
Leistus ferrugineus (L.)	r												9
Loricera pilicornis (Fabricius)			r		0.3	1.2			0.4	0.6		r	6-8
Nebria brevicollis (Fabricius)			r										8
Notiophilus aesthuans Motschulsky				r									8
N. aquaticus (L.)	r		r										7-9
N. biguttatus (Fabricius)											r		7
N. germinyi Fauvel				r					r				7
Patrobus atrofus (Strøm)				r	r		r	r	0.3	r	r	0.1	VII-VIII
Pterostichus cupreus (L.)					r		r		r	r		r	V-VI
P. melanarius (Illiger)	r	0.3	r	r	r		1.1	24.9	7.1	15.2	1.2	0.6	VII-VIII
P. niger (Schaller)	r	r	0.2	0.4	1.5	0.9	0.1	2.1	2.0	1.8	r	0.4	VIII
P. nigrita (Paykull)			r										6
P. oblongopunctatus (Fabricius)					r						r	r	5-7
P. strenuus (Panzer)	r				r		r				r		5-6,9
P. versicolor (Sturm)								r					5
Syntomus (Metabletus) truncatellus (L.)		r		r				r				r	6-8
Synuchus vivalis (Illiger) (=nivalis Panzer)	0.2	r	r		0.1	0.5	r	0.3	0.6	5.5		r	VII-VIII
Tachys bisulcatus (Nicolai)							r						5
Trechus discus (Fabricius)							0.1	0.1	0.5		0.3	0.1	VII-VIII
T. micros (Herbst)	r	r					0.1	0.6	0.2	0.6	r	r	VI-VII
T. quadristriatus (Schrank)	r	r	0.9	r	0.2	0.2	3.5	8.3	1.6	1.4	5.4	1.3	VII-IX
T. secalis (Paykull)		r	r			0.1	0.4	0.9	2.6	5.2	0.1	0.2	VIII
Number of specimens	1697	2776	1012	540	1129	767	2701	3686	3989	1027	609	498	
" " species	33	37	28	25	35	19	31	30	29	24	30	37	
" " trapdays	10530	10206	4410	2670	2940	1386	8960	5088	5424	2340	5910	7284	
HS Shannon-index	1.71	1.23	1.89	2.18	1.81	1.42	2.50	2.18	2.11	2.11	1.71	2.58	

Table 2. Mean activity density, given in specimens per 100 trap days for staphylinids caught at Jeløy, Ås and Ski 1975—1981 together with their activity months. r ⩽ 0.1 secimens per 100 trap days. Roman number = maximum, probably reproduction activity.
Latin numbers = trapping months.

	JELØY						ÅS				SKI		Activity
Species	1975	1976	1978	1979	1980	1981	1978	1979	1980	1981	1979	1980	months
Acidota crenata (Fabricius)					r				r	r		0.2	5-8
Acrotona (Atheta) aterrima (Gravenhorst)	r	r	r	0.3	0.1	0.5	0.9	0.3	0.3	0.1	0.2	r	V
A. (A.) sordida (Marsham)							0.4	r					V-VI
Aleochara bilineata Gyllenhal	1.6	2.7	0.1	0.3	r	1.3	1.6	0.4	0.3	r	r	r	5-9
A. bipustulata (L.)	1.2	3.5	2.9	35.5	0.6	0,2	9.6	2.0	1.9		2.0	0.9	V-VI
A. brevipennis Gravenhorst		r	r	r	0.3	r	0.5	1.4	0.9		r	0.1	V-VI
A. curtula (Goeze)		r			r								7,9
A. spadicea (Erichson)					0.1		0.3	r					5-9
A. verna Say	0.4	0.3	r			r	r						VI-VII
A. sp.			0.1				r						-
Aleocharinae spp.	r	r	0.5	0.9	1.2	3.6	1.1	0.6	0.5	r	0.6	1.2	-
Aloconota (Atheta) gregaria (Erichson)	1.2	1.0	3.5	5.4	10.1	25.6	90.7	33.7	50.9	3.6	6.6	2.8	V-VI
Amischa analis (Gravenhorst)	2.5	6.3	13.9	15.5	9.4	8.4	38.6	23.3	16.9	0.4	25.2	5.8	V-VI
Anotylus (Oxytelus) nitidulus (Gravenhorst)							r						6
A. (O.) ruqosus (Fabricius)	0.6	0.6	0.4	1.6	3.9	5.3	9.2	4.2	6.7	3.8	2.7	6.2	V-VI
A. (O.) tetracarinatus (Block)			r				r						5,7
Anthophagus omalinus Zetterstedt							r					r	7-8
Arpedium quadrum (Gravenhorst)	r	r	0.3		r		3.4	0.4	0.4		0.4	r	V(+IX?)
Atheta amicula (Stephens)	r												7
A. brunnea (Fabricius)		r		r			r	r	0.1				5-7
A. celata (Erichson)	r												7
A. elongatula (Gravenhorst)		r											6-7
A. fungi (Gravenhorst)	0.8	0.9	5.6	9.9	6.1	12.0	1.8	4.9	7.9	6.8	2.3	5.6	VII-VIII
A. laticollis (Stephens)	0.1	r	0.1		1.2	1.6			r	r		r	VII-VIII
A. macrocera (Thomson)	r	r											6-7
A. palustris (Kiesenwetter)	0.3	0.4											VII
A. trinotata (Kraatz)	r												6
Autalia puncticollis Sharp						r							8
A. rivularis (Gravenhorst)			r										8
Atrecus (Baptolinus) longiceps (Fauvel)					r								7
Cordalia obscura (Gravenhorst)		r											6
Carpelimus (Trogophloeus) sp.					r		r						-
Callicerus obscurus										r			6
Deliphrum tectum (Paykull)	r						r						9
Dinaraea (Atheta) angustula (Gyllenhal)	r	r	0.2	0.5	0.7	0.2	5.7	18.0	25.5	0.4	r	r	V-VI
Dinothenarus (Staphylinus) pubescens (Gegeer)							r						5
Drusilla (Astilbus) canaliculata (Fabricius)		r			0.2		r	0.2	r	r	r	r	VI
Falagria caesa Erichson (sulcata Paykull)				r			r						5,7-8
Gabrius pennatus Sharp ♂				r	0.2	0.3	r	r	r		r		V-VI
G. trossulus (Nordmann) ♂							r				r		5-6
G. velox Sharp ♂				0.1	r	r	0.4	0.3	0.5	r	r	r	V-VI
G. pennatus/trossulus/velox ♀	r		r	0.1	0.2	0.3	0.3	r	0.2		r		-
G. sp.												r	-
Geostiba (Sipalia) circellaris (Gravenhorst)	r	r			0.4	0.2	r	1.3	r	0.2		r	V-VI
Gnypeta ripicola (Kiesenwetter)											r		7
Gyrohypnus angustatus Stephens	r	0.4	r		0.6		0.2	1.1	0.8	r	r	r	V-VI
G. atratus (Heer)							r						5-7
G. fracticornis (Müller)	r												8-9
G. sp.			r		r								-
Heterothops quadripunctulus (Gravenhorst)	r	r		r	0.5	0.1		0.2	0.4			r	V-VI
Ilyobates subopacus Palm							r	r			r		6-7
Ischnopoda (Tachyusa) atra (Gravenhorst)											r		7
I. (T.) leucopus (Marsham)							r	r					5-6
Lathrobium fulvipenne Gravenhorst	r	r	r			r	0.2	0.6	0.5	0.2	r	r	V-VI
L. geminum Kraatz							r	0.1	r				5-6
L. sp.						r	r					r	-
Lesteva longoelytrata (Goeze)			r										6
Liogluta (Atheta) microptera (Thomson)								1.8		r	r	r	V-VI
Lithocharis obscurella Erichson							r						5-6
Lordithon (Bolitobius) lunulatus (L.)		r											6
Megarthrus denticollis (Beck)					r				r				7-8
M. sinuatocollis (Lacordaire)					r	r			r				8
Mycetoporus forticornis Fauvel	r												7
M. longicornis Mäklin					r								5-6
M. punctus (Gravenhorst)	r												6
M. splendidus (Gravenhorst)			r		0.1			r		r	r	0.2	VI-VII
M. sp.	0.3	0.1	r		2.8	2.4	0.1	r	1.0	0.2		r	-

Species	JELØY 1975	1976	1978	1979	1980	1981	ÅS 1978	1979	1980	1981	SKI 1979	1980	Activity months
forts. tab. 2													
Neobisnius lathrobioides (Baudi) (cerruti Gridelli							r						5-6
Ocypus (Staphylinus) melanarius Heer (globulifer auct.nec. Fourcroy)		r			0.1	r							8-9
Oligota inflata Mannerheim		1.4	0.5	0.1			0.3	r	0.1				VI
Olophrum assimile (Paykull)									0.2	0.1			6
O. fuscum (Gravenhorst)						r			r				8
Omalium caesum Gravenhorst	r			0.3			1.0	r					7-9
O. rivulare (Paykull)	r						r		r		0.1		6-7,9
Othius angustus Stephens (melano-cephalus Gravenhorst)		r	r					r	r		r	r	6-9
O. myrmecophilus Kiesenwetter								r				r	7-8
Oxypoda advena Mäklin		0.4											6-7,9
O. brachyptera (Stephens)		1.2											6-7
O. exoleta Erichson	r	r											7
O. haemorrhoa Mannerheim		0.9											6-7,9
O. longipes Mulsant & Rey	r						r	r					5-6,9
O. opaca (Gravenhorst)							r	r					5-6
O. spectabilis Märkel			r							r			7,9
O. sp.	r	0.2	1.0	0.7	0.5	1.8	3.4	4.1	8.0	0.6	0.3	0.3	-
Oxytelus sculptus Gravenhorst							r						5
Parocyusa (Chilopora) rubicunda (Erichson)							r						9
Philonthus addendus Sharp.												r	7
P. atratus (Gravenhorst)					r		0.7	0.3	r		r		V-VI
P. carbonarius (Gravenhorst) (varius Gyllenhal)	r	r	r	0.6	2.7	0.1	1.4	0.5	0.8	1.2	r	r	VI-VII
P. cognatus Stephens (fuscipennis Mannerheim)	0.1	r	0.4	0.5	1.6	r	3.8	r	0.4	0.6	r	r	VI-VII
P. decorus (Gravenhorst)					r						r		7
P. debilis (Gravenhorst)			0.2		r	r	0.1						VI
P. nitidus (Fabricius)				r									7
P. ochropus (Gravenhorst) (concinnus Gravenhorst)		r	r	3.3	0.5	0.4	16.0	11.0	6.2	1.6	0.2	0.5	VI
P. politus (L.)					0.3								8
P. pachycephalus Nordmann (sordidus Gravenhorst)	r	r					0.2	r		r		r	5-6,8
P. splendens (Fabricius)				r		r							8
P. succicola Thomson (chalceus Ganglbauer)			r	0.6	1.1				0.2			r	VII
P. varians (Paykull)							r						8-9
P. sp.		r				r	r	r	r	r			-
Phloeocharis subtilissima Mannerheim	r												6
Platydracus (Staphylinius) stercorarius (Olivier)			r										7
Quedius boops (Gravenhorst)									r				6-7
Q. fuliginosus (Gravenhorst)					r								6
Q. molochinus (Gravenhorst) (picipennis Paykull)			r		0.1	r	r	r	r	0.2		r	7-8
Q. nitipennis (Stephens)		0.2	r										6-9
Q. sp.									r		r		-
Rugilus (Stilicus) fufipes Germar								r					5
Sepedophilus (Conosoma) testaceus (Fabricius)												r	6
Stenus biguttatus (L.)	r				0.1	0.3				r		r	5-7
S. clavicornis (Scopoli)			r			0.3						r	5,7
S. similis (Herbst)											r	r	6-7
S. tarsalis Ljungh						0.1							7
S. sp.							r					r	-
Tachinus corticinus Gravenhorst		10.0	r	0.1	r			r	0.3		r	r	VI-VII
T. laticollis Gravenhorst	r	r				0.3							7-8
T. lignorum (L.)	r	r	r										6,9
T. marginellus (Fabricius)	r	r					r						7,9
T. signatus (Gravenhorst) (rufipes Degeer)	r		r		r		r	0.6	0.2	0.7	r	r	V-VI
Tachyporus chrysomelinus (L.)	0.2	0.3	0.5	3.5	1.8	2.0	2.4	3.1	1.2	1.7	2.9	0.2	VI-VII
T. hypnorum (Fabricius)	0.3	0.5	3.4	3.6	2.7	7.1	6.0	2.2	6.7	0.3	3.2	1.0	VI-VII
T. nitidulus (Fabricius)	r	r			0.1	r	r	r		0.1	0.2		5-8
T. obtusus (L.)	0.5	0.7	0.2	0.8	1.2	2.6	0.1	r	0.3	0.3	1.1	0.3	VI-VII
T. pulchellus Mannerheim											r	r	6
T. pusillus Gravenhorst							0.1	r	2.0		r	r	V
T. solutus Erichson	r	r	r	r	0.2	0.1	r		r	r		r	VII
T. sp.		r	r				r						-
Tinotus morion (Gravenhorst)							r	r					5-6,8
Trichophya pilicornis (Gyllenhal)						r	r					r	5-6
Xantholinus clairei Coiffait		r											7
X. linearis (Olivier)	r	0.6	0.3	0.1	0.1		r	r	0.3	r			V-VI
X. tricolor (Fabricius)							0.1	0.4	0.4	0.8	r	r	VII
X. sp.			r										-
Xylodromus depressus (Gravenhorst)		r											6
Zyras humeralis (Gravenhorst)								r			r		6-7
Z. limbatus (Paykull)											r		7
Number of specimens	1159	3421	1544	2267	1548	1087	18125	6003	7779	578	2881	1981	
" " species	48	52	46	31	50	42	70	54	52	36	44	50	
" " trapdays	10530	10206	4410	2670	2940	1386	8960	5088	5424	2340	5910	7284	

some of the easier and more numerous species. Because of this, diversity indices are calculated only for carabids.

RESULTS AND DISCUSSION

Fig. 1 shows the total activity density of carabids and staphylinids in the 12 fields. The carabids are often divided into two main reproductive groups, spring and autumn breeders (Larsson 1939). The spring breeders have high activity in May—June and for many species a lower activity again occur when the next generation emerges in Aug.—Sept. The autumn breeders have a high activity in July—Sept. The curves for the total catch in Fig. 1 vary depending upon how much is caught of the two groups.

According to Thiele (1977), a higher percentage of spring breeders are found on sand than on clay, showing an overall preference for dryness and heat. This was confirmed in the present investigation, the ratio of individuals of autumn to spring breeders at Jeløy (sandy soil) being 1:2, while the ratio at Ås and Ski (clayish soils) was about 2:1. The percentage of autumnbreeding species was 43, 44 and 39, respectively, which corresponds well with data in Basedow et al. (1976).

Most of the staphylinids in the present investigation had their maximum activity density in May—July and a lower activity in Aug.—Sept., when probably the next generation occurs (Fig. 1). However, the variation from field to field is great. These results correspond well with what is found by other authors (Geiler 1959/60, Hassan 1969, Topp & Trittelvitz 1980).

Tab. 1 and 2 show the total catch of the different species for each field. To the right the tables show when the species occurred during the trapping season. For the more numerous species with a typical maximum that probably is reproduction activity, Roman numbers give the month(s) when this occur. For the less numerous species and for species with a more evenly distributed activity density, Latin numbers give the month(s) they were caught.

At the bottom of the tables also the number of specimens and the minimum number of species found per field are given, as well as the number of trap days and the diversity index (for carabids only).

The Sørensen index of similarity between the three localities was 62 for Jeløy/Ås, 44 for Jeløy/Ski and 86 for Ås/Ski. The Sørensen index between fields in the same locality varied between 50—74 at Jeløy, 70—83 at Ås and it was 72 at Ski. The index between fields from different localities varied between 45—82. The mean between fields from the same locality was 66.2 as compared with 59.4 for fields from different localities. These values clearly show the great similarity between the faunas in the three localities. Tab. 3 and 4 show the ten most numerous species at each of the three localities. Six of the carabids and seven of the staphylinid species are in common, which again strongly emphasizes this similarity. Probably the dominant species are much the same for fields in this geographical area, and only their degree of dominance is modified by extrinsic and intrinsic factors between fields and years.

The diversity index for carabids is shown at the bottom of Tab. 1. The high diversity at Ås is probably mainly due to the high density of weeds that made these fields more heterogenous. Ås also had the highest activity densities, with yearly means for carabids varying between 30—74 per 100 trap days and for staphylinids between 25—202 each year. Corresponding numbers for Jeløy was 16—55 and 11—85. The

Table 3. The most numerous carabid species in each of the 3 localities.

Abundance No	JELØY	ÅS	SKI
1	Bembidion lampros	Pterostichus melanarius	Trechus quadristriatus
2	Calathus melanocephalus	Bembidion lampros	Bembidion lampros
3	Agonum dorsale	Calathus melanocephalus	Pterostichus melanarius
4	Harpalus rufipes	Bembidion quadrimaculatum	Bembidion quadrimaculatum
5	Clivina fossor	Trechus quadristriatus	Harpalus rufipes
6	Bembidion quadrimaculatum	T. secalis	Pterostichus niger
7	Amara bifrons	Amara bifrons	Calathus melanocephalus
8	Pterostichus niger	Harpalus rufipes	Trechus discus
9	Amara fulva	Clivina fossor	Clivina fossor
10	Trechus quadristriatus	Bembidion guttula	Trechus secalis

Table 4. The 10 most numerous staphylinid species in each of the 3 localities.

Abundance No.	JELØY	ÅS	SKI
1	Amischa analis	Aloconota gregaria	Amischa analis
2	Aloconota gregaria	Amischa analis	Aloconota gregaria
3	Aleochara bipustulata	Dinaraea angustula	Anotylus rugosus
4	Atheta fungi	Philonthus ochropus	Atheta fungi
5	Tachyporus hypnorum	Anotylus rugosus	Tachyporus hypnorum
6	Anotylus rugosus	Atheta fungi	Tachyporus chrysomelinus
7	Tachinus corticinus	Tachyporus hypnorum	Aleochara bipustulata
8	Tachyporus chrysomelinus	Aleochara bipustulata	Tachyporus obtusus
9	Aleochara bilineata	Tachyporus chrysomelinus	Philonthus ochropus
10	Tachyporus obtusus	Philonthus cognatus	Arpedium quadrum

fact that clay soil has a higher beetle population than sandy soil has been generally found in European fields (Thiele 1977).

Ski had extraordinarily few beetles, the numbers being 7—10 for carabids and 27—49 for staphylinids. This was probably due to the heavy use of insecticides for several years and the fact that herbicides reduced the weed cover to almost nil.

Total number of carabids species caught at Jeløy, Ås and Ski were 62, 43 and 43, respectively, the same for staphylinids being 101, 91 and 63. The 8 most numerous carabids and staphylinids are in the following treated separately, and comments are given to some of the other species. Numbers given in brackets are the mean number of specimens per 100 trap days per year (calculated mean from the numbers in Tab. 1 and 2). Breeding periods and habitat preferences for carabids not specifically mentioned are taken from Lindroth (1945).

Carabids

Bembidion lampros (Herbst) was the most numerous carabid, making up 24.2% of the material. The mean per year was highest at Jeløy (11.8) and Ås (11.3) while the activity density at Ski was only about 10% of this. Lindroth (1945) says it prefers open and sunny areas, and it is frequently mentioned as dominating in European fields (Thiele 1977). The maximum activity density was found in May—June (Fig. 2), when it reproduces, and among the lower catch in July—Sept. several callow specimens, belonging to the next generation, appeared.

The second most numerous carabid was *Calathus melanocephalus*, (L.) making up 20.6% of the material. Like the previous species the mean per year was highest at Jeløy (6.0) and Ås (7.0). The Ski catch was only about 5% of that at Jeløy. This is probably due mainly to the irrigation, as it is known to prefer very dry areas. It is said to appear on all sorts of soils, and is common in European fields (Thiele 1977). A possible preferance for sandy soil could not be confirmed in the present investigation. Maximum activity density occurred during Aug. (Fig. 3), when it is known to reproduce. A smaller and varying peak of acitivty in June—July, seen most easily in Jeløy 1976, probably represents specimens that have overwintered as adults, as shown by van Dijk (1973).

Pterostichus melanarius (Illiger), the third most numerous species, made up 11.0% of the material. At Ås (12.1) and Ski (0.9) it was among the dominating species, which confirms what is previously known from other European fields. It is said to be lacking on sand and this was verified by the fact that is was rarely caught at Jeløy (Tab. 1). Maximum activity density appeared in July—Aug. (Fig. 4), when it reproduces. The smaller peak in May—June, most easily seen at Ås 1979, probably represents animals

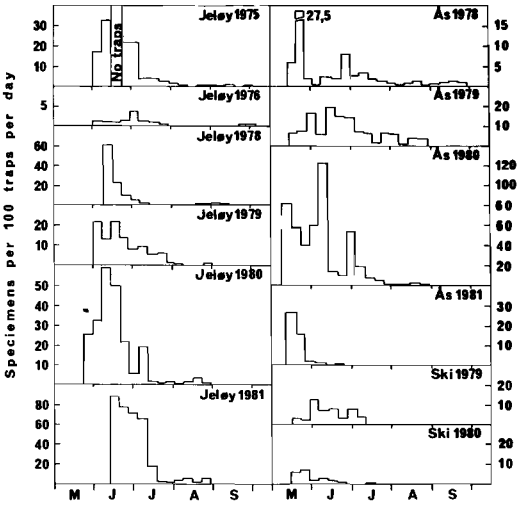

Fig. 2. Activity density for *Bembidion lampros* in each of the 12 fields.

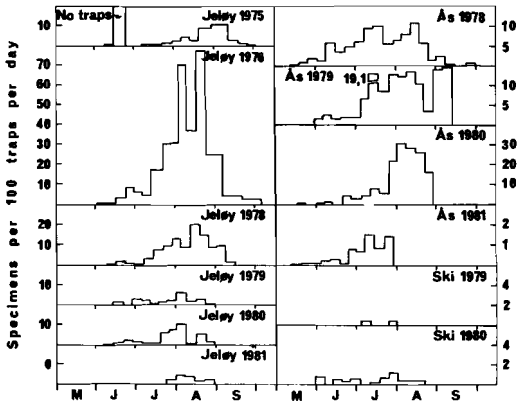

Fig. 3. Activity density for *Calathus melanocephalus* in each of the 12 fields.

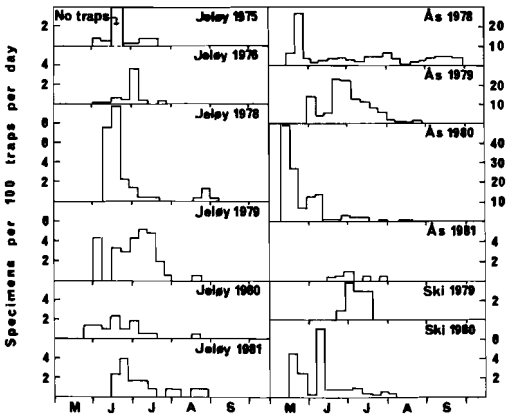

Fig. 5. Activity density for *Bembidion quadrimaculatum* in each of the 12 fields.

that have overwintered as adults, as shown for *Calathus melanocephalus* by van Dijk (1973).

Bembidion quadrimaculatum (L.), making up 7.6% of the material was most numerous at Ås (5.0), ranked as nr. 4. Also at Ski it was ranked as nr. 4, but the mean activity of 0.85 was no higher than that at Jeløy (1.1). It is common on both clay and sand in European fields (Thiele 1977), but in the present investigation it obviously preferred clay. The maximum acitivty, in contrast to *B. lampros,* was spread over a long period, from May—July (Fig. 5). It is a spring breeder, and in July—Sept. callow specimens of the next generation appeared in the traps.

Trechus quadristriatus (Schrank) made up 6.5% of the material and was one of the very few relatively numerous species at Ski (3.4). The reason might be that the leaves of the cauliflower gave more shade than those of the swedes and thus were more attractive, as this species is known to prefer more shade than for instance *Bembidion lampros* (Mitchell 1963). It was common also at Ås (3.7), but more scarcely caught at Jeløy (0.2). It is previously known as a dominating species in European fields (Thiele 1977). The maximum activity density occurred in Aug.—Sept. (Fig. 6), when it reproduces.

Harpalus rufipes (Degeer), known as a typical field-species (Thiele 1977) made up 5.0% of the material. It is said to avoid sand (Lindroth 1945), but this was not confirmed by the present investigation, as it was as numerous at Jeløy (1.5) as at Ås (2.0). At Ski it was, as most species, less numerous (0.3). The maximum activity density occurred in June—Aug. (Fig. 7), when it reproduces. For some unknown reason this species seems to have a more stable activity den-

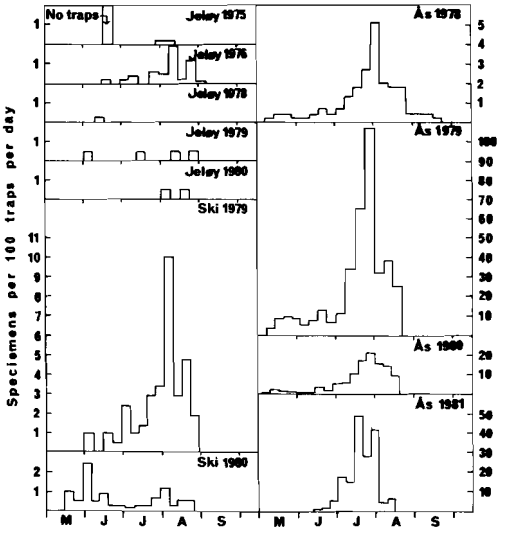

Fig. 4. Activity density for *Pterostichus melanarius* in each of the 12 fields.

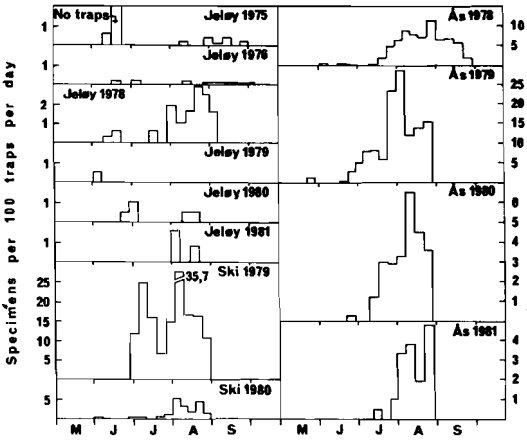

Fig. 6. Activity density for *Trechus quadristriatus* in each of the 12 fields.

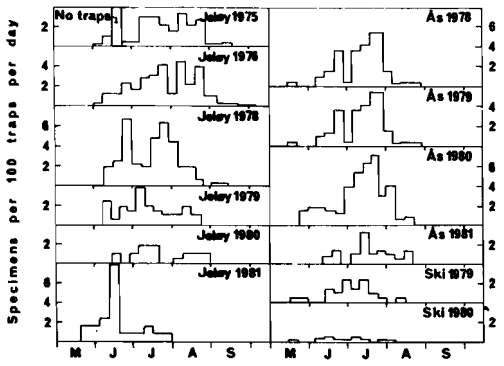

Fig. 7. Activity density for *Harpalus rufipes* in each of the 12 fields.

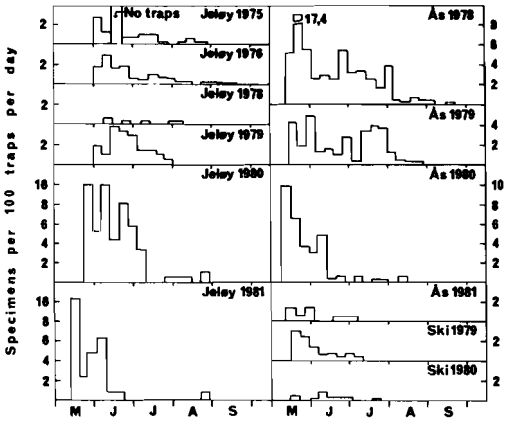

Fig. 9. Activity density for *Clivina fossor* in each of the 12 fields.

sity from year to year than most other carabids (Tab. 1).

Amara bifrons (Gyllenhal), making up 4.5% of the material, is said to prefer dry sand. The preference for dryness was confirmed, as it was rarely caught in the irrigated fields at Ski (Tab. 1), but it was found relatively more often on the clay at Ås (2.2) than on the sand at Jeløy (0.9). As both places were dry during summer, this species might be more dependent upon the dryness than the type of soil. Thiele (1977) says it is common in fields only in eastern Europe. It was most numerous in July—Aug. (Fig. 8), when it reproduces. A smaller peak in June—July, most easily seen at Jeløy 1976, probably represents individuals that have overwintered as adults, as was shown for *Calathus melanocephalus* by van Dijk (1973).

Clivina fossor (L.) made up 4.0% of the material. It is eurotyp, but prefers wet clay and is lacking on sand. In this investigation it was most numerous at Jeløy (1.4) and Ås (2.0) the catch at Ski was much lower (0.2). Clearly no preference for clay was found. As to the wetness there is no typical preference, as shown by the low catches at Ski, but there are higher catches at Jeløy the last years when irrigation made the fields more moist (Fig. 1). It is previously known as common in European fields (Thiele 1977). Maximum activity density occurred in May—June (Fig. 9), when it reproduces. During July—Aug. callow specimens belonging to the next generation appeared in the traps.

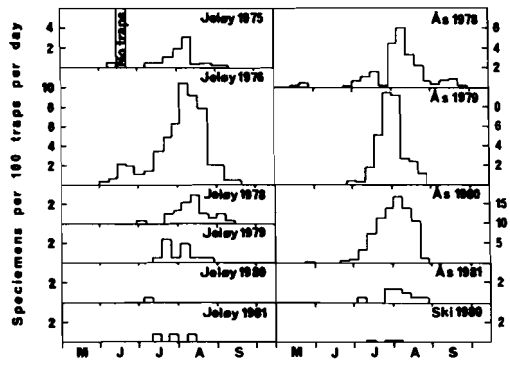

Fig. 8. Activity density for *Amara bifrons* in each of the 12 fields.

Staphylinids

Aloconota gregaria (Erichson) was the most numerous staphylinid, making up 29.9% of the staphylinid material. The mean activity density per year was much higher at Ås (44.7) than at Jeløy (7.8) and Ski

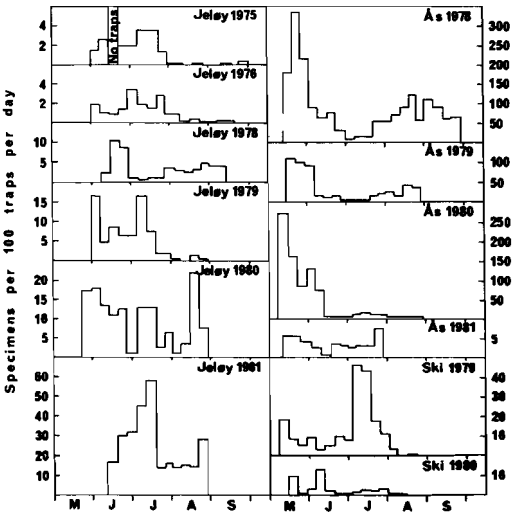

Fig. 10. Activity density for *Aloconota gregaria* in each of the 12 fields.

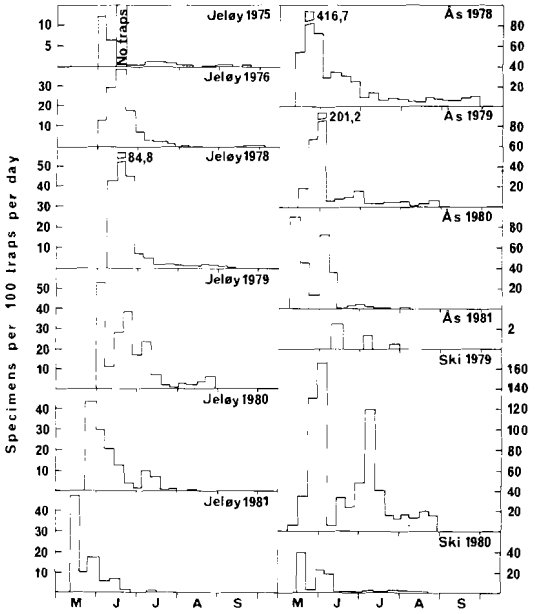

Fig. 11. Activity density for *Amischa analis* in each of the 12 fields.

(4.7), so although it was commong at all three localities, it obviously preferred the clay soil at Ås. Hassan (1969) found it numerous in cabbage fields and Geiler (1959/60) also caught it in various fields. Maximum activity density occurred in May—June (Fig. 10), when it probably reproduces. More than 200 callow specimens that must belong to the next generation were caught from 26. June—29. Sept., mainly in Aug. and the beginning of Sept. This generation probably overwinters as adults and reproduces next summer.

Amischa analis (Gravenhorst) was the second most numerous species, making up 20.3% of the material. This species also was common at all three localities, but was caught more at Ås (20.7) and Ski (15.5) than at Jeløy (9.3). The reason for this may be a preference for clay and wet soil. Previously Geiler (1959/60) and Topp & Trittelvitz (1980) have caught it in various fields. Maximum activity density occurred in May—June (Fig. 11), when it probably reproduces. About 20 callow specimens were caught from 7. July—8. Sept., which shows that a new generation emerges. One callow specimen caught 29. May 1979 at Ski shows a possible second generation or indicated that part of the population emerges the next spring.

Dinaraea angustula (Gyllenhal), making up 6.1% of the material, was numerous on the clay soil at Ås (12.4), but only rarely caught at Jeløy and Ski (Tab. 1). Geiler (1959/60) and Topp & Trittelvitz (1980) found it numerous in various fields. Maximum activity density occurred in May—June (Fig. 12), when it

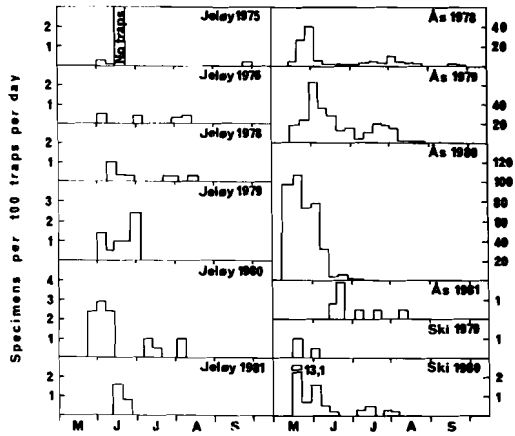

Fig. 12. Activity density for *Dinaraea angustula* in each of the 12 fields.

probably reproduces and a smaller peak appeared in July—Aug. From 22. June—18. Aug. about 60 callow speciemens were caught which must belong to the next generation that emerges. As with *Aloconota gregaria* this generation probably overwinters as adults and reproduces the next summer.

Aleochara bipustulata (L.) made up 5.8% of the material and was most numerous at Jeløy (7.3), less numerous at Ås (3.4) and Ski (1.5). This species parasitizes among several dipterous species also on *Delia brassicae* (Wiedemann), and to a lesser extent on *D. floralis* (Peschke & Fuldner 1977). Although Sundby and Taksdal (1969) did not find it in a survey of Norwegian hosts of these two *Delia*-species, the fact that these were common at the sandy soil at Jeløy might be the reason for the high catches of *A. bipustulata* here. It is often reported as common in European *Brassica*-crops (Coaker & Williams 1963). Maximum activity density occurred in May—June (Fig. 13),

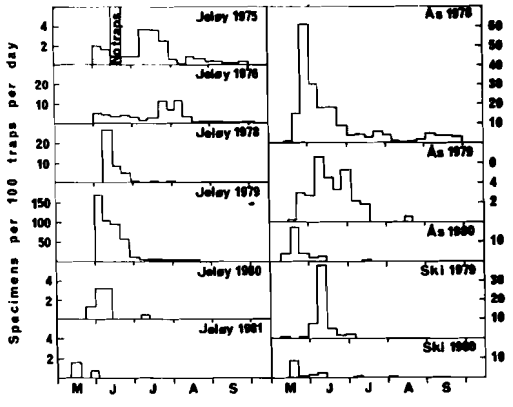

Fig. 13. Activity density for *Aleochara bipustulata* in each of the 12 fields.

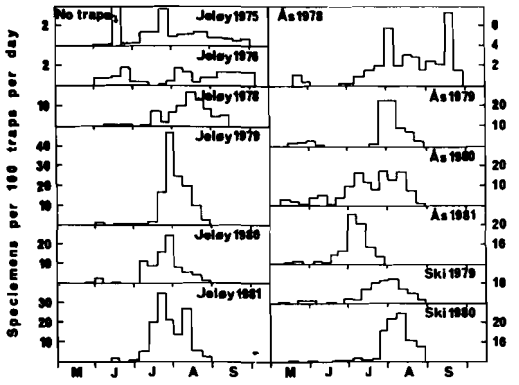

Fig. 14. Activity density for *Atheta fungi* in each of the 12 fields.

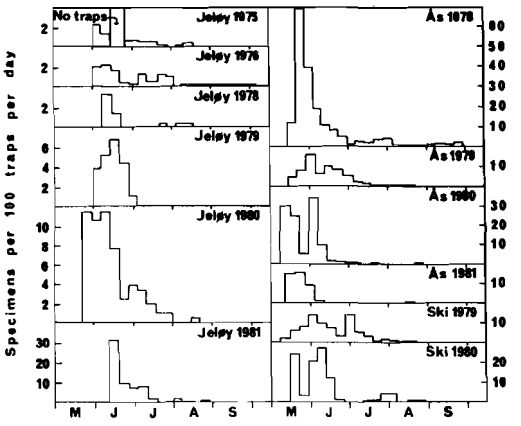

Fig. 16. Activity density for *Anotylus rugosus* in each of the 12 fields.

when it probably reproduces. From Fig. 13 it is, however, not possible to conclude whether it has 1 or 2 generations a year, or even 3, as reported by Fuldner (1960).

Atheta fungi (Gravenhorst), making up 5.3% of the material, was numerous both at Jeløy (5.9), Ås (5.4) and Ski (4.0). It is common in European fields (Geiler 1959/60, Pietraszko & Clercq 1978, Topp & Trittelvitz 1980). Maximum activity density occurred in July—Aug. (Fig. 14), and during June-Sept. about 15 callow specimens were caught. Possibly it emerges from pupae in June-Sept. and reproduces the same summer. According to Topp (1975) it overwinters as adults.

Philonthus ochropus (Gravenhorst) made up 5.2% of the material. It was most numerous at Ås (8.7), more scarcely caught at Jeløy (0.7) and Ski (0.4), which shows that it probably prefers clay soil. Geiler (1959/60) found it in fields, otherwise little is known about it appearance in European fields. Maximum activity density occurred in June (Fig. 15), when it probably reproduces. A lower activity density is again seen in Aug.—Sept., when also a few callow specimens were caught indicating the emergence of the next generation. This generation probably overwinters as adults and reproduces next summer.

Anotylus rugosus (Fabricius), making up 5.1% of the material, was most numerous at Ås (6.0) and Ski (4.5), less numerous at Jeløy (2.1). This confirms its affinity for clay and wetness (Strand 1946, Tischler 1958). It is common in European fields (Geiler 1959/60, Coaker & Williams 1963). The maximum activity density occurred in May—June (Fig. 16), when it probably reproduces. From 18. July—22. Sept. about 30 callow specimens of the next generation were caught, and they probably overwinters as adults and reproduce next summer.

Tachyporus hypnorum (Fabricius) made up 3.7% of the material. Its activity density was relatively high both at Ås (3.8), Jeløy (2.9) and Ski (2.1). It has been

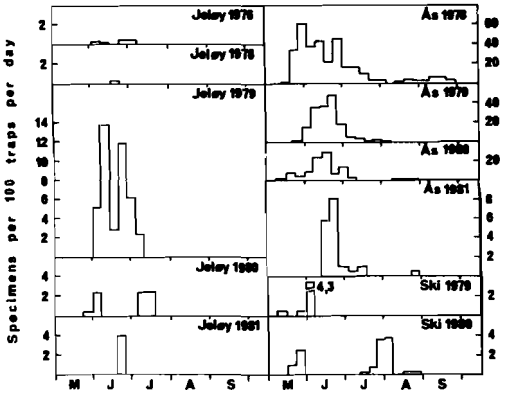

Fig. 15. Activity for *Philonthus ochropus* in each of the 12 fields.

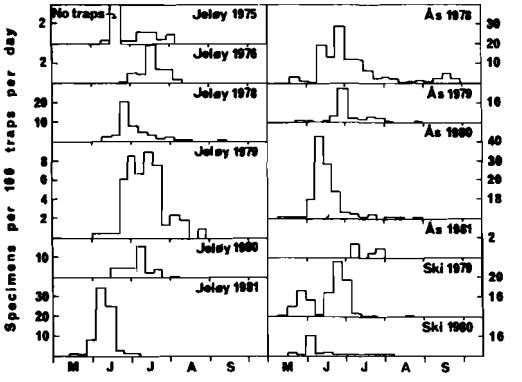

Fig. 17. Activity density for *Tachyporus hypnorum* in each of the 12 fields.

shown to be common in many European fields (Tischler 1958, Geiler 1959/60). Maximum activity occurred in June—July (Fig. 17), when it probably reproduces. From 18. Aug.—29. Sept. callow *Tachyporus*-specimens belonging to the next generation were caught. As shown by Lipkow (1966) this generation probably overwinters and reproduces the next summer.

The separately treated eight carabid species together with *Peterostichus niger* (Schaller), *Amara apricaria* (Paykull) and *Harpalus affinis* (Schrank) were those caught in all the fields or all but one, making op 87.7% of the carabid material. For the staphylinids, the same holds for the eight separately treated species together with *Tachyporus chrysomelinus* (L.), *Aleochara bilineata* (Gyllenhal), *Philonthus cognatus* (Stephens), *Tachyporus obtusus* (L.), *Philonthus carbonarius* (Gravenhorst) and *Acrotona aterrima* (Gravehorst), making up 87.4% of the material. Most of these 25 species are frequently mentioned as common in other European fields and may be regarded as the common field species in the investigated area.

In addition, some species were common at only one or two of the localities. The carabid *Agonum dorsale* (Pontoppidan) made up 6.7% of the catch at Jeløy, and was only trapped here (Tab. 1). This species is rare in Norway, Jeløy being one of the few places where it is known to occur (Kvamme 1977), though common in other European fields (Nedstam & Johansson 1974, Thiele 1977). *Amara fulva* (Degeer), a carabid strongly preferring dry sandy areas (Lindroth 1945), was only trapped at Jeløy (Tab. 1), while *Bembidion guttula* (Fabricius) and *Trechus secalis* (Paykull) were mainly caught at Ås, as they are known to prefer clay (Lindroth 1945). The staphylinid *Tachinus corticinus* (Gravenhorst) was for some unknown reason very common at Jeløy in 1971, but otherwise a rare species (Tab. 1). In the *Oxypoda*-material the following species were common at Jeløy in 1976 and may dominate in the unclassified material in the rest of the fields as well: *O. bracyptera* (Stephens), *O. haemorrhoa* (Mannerheim) and *O. advena* (Mäklin). At least *O. brachyptera* is reported from other fields (Geiler 1959/60, Topp & Trittelvitz 1980). *Aleochara spadicea* (Erichson), *A. verna* (Say) and *Quedius nitipennis* (Stephens) are new to Østfold county.

As shown in Figs. 2—17 the activity density of a species might vary considerably from one year to the next in the same locality, often as much as a 10-fold increase or decrease. As a result both the dominating species and the whole beetle fauna in each locality varied a lot from year to year. However, a species dominating one year was usually among the more abundant species all years in the same locality. In this way the same few species would make up a large part of the fauna in the locality each year although their relative importance would change from year to year.

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Contribution to the knowledge of the distribution, habitat selection and life-history of the riparian beetles in Norway

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New finds of Coleoptera occurring on river banks in Norway are reported. Two finds are situated quite isolated from the rest of the known distributional area: *Perileptus areolatus* (Creutzer) is reported from Sør-Trøndelag province (Fig. 1) and *Anthicus flavipes* (Panzer) from the inner part of Troms.

The southernmost finds of *Bembidion mckinleyi scandicum* Lindroth and *Fleutiauxellus maritimus* (Curtis) are now in the northernmost part of Nordland county (Fig. 1). The habitat selection and to some extent the life history of the riparian beetles are described and discussed.

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INTRODUCTION

During studies of the riparian *Bembidion* species in Norway (Andersen 1970a, 1980), Coleoptera others than the *Bembidion* species were collected as well. Some of the results of these investigations are presented here as the published data about the habitat selection, life history and distribution of the species occurring on river banks in Norway are often scarce.

The epigeic species were collected in the same way as in Andersen (1970a), but to a large extent without reference to the size of the area investigated or the time used in the collecting. The hypogeic species (mostly *Dyschirius* spp. and *Bledius* spp.) were collected by washing the substratum in water.

Dr. philos. h.c. A. Strand has made an unpublished catalogue of all the known Norwegian records of Coleoptera in Norway. This catalogue has been brought up-to-date by T. Kvamme. In the present paper I report records not mentioned in this catalogue (T. Kvamme, pers. comm.).

The district division follows Strand (1943). Species not reported previously from the districts in question (see Lindroth 1960, Strand 1977, Nilssen & Andersen 1977) are marked with an asterisk. The position of the localities investigated in northern Norway is given in Andersen (1980, Fig. 1 and Table 1).

The distribution and habitat selection of the *Bembidion* species in S Norway will be treated in a separate paper. The division in habitats (here called microhabitats) is in accordance with Andersen (1970a). The terms stenotopic, oligotopic and eurytopic are in accordance with Andersen (1970a). The nomenclature follows Silfverberg (1979).

THE SPECIES

Nebria rufescens (Strøm).

According to Lindroth (1945) this species is ubiquitous in the mountains, whereas it should be stenotopic for stony or gravelly shores of lakes, rivers and brooks in the lowland. In most of Norway, however, the species is quite eurytopic also in the lowland. At Eide in Tune (Ø) the species was abundant among dense vegetation on very moist clay in a clay pit. At the river Gaula (STI) the species is abundant both on gravelly-stony sites as well as in the more vegetated, shady habitats (microhabitat 3a, 4a). Around Trondheim (STI) it is present in woods of alder *(Alnus incana* (L.) Moench) and spruce *(Picea abies* (L.) Karst.) without open water in the vicinity. As pointed out by Lindroth (1945) and Larsson & Gigja (1959) the species hibernates both as imago and larva, third stage larvae as well as imagines are abundant in September—October and in May—June (vide Andersen 1970b)and fully hardened imagines are present in May both in central and northern Norway.

Dyschirius septentrionum Munster.

*MRI: 5 km E of Surnadal, June 1970. STI: Orkanger, June 1970. NTI: Stiklestad, 17 June 1972; Bergsmoen in Namdalen, 4 August 1966; Skorovasselv in Namdalen, 18 June 1972. NSI: Grane. TRI: Norkjosbotn, 30 May 1973.

Dyschirius septentrionum is a regular and often abundant species on river banks where it reaches its highest abundance in the same microhabitats as *Bembidion schueppeli* Dejean and *B. semipunctatum* Donovan, i.e. in somewhat shaded and/or more or less vegetated, silty sites (microhabitat 3a, 3b, 4a, 4c).

The species has been found rather scattered in fields near the rivers Gaula and Surnadalslågen, and at Trondheim in a clay pit, at the latter place together with among others *Bembidion lunatum* Duftschmid, *B. deletum* Audinet-Serville and *Bledius crassicollis* Lacordaire. It seems correct, then to regard *Dyschirius sephentrionum* as an oligotopic river bank species in Norway.

Dyschirius angustatus (Ahrens).

The species is rather abundant in sparsely vegetated or barren, relatively elevated and often dry sites (microhabitats 4d, 4e, 4g) at the rivers Gaula, Saltdalselva (NSI) and Målselva (TRI). *D. angustatus* is probably limited to the banks of the large rivers in Norway.

Bembidion mckinleyi scandicum Lindroth.

*NNØ: Near Gamnes, Skjomendalen, 30 June 1980. One specimen was found in a typical habitat (vide Andersen 1970c).

Previously the species is known only from Troms and Finnmark provinces (Andersen 1980).

Bembidion transparens (Gebler).

*TRI: Buktelv, 7 July 1973. One specimens was collected at the outlet of the river in the sea. The vegetation was halophilous.

The species seems to be confined to sea shores in Nordland and Troms (Lindroth 1945, Strand 1946).

Perileptus areolatus (Creutzer).

VAY: Audnedalen 6 km S of Konsmo, 3 June 1972, 3 specimens. TEI: Melås bru, at Heddalselva, 6 June 1972. OS: Gullerud at Randsfjorden. AK: Hurdalselva, near Hurdal, 9—10 June 1972. *VE: 2 km S of Hof, near the lake Eikeren, 8 June 1972. *STY: near Skau, at the river Skaua, 22—23 may 1981, 15 specimens (Leg. J. Nikolaysen, J. Andersen). At most of the localities the species was rather abundant. The find at river Skaua seems to be isolated from the distributional area in S Norway (Fig. 1).

At all the localities where I have observed *P. areolatus* it has been found on gravelly-stony banks of small rivers. The underlying substratum is made of sand (partly rather coarse) or silt. The species is pronouncedly lithophilous and is stenotopic for running waters (Jeanell 1967, Lindroth 1974, Freude et al. 1976). Within the localities studied the species occurred together with *Bembidion virens* (Gyllenhal), *B. saxatile* (Gyllenhal) or *B. prasinum* (Duftschmid).

P. areolatus is less hygrophilous than *B. prasinum* and *saxatile* and it is most abundant in zones somewhat distant from the river (Table 1). Deviating from this was only the observations at the river Skaua where *P. areolatus* occurred in sites saturated with water. The river was flooding at this time, however, and only a very small zone with gravel and stones was available for the beetles.

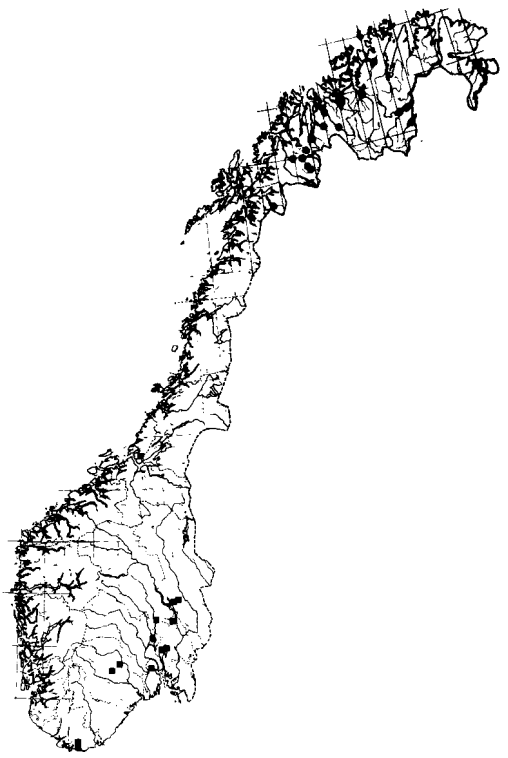

Fig. 1. The presently known distribution of *Perileptus areolatus* (Creutzer) (squares) and *Fleutiauxellus maritimus* (Curtis) (filled circles) in Norway.

Four females from Skaua had immature ovaries, whereas four females of *B. prasinum* from the same locality had mature ovaries. Two dissected females of *P. areolatus* from Heddalselva had mature ovaries. Studies in N Norway show that *P. prasinum* has a later reproduction period than the other lithophilous, imaginal hibernators of this genus (Andersen unpublished data). Although *P. areolatus* thus seems to breed later than the imaginal hibernators of the lithophilous *Bembidion* species, it is no doubt an imaginal hibernator, as supposed by Lindroth (1945). The later reproduction may perhaps explain why this species is limited to rather southern areas of Scandinavia which have comparatively warm and long summers.

Agonum micans (Nicolai).

*MRI: 5 km E of Surnadal, June 1970.

Most of the finds of this species in Norway seem to have been done on river banks. According to Lindroth (1945) the habitat preference of *Agonum micans* is rather similar that of *A. piceum*. This

Table 1. The microhabitat distribution of *Perileptus areolatus* and two *Bembidion* species according to time catch. The figures give the number of specimens caugt per 10 min. Figures in brackets give the investigation time in min.

Locality	Species	Microhabitat 6aI		6aII	
Heddalselva	*Perileptus areolatus* (Creutzer)	2.0	(20)	4.4	(40)
	Bembidion prasinum (Duftschmid)	7.5		0.5	
	B. saxatile (Gyllenhal)	2.0		3.0	
Hurdalselva	*Perileptus areolatus*	0.7	(15)	12.7	(15)
	Bembidion saxatile	8.0		4.0	

6aI: zones close to the river, saturated with water
6aII: zones higher up, not satured with water

does not apply to Norway, however. *Agonum piceum* is a very typical member of the stagnant, often eutrophic waters in Norway whereas *A. micans* occurs frequently at the large rivers. In Sweden, however, *A. micans* is abundant also on the shores of eutrophic lakes. At the river Gaula the species is abundant in more or less developed vegetation (microhabitats 2a, 3a, 4a, 4c), often together with *Bembidion dentellum* (Thunberg).

Hydnobius tibialis J. Sahlberg.

The species is rather frequent in elevated, dry, fine sandy-silty spots together with *Bledius arcticus* J. Sahlberg at the river Målselva (TRI: Rundhaug). Strand (1946) has similar experiences, but very little information is available about the ecology of this species, so it is uncertain whether it is limited to river banks. Generally little is known about the ecology of the species of this genus.

Coryphium hyperboreum (Mäklin).

TRI: Puntaelv, 19 July 1969; Guolasjavri, 750 m a.s.l., 21 August 1969, seven specimens (alpine zone). FN: Luostejåkka, near Baktejavri (alpine zone), 28 june 1976.

In all places in Scandinavia where this species has been found in some abundance the habitat has been gravelly-stony river banks or lake shores. I therefore find it legitimate to regard the species as lithophilous although it has also been found in *Salix* thickets (Strand 1946).

Besides *Bembidion hasti* Sahlberg and *B. fellmani* (Mannerheim), *Coryphium hyperboreum* is the only Fennoscandian lithophilous species that have been found high up in the alpine zone.

Ochthephilus omalinus (Erichson).

The species seems to be little selective in choice of type of habitat. Thus, it has been found abundantly in gravelly-stony, as well as in silty and sparsely vegetated, habitats on the banks of the river Gaula. In Norway only found on river banks, but it is also reported from lake shores in Sweden (Palm 1961).

Thinobius longicornis J. Sahlberg.

TRI: Near the outlet of the river Skakterelva, 30 August 1981, one specimen. The specimen was found on a stony bank with gravel and sand underneath.

The species seems to be lithophilous (Strand 1946).

Thinobius munsteri Scheerpeltz.

*NNØ: Near Gamnes in Skjomen, 9 August 1981. Two specimens on a gravelly-stony bank of the river Skjoma. Together with *Hydrosmecta subtilissima* (Kraatz) (see that species). TRI: Near the outlet of the river Skakterelva, 14 July 1981. Several specimens under smaller or larger stones on a silty substratum. Together with *Bembidion mckinleyi scandicum*.

In Norway the species has mostly been collected in flotsam. As most other *Thinobius* species, however, it is no doubt a lithophilous species (vide also Palm 1961). In Norway a stenotopic river bank species.

Thinobius strandi Smetana.

TRI: Straumsmo in Østerdalen, 19 August 1969, 26 specimens. Very abundant under stones on a rather heterogeneous substratum. Only a small fraction of the beetles seen were collected. The species occurred close to the river (together with *Bembidion hyperboraeorum* Munster) as well as higher up (together with *B. hasti*).

At Rundhaug (TRI) several specimens were collected together with *Bembidion petrosum siebkei* Sparre Schneider in rather elevated, stony sites with an underlying substratum of silt. *T. strandi* is lithophilous (vide also Palm 1961) and it is an oligotopic river bank species. Among the 26 specimens collected at Straumsmo 22 were quite pale. No doubt it is an imaginal hibernator.

The *Thinobius* species are supposed to have been overlooked due to their small size, and some of the species may have a more continuous distribution than what is known at present.

Bledius arcticus.

TRI: Furuflaten, 20 August 1969. At this place as well as at Rundhaug the species was numerous in rather elevated, fine sandy-silty sites with sparse vegetation.

As stated by Platonoff (1943) the species seems to occur in rather dry sites. *B. arcticus* has been regarded as a stenotopic river bank species (Strand 1946, Palm 1961), but at Forsheim in Skjomen (NNØ) *Bledius arcticus* was rather abundant on

sparsely vegetated fallow land with fine sand far from streaming water. Seven of 28 specimens collected at Furuflaten were teneral. No doubt the species is an imaginal hibernator.

Bledius denticollis Fauvell.

The species is abundant on sparsely vegetated sites together with *B. fontinalis* Bernhauer at the river Gaula (STI: Melhus).

B. denticollis is stenotopic for river banks (Strand 1946, Freude et al. 1964, Lundberg 1969).

At the river Gaula several quite large larvae belonging to the genus *Bledius* were found 1 May 1966 in microhabitat 4e. At the site studied *Bledius denticollis* and *B. fontinalis* were abundant and one or both of this species certainly hibernate as larvae although imaginal hibernation probably is normal in both species.

Bledius fontinalis.

NTI: Bergsmoen, at the river Namsen, 4—5 August 1966. TRI: Furuflaten, 20 August 1969, 2 specimens.

The species is very abundant in moist, as well as in rather dry, fine sandy-silty sites with no or moderate vegetation (microhabitat 4c, 4e, 4g) on the banks of Gaula and Namsen. At the river Gaula *B. fontinalis* has been found to be numerous also in barren sites with a rather clay-mixed substratum. *Bledius fontinalis* seems to be a stenotopic river bank species (Freude et al. 1964). The two specimens collected at Furuflaten were tenerals. This indicates imaginal hibernation, at least in part (vide *Bledius denticollis).*

Bledius fuscipes Rye.

The species is rather abundant in sites with fine sand and a somewhat developed vegetation (microhabitats 4b—4c) at Rundhaug (TRI). The specimens from Norway referred to as *B. bernhaueri* Poppius in Strand (1946) belong to *B. fuscipes* (see also Palm 1961). Most of the finds of *B. fuscipes* in Norway are from river banks.

Bledius litoralis Heer.

NTI: Verdalsøra, 17 June 1972. NSI: Bleiknesmo in Saltdalen, 2 August 1966.

As stated by Palmén & Platonoff (1943), Strand (1946) and Palm (1961) the species has a preference to silty or clayish soil. *B. litoralis* is abundant in humid and somewhat vegetated and shady sites, but the demand to moist sites is perhaps not so obvious as stated by Palmén & Platonoff (1943). Thus, several specimens were collected in microhabitat 4e together with *Dyschirius angustatus* at Bleiknesmo. *Bledius litoralis* is a stenotopic river bank species within its whole distributional area (Palm 1961, Freude et al. 1964). I have found a single specimen in a clay pit in NTI: Steinkjer, but this was certainly a straggler. Three of seven specimens collected at Rundhaug 30 August 1981 were pale. This indicates imaginal hibernation.

Bledius longulus Erichson.

*TEI: Heddalselva, 6 June 1972. STI: Tiller, near Jonsvatnet. NTI: Bergsmo i Namdalen, 4—5 August 1966. TRI: Setermoen, July 1959.

I have found a few specimens on a lake shore (Randsfjorden) and in a sand pit (Tiller), but as the other finds in Norway are from river banks it must be regarded as an oligotopic river bank species in our country. As stated by Palm (1961) and Palmén & Platonoff (1943) the species occurs in more elevated sites than many of the other *Bledius* species. Thus, at Bergsmoen and Bleiknesmo in Saltdalen (NSI) the species was very abundant in microhabitat 4b and 4e. The species occurs regularly also in rather vegetated, somewhat shady habitats together with *Dyschirius septentrionum.*

Bledius poppiusi Bernhauer.

TRY: Oldervikdalen, 25 August 1969. TRI: Kittdalen, 25 June 1969. The species was abundant in rather moist, as well as in rather dry, fine sandy-silty sites with some vegetation (coverage 1—3) in Oldervikdalen.

B. poppiusi is reported also from flotsam at lake shores in Norway (Strand 1946). It is difficult to draw any conclusions about the habitat selection on the basis of such finds, and I find it legitimate to regard the species as rather dependent on running waters in Norway.

Among 43 specimens from Oldervikdalen eleven specimens were quite pale. This indicates imaginal hibernation.

Bledius talpa (Gyllenhal).

Ø: Eide in Tune, 2 September 1981. Very abundant in a sand pit. NSI: Røssåga, June 1972, one specimen. TRI: Kittdalselva, 25 June 1969, abundant; Buktelv, 7 July 1973, one specimen.

In Norway, as elsewhere, the species occurs both on river banks and lake shores (Strand 1946, Palm 1961), and the occurrence in Tune shows that it is also able to colonize secondary, human made habitats. In Tune *B. talpa* occurred in coarse, moist sand as well as in rather dry, more fine grained sand. The vegetation was sparse or lacking.

Stenus biguttatus (L).

STI: Orkanger, at the river Orkla. The species is abundant on sparsely vegetated, moist, silty sites at the rivers Orkla and Gaula. *S. biguttatus* should be quite eurytopic (Palm 1961), but I have found the species exclusively on river banks in Central Norway.

Stenus fossulatus Erichson.

*Ø: Eide in Tune, 2 September 1981. Rather abundant in a clayish, V-facing slope above a brook. The clay was medium moist and with some vegetation of among others *Tussilago farfara* L.

This habitat description is in full accordance with that given by Palm (1961). The species seems to be stenotopic for running waters in Norway and Sweden.

Several other *Stenus* species, e.g. *S. bimaculatus* Gyllenhal, *S. strandi* L. Benick, *S. ruralis* Erichson, *S. juno* Fabricius, *S. canaliculatus* Gyllen-

hal, are present on river banks. Except for *S. bimaculatum*, none of these species seem to be oligotopic or stenotopic for river banks in Norway and Sweden (see Palm 1961).

Philonthus subvirescens Thomson.

*MRI; 5 km E of Surnadal, June 1970. STI: Melhus, May, June, August, September 1962—1981. NTI: Bergsmoen, 4—5 August 1966.

The species is abundant in sparsely vegetated, moist, silty sites at the localities studied (microhabitat 4d). The species probably prefers such habitats (vide also Palm 1963) although I have found it rather sparsely also on stony-gravelly ground just as Palmén & Platonoff (1943) have done. After a large flooding at the river Gaula (STI: Melhus) in May 1981 crowdings were observed eating on dead, large earthworms. Like *Stenus biguttatus* this is a day active species.

P. subvirescens is a stenotopic river bank species in Norway, but in Finland it occurs on lake shores as well (Palmén & Platonoff 1943).

Brachyusa concolor (Erichson).

NTI: Stiklestad, June 1972.

The species occurs in moist, silty sites with moderate or sparse vegetation (microhabitat 4c—4d) at the rivers in Trøndelag (STI, NTI) and Troms (TRI). In Norway *B. concolor* must be regarded as an oligotopic river bank species, whereas it seems to be more eurytopic further to the south (Hansen 1964).

Ischnopoda leucopus (Marsham).

*HOI: Vinje, at the river Strandaelva, 15 June 1972. NTI: Stiklestad, 17 June 1972.

The species is abundant on sparsely vegetated, moist silty ground at the rivers in Trøndelag (STI, NTI), but it is quite eurytopic and also occurs on lake shores as well as in clay pits.

Dasygnypeta velata (Erichson).

The species is abundant in the same microhabitats as *Brachyusa concolor* at the river Gaula. *Dasygnypeta velata* seems to be an oligotopic river bank species in Fennoscandia (Palm 1966).

Hydrosmecta subtilissima (Kraatz).

NTI: About 3 km S of Elvran at the river Leksa, 25 May 1970. Under small stones and gravel of schist. The underlying substratum was heterogeneous. The species occurred together with *Bembidion saxatile*. The river is small and rapidly flowing. *NNØ: Near Gamnes in Skjomen, 9 August 1981. Seven specimens under stones on a moist, stony-gravelly bank of the river Skjoma. The underlying substratum was rather coarse, moist sand.

At Rundhaug I have found the species together with *Thinobius strandi* (vide this species).

H. subtilissima is no doubt lithophilous (vide also Munster 1930; Jansson & Palm 1936; Palm & Lindroth 1936; Strand 1946; Lundberg 1972). The species seems to occur exclusively at running waters. *H. subtilissima* is very small (1.4—1.5 mm) and the species is probably overlooked and may have a more continuous distribution in Fennoscandia than is known at present.

Hydrosmecta thinobioides (Kraatz).

NTI: About 3 km S of Elvran, 25 May 1970. Together with the foregoing species.

Although *H. thinobioides* is abundant on gravelly and stony sites (Jansson & Palm 1936, Palmén & Platonoff 1943, Strand 1946) it is also frequent on sandy shores (Platonoff 1943, Hansen 1964, Freude et al. 1974) and the species can not be regarded as lithophilous. The species occurs at streaming, as well as at stagnant waters (Strand 1946, Hansen 1964).

Aloconota currax (Kraatz).

*MRI: Uri in Valldal, June 1972, 3 specimens. NTI: About 3 km S of Elvran at the river Leksa, 25 May 1970. One specimen together with *Hydrosmecta subtilissima* (vide this species). TRI: Balsfjordelva, June 1969; Skakterelva 30 August 1981, ten specimens; Puntaelva, July 1969.

The available data from the literature (Munster 1924, Jansson & Palm 1936) as well as my own experience indicate that *A. currax* is lithophilous. In this it is sharply separated from *Aloconota sulcifrons* (Stephens) which is abundant in densely vegetated, somewhat shady sites (microhabitat 3a) on the river banks. *A. currax* has mostly been found close to the water, partly together with *Bembidion hyperboraeorum*.

A. currax is probably a stenotopic river bank species (Strand 1946, Fjellberg 1972, Freude et al. 1974).

Parocyusa rubicunda (Erichson).

NTI: Bergsmoen, at the river Namsen 4—5 August 1966. TRI: Setermoen, July 1959; Rundhaug; Skakterdalen, near the outlet of the river Skakterelva, September 1967. *TRY: Tønsvika, near the outlet of the river Tønsvikelva; Tromsø, July 1979.

The species occurs in rather densely vegetated sites (microhabitat 3a, 4a) at the rivers. Although *P. rubicunda* must be regarded as an oligotopic river bank species in Fennoscandia (Palmén & Platonoff 1943, Strand 1946) I have found several specimens in a lawn in Tromsø. Also from other parts of Scandinavia the species is reported from secondary habitats (Palmquist 1954).

Aleochara brundini (Bernhauer).

STI: Melhus, at the river Gaula.

The species is abundant in elevated, dry sites with a fine sandy-silty substratum with sparse vegetation (microhabitat 4e). This is in full accordance with the habitat description given by Strand (1946). According to Palm (1946) the species occurs also on dry ground under stones or at the roots of plants, without connection with open water.

A. brundini is most likely a stenotopic or oligotopic river bank species in Norway.

Fleutiauxellus dermestoides (Herbst).

According to Palmén & Platonoff (1943) the spe-

Table 2. The abudance (number per 0.125 m²) of *Fleutiauxellus maritimus* (Curtis) in different microhabitats at the outlet of the river Skakterelva in Dividalselva, June 1973. For explanation of symbols, see Table 1.

	Michrohabitat	
	6aI	6aII
Abudance	< 0.1	0.5
Number of samples of 0.125 m²	18	18

cies should prefer stony sites. In Norway, however, the species is quite eurytopic and it is abundant in a wide variety of open microhabitats, both on river banks and at lake shores.

Fleutiauxellus maritimus (Curtis).

*NNØ; Near Gamnes in Skjomen, 9 August 1981. One larvae and one imago on a gravelly-stony bank of river Skjoma. TRI: Revedalen; near the outlet of the river Skakterelva (observed frequently several years); Tamokdalen; Kittdalen, about 0.5 km E of the outlet of the river; Kåfjordelva, near Birtavarre; 1 km E of Storslett, at the river Reisaelva; Kjækan, at the river Kjækanelva. *FV: near Skaidi, at river Repparfjordelva (Leg. A. Nilssen).

The species is quite abundant and it has a continuous distribution in North Norway (Fig. 1).

The species comes close to *Bembidion mckinleyi scandicum* both in its habitat selection and in its life history. *F. maritimus* is a markedly lithophilous species which I never have found outside the gravelly — stony banks of the rivers. The underlying substratum may be silty or a more heterogeneous mixture of gravel and sand. The species has a clear preference to the elevated parts of the river banks (Table 2). I have found the species in extremely dry and warm sites where no other lithophilous species have been observed. *F. maritimus* seems to be limited to river banks within its whole distributional area (vide Freude et al. 1979). In the Alps the species is present high up in the mountains (Freude et al. 1979) but it has not been found above the timber line in Norway. In contrast to *Bembidion mckinleyi scandicum, F. maritimus* is present also at the large rivers in Troms and Finnmark (the rivers Målselva, Reisaelva, Altaelva and Karasjåkka).

Imagines of *F. maritimus* were collected from end of June to August. Tenerals were present in June and July. I have not found imagines in May and the first part of June. A pupa collected 13 July 1981 hatched 20 July in the laboratory. I have found larvae in May—August of a quite varying size. A larva collected 13 July 1981, pupated and hatched 22 July. The data shows that the species hibernates as larvae and most likely exclusively in that stage. However, as larvae of a rather different size are found together it is likely that the life cycle takes more than one year.

Fleutiauxellus pulchellus (L).

The species is abundant in elevated and dry sites with fine sand (microhabitat 4b) at the rivers Gaula and Målselva. In Norway *F. pulchellus* occurs both on river banks and at the sea (Munster 1935).

Dryops nitidulus (Heer).

*NTI: Bergsmoen, at the river Namsen, 4—5 August 1966. The only previous Norwegian records are two specimens from flotsam and under a stone at STI: Gaulosen (Andersen 1962). Although the larva of this species is aquatic, the adult beetle is amphibious. At the river Namsen and Gaula *D. nitidulus* was rather abundant in microhabitat 4c in August 1966. The species is known only from river banks in Norway but it is not limited to such habitats. In Denmark as well as in Central Europe it is also present in or at stagnant waters (Hansen 1964, Freude et al. 1979).

Morychus dovrensis Munster.

I have found this species scattered in elvated, dry sandy sites (partly with mats of *Rhacomitrium* sp.) on the banks of the rivers Gaula and Målselva. These findings together with those in Strand (1946) suggest that the species is almost xerophilous. *M. dovrensis* has been found in a sand pit (Nilssen & Andersen 1977) but this was rather close to a river (about 50 m) and the species is no doubt a stenotopic or an oligotopic river bank species.

Chaetophora cyclolepidia Munster.

TRI: Kittdalen, 25 June 1969. 3 specimens in sparsely vegetated, silty sites.

Although the species is frequently found on river banks, it seems to be less dependent upon such habitats than *C. paleata* (Erichson). The latter species has only been found on river banks in Norway (Strand 1946).

Anthicus flavipes (Panzer).

*TRI: Svartnes, September 1979, June 1980. Some specimens were found on dry sand at the outlet of a brook into the sea.

The occurrence is very isolated from the rest of the distributional area in Scandinavia. In Sweden the species is known north to Norrbotn and Lycksele Lappmark. In northern Norway it is otherwise known from Røssvatn in southern Nordland (NSI). The species is common both on river banks, on lake shores and at the sea (Strand 1946).

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Contribution to the knowledge of the Norwegian fauna of Ophioninae (Hym., Ichneumonidae)

ØYSTEIN WIIG

Wiig, Ø. 1982. Contribution to the knowledge of the Norwegian fauna of Ophioninae (Hym., Ichneumonida). *Fauna norv. Ser. B 29,* 69—71.

Records of nine species of Ophioninae caught in light traps mainly in Vestfold and Hordaland, Norway, are given. Four of the species, *Platophion areolaris* (Brauns, 1890), *P. ocellaris* (Ullbricht, 1926), *Ophion longigena* Thomson, 1888, and *O. parvulus* Kriechbaumer, 1879 are new to Norway. The known distribution in the Western palearctic region is outlined. Norwegian Lepidoptera species recorded as hosts abroad are given.

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INTRODUCTION

The Ichneumonidae (Hymenoptera) is one of the largest families in the animal kingdom. Townes (1969) estimates the family to contain about 60.000 species. In Norway the family is poorly known, and only two extensive studies have appeared recently (Jussila 1973, 1976).

The present paper deals with two genera of the subfamily Ophioninae, *Platophion* and *Ophion*. The former was synonymized with *Ophion* by Townes & al. (1965), but as I follow Gauld (1973) and Oosterbrock (1978) *Platophion* is here treated as a valid genus.

The term «Ophions» is frequently applied to nocturnal Ichneumonidae with large ocelli, long antennae and pale yellow-brown body. These characteristics are however present in several groups of Ichneumonidae and Brachonidae, but Ophioninae is in addition characterized by a long spurious vein in the second brachial cell.

The species of this subfamily are protelean parasits on Lepidoptera larva. The adults are crepuscular or nocturnal. Nothing is known of their host preference in Norway, but Norwegian Lepidoptera species recorded as hosts abroad are given. The subfamily has a worldwide distribution (Townes 1971).

The material treated are mostly taken in light traps set out for nocturnal Lepidoptera. A total of 517 specimens have been examined, mainly from Vestfold and Hordaland. Four of the species recorded are new to Norway.

The geographical division of Norway follows Løken (1973). Known distribution in the Western Palaearctic region is outlined.

LIST OF SPECIES

Platophion areolaris (Brauns, 1890).
VE: Tjøme, Mostranda, 9.—12. Aug. 1974, 1 ♀.
The species is new to Norway.
Also recorded from Kurland (Latvia) and Rumania (Schmiedeknecht 1933—36), England (very rare) (Gauld 1973), and The Netherlands (rare) (Oosterbroek 1978).

P. ocellaris (Ullbricht, 1926).
Hoi: Odda, 8 Aug. 1976, 3 ♀ ♀; Hoy: Bergen, Ervik, 14—19 July 1976, 1 ♀, 9 Aug. 1976, 1 ♀, Sætre 21 July 1973, 1 ♀; SFy: Gulen, Eide, 29 July—19 Aug. 1973, 2 ♀ ♀. The species is new to Norway.
Also recorded from Germany (Schmiedeknecht 1933—36), England (very rare) (Gauld 1973), and The Netherlands (uncommon) (Oosterbroek 1978).

Ophion longigena Thomson, 1888.
VE: Tjøme, Mostranda, 9—12 Aug. 1974, 1 ♂; Hoi: Odda, 8 Aug. 1976, 1 ♀; Hoy: Bergen, Fjellsiden, 15—19 July 1976, 2 ♀ ♀, 10 Aug. 1976, 1 ♂, Kalandsvann, 6—12 Aug. 1976, 1 ♂, Sætre, 21 July 1973, 1 ♀; Os, Lii, 6—12 Aug. 1976, 1 ♀; Osterøy, Haus, 4—8 Aug. 1971, 1 ♂, Herland, 30 Aug. — 4 Sep. 1972, 1 ♀, Kleppe, 16 Aug. 1971, 1 ♂, 4 July 1972, 1 ♂; SFy: Gulen, Eide, 29 July — 19 Aug. 1973, 4 ♂ ♂.
The species is new to Norway.
Also recorded from England, Finland, Germany, and Sweden (Schmiedeknecht 1933—30).
Among it's hosts is *Agrotis segetum* (Denis & Schiffermüller, 1775) (Noctuidae) (Schmiedeknecht 1933—36).

O. luteus (L., 1758).
VE: Nøtterøy, Herstad, 3 Aug. 1969, 2 ♂ ♂, 9 Aug. 1969, 7 ♂ ♂ + 7 ♀ ♀; Tjøme, Havna

9—11 Aug. 1974, 1 ♂; Hoy: Bergen, Sætre, 21 July 1973, 1 ♂ + ♀; Osterøy, Herland, 30 Aug. — 4. Sep. 1972, 2 ♀ ♀, Holo, 20—25 Aug. 1972, 2 ♀ ♀, Kleppe, 2 Sep. 1971, 5 ♀ ♀, Lono, 11—16 Aug. 1972, 1 ♀, Valestrandfossen, 31 Aug.—4 Sep. 1972, 1 ♀.

Distributed throughout Norway (Jussila 1976) and Europe (Hellen 1926).

Among it's hosts are *Synanthedon formicaeformis* (Esper, 1779) (Aegeriide); *Poecilocampa populi* (L., 1758), *Lasiocampa quercus* (L., 1758), *Dendrolimus pini* (L., 1758) (Lasiocampidae); *Cerura vinula* (L., 1758, *C. bifida* (Brahm, 1787) (Notontidae); *Ochropleura praecox* (L., 1758), *Ceramica pisi* (L., 1758), *Hadena rivularis* (Fabricius, 1775), *H. bicrurus* (Hufnagel, 1766), *Panolis flammea* (Denis & Sciffermüller, 1775), *Orthosia populeti* (Fabricius, 1781), *Mythimna ferrago* (Fabricius, 1787), *Cucullia absinthii* (L., 1761), *Allophyes oxyacanthae* (L., 1758), *Acronicta aceris* (L., 1758), *A. leporina* (L., 1758), *Colocasis coryli* (L., 1758) (Noctuidae) (Morley 1914).

O. mocsaryi Brauns, 1890.

VE: Tjøme, Mo, 30 July 1969, 1 ♀; Hoy: Bergen, Ervik, 9—14 July 1976 1 ♂, Fjellsiden, 15—19 July 1976, 2 ♀ ♀, Flesland, 11—17 June 1976, 2 ♂ ♂, 17—22 June 1976, 1 ♀, Grimstad, 14—19 July 1976, 2 ♀ ♀, Straume, 6—11 June 1976, 2 ♂ ♂, 19—25 June 1976, 1 ♂; Fjell, Eidsvåg, 17—22 June 1976, 1 ♂, 22—30 June 1976, 3 ♂ ♂, Ongeltveit, 17—21 June 1976, 1 ♂ + 1 ♀; Os, Gaassand, 18—22 May 1976, 1 ♀, 22 June—1 July 1976, 1 ♂, 20 May 1980, 1 ♂.

In Norway previously known from Hordaland (Jussila 1973). Also recorded from England, Finland, Hungary, and The Netherlands (Schmiedeknecht 1933—36).

Among it's hosts are *Biston betularia* (L., 1758) (Geometridae) (Schmiedeknecht 1933—36).

O. obscuratus Fabricius, 1798.

VE: Nøtterøy, Vestfjordv., 14 May 1974, 1 ♀; Sem, Akersmyra, 8 May 1974, 1 ♂; Tjøme, Mostranda, 22—28 Sep. 1974, 3 ♂ ♂; Hoy: Bergen, Ervik, 1—5 June 1976, 1 ♀, 8—10 June 1976, 2 ♀ ♀, 16—19 June 1976, 4 ♀ ♀, 21—30 June 1976, 4 ♀ ♀, 12—20 Sep. 1976, 1 ♀, Espeland, 25 May 1980, 1 ♀, Fjellsiden, 15—18 June 1976, 1 ♀, Flesland, 22—25 May 1976, 1 ♂, 25—30 May 1976, 3 ♂ ♂, 11—17 June 1976, 1 ♀, Hausdalen, 19—22 May 1976, 1 ♂, Kalandsvann, 18—22 May 1976, 1 ♀, 22—25 May 1976, 1 ♀, Lundatre, 22—25 June 1976, 1 ♀, Straume, 19—23 May 1976, 1 ♂, 20—30 May 1976, 1 ♂ + 2 ♂ ♂, 30 May—3 June 1976, 1 ♂; Fjell, Eidesvåg, 19—27 Aug. 1976, 2 ♂ ♂, Ongeltveit, 23—29 May 1976, 2 ♂d + 1 ♀, 2—6 June 1976, 1 ♀; Os, Gaassand, 18—22 May 1976, 3 ♂ ♂, 20 May 1980, 1 ♂, Lii, 30 May—3 June 1976, 1 ♂, 3—11 June 1976, 1 ♀, 11—16 June 1976, 1 ♀, 20—28 Sep. 1976, 1 ♂, 20 May 1980, 2 ♂ ♂ + 1 ♀; Osterøy, Hamre, 20—24 Sep. 1971, 2 ♀ ♀, Herland, 4—15 Oct. 1972, 1 ♀, Lono, 4—9 Sep. 1972, 1 ♂, Revheim, 4—15 Oct. 1976, 1 ♀; SFy: Gulen, Steine, 16 Oct.—31 Nov. 1973, 12 ♂ ♂ + 1 ♀.

In Norway previously known from Bergen (Jussila 1976). Distributed throughout Middle and North Europe (Schmiedeknecht 1933—36).

Among it's hosts are *Synanthedon formicaeformis* (Esper, 1779) (Aegeriidae); *Dendrolimus pini* (L., 1758) (Lasiocampidae); *Agriopis aurantiaria* (Hübner, 1799) (Geometridae); *Cerura vinula* (L., 1758), *C. furcula* (Clerck, 1759) (Notodontidae); *Euxoa tritici* (L., 1761), *Noctua fimbriata* (Schreber, 1759), *Mythimna straminea* (Treitschke, 1825), *Dryobotodes eremita* (Fabricius, 1775), *Acronicta leporina* (L., 1758) (Noctuidae) (Morley 1914) and *Acronicta cuspbis* (Hübner, 1813) (Noctuidae) (Oosterbroek 1978).

O. parvulus Kriechbaumer, 1879.

VE: Nøtterøy, Herstad, 3 Aug. 1979, 1 ♂; Tjøme, Mostranda, 4—13 Aug. 1974, 1 ♀; Hoi: Odda, 8 Aug. 1976, 2 ♀ ♀; Hoy: Bergen, Eidsvåg, 24—28 July 1976, 2 ♂ ♂ + 1 ♀, Ervik, 21—30 June 1976, 1 ♂, 30 June—5 July 1976, 1 ♂, 5—9 July 1976, 1 ♀, 9—14 July 1976, 1 ♀, 14—19 July 1976, 2 ♀ ♀, 3 Aug. 1976, 5 ♀ ♀, 9 Aug. 1976, 1 ♀, 20—28 Aug. 1976, 3 ♀ ♀, 12—20 Sep. 1976, 1 ♀, Fjellsiden, 9—15 July 1976, 1 ♂ + 1 ♀, 15—19 July 1976, 1 ♀, 19—22 July 1976, 1 ♀, 10 Aug. 1976, 1 ♀, Flesland, 10—14 July 1976, 1 ♀, 19—24 July 1976, 2 ♀ ♀, Grimstad, 14—19 July 1976, 1 ♀, 28 July—2 Aug. 1976, 1 ♀, Hausdalen, 24—28 July 1976, 1 ♂, 29 July—2 Aug. 1976, 1 ♀, Kalandseid, 9—12 Sep. 1976, 2 ♀ ♀, 14—18 Sep. 1976, 1 ♂ + 3 ♀ ♀, Kalandsvann, 29 July—2 Aug. 1976 1 ♂, 12—20 Sep. 1976, 1 ♂ + 1 ♀, Saudalskleivane, 19—24 July 1976, 1 ♀, 20—28 Aug. 1976, 1 ♂ + 1 ♀, 28 Aug.—12 Sep. 1976, 1 ♀, 20 Sep.—2 Oct. 1976, 5 ♀ ♀, Straume, 14—19 July 1976, 9 ♀ ♀, 24—28 July 1976, 2 ♀ ♀, 28 July—2 Aug. 1976, 2 ♀ ♀, 2—6 Aug. 1976, 1 ♂, 27 Aug.—3 Sep. 1976, 2 ♀ ♀, Sætre, 21 July 1973, 2 ♀ ♀; Fjell, Eidesvåg, 10—14 July 1976, 1 ♂ + 1 ♀, 11—17 Aug. 1976, 1 ♂, Ongeltveit, 10—14 July 1976, 2 ♀ ♀, 24—28 July 1976, 1 ♀, 2—6 Aug. 1976, 1 ♀; Kvinnherad, Rosendal, 13—15 Sep. 1976, 1 ♀; Os, Gaassand, 22 June—1 July 1976, 1 ♂ + 1 ♀, 29 July—2 Aug. 1976, 1 ♂ + 1 ♀; Lii, 22 June—1 July 1976, 1 ♀, 6—12 Aug. 1976, 3 ♀ ♀, 17—20 Aug. 1976, 11 ♀ ♀, 27 Aug. 1976, 1 ♂ + 8 ♀ ♀, 27 Aug.—3 Sep. 1976, 17 ♀ ♀, 12—20 Sep. 1976, 23 ♀ ♀, 20—26 Sep. 1976, 15 ♀ ♀; Osterøy Hamre, 20—24 Sep. 1971, 3 ♀ ♀, 24—27 Sep. 1971, 4 ♀ ♀, Haus 8—15 Aug. 1971, 2 ♀ ♀, Herland, 26 June—1 July 1972, 1 ♂, 30 Aug.—4 Sep. 1972 2 ♂ ♂ + 4 ♀ ♀, 4—15 Oct. 1972, 2 ♂ ♂, Holo, 20—25 Aug. 1972, 1 ♀, Hosanger, 2—4 Oct. 1971, 1 ♀, Kleppe, 2 Sep. 1971, 3 ♀ ♀, 15—17 Aug. 1972, 1 ♂ + 2 ♀ ♀, Lono, 11—16 Aug. 1972, 1 ♂ + 2 ♀ ♀, 21—26 Aug. 1972, 1 ♂ + 1 ♀, 31 Aug.—4 Sep. 1972, 2 ♂ ♂ + 8 ♀ ♀, 4—9 Sep.

1972, 4 ♀ ♀, 4—15 Oct. 1972, 2 ♀ ♀, Revheim, 12—26 Aug. 1972, 1 ♂ ♂ + 2 ♀ ♀, 31 Aug.—4 Sep. 1972, 17 ♀ ♀, 4—9 Sep. 1972, 1 ♂ + 6 ♀ ♀, 9—14 Sep. 1972, 3 ♀ ♀, 4—15 Oct. 1976, 15 ♀ ♀; SFy: Gulen, Eide, 29 July—19 Aug. 1973, 1 ♂ + 1 ♀, Steine, 16 Oct.—31 Nov. 1973, 3 ♀ ♀.

The species is new to Norway.

Also recorded from England (Morley 1914),Germany and Hungary (Schmiedeknecht 1933—36), Finnland (Jussila 1968), and The Netherlands (Oosterbroek 1978).

Among it's hosts are *Philudoria potatoria* (L., 1758) (Lasiocampidae) and *Orthosia cruda* (Denis & Schiffermüller, 1775) (Noctuidae) (Oosterbroek 1978).

O. pteridis Kriechbaumer, 1879.

VE: Tjøme, Mo, 25 July 1969, 2 ♂ ♂ + 1 ♀, 30 July 1969, 2 ♀ ♀, Mostranda, 4—13 Aug. 1974, 2 ♀ ♀; Hoi: Odda, 8 Aug. 1976, 1 ♂; Hoy: Bergen, Ervik, 30 June—5 July 1976, 1 ♂, 14—19 July 1976, 1 ♀, 3 Aug. 1976, 8 ♂ ♂ + 1 ♀, 9 Aug. 1976, 2 ♂ ♂, 12 Aug. 1976, 1 ♂, 20—27 Aug. 1976, 2 ♂ ♂ + 3 ♀ ♀, 27 Aug.—12 Sep. 1976, 1 ♂ + 2 ♀ ♀, 12—20 Sep. 1976, 2 ♂ ♂ + 3 ♀ ♀, Fjellsiden, 10 Aug. 1976, 1 ♀, 12 Aug. 1976, 2 ♂ ♂, 25—27 Aug. 1976, 1 ♀, 9—14 Sep. 1976, 1 ♀, Hausdalen, 15—19 July 1976, 1 ♂, 24—29 July 1976, 1 ♀, 29 July—2 Aug. 1976, 1 ♀, Kalandsvann, 10—15 July 1976, 1 ♀, 12—20 Sep. 1976, 1 ♀, Saudalskleivane, 19—24 July 1976, 1 ♂, 9 Aug. 1976, 1 ♀, 27 Aug.—12 Sep. 1976, 1 ♀, 20 Sep.—20 Oct. 1976, 1 ♂ + 1 ♀, Straume, 28 July—2 Aug. 1976, 1 ♂, 6—11 Aug. 1976, 2 ♀ ♀, 27 Aug. 1976, 1 ♂, 27 Aug.—3 Sep. 1976, 3 ♀ ♀; Os, Gaassand, 20 Aug.—3 Sep. 1976, 2 ♂ ♂ + 2 ♀ ♀, Lii, 10—15 July 1976, 1 ♀, 2—6 Aug. 1976, 1 ♂ + 1 ♀, 17—20 Aug. 1976, 3 ♀ ♀, 3—12 Sep. 1976, 8 ♀ ♀, 12—20 Sep. 1976, 3 ♀ ♀, 20—26 Sep. 1976, 1 ♀, Lindatre, 3—12 Sep. 1976, 1 ♀; Osterøy, Hamre, 24—27 Sep. 1971, 2 ♀ ♀, Haus, 16—24 Sep. 1971, 1 ♀, Herland, 30 Aug.—4 Sep. 1972, 5 ♀ ♀, Kleppe, 2 Sep. 1971, 1 ♀, 4 July 1972, 1 ♀, 15—17 Aug. 1972, 2 ♀ ♀, Lono, 31 Aug.—4 Sep. 1972, 1 ♀, 4—9 Sep. 1972, 4 ♀ ♀, Revheim, 4—9 Sep. 1972, 4 ♀ ♀; Stord, Rommeltveit, 7—13 Sep. 1975, 6 ♀ ♀; SFy: Gulen, Eide, 29 July—19 Aug. 1973, 1 ♀, Steine, 16 Oct.—31 Nov. 1973, 1 ♀.

In Norway previously known from Rogaland (Jussila 1976).Also recorded from Germany (Schmiedeknecht 1933—36), England (Gauld 1973), and The Netherlands (Oosterbroek 1978).

O. scutellaris Thomson, 1888.

R: Egersund, Fjellstedt, 1 May 1973, 3 ♀ ♀; Hoy: Fjell, Ongeltveit, 20—23 May 1976, 1 ♀.

In Norway previously known from Sogn og Fjordane (Løken 1966). Distributed throughout Middle and North Europe (Schmiedeknecht 1933—36).

Among it's hosts are *Mamestra brassicae* (L., 1758), *Ceramica pisi* (L., 1758), *Hadena bicrurus* (Hufnagel, 1766), *Agrochola lota* (Clerck, 1759), and *Cosmia trapezina* (L., 1758) (Noctuidae) (Morley 1914).

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The effect of latitude on colony size in *Bombus monticola* Smith and *B. lapponicus* (Fabricius) (Hym., Apidae).

PATRICIA E. YALDEN

Yalden, P.E. 1982. The effect of latitude on colony size in *Bombus monticola* Smith and *B. lapponicus* (Fabricius) (Hym., Apidae). *Fauna norv. Ser. B.* 29, 72—73.

Svensson (1979) suggested that small colony size of *B. monticola* and *B. lapponicus* in northern Sweden, was the result of the severe climate at the altitude at which the nests were found. Studies in the Peak District, England, indicate that a more northerly latitude, rather than altitude, may be a factor limiting colony size.

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INTRODUCTION

B. monticola Smith and *B. lapponicus* (Fabricius) are recorded as forming small colonies (Løken 1973, Svensson 1979). Reinig (1965) records a colony of *B. lapponicus* from northern Norway (Målselv: Andsfjell, latitude 69°N) which contained only «about two dozen cocoons». Svensson and Lundberg (1977), working in northern Sweden (Abisko, latitude 68°N), found 11 *B. lapponicus* nests containing from 17 to 61 (mean 30.5) cocoons. In the same region they also found nests of *B. monticola* (= *B. scandinavicus)* and *B. lucorum* (L.) containing 103 and 113 cocoons respectively. All these nests were considered to be fairly small.

Sladen (1912) and Alford (1975) record *B. lucorum* as having populous colonies of 200 plus workers. This fact, coupled with the relatively small size of the single *B. lucorum* nest that he found, led Svensson (1979) to suggest, that the climate of a mountainous habitat limits colony size. He felt that what had previously been thought of as a characteristic of *B. lapponicus* and *B. monticola,* i.e. small colony size, was in fact the effect of climate.

Work in the Peak District, England, has yielded some more information on this topic.

RESULTS

During a study of bumblebees from 1977 to 1981 in the Peak District, latitude 53°N, several nests were found. Five that were undamaged were excavated at the end of summer and their sizes are recorded in Table 1.

In England *B. monticola* can form very large nests; the mean number of cocoons per nest for *B. monticola* was 182.6 and for *B. lucorum* was 208.5. *B. lucorum* is reputed to be a large colony builder (Sladen 1912, Alford 1975). The mean size of the Swedish nests was 36.5 for the subgenus *Pyrobombus* and 113 for *B. lucorum* (Table 1). Thus the average size of the English nests was larger than the Swedish nests.

The altitudes at which the English *B. lucorum* nests were found (350 m and 380 m) are very similar to that of the *B. lucorum* nest (375 m) found by Svensson & Lundberg (1977). The larger mean size of the English nests suggests that in this case altitude alone is not important in determining nest size.

DISCUSSION

Bumblebee nests are difficult to find and the small sample could have produced misleading results as there was considerable variation in nest size within a species and also, because nest size had to be compared between subgenera rather than species.

The Swedish *B. monticola* nest was much larger than the *B. lapponicus* nests found in the same area which throws doubt upon the validity of comparing taxa above the species level.

Colony size could also be underestimated if nests were excavated before reaching maximum size or if cocoons had been destroyed.

Notwithstanding these reservations, the Peak District nests are larger than the Swedish nests; this suggests that a more northerly latitude limits bumblebee size. This is not surprising as the length of the flowering season, and thus the bumblebees' active period, is curtailed further

Table 1. Bumblebee nests from two different latitudes.

Data from Sweden, Svensson & Lundberg (1977). Date, date on which nests excavated; altitude, altitude at which nests found; no: cocoons, number of cocoons in each nest. *B. lapponicus* from 11 nests, all other results from single nests.

Peak District, England, latitude 53 N.					Abisko, Sweden, latitude 68 N.			
Species	date	altitude	no: cocoons	mean no: cocoons	date	altitude	no: cocoons	mean no: cocoons
B. monticola	19.9.77	380 m	144	182.6	12.7.75	675 m	103	36.5
B. monticola	24.8.80	365 m	323					
B. monticola	23.8.80	305 m	81					
B. lapponicus	Does not occur in Britain.				16 July—13 Aug 1972—1975	380—950 m	17—61	
B. lucorum	27.8.79	350 m	126	208.6				
B. lucorum	19.9.81	380 m	291		9.8.73	375 m	113	113

north. Løken (1973) records the flight season for *B. lapponicus* from the beginning of May until September in Scandinavia but Svensson (1979) found that in northern Sweden *B. lapponicus* and *B. monticola* have very reduced active periods of less than 2 months. In contrast, in the Peak District, England, *B. monticola* queens are flying in mid April during a warm Spring, and some workers are still active at the end of September.

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Nye funn av Coleoptera fra Møre og Romsdal

ODDVAR HANSSEN OG HANS OLSVIK

Hanssen, O. & H. Olsvik. New records of Coleoptera from Møre and Romsdal. *Fauna norv. Ser. B 29*, 74—77.

This article presents a list of 96 species of Coleoptera which are new to the inner and outer regions of Møre and Romsdal province in Norway.

The distribution of Coleoptera in this part of the country is poorly known. Most of these records are of species widely distributed in southern Norway, but which have not been reported previously from Møre and Romsdal. Exceptions are *Oedemera femorata* (Scopoli) and *Rhantus notaticollis* (Aubé), which have recently reported as being new to Norway. *Ampedus pomonae* (Stephens), *Aromia moschata* (L.) and *Acanthoderes clavipes* (Schank) have previously been found only in the more southern areas of the country, while *Acanthoderes clavipes* (Schank) has been recorded only around Oslofjord and in northern part of Hedmark.

Oddvar Hanssen, Langslågt. 8, N-6600 Sunndalsøra, Hans Olsvik, Zool. Mus., Sars gt. 1, N-Oslo 5.

Vi presenterer her funn av 96 billearter som tidligere ikke er registrert i de respektive områdene av Møre og Romsdal fylke (Strand 1943, Lindroth 1960, Zachariassen 1977, Engdal & Zachariassen 1979, Refseth 1979). Artikkelen kommer som tillegg til publiserte funn av *Oedemera femorata* (Scopoli) (Dragseth & Hanssen 1981) og *Rhantus notaticollis* (Aubé) (Dolmen & Hanssen, 1982).

Nomenklaturen følger Silfverberg (1979).

De fleste artene er kun funnet som enkeltindivider, det framgår således ikke i presentasjonen om noen funn representerer flere individer. Foruten undertegnedes eget materiale, har Alf Harald Dragseth, Hoelsandvegen, N-6600 Sunndalsøra bidratt med noen funn.

Funnene er gjort ved tilfeldige innsamlinger med slaghåv, fallfeller, leting under steiner, bark og på blomster etc. Materialet oppbevares hos forfatterne og A.H. Dragseth.

Møre og Romsdal er et av våre minst undersøkte fylker angående billers utbredelse. Det er således ikke oppsiktsvekkende med såpass mange nye funn. De fleste presenterte arter er tidligere funnet i de tilstøtende områder, og må betegnes som vanlig utbredt i landsdelen. Unntak er kommentert i listen.

Vi retter en takk til Dag Dolmen, Jostein Engdal, Dagfinn Refseth og Karl Erik Zachariassen for kontroll og hjelp til artsbestemming av vårt materiale. Vi takker videre John Brittain for å ha lest gjennom og rettet den engelske teksten.

Cicindela campestris L.
MRi: Seljebømarka i Ålvundfjord, Sunndal 11 mai 1975. Orheiman, Sunndal 19 mai 1978. Øvre Folldalsvegen, Surnadal 15. mai 1980. Hoelsand, Sunndal 16. mai 1980.

Loricera pilicornis (Fabricius)
MRy: Aure, Aure 20. mai 1979.

Asaphidion pallipes (Duftschmid)
MRi: Todalen, Surnadal 2. juni 1980. Grøa, Sunndal 11. juli 1981.

Patrobus assimilis Chaudoir.
MRy: Aure, Aure 20. mai 1979.

Patrobus septentrionis Dejean.
MRy: Foldfjord, Aure 25. mai 1979.

Trechus rubens (Fabricius).
MRi: Todalen, Surnadal 30. mai 1980.

Bembidion difficile (Motschulsky).
MRi: Romfo, Sunndal 19. mai 1978.

Bembidion quadrimaculatum (L.).
MRi: Orheiman, Sunndal 8. Juni 1980.

Agonum gracile (Gyllenhal).
MRy: Eide på Nordmøre 15. juli 1978.

Amara communis (Panzer).
MRy: Knudtzondalen, Kristiansund 12. juli 1979.

Amara eurynota (Panzer).
MRi: Fagerhaugen, Sunndal 29. juli 1975.

Harpalus solitaris Dejean.
(= fuliginosus Duftschmid) MRi: Rindal 1976.

Hydroporus lapponum (Gyllenhal).
MRi: Gruvedalen, Sunndal (840 m.o.h.)

Hydroporus erythrocephalus (L.).
MRi: Reinset i Ålvundfjord, Sunndal 25. september 1979.
Platambus maculatus (L.).
MRi: Hovin, Sunndal 7. september 1979.
Agabus guttatus (Paykull).
MRi: Grønnørene, Sunndal 31. mai 1975. Almberg, Rindal 8. mai 1979.
Agabus bipustulatus (L.).
MRi: Rindal, årlig 1973—79. Mæhle, Sunndal 7. september 1979.
Agabus sturmi (Gyllenhal).
MRi: Rindal, årlig 1973—79. Mæhle og Vinnu, Sunndal 7. september 1979. Røyhjell, Sunndal 9. september 1979. Tredal, Sunndal 24. september 1979. Reinset i Ålvundfjord, Sunndal 25. september 1979.
Agabus congener (Thunberg).
MRi: Mæhle, Sunndal 7. september 1979. Håkådalen, Sunndal (1000 m.o.h.) august 1980.
Ilybius fuliginosus (Fabricius).
MRi: Rindal, årlig 1973—79. Mæhle og Hovin, Sunndal 7. september 1979. Furu, Sunndal 24. september 1979. Reinset i Ålvundfjord, Sunndal 25. september 1979.
Ilybius angustior (Gyllenhal)
MRi: Gruvedalen, Sunndal (840 o.h.) 15. mai 1980.
Ilybius aënescens Thomson.
MRi: Rindal 8. juli 1978.
Rhantus notaticollis (Aubé).
MRi: Vinnu, Sunndal 20. august 1980. Arten ble rapportert ny for Norge (Trøndelag og Nordmøre) av Dolmen & Hanssen (1982). Lokaliteten i Sunndal, hvor ett eksemplar av arten ble fanget, er en liten dam (60 m.o.h.) omkranset av frodig løvskog. Vannvegetasjonen består bl.a. av starr *(Carex sp.),* myrhatt *(Comarum palustre* L.), bukkeblad *(Menyanthes trifoliata* L.) og vanlig tjønnaks *(Potamogeton natans* L.).
Rhantus suturellus (Harris).
MRi: Rindal, årlig 1974—77. Ålvvatna i Ålvundfjord, Sunndal 22. mai 1976. Gruvedalen, Sunndal (840 m.o.h.) 15. mai 1980. Naustådalen, Surnadal (650 m.o.h.) 11. juni 1980. MRy: Kristiansund høsten 1976.
Colymbetes paykulli Erichson.
MRi: Rindal, årlig 1973—79. Reinset, Ålvundfjord, Sunndal 25. september 1979. Gruvedalen, Sunndal (840 m.o.h.) 15. mai 1980.
Colymbetes dolobratus (Paykull).
MRi: Gruvedalen, Sunndal 15. mai 1980 (840 m.o.h.).
Acilius sulcatus L.
MRi: Rindal, årlig 1973—81. Seljebøbotn i Ålvundfjord, Sunndal (570 m.o.h.) 4. juli 1976. Vinnu, Sunndal 7. september 1979. Røyhjell, Sunndal 9. september 1979.
Acilius canaliculatus (Nicolai).
MRi: Rindal, årlig 1974—77.
Dytiscus lapponicus Gyllenhal.
MRi: Seljebøbotn i Ålvundfjord, Sunndal (570 m.o.h.) 4. juli 1976.
Gyrinus opacus Sahlberg.
MRi: Seljebøbotn i Ålvundfjord, Sunndal (570 m.o.h.) 4. juli 1976.
Gyrinus minutus Fabricius.
MRi: Rindal, årlig 1974—79. Vinnu, Sunndal 21. mai og 20. august 1980.
Thanatophilus rugosus (L.).
MRi: Hoelsand, Sunndal 23. juli 1978 (A.H. Dragseth).
Creophilus maxillosus (L.).
MRi: Sande, Sunndal juni 1973 og august 1980. Håsenørene, Sunndal 27. juni 1975.
Hister unicolor L.
MRi: Sande, Sunndal juni 1974.
Hister striola Sahlberg.
MRi: Håsenørene, Sunndal 19. juni 1975. Fagerhaugen, Sunndal 17. mai, 22. juni 1976 og 13. juni 1977. Sande, Sunndal 24. juni 1978. MRy: Aure, Aure 20. mai 1979.
Hister merdarius Hoffmann.
MRi: Hoelsand, Sunndal 11. mai 1976.
Geotrupes stercorarius (L.).
MRi: Smiset i Ålvundfjord, Sunndal 16. mai 1975. Sande, Sunndal 5. juni 1975.
Geotrupes stercorosus (Scriba)
MRi: Orheiman, Sunndal 18. juni 1976.MRy: Roldfjord, Aure 27. mai 1979.
Aphodius depressus (Kugelann)
MRi: Sande, Sunndal 15. juni 1975.
Aphodius fimetarius (L.)
MRy: Ånes, Aure 20. mai 1979.
Dictyoptera (= Dictyopterus) aurora (Herbst)
MRi: Igletjønna, Rindal 16. mai 1975. Drøppingstranda, Sunndal 7. juni 1975. Todalen, Surnadal 2. juni 1980.
Cantharis figurata Mannerheim.
MRi: Igletjønna, Rindal 1975.
Athous subfuscus (Müller).
MRi: Fagerhaugen, Sunndal 17. mai, 27. mai 1976 og 19. mai 1980. Rindal 30. mai og 1. juli 1978. Hoelsand, Sunndal 16. mai 1980.
Limonius (= Pheletes) aëneoniger (De Geer)
MRi: Almberg, Rindal 9. mai 1975. Fagerhaugen, Sunndal 22. juni 1976. MRy: Foldfjord, Aure 27. mai 1979.

Denticollis linearis (L.)
MRi: Fagerhaugen, Sunndal 1. juni 1975, 16. og 22. juni 1976. Håsenørene, Sunndal 10. juni 1976.

Cidnopus (= Limonius) aeruginosus (Oliver)
MRi: Gikling, Sunndal 13. juni 1977.

Hypnoidus (= Hypolithus) *riparius* (Fabricius)
MRi: Sande, Sunndal 2. mai 1977 og 13. mai 1980. Viklandet, Sunndal 26. september 1977. Rindal 30. mai 1978.

Corymbites pectinicornis (L.)
MRi: Bjørnhjell, Sunndal 7. juni 1975. Fagerhaugen, Sunndal 19. juni 1975. Hoel, Sunndal 31. mai 1979. Almberg, Rindal 4. juni 1979.

Actenicerus (= Corymbites) sjaelandicus (Müller)
MRi: Igletjønna, Rindal 4. juni 1979.

Anostirus (= Corymbites) castaneus (L.)
MRi: Almberg, Rindal 9. mai 1975. Hoel, Sunndal 19. mai 1978. Furu, Sunndal 7. juli 1978 (A.H. Dragseth). Hoelsand, Sunndal 9. juni 1979 (A.H. Dragseth). Virumdalen, Sunndal 19. mai 1981.

Prosternon tesselatum (L.)
Fagerhaugen, Sunndal 30. juni 1975. Hoel, Sunndal 19. mai 1978. Rindal 4. juni 1979.

Selatosomus (= Corymbites) impressus (Fabricius)
MRi: Hoel, Sunndal 19. mai 1978. Todalen, Surnadal 2. juni 1980.

Ampedus (= Elater) pomonae (Stephens)
MRi: Igletjønna, Rindal 1975. Dette funnet representerer ny nordgrense for arten i Norge.

Ampedus (= Elater) tristis (L.)
MRi: Seljebømarka i Ålvundfjord, Sunndal 18. mai 1981.

Agriotes obscurus (L.)
MRi: Fagerhaugen, Sunndal 13. juni og 19. juli 1977. Romfo, Sunndal 19. mai 1978.

Cardiophorus ruficollis (L.)
MRi: Hoelsand, Sunndal 17. juni 1979.

Cytilus sericeus (Forster)
MRi: Hoel, Sunndal 4. oktober 1976. Sunndalsøra, Sunndal 23. juli 1979. Todalen, Surnadal 4. juni 1980.

Dermestes lardarius L.
MRi: Todalen, Surnadal 4. juni 1980. Sande, Sunndal 28. juni 1980.

Anthrenus museorum (L.)
MRi: Sande, Sunndal 11. april 1981. Arten ble funnet inne i hus.

Grynobius planus (Fabricius) (= tricolor (Oliver))
MRi: Fagerhaugen, Sunndal 22. juni 1976.

Niptus hololeucus (Faldermann)
MRi: Sande, Sunndal 9. oktober 1976.

Thanasimus formicarius (L.)
MRi: Årammen på Ålvundeid, Sunndal 17. mai 1978. Gjøra, Sunndal 17. mai 1979.

Pityophagus ferrugineus (L.)
MRi: Rindal 1. juli 1978.

Rhizophagus parvulus (Paykull)
MRi: Hoelsand, Sunndal 16. mai 1980.

Aphidecta obliterata (L.)
MRi: Sande, Sunndal 12. august 1977.

Coccinella trifasciata L.
MRi: Gruvedalen, Sunndal 3. juli 1977. (A.H. Dragseth). Lindalen, Sunndal (830 m.o.h.) 14. juli 1976.

Coccinella undecimpunctata L.
MRi: Sunndalsøra, Sunndal 25. juni 1980.

Myrrha octodecimguttata (L.)
MRi: Rindal, Rindal 31. juli 1978.

Calvia quattordecimguttata (L.)
MRi: Fagerhaugen, Sunndal 22. juni 1976. Hoel, Sunndal 19. mai 1978.

Myzia (= Paramysia) oblongoguttata (L.)
MRi: Rindal, Rindal 4. juni 1978. Hoelsand, Sunndal 14. juni 1980.

Byturus tomentosus Fabricius.
MRi: Rindal årlig 1973—81. Fagerhaugen, Sunndal 27. mai og 22. juni 1976. Vinnu, Sunndal 21. mai 1980.

Oedemera femorata (Scopoli)
MRi: Hoel, Sunndal 7. juni 1979. Litle-Fale, Sunndal 25. juli 1980. Disse funnene er gjort langt fra artens nærmeste tidligere kjente funnsted, som er Bohuslän i Syd-Sverige, og representerer trolig en relikt populasjon. Sunndalens gunstige klima og vegetasjon (frodige løvskoger med høgstaude-undervegetasjon og åpne blomsterenger på rasmark) kan gi grunnlag for populasjoner av slike varmekjære insektarter (Dragseth & Hanssen 1981).

Oedemera virescens (L.)
MRi: Fagerhaugen, Sunndal 2. juni 1975. Rindal 4. juni 1979.

Schizotus pectinicornis (L.)
MRi: Gikling, Sunndal 13. juni 1977. Hoel, Sunndal 19. mai 1978 og 31. mai 1979. Almberg, Rindal 4. juni 1979.

Bolithophagus reticulatus (L.)
MRi: Gjøra, Sunndal 20. mai 1981. Nærmere tyve eksemplarer ble iaktatt (derav noen fanget) på undersiden av kjuker på bjørkestammer i ei sydvendt li (300 m.o.h.) med blandingsskog av furu (*Pinus silvestris* L.) og bjørk (*Betula sp.*). Arten har en østlig utbre-

delse i Norge, og er tidligere ikke registrert hverken i Vestlandsfylkene eller i Sør-Trøndelag.

Asemum striatum (L.)
MRi: Smiset i Ålvundfjord, Sunndal 23. juni 1976. Hoel, Sunndal 24. juli 1978 (A.H. Dragseth).

Tetropium castaneum (L.)
MRi: Rindal 7. juli 1975.

Rhagium mordax (De Geer)
MRi: Orheiman, Sunndal 29. juli 1975. Seljebømarka i Ålvundfjord, Sunndal 22. mai 1976. Vinnu, Sunndal 19. mai 1978. Rindal 30. mai 1978. Mæhle, Sunndal august 1979. Hoelsand, Sunndal 16. mai 1980. Todalen, Surnadal 29. mai 1980.

Evodinus interrogationis (L.)
MRi: Ottem, Sunndal 7. juni 1975. Ett individ ble her fanget på tyrihjelm *(Aconitum septentrionale* Koelle) i en løvskog av gråor *Alnus incana* (L.)) og hegg *(Prunus padus* L.). Arten har en østlig utbredelse i Norge, og er tidligere ikke registrert i noen av Vestlandsfylkene.

Alosterna tabacicolor (De Geer)
MRi: Orheiman, Sunndal 18. juni 1976. Hoel, Sunndal 23. juli 1978 (A. H. Dragseth).

Aromia moschata (L.)
MRi: Almberg, Rindal 10. august 1978. En hann ble tatt på mjødurt *(Filipendula ulmaria* (L.)) i ei sydvendt li med innslag av varmekjære treslag som bl.a. alm *(Ulmus glabra* Huds.). Arten er tidligere registrert nord til indre Sogn og Fjordane.

Monochamus sutor (L.)
MRi: Håsen, Sunndal juni 1973. Sande, Sunndal 22. august 1979. Øksendalen, Sunndal 1. juli 1980.

Acanthoderes clavipes (Schank).
MRi: Hoel, Sunndal 29. juli 1977. 5—6 individer av arten ble funnet i en vedhaug (gråor *(Alnus incana* (L.)). Tidligere norske funn er gjort omkring Oslofjorden, samt i nordre del av Hedmark.

Leiopus nebulosus (L.)
MRi: Hoelsand, Sunndal 5. juli 1978. Ett individ ble funnet på en vedstabel i tett løvskog. Arten har en relativt sydlig utbredelse i Fennoskandia, men er i Norge funnet nord til og med Sør-Trøndelag (A.H. Dragseth).

Saperda scalaris (L.)
MRi: Rindal juni 1978. Hoelsand, Sunndal 5. juli 1978 og 14. juni 1979 (A.H. Dragseth).

Donacia versicolorea (Brahm)
MRi: Vinnu, Sunndal 7. september 1979.

Donacia obscura Gyllenhal
MRi: Igletjønna, Rindal 1975. Ålvvatna i Ålvundfjord, Sunndal 4. juli 1976. MRy: Vassgårdsvatn, Eide på Nordmøre 15. juli 1978.

Bromius (= Adoxus) obscurus (L.)
MRi: Vinnu, Sunndal 21. mai 1980.

Gonioctena (= Phytodecta) viminalis (L.)
MRy: Tingvoll 18. august 1979.

Galerucella numphaeae (L.) *(= sagittariae)* Gyllenhal)
MRi: Rindal 19. juni 1977.

Otiorhynchus lepidopterus (Fabricius) *(= salicis* Strøm)
MRi: Fagerhaugen, Sunndal 27. mai 1976.

Pissodes pini (L.)
MRi: Hoelsand, Sunndal 5. august 1977. Rindal 1. juli 1978.

Hylobius piceus (De Geer)
MRi: Todalen, Surnadal 4. juni 1980.

Rhinoncus pericarpius (l.)
MRi: Almberg, Rindal 4. juni 1979. MRy: Foldfjord, Aure 27. mai 1979.

Hylurgops palliatus (Gyllenhal)
MRi: Todalen, Surnadal 29. mai 1980.

Trypodendron lineatum (Oliver)
MRi: Todalen, Surnadal 4. juni 1980.

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Lepidoptera from Sigdal and adjacent districts, western Buskerud, Norway. III. Ditrysia (continued).

TROND ANDERSEN, ARILD FJELDSÅ AND ASBJØRN MØRCH (†)

Andersen, T., Fjeldså, A & Mørch, A. 1982. Lepidoptera from Sigdal and adjacent districts, western Buskerud, Norway. III. Ditrysia (continued). *Fauna norv. Ser. B. 29*, 78—84.

A list of 301 species of Lepidoptera of the superfamilies Hesperioidea, Papilionoidea, Bombycoidea, Geometroidea, Sphingoidea, Notodontoidea and Noctuoidea from western Buskerud is given. 165 of the species are previously not recorded from the area.

Several mainly boreo-alpine species, viz.: *Xestia collina* (Boisduval, 1840), *Xestia rhaetica* (Staudinger, 1871), *Hillia iris* (Zetterstedt, 1839), *Syngrapha diasema* (Boisduval, 1829), *Syngrapha microgamma* (Hübner, 1823), and *Sparganía luctuata* (Denis & Schiffermüller, 1775), or continental species, viz.: *Lampropteryx otregiata* (Metcalfe, 1917), and *Opigena polygona* (Denis & Schiffermüller, 1775), have got their known range in Fennoscandia extended to the southwest or west.

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INTRODUCTION

The present paper is the last in a series of three based on the collections made by the late Asbjørn Mørch in Sigdal and adjacent areas in western Buskerud during the years 1968 to 1974. Two previous papers (Andersen et al. 1978, 1979) covers the Monotrysian groups and the Ditrysia up to Pterophoroidea, while the remaining part of Ditrysia, Hesperioidea up to Noctuoidea, is treated here.

The only extensive list of Lepidoptera from western Buskerud was published by Strand (1899) from Ål in Hallingdal. Further information on the «Macrolepidoptera» fauna of this region has appeared in distribution maps (Nordström et al. 1955, 1961, 1969) and as records in tabular form given for western Buskerud (Opheim 1958, 1962, 1972). Single records have been published by Strand (1901, 1902, 1904), and by Opheim (1938, 1945, 1967, 1978). Finally, one record based on material included in the present paper was given by Andersen and Fjeldså (1974).

Six species of Lepidoptera have previously been recorded from Sigdal (Opheim 1967). Two of these, viz.: *Maniola jurtina* (L., 1758) and *Macrothylacia rubi* (L., 1758), were not taken by A. Mørch.

STUDY AREA

The localities are listed in Table 1. The majority of the localities lie within the municipality of Sigdal, from near the bottom of the valley system to somewhat beyond the treeline. The easternmost part of the area is characterized by spruce forests intermixed with pine and hardwoods. Scattered *Fraxinus excelsior* and *Acer campestris* here reach their northwest limits, while *Ulmus glabra* forms extensive stands in south bent slopes. *Quercus robur* and *Tilia cordata* have their northwest limits just south of the area. In the eastern branches of the mountains further west the subalpine birch *(Betula pubescens)* woods and shrubs extend.

METHODS AND MATERIAL

Mørch's collecting activity in Sigdal was restricted to the Easter time and to the summer months. As practically no work was done on immature stages, his collecting reflects the summer aspects of imaginal activity. Material from Hollerud from early autumn 1970 and 1971 was obtained through the assistance of Svein J. Hollerud.

The localities were worked with net and with sugar baits. Light traps were operated at Hollerud, Juvet, Prestfoss, and for shorter periods, probably also elsewhere.

The flight period is given as the first and last date of capture, regardless of the year, except in the case of single captures. Bivoltine cycles or imaginal hibernation is indicated by an interrupted period. Information on abundance is, when

Table 1. Localities.

Abbreviation	Locality	Municipality	UTM-reference	m. a.s.l.
Bh.	Berghammeren	Sigdal	32VNM0992	1260
Bs.	Båssætra	Sigdal	32VNM108748	870
Be.	Bøle	Sigdal	32VNM134782	620
Gl.	Grimeli-skogen	Krødsherad	32VNM3266	400
Hb.	Haglebu	Sigdal	32VNM099899	820
Hr.	Hollerud	Sigdal	32VNM183803	540
Hs.	Hollerudsætra	Sigdal	32VNM189829	950
Hv.	Høgevarde	Nore	32VNM060801	940
Jt.	Juvet (Eggedal)	Sigdal	32VNM205798	480
Kr.	Kaugerud	Sigdal	32VNM199790	280
Lo.	Liodden st.	Nes	32VNN0910	170
Nb.	Nesbyen st.	Nes	32VNN062159	170
Pf.	Prestfoss	Sigdal	32VNM3557	140
Rb.	Rødberg	Nore	32VMM969814	350
Sn.	Soneren	Sigdal	32VNM3256	110
Sm.	Solumsmoen	Sigdal	32VNM4348	100
St.	Småtjærna	Sigdal	32VNM1490	1020
Sb.	Steinbotn	Hol	32VMN438085	990
Sl.	Storeli	Nes	32VNN1011	470
Sf.	Strandefjorden	Hol	— — — —	450
Ts.	Tovaseter	Sigdal	32VNM179879	1000
Td.	Tukudalen	Sigdal	— — — —	
Uo.	Ustaoset	Hol	— — — —	990
Vb.	Vestbygda	Sigdal	— — — —	
Ål	Ål	Ål	32VMN7621	490

given, arrived from written notes and from what could be concluded from a few unsorted light trap batches. The number and sex given in the list refers to material now kept in the Museum of Zoology, Bergen.

THE SPECIES

Hesperiidae

Hesperia comma (L., 1758) Hb. July 1969 1 ♂. *Ochlodes venata* (Bremer & Grey, 1852) Pf. 19 June—24 July. *Pyrgus alveus* (Hübner, 1803) Bs. 2 July 1971 1 ♀. *P. centaureae* (Rambur, 1839) Bs. 2 July 1971 1 ♂, 2 ♀.

Papilionidae

Papilio machaon L., 1758 Pf. 22 June 1969 1 ♀.

Pieridae

Leptidea sinapis (L., 1758) Pf. 18—28 June 5 ♂, 3 ♀. *Colias palaeno* (L., 1761) Gl. 21—22 June 1969 6 ♂, 2 ♀. *Gonepteryx rhamni* (L., 1758) Sm. 28 July 1968 1 ♂. *Pieris brassicae* (L., 1758) Lo. 23 June 1969 1 ♂, 1 ♀. *P. rapae* (L., 1758) Sm. 28 July 1968 1 ♀. *P. napi* (L., 1758) Td. 26 July 1968 1 ♂, 1 ♀. *Anthocharis cardamines* (L., 1758) Ål 5 June 1968 2 ♂, 2 ♀.

Nymphalidae

Inachis io (L., 1758) Pf. June 1968. *Aglais urticae* (L., 1758) Hb., Pf. 28 June and 29 July 2 ♂, 2 ♀. *Mesoacidalia aglaja* (L., 1758) Td. 26 July 1968 1 ♂. *Fabriciana adippe* (Denis & Schiffermüller, 1775) Sm., Td. 26 and 28 July 3 ♀. *Brenthis ino* (Rottemburg, 1775) Pf., Td. 28 June and 26 July 3 ♂. *Boloria aquilonaris* Stichel, 1908 Hb., Td., Uo. 18 June—1 Aug. 6 ♂, 1 ♀. *Clossiana selene* (Denis & Schiffermüller, 1775) Gl. 21 June 1969 2 ♂. *C. freija* (Thunberg, 1791) St. 4—18 July, rare. *C. euphrosyne* (L., 1758) Gl., Hb. 17 and 21 June 3 ♂, 2 ♀. *Mellicta athalia* (Rottemburg, 1775) Gl., Hr. 21—26 June 5 ♂, 4 ♀. *Erebia ligea* (L., 1758) Be., Hb. 8—10 July 3 ♂. *E. pandrose* (Borkhausen, 1788) Bs., Hb. 17 June—10 July 4 ♂, 3 ♀. *Aphantopus hyperantus* (L., 1758) Pf. 28 June—18 July 1 ♂. *Coenonympha tullia* (Müller, 1764) Pf., Td. June 8 ♂. *C. pamphilus* (L., 1758) Lo. 23 June 1969 1 ♂. *Lasiommata petropolitana* (Fabricius, 1787) Gl., Lo., Pf. 1—24 June 3 ♂, 1 ♀.

Lycaenidae

Lycaena phlaeas (L., 1761) Pf. June. *L. hippothoe* (L., 1761) Hb. 27 July 1968 1 ♂. *Plebejus idas* (L., 1761) Hr., Lo., Pf., Td. 19 June—6 Aug. 7 ♂, 1 ♀. *Vacciniina optilete* (Knoch, 1781) Gl., Td. 21 and 24 June 4 ♂. *Eumedonia eumedon* (Esper,

1780) Lo., Sf., Ål 19—23 June 5 ♂, 9 ♀. *Aricia artaxerxes* (Fabricius, 1793) Vb., Ål 19 June and 3 July 2 ♂. *Cyaniris semiargus* (Rottemburg, 1775) Lo., Pf., Sl. June 9 ♂, 4 ♀.

Lasiocampidae

Poecilocampa populi (L., 1758) Vo. 5 Sept. 1970 1 ♂. *Trichiura crataegi* (L., 1758) Hb., Pf. 7 and 9 July 2 ♂. *Eriogaster arbuscula* Freyer, 1843 Hs. July 1971, numerous larvae, ex. l. 1 ♀ pupa, 1 ♂ hatched winter 1972—73. *Dendrolimus pini* (L., 1758) Hr. 7—11 July 1970 1 ♂.

Drepanidae

Falcaria lacertinaria (L., 1758) Jt. 21—23 June 1970 1 ♂. *Drepana falcataria* (L., 1758) Hr., Jt. 19—26 June 3 ♂, 2 ♀.

Thyatiridae

Thyatira batis (L., 1758) Jt. 20—22 June 1970 4 ♂. *Tethea or* (Denis & Schiffermüller, 1775) Jt. 20—26 June 1970, abundant. *Ochropacha duplaris* (L., 1761) Jt. 19 June—11 July, common.

Geometridae

Archiearis parthenias (L., 1761) Hr., Lo. Apr.—May, not rare. *A. notha* (Hübner, 1803) Hr. 13 Apr. 1971 1 ♂. *Geometra papilionaria* (L., 1758) Hr., Jt., Pf. 17 July—6 Aug., abundant. *Jodis putata* (L., 1758) Hr., Jt. 20 June 2 ♂. *Cyclophora albipunctata* (Hufnagel, 1767) Hr., Jt. 19 June—11 July. *Timandra griseata* (W. Petersen, 1902) Jt. 21 June 1970 1 ♂. *Scopula incanata* (L., 1758) Hr., Jt. 20 June—10 July, abundant. *S. floslactata* (Haworth, 1809) Hr. 24 June—11 July. *S. ternata* Schrank, 1802 Hr., Jt. 19 June—11 July, abundant. *Idaea aversata* (L., 1758) Jt., Pf. 19—24 June 3 ♂, 1 ♀. *I. biselata* (Hufnagel, 1767) Hr., Pf. 19—26 June. *Scotopteryx chenopodiata* (L., 1758) Hr., Jt., Pf. 30 June—6 Aug., abundant. *Xanthorhoe munitata* (Hübner, 1809) Hb., Pf., St., Uo. 30 June—28 July, abundant. *X. spadicearia* (Denis & Schiffermüller, 1775) Hr., Jt. 20 June—11 July, abundant. *X. ferrugata* (Clerck, 1759) Jt., Pf. 19—26 June, 30 July—20 Aug., not rare. *X. annotinata* (Zetterstedt, 1839) Bs., Uo. 18 June and 2 July 2 ♂, 1 ♀. *X. montanata* (Denis & Schiffermüller, 1775) Hr., Jt., Pf. 20 June—4 July, common. *X. fluctuata* (L., 1758) Hr., Pf. June—20 Aug., (bivoltine) abundant. *X. quadrifasiata* (Clerck, 1759) Jt. 20—26 June 1970 1 ♀. *Epirrhoe tristata* (L., 1758) Jt., 20 June 1970 1 ♀. *E. alternata* (Müller, 1764) Hr., Jt., Pf. 20—26 June, 10—20 Aug., common. *Camptogramma bilineata* (L., 1758) Pf. *Entephria caesiata* (Denis & Schiffermüller, 1775) Hb., Hr., Jt., Pf., Uo. 30 June—9 Sept., common. *Lampropteryx otregiata* (Metcalfe, 1917) Jt. 20 June—11 July, abundant. *L. suffumata* (Denis & Schiffermüller, 1775) Jt. 20—26 June, less frequent. *Cosmorhoe ocellata* (L., 1758) Hr., Jt., Pf. 20 June—4 July, abundant. *Eulithis prunata* (L., 1758) Hr., Pf. 17 July—20 Aug. *E. populata* (L., 1758) Hb., Hr., Jt., Pf. 10 Aug.—9 Sept., common. *E. mellinata* (Fabricius, 1787) Pf. 27 July 1968 1 ♂. *E. pyraliata* (Denis & Schiffermüller, 1775) Hr., Pf. 27 July—20 Aug. 1 ♂. *Ecliptopera silaceata* (Denis & Schiffermüller, 1775) Hr., Jt. 20—27 June, less frequent. *Chloroclysta siterata* (Hufnagel, 1767) Jt. 22 June 1970 1 ♀ (hibernated). *C. citrata* (L., 1761) Hr., Jt., Pf. 9 Aug.—9 Sept., common. *C. miata* (L., 1758) Hr. Sept. 1971. *C. latefasciata* (Staudinger, 1889) Hr. 10—20 Aug. 1970, not rare. *C. truncata* (Hufnagel, 1767) Hr., Jt., Pf. 20 June—11 July, 3—20 Aug., abundant. *Plemyria rubiginata* (Denis & Schiffermüller, 1775) Jt. 10 Aug. 1969 1 ♂. *Thera firmata* (Hübner, 1822) Hr., Jt. 10—20 Aug., 2 ♂. *T. variata* (Denis & Schiffermüller, 1775) Hr., Jt. 20 June—4 July, 2 Aug., first generation quite common. *T. obeliscata* (Hübner, 1787) Hr., Jt., Pf. 24—30 June, 10—20 Aug., second generation common. *T. cognata* (Thunberg, 1792) Hr. 10—20 Aug., common. *T. serraria* (Lienig & Zeller, 1846) Hr., Jt., Pf. 19—26 June, abundant. *Electrophaes corylata* (Thunberg, 1792) Jt. 20 June 1970 2 ♀. *Colostygia pectinataria* (Knoch, 1781) Hr., Jt., Pf. 22 June—4 July 3 ♂. *Hydriomena furcata* (Thunberg, 1784) Hr., Jt. 27 June—9 Sept., abundant. *H. impluviata* (Denis & Schiffermüller, 1775) Jt. 20 June 1970 2 ♂, 2 ♀. *H. ruberata* (Freyer, 1831) Uo. 18 June 1970 1 ♀. *Horisme tersata* (Denis & Schiffermüller, 1775) Jt. 19—26 June, sparsely. *Spargania luctuata* (Denis & Schiffermüller, 1775) Hr., Jt. 20 June—4 July 1 ♂, 1 ♀. *Rheumaptera subhastata* (Nolcken, 1870) Bs., Sl. 21 June—2 July 3 ♂. *Euphyia unangulata* (Haworth, 1809) Jt. 20—26 June, less frequent. *Epirrita autumnata* (Borkhausen, 1794) Hr. 9 Sept. 1971, common. *Operophtera brumata* (L., 1758) Hr. Sept. 1971. *O. fagata* (Scharfenberg, 1805) Hr. Sept. 1971. *Perizoma taeniata* (Stephens, 1831) Hr., Jt., Pf. 20—30 June 2 ♂, 4 ♀. *P. affinitata* (Stephens, 1831) Hr., Jt. 19 June—11July, less frequent. *P. alchemillata* (L., 1758) Hr., Jt., Pf. 20 June—17 July, common. *P. hydrata* (Treitschke, 1829) Jt. 19—26 June, abundant. *P. blandiata* (Denis & Schiffermüller, 1775) Hr. 4—11 July 2 ♂, 1 ♀. *P. didymata* (L., 1758) Hr., Pf. 17 July—20 Aug., common. *Eupithecia plumbeolata* (Haworth, 1809) Jt. 20—26 June 2 ♀. *E. abietaria* (Goeze, 1781) Jt. 20—26 June, abundant. *E. analoga* Diakonoff, 1926 (syn.: *bilunulata* auct., plur.) Jt. 19—26 June 3 ♂, 5 ♀. *E. linariata* (Denis & Schiffermüller, 1775) Hr., Pf. June, 10—20 Aug. (bivoltine). *E. exiguata* (Hübner, 1813) Pf. June 1 ♂. *E. venosata* (Fabricius, 1787) Jt. 20—26 June, abundant. *E. intricata* (Zetterstedt, 1839)

Hr., Jt., Pf. 1 June—4 July, abundant. *E. satyrata* (Hübner, 1813) Hr., Jt., Pf. 19 June—11 July, common. *E. absinthiata* (Clerck, 1759) Hr. 4 June 1973 1 ♂. *E. assimilata* Doubleday, 1856 Hr. 4 June 1973 1 ♀. *E. vulgata* (Haworth, 1809) Jt. 19—26 June, common. *E. denotata* (Hübner, 1813) Pf. 1 July 1969 1 ♂. *E. subfuscata* (Haworth, 1809) Jt. 20—26 June 7 ♂, 4 ♀. *E. icterata* (Villers, 1789) Hr., Jt. 20 June—4 July 2 ♂, 1 ♀. *E. succenturiata* (L., 1758) Hr. 4 July 1973 1 ♀. *E. indigata* (Hübner, 1813) Jt. 19—26 June, common. *E. pusillata* (Denis & Schiffermüller, 1775) Hr., Pf. 17 July—9 Sept., common. *E. tantillaria* Boisduval, 1840 Jt. 20—26 June 4 ♂, 5 ♀. *Chloroclystis rectangulata* (L., 1758) Jt. 20—26 June 1 ♂, 2 ♀. *Carsia sororiata* (Hübner, 1813) Hb. 7 Aug. 1969 1 ♀. *Aplocera plagiata* (L., 1758) Hr., Pf. June, 10—20 Aug. (bivoltine). *Odezia atrata* (L., 1758) Pf. June 1968. *Discoloxia blomeri* (Curtis, 1832) Jt. 20—26 June, common. *Venusia cambrica* Curtis, 1839 Hr., Jt., Pf. 20 June—4 July, common. *Euchoeca nebulata* (Scopoli, 1763) Jt. 20—26 June, not rare. *Hydrelia flammeolaria* (Hufnagel, 1767) Pf. 30 June 1968 1 ♀. *Lobophora halterata* (Hufnagel, 1767) Jt. 20—26 June 1 ♂, 2 ♀. *Pterapherapteryx sexalata* (Retzius, 1783) Jt. 20—26 June, not rare. *Lomaspilis marginata* (L., 1758) Hr., Jt., Pf. 20 June—11 July, common. *Semiothisa alternaria* (Hübner, 1809) Hr., Jt. 20 June—4 July, abundant. *S. signaria* (Hübner, 1809) Jt. 20—26 June, common. *S. liturata* (Clerck, 1759) Jt. 20—26 June 1 ♂, 4 ♀. *S. clathrata* (L., 1758) Pf. June. *Isturgia carbonaria* (Clerck, 1759) Bs. 2 July 1973 1 ♀. *Itame wauaria* (L., 1758) Hr., Jt., Pf. 1—20 Aug. 5 ♂, 2 ♀. *I. brunneata* (Thunberg, 1784) Pf. 30 June 1968 1 ♂. *Plagodis pulveraria* (L., 1758) Jt. 20 and 26 June 1 ♂, 2 ♀. *Opistograptis luteolata* (L., 1758) Hr., Jt., Pf. 1—27 June, common., *Epione repandaria* (Hufnagel, 1767) Hr., Jt., Pf. 5—20 Aug., less frequent. *E. paralellaria* (Denis & Schiffermüller, 1775) Hr. 10—20 Aug., abundant. *Selenia dentaria* (Fabricius, 1775) Hr., Jt., Uo. 18 June—4 July 3 ♂, 6 ♀. *Odontopera bidentata* (Clerck, 1759) Hr., Jt., Pf. 1 June—11 July, common. *Crocallis elinguaria* (L., 1758) Hr., Jt., Pf. 27 July—20 Aug., common. *Angerona prunaria* (L., 1758) Jt. 2 July 1968 1 ♂. *Biston betularia* (L., 1758) Pf. *Agriopis aurantiaria* (Hübner, 1799) Hr. Sept. 1971 1 ♂. *Alcis repandata* (L., 1758) Hr., Jt., Pf. 22 June—17 July, abundant. *Bupalus piniaria* (L., 1758) Hr., Jt. 22 June and 2 July 1 ♂, 1 ♀. *Cabera pusaria* (L., 1758) Hr., Jt., Pf. 1 June—11 July, common. *C. exanthemata* (Scopoli, 1763) Jt., Pf. 20 June—3 July 5 ♂. *Campaea margaritata* (L., 1767) Hr., Jt. 7 July—3 Aug. 2 ♂. *Hylaea fasciaria* (L., 1758) Jt. 22 June 1970 1 ♂. *Gnophos obfuscatus* (Denis & Schiffermüller, 1775) Hr., Jt. 22 June—2 Aug., common. *Catascia sordaria* (Thunberg, 1792) Hr. 7—11 July, less frequent. *Glacies coracina* (Esper, post 1796) Bs., Hb., Hv., Ts. 2—5 July, abundant.

Sphingidae

Agrius convolvuli (L., 1758) Kr. 2 Sept. 1970 1 ♂. *Hyloicus pinastri* (L., 1758) Jt. 21 June 1970 1 ♂. *Laothoe populi* (L., 1758) Jt., Pf. 22—28 June, abundant. *Deilephila elpenor* (L., 1758) Jt. 22 June 1970 1 ♂. *D. porcellus* (L., 1758) Hr., Jt. 2 and 3 June 4 ♂.

Notodontidae

Harpyia furcula (Clerck, 1759) Jt. 19 June 1970 1 ♀. *Notodonta dromedarius* (L., 1767) Hr., Jt. 20 June—4 July 3 ♂. *Tritophia tritophus* (Denis & Schiffermüller, 1775) Hr. 23—26 June 1970 1 ♀. *Pheosia tremula* (Clerck, 1759) Hr., Jt. 19 June—11 July, 3 Aug. 2 ♀. *P. gnoma* (Fabricius, 1777) Hr., Jt., Pf. 1 June—11 July 7 ♂, 1 ♀. *Pterostoma palpina* (Clerck, 1759) Hr., Jt. 20 June—4 July 11 ♂, 1 ♀. *Ptilodon capucina* (L., 1758) Hr., Jt. 20 June—7 July, abundant. *Eligmodonta ziczac* (L., 1758) Jt., Pf. 21—24 June, 6 Aug. 3 ♀. *Odontosia sieversi* (Ménétriès, 1856) Rb. Apr. 1971 1 ♂. *Clostera curtula* (L., 1758) Hr., Jt. 20—26 June, abundant. *C. pigra* (Hufnagel, 1766) Jt., Uo. 18—22 June 3 ♂, 1 ♀.

Lymantriidae

Leucoma salicis (L., 1758) Hr. 23 June—11 July 2 ♂.

Arctiidae

Eilema complana (L., 1758) Pf. 17 July 2 ♂. *E. luridеola* (Zincken, 1817) Hr., Jt., Pf. 19 June—17 July, common. *Parasemia plantaginis* (L., 1758) Bs., Hb., Hr., Pf., Vb. 1 July—6 Aug. 8 ♂, 4 ♀. *Diacrisia sannio* (L., 1758) Hr., Jt. 19 June—4 July 6 ♂. *Spilosoma lubricipeda* (L., 1758) Hr., Jt., Pf. 1 June—11 July, common. *Diaphora mendica* (Clerck, 1759) Jt. 19 June 1970 2 ♂. *Phragmatobia fuliginosa* (L., 1758) Hr. 8 Apr. 1971 larva, ex l. 1 ♀.

Noctuidae

Euxoa nigricans (L., 1761) Jt. 1 Sept. 1970 1 ♀. *E. recussa* (Hübner, 1817) Hr., Jt., Pf. 3—20 Aug. 9 ♂, 1 ♀. *Agrotis clavis* (Hufnagel, 1766) Hr. 24 June—11 July, abundant. *A. exclamationis* (L., 1758) Jt., Pf. 26 June—1 July, abundant. *Actinotia polyodon* (Clerck, 1759) Hr., Jt. 20—27 June 13 ♂, 5 ♀. *Ochropleura praecox* (L., 1758) Nb. 8 Aug. 1969 1 ♂. *O. plecta* (L., 1761) Jt., Pf., Sn. 21—30 June, abundant. *Rhyacia grisescens* (Fabricius, 1794) Hr., Jt. 3 Aug.—1 Sept. 1 ♂, 2 ♀. *Chersotis cuprea* (Denis & Schiffermüller 1775) Hb., Hr., Jt., Pf. 7 July—7 Aug., abundant. *Noctua pronuba* (L., 1758) Pf. 27 July 1968. *Opigena polygona* (Denis & Schiffermüller 1775) Hr., Jt. 26 July—1 Sept., abundant. *Graphiphora augur* (Fa-

bricius, 1775) Hr., Jt., Pf. 23 June—27 July, abundant. *Paradiarsia sobrina* (Duponchel, 1843) Hr., Jt., Pf. 15 July—10 Aug. 9 ♂, 1 ♀. *Lycophotia porphyrea* (Denis & Schiffermüller, 1775) Hr., Jt., Pf. 21 June—1 July 5 ♂, 1 ♀. *Diarsia mendica* (Fabricius, 1775) Hb., Hr., Jt., Pf. 22 June—7 Aug., common. *D. dahlii* (Hübner, 1813) Jt. 10 Aug. 1969 1 ♂. *D. brunnea* (Denis & Schiffermüller, 1775) Hr., Jt., Pf. 19 June—3 July 3 ♂. *D. rubi* (Vieweg, 1790) Hr., Jt., Pf. 22 June—2 Aug. 3 ♂. *Xestia rhaetica* (Staudinger, 1871) Hr. 18 Aug. 1971 1 ♂. *X. speciosa* (Hübner, 1813) Hr. 8—18 Aug. 1971 2 ♂. *X. alpicola* (Zetterstedt, 1839) Hb., Pf. 1—28 July, less frequent. *X. collina* (Boisduval, 1840) Hr. 7—11 July 1970 2 ♂. *X. triangulum* (Hufnagel, 1766) Hr. 7—11 July 1970 1 ♂. *X. baja* (Denis & Schiffermüller, 1775) Hr., Jt., Pf. 4 July—1 Sept., abundant. *X. sexstrigata* (Haworth, 1809) Pf. 1 July—9 Aug. 2 ♂. *Naenia typica* (L., 1758) Pf. 1 July 1968 1 ♂. *Eurois occulta* (L., 1758) Jt. 20 Aug.—1 Sept. 2 ♂. *Anaplectoides prasina* (Denis & Schiffermüller, 1775) Pf. 1 July 1968 1 ♂. *Anarta cordigera* (Thunberg, 1788) Bs. 4 July 1971 1 ♀. *Hada proxima* (Hübner, 1808) Hr., Jt., Pf. 22 June—1 Sept. 10 ♂, 8 ♀. *H. nana* (Hufnagel, 1766) Jt., Pf., Sn., Uo. 22 June—20 Aug., abundant. *Polia bombycina* (Hufnagel, 1766) Hr., Jt., Pf. 21 June—1 July 3 ♂. *P. hepatica* (Clerck, 1759) Hr. 23 June—3 July 5 ♂, 1 ♀. *P. nebulosa* (Hufnagel, 1766) Hr. 7—11 July 1970 3 ♂. *Heliophobus reticulata* (Goeze, 1781) Jt. 20—26 June 12 ♂. *Mamestra brassicae* (L., 1758) Hr. 7—11 July 1 ♂. *Lacanobia contigua* (Denis & Schiffermüller, 1775) Jt. 20—22 June 1 ♂, 3 ♀. *L. thalassina* (Hufnagel, 1766) Hr., Jt., Sn. 19 June—11 July 2 ♂, 6 ♀. *L. suasa* (Denis & Schiffermüller, 1775) Jt., Sn. 21—28 June 4 ♂, 1 ♀. *L. oleracea* (L., 1758) Jt. 22 June 1970 1 ♂. *L. biren* (Goeze, 1781) Hr., Jt. 21—26 June 5 ♂, 4 ♀. *Ceramica pisi* (L., 1758) Hr., Jt., Pf., Sn. 21 June—11 July 4 ♂. *Hadena rivularis* (Fabricius, 1775) Hr., Jt., Pf. 22—30 June 6 ♂, 2 ♀. *H. perplexa* (Denis & Schiffermüller, 1775) Hr., Jt. 20—26 June 6 ♂. *H. confusa* (Hufnagel, 1766) Hr., Jt. 20—26 June 8 ♂, 3 ♀. *H. bicruris* (Hufnagel, 1766) Hr., Jt. 20—22 June, 18 Aug., abundant. *Cerapteryx graminis* (L., 1758) Jt., Pf., Sn. 28 June—19 Aug., common. *Tholera cespitis* (Denis & Schiffermüller, 1775) Jt., Pf. 6—20 Aug. 7 ♂. *T. decimalis* (Poda, 1761) Jt. 18 Aug.—1 Sept. 5 ♂, 1 ♀. *Orthosia gothica* (L., 1758) Hr., Apr. *Mythimna conigera* (Denis & Schiffermüller, 1775) Hr., Jt., Sn. 27 June—3 Aug., common. *M. ferrago* (Fabricius, 1787) Hr. 3 July 1973 1 ♂, 1 ♀. *M. impura* (Hübner, 1808) Hr., Jt., Pf. 26 June—11 July 1 ♂, 1 ♀. *M. pallens* (L., 1758) Pf. 27 July—9 Aug. 2 ♂, 1 ♀. *M. comma* (L.,1761) Hr., Jt., Pf. 20 June—1 July 18 ♂. *Brachylomia viminalis* (Fabricius, 1777) Hr., Jt., Pf. 3—20 Aug., abundant. *Hillia iris* (Zetterstedt, 1839) Hb., Hr., Sb. 6—20 Aug. 3 ♂. *Sympistis heliophila* (Paykull, 1793) Bs. 5 July 1969 1 ♂. *Dasypolia templi* (Thunberg, 1792) Hr. 2 Sept. 1970. *Lithomoia solidaginis* (Hübner, 1803) Jt. 30 Aug.—1 Sept. 1970. *Lithophane consocia* (Borkhausen, 1792) Hr., Rb. Apr., Aug.—3 Sept. 2 ♂. *Blepharita adusta* (Esper, 1790) Hr., Jt., Pf. 21 June—1 Sept. 1 ♂, 4 ♀. *Polymixis gemmea* (Treitschke, 1825) Jt. 18 Aug.—1 Sept. 7 ♂. *Antitype chi* (L., 1758) Hr. 2 Sept. 1970. *Ammoconia caecimacula* (Denis & Schiffermüller, 1775) Hr. 10 Aug.—7 Sept. 7 ♂. *Agrochola helvola* (L., 1758) Jt. 30 Aug.—1 Sept. 1970. *A. litura* (L., 1761) Hr., Jt. 13 Aug.—1 Sept. 3 ♀. *Parastichtis suspecta* (Hübner, 1817) Hr., Jt., Pf. 27 July—20 Aug., abundant. *Xanthia aurago* (Denis & Schiffermüller, 1775) Hr. 30 Aug.—1 Sept. 1970 1 ♂. *X. togata* (Esper, 1788) Jt. 19 Aug. 1970 2 ♂. *X. icteritia* (Hufnagel, 1766) Jt. 19 Aug.—1 Sept. 3 ♂, 4 ♀. *Acronicta megacephala* (Denis & Schiffermüller, 1775) Hr., Jt. 20 June—11 July 14 ♂, 1 ♀. *A. alni* (L., 1767) Jt. 21 June 1970 1 ♀. *A. menyanthidis* (Esper, 1789) Jt. 21 June 1970 1 ♂. *A. auricoma* (Denis & Schiffermüller, 1775) Hr., Jt. 20—23 June 11 ♀. *A. rumicis* (L., 1758) Hr., Jt. 20—26 June 1 ♂, 7 ♀. *Amphipyra tragopoginis* (Clerck, 1759) Pf. Aug. 1 ♂. *Dipterygia scabriuscula* (L., 1758) Hr. 24—26 June 1970 1 ♂. *Rusina ferruginea* (Esper, 1785) Jt., Pf. 20 June—13 July, common. *Euplexia lucipara* (L., 1758) Hr., Jt. 21—26 June 6 ♂. *Ipimorpha subtusa* (Denis & Schiffermüller, 1775) Hr. 10—20 Aug. 1971 1 ♂. *Enargia paleacea* (Esper, 1788) Hr., Jt., Pf. 9—20 Aug., abundant. *Hyppa rectilinea* (Esper, 1788) Hr., Jt. 21—26 June 8 ♂, 3 ♀. *Apamea monoglypha* (Hufnagel, 1766) Jt. 1 Aug. 1968 1 ♂. *A. crenata* (Hufnagel, 1766) Hr., Jt., Pf. 21 June—3 Aug., abundant. *A. lateritia* (Hufnagel, 1766) Hr., Jt., Pf. 24 June—1 Sept., abundant. *A. furva* (Denis & Schiffermüller, 1775) Hr. 7—11 July 1970 4 ♂. *A. rubrirena* (Treitschke, 1825) Hr. 6 Aug. 1971 1 ♀. *A. maillardi* (Geyer, 1832) Bh., Hr. 7 July—2 Aug. 3 ♂, 2 ♀. *A. remissa* (Hübner, 1809) Pf. 27 July 1968 1 ♂. *A. illyria* (Freyer, 1852) Hr., Jt. 21—26 June 6 ♀. *Oligia strigilis* (L., 1758) Hr., Jt. 22—26 June 2 ♂, 4 ♀. *O. latruncula* (Denis & Schiffermüller, 1775) Hr., Jt., Pf. 21 June—3 Aug. 5 ♂, 1 ♀. *Mesapamea secalis* (L., 1758) Pf. 9 Aug. 1969 1 ♂. *Amphipoea fucosa* (Freyer, 1830) Pf. 27 July—9 Aug. 4 ♂. *A. oculea* (L., 1761) Jt. 10 Aug. 1968 1 ♂. *Hydraecia micacea* (Esper, 1789) Jt., Pf. 28 July—19 Aug. 3 ♂, 1 ♀. *Celaena haworthii* (Curtis, 1829) Jt. 1 Sept. 1970 1 ♂. *Hoplodrina alsines* (Brahm, 1791) Pf. 27 July 1968 1 ♂. *H. blanda* (Denis & Schiffermüller, 1775) Hr. 10—20 Aug. *Caradrina morpheus* (Hufnagel, 1766) Hr., Jt., Pf. 24 June—27 July, abundant. *C. cinerascens* (Tengström, 1869) Hr. 10—20 Aug. *C. selini* (Boisduval, 1840) Jt. 20 June 1970 2 ♂. *Colocasia coryli* (L., 1758) Hr., Jt. 24 June—3 July 3 ♂. *Diachrysia chrysitis* (L., 1758) Hr., Jt., Pf. 21 June—3 July, 10 Aug. 9 ♂. *Autographa pulchrina* (Haworth, 1809) Hr., Jt., Pf., Sn. 22 June—20 Aug., common. *A. bractea* (Denis & Schiffermül-

ler, 1775) Jt. 3 and 18 Aug. 2 ♂, 1 ♀. *Syngrapha diasema* (Boisduval, 1829) Hr. 7—18 July 3 ♂. *S. microgamma* (Hübner, 1823) Hr. 24—26 June 1970 1 ♀. *S. interrogationis* (L., 1758) Hb., Hr., Jt. 7 July—1 Sept. 3 ♂, 2 ♀. *Abrostola triplasia* (L., 1758) (syn.: *triplasia* sensu Dufay 1956, *tripartita* (Hufnagel, 1766)) Hr., Jt., Pf. 20 June—1 July, 3—19 Aug. 9 ♂, 2 ♀. *Euclidia glyphica* (L., 1758) «Sigdal» 30 June 1968. *Lygephila craccae* (Denis & Schiffermüller, 1775) Hr. 15 Aug.—9 Sept., several specimens. *L. pastinum* (Treitschke, 1826) Pf. July 1968 1 ♂. *Scoliopteryx libatrix* (L., 1758) Jt. 20 June 1970 1 ♂, 1 ♀. *Hypena crassalis* (Fabricius, 1787) Hr. 7—11 July 1970 1 ♀. *Hypena proboscidalis* (L., 1758) Jt., Pf. 30 June and 3 Aug., abundant. *Herminia tarsipennalis* (Treitschke, 1835) Pf.

DISCUSSION

Mørch's collection contained a total of 496 species of Lepidoptera from western Buskerud. This represented an increase in the number of species recorded for western Buskerud of about 40 percent; in the case of Geometridae and Noctuidae almost 100 and 125 percent, respectively.

The occurence of most of the species was expected when their known range in comparable inland localities elsewhere in eastern Norway is considered. But there are also records of particular faunistical interest. Firstly some Eurasiatic, principally continental boreal, boreo-montane or boreo-alpine species, viz.: *Xestia collina* (Boisduval, 1840), *Xestia rhaetica* (Staudinger, 1871), *Hillia iris* (Zetterstedt, 1839), *Syngrapha diasema* (Boisduval, 1829), *Syngrapha microgamma* (Hübner, 1823), and *Spargania luctuata* (Denis & Schiffermüller, 1775), have got their known range extended to the southwest. Secondly, a westward extension of mainly continental, European or Eurasiatic species viz.: *Chionodes luctuella* (Hübner, 1793), *Lampropteryx otregiata* (Metcalfe, 1917), *Opigena polygona* (Denis & Schiffermüller, 1775). Thirdly, a southward extension of *Agonopterix broennoeensis* (Strand, 1920), at present a Scandinavian endemic. The capture of several of these, mainly boreo-alpine species, outlines an increase of their presumed continous Fennoscandian range. Other captures join, together with captures further south and west, a prospected range penetrating deep into the southwest mountain districts of Norway. The latter statement is explained by some unpublished records: *L. otregiata* Kvassdalen, HOi: Voss 4 July 1940 1 ♂ N. Knaben leg. *X. collina* Solhaug, HOi: Røldal 2 July 1942 1 ♂, 1 ♀ O.B. Lundetræ leg. *H. iris* Rosendal, HOi: Kvinnherad 10—15 Aug. 1977 1 ♂ T. Andersen leg.; Dimmelsvvik, HOi: Kvinnherad 17 Aug. 1977 5 ♂ T. Andersen leg.: Uskedalen, HOi: Kvinnherad 17. Aug. 1977 3 ♂ T. Andersen leg. *S. diasema* Nedrestøl, BV: Hol 18 July 1971 1 ♀ T.I. Baldersheim leg.; Bykle, AAi: Bykle July 1969 1 ♀ A. Fjellberg leg.

L. otregiata and *O. polygona* occured commonly in Sigdal. This is interesting as there are only a few previous observations of these species in Norway. *L. otregiata* has previously only been recorded from Akershus (Knaben 1951, Opheim 1967 as *Lampropteryx minna* auct.). At Juvet the species even outnumbered other geometrids. *O. polygona* was recorded for the first time in Norway from Akershus (Opheim 1969), and it has recently been recorded from Rollag in western Buskerud (Opheim 1978). There is one additional unpublished record from eastern Buskerud: Svene, Bø: Flesberg 1 Sept. 1969 1 ♂ O.B. Lundetræ leg.

A number of the species have previously not been taken in the inlands west of the Oslofjord, viz.: *Archiearis notha* (Hübner, 1803), *Eulithis mellinata* (Fabricius, 1787), *Angerona prunaria* (L., 1758), *Tritophia tritophus* (Denis & Schiffermüller, 1775), *Eilema complana* (L., 1758), *Polia nebulosa* (Hufnagel, 1766). *Ammoconia caecimacula* (Denis & Schiffermüller, 1775), *Xanthia aurago* (Denis & Schiffermüller, 1775), *Acronicta alni* (L., 1757) and *Lygephila craccae* (Denis & Schiffermüller, 1775). It must however, be emphasized that the occurence of these species in Sigdal does not deviate much from their expected range if their Swedish distribution is considered, but merely points out the unsufficient knowledge of districts of eastern Norway.

The food plant of *X. aurago, Tilia cordata,* does not grow naturalized in Sigdal. However, experience from other districts will associate *X. aurago* with *Ulmus glabra,* which is common in the eastern part of Sigdal.

Opheim (1958, 1962) has given graphs of the supposed number of species of various family groups in different parts of Norway. The revised figures for western Buskerud, compared to Opheim's estimates (given in brackets), are: Rhopalocera 47 (53), «Sphinges, Bombyces» 29 (35) and «Noctuoidea» 126 (125). The overall figure for the area is hence almost brought up to the estimate, but western Buskerud still remains amongst the least explored areas. In the advanced lowlands in the eastern part of western Buskerud there are undoubtly several species still to be taken. Also if compared to northern Opland, a well-worked inland and mountainous

district, the numbers estimated for western Buskerud appear to be much too low. The fauna of northern Opland includes a number of subarctic-, arctomontan- and some xerothermic or even helophilic species, that cannot be expected to occur in western Buskerud, but these species cannot entirely compensate for the considerable difference in actual and estimated fauna of northern Opland and western Buskerud.

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Some studies on Macrolepidoptera in coastal heathland habitats in Western Norway

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Between 1975 and 1980 some 225 species in 11 families and more than 25.000 specimens were collected on northern Sotra, mainly in light traps, but also with nets and as larvae. The two important families were Noctuidae with 105 species and Geometridae with 85 species. *Mythimna unipuncta* (Haworth, 1809) was recorded for the first time in Scandinavia.

Based on light trap catches the composition of the Macrolepidoptera fauna in the two main heathland habitats, the *Calluna*- heath and the grassland, were compared using various species diversity indices. The *Calluna*- heath had lowest species diversity due to the poor flora. In both habitats species diversity was higher in Noctuidae than in Geometridae. Similarity indices showed that the number of species common to both habitats was highest in Noctuidae which might reflect a higher dispersal potensial. The ranking of the dominant species was more similar in Geometridae indicating the importance of *Juniperus* as foodplant in both habitats.

Thera cognata (Thunberg, 1792) was the dominant species in both habitats, while *Lycophotia porphyrea* (Denis & Schiffermüller, 1775) ranged second in the *Calluna*- heath and *Cerapteryx graminis* (L., 1758) on the grassland. Most of the abundant species are common and widespread in Western Norway, but *Pachycnemia hippocastanaria* (Hübner, 1799) and *Stilbia anomala* (Haworth, 1812) are typical for the coastal heathlands.

The flight periods of the abundant species are given. The median day of the flight generally occurred earlier in the males than in the females. The sex-ratio in the light trap catches differed strongly in favour of males.

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INTRODUCTION

The heathlands in Western Norway are at the northern border of the typical West European lowland heaths (Gimingham 1976). These heathlands are situated in the oceanic and suboceanic regions of Western Europe, characterized by a mild temperate climate with relatively cool summers and mild winters. As in most parts of Western Europe the formation of lowland heaths in Western Norway is probably due to activities of man. About 2000 years ago the coast of Western Norway was covered with pine forests, which later were cut down to give grazing land to the livestock (Kaland 1974). On poor and shallow soils the typical heath developed, and with it a characteristic, rather marginal type of farming, mainly based on sheep. Grassland evolved in places with richer and deeper soils. To prevent the recolonization of trees and to stimulate the growth of young nutritious shoots on the *Calluna,* the heaths were burned every tenth year.

During the last century, old farming habits have changed. As a result old *Calluna*- heath is today the dominant vegetation type, in several places also replacing grassland. Seedlings of Pine, *Pinus silvestris,* and decidious trees like Mountain Ash, *Sorbus aucuparia,* and Birch, *Betula pubescens,* are now allowed to invade the heathlands. Several municipalities along the West Coast also have programs for vegetating the heathlands with foreign coniferous species. The coastal heathlands in Western Norway therefore gradually change, and in some areas the typical heaths have already disappeared.

In recent years the lowland heaths of Western Europe have attracted much attention, particularly among botanists (e.g. Gimingham 1976). In Western Norway the «Lindåsprosjektet» has worked on the ecology of heathlands (Mortensen 1974) including surveys of invertebrates (Hauge 1976, Solhøy et al. 1981).

Larvae of Macrolepidoptera are herbivorous

and probably play an important role as consumers of the heather plants. They also are important as food for passerine birds. However, little attention has been paid to the Lepidoptera fauna of the coastal heathlands in West Norway. Lie-Petersen (1905) listed 39 species of Macrolepidoptera from small islands in Feiefjorden NW of Bergen. A list of Lepidoptera from Gulen in outer Sogn and Fjordane also included some records from heathland habitats (Andersen 1974).

This paper gives a survey of the species, figures of relative abundance, and flight periods of Lepidoptera in a typical Western Norwegian coastal heathland on the island of Sotra, west of Bergen. The two main habitats, the *Calluna*-heath and the grassland, have been studied in detail. Other habitats such as hardwood shrubs, cultivated fields and gardens, swampy vegetation along ponds and lakes etc., also have been sampled. The superfamilies Papilionoidea, Bombycoidea, Geometroidea, Sphingoidea, Notodontoidea, and Noctuoidea are treated here.

STUDY AREA

The field work was carried out on northern Sotra (approx. 4°57'—5°03'E and 60°22'—60°27'N), a rather large island situated on the Atlantic Coast west of Bergen (Fig. 1). The

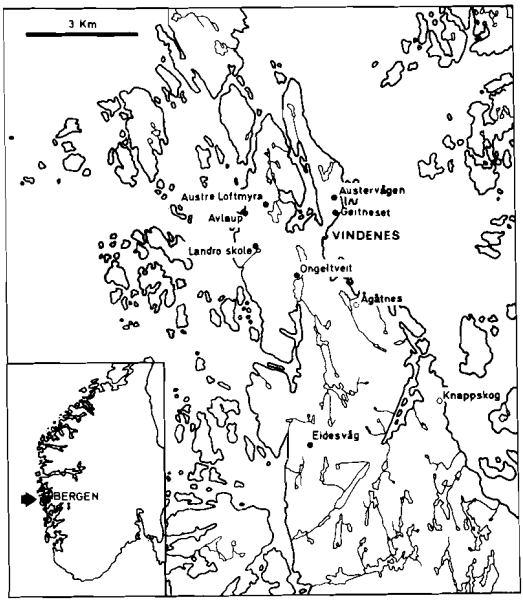


Fig. 1. Northern Sotra, showing the position of the sampling sites. Black symbols: location of light traps; open symbols: additional localities.

landscape is rather flat and most of the area is situated between 20 and 50 m a.s.l. The topography is characterized by expanses slightly elevating to the west and ending abruptly in steep, westward-facing escarpments. The bedrock consists mainly of gneisses of precambrian origin. Some amphibolites with a richer soil occurs mainly in the Vindenes area.

Northern Sotra has a typical oceanic climate. The meteorological station Hellisøy, about 50 km to the north of northern Sotra probably is the station with a climate most similar to the study area. Hellisøy has a mean annual temperature of 7.6°C, the mean temperature in January and July is 2.3°C and 13.8°C, respectively. Normally 11 days/yr have a maximum temperature above 20°C, 43 days have a minimum temperature below 0°C, and the ground is covered with snow about 40 days/yr. The mean annual precipitation is 1218 mm and about 220 days have a precipitation of $\geqslant 0.1$ mm. Strong breeze (Beaufort scale 6) or stronger winds blow normally 107 days/yr.

There are a few settlements and farms on northern Sotra surrounded by cultivated fields and pastures, but the main part of the area is dominated by heathland. A botanical survey of the Vindenes area recorded 219 species of vascular plants (Øvstedal 1978). About 20 different plant communities were recognized. The most common types were dry heath (Vaccinio-Callunetum Büker 1942) dominated by *Calluna* and with *Vaccinium myrtillus, V. vitis-idaea* and *Hypnum jutlandicum,* wet heath (Ericetum tetralicis Schwick 1933) with *Calluna, Erica tetralix, Narthecium ossifragum, Juncus squarrosus,* and *Sphagnum compactum,* and ombrotrophic mire (Vaccinio-Ericetum J.J. Moore 1962) dominated by *Eriophorum vaginatum* and *Calluna.* The grassland communities belong to the association Nardo-Galion Preisinger 1949; the most common type is dominated by *Agrostis tenuis, Anthoxanthum odoratum* and *Galium saxatile.*

Juniperus is a dominant plant species in most of the dryer heathlands. *Salix aurita* and *S. repens* are also common in the area. Deciduous trees grow mainly in connection with the farms and settlements. Hardwood shrubs, mainly *Corylus avellana* and *Populus tremula,* can also be found in sheltered places in the heath. At Geitneset there is a rather large stand of *Quercus robur.* Seadlings of *Betula pubescens, Sorbus aucuparia* and *Pinus silvestris* spread in the heath, and a number of foreign conifers *(Pinus mugo, Picea sitchensis, P. abies, Larix decidua)* have

been planted, mostly as single trees, but also as forest-forming stands.

Several small lakes and ponds are situated in the area, mainly oligotrophic with sparse vegetation, but a few ponds have a richer vegetation dominated by *Phragmites communis*. The sea shores are mainly rocks covered with lichen vegetation, but there are also a few coves with halophytes such as *Puccinellia, Triglochin* and *Atriplex*.

In 1978 two light traps were operated in a rather extensive heathland in Austre Loftmyra (Fig. 1). At the trapping site dry heath, dominated by *Calluna, Erica cinerea* and *Juniperus*, alternate with wet heath and ombrotrophic mire, dominated by sedges and grasses, mainly *Scirpus caespitosus, Eriophorum vaginatum* and *Molinia coerulea*, but also with *Calluna, Empetrum nigrum* and *Erica tetralix*. The vegetation in the wettest parts were dominated by *Eriophorum angustifolium*. The same year two light traps were situated at Austervågen (Fig. 1), in an area with grassland and cultivated meadows, intensively used as grazing land for sheep. The vegetation at the trapping site was dominated by sedges, mainly *Carex* spp. and *Scirpus caespitosus*, and grasses like *Sieglingia decumbens, Anthoxanthum odoratum* and *Festuca vivipara*. *Juniperus, Vaccinium uliginosum* and *Salix repens* were common, and on swampy ground also *Myrica gale*. A few trees and shrubs, mainly *Betula pubescens, Sorbus aucuparia* and *Salix aurita*, were growing nearby.

MATERIAL AND METHODS

Sampling

The study was carried out between 1975 and 1980. The main sampling period was in 1978. Day-active species were collected mainly in the Vindenes area. Heathlands were particularly thoroughly searched, but specimens were also hunted in other types of habitats such as gardens and cultivated fields. The rainy climate in northern Sotra prevented regular sampling of day-active species, and the records of butterflies and other day-active species are therefore based on the collections made during the relatively few days of fine weather. A few species were also taken exclusively as larvae.

Most of the material was collected in light traps. The light traps used were of a modified Robinson type, fitted with mercury vapour bulbs (Philips HPL-N 125 W). The trapping periods were 3—5 days.

The trapping at Austre Loftmyra and at Austervågen in 1978 were started on March 31. At Austervågen the traps were operated without major accidents until November 5, when a period of cold weather set in. The traps at Austre Loftmyra were situated at a rather wind-exposed site, and the trapping had to be terminated in September, when the traps were destroyed by storm.

A total of 8636 and 7436 specimens of «Macrolepidoptera» were taken in the traps at Austre Loftmyra and at Austervågen, respectively. The sections on species diversity, similarity, the dominant species and flight periods are based on these two sets of material. The localities will be referred to as the «heath» and the «grassland».

In addition light traps were operated for shorter or longer periods in several other localities, Tab. 1, Fig. 1. These localities were chosen to cover the main vegetation types in the area. However, only records of species not taken at Austre Loftmyra or at Austervågen in 1978 are included in this paper.

Calculations

Based on the light trap catches from Austre Loftmyra and Austervågen in 1978 the species richness and equitability in the apportionment of the specimens among the species in the two main habitats have been studied. The species richness is expressed using Menhinick (1964) index $d = S/\sqrt{N}$, where S is the number of species and N the number of specimens. The index has pro-

Table 1. Localities on northern Sotra sampled with light traps between 1975 and 1978.

No.	Locality	UTM-reference	Year	Habitat type
1	Austervågen	32VKN803064	1977—79	Grassland
2	Austre Loftmyra	KN787062	1978	*Calluna* heath
3	Avlaup	KN779062	1978	Shore with saline vegetation
4	Eidesvåg	KM792999	1975—76	*Calluna* heath
5	Geitneset	KN805057	1978	Hardwood thicket with *Quercus* and *Corylus*
6	Landro skole	KN782051	1978	Pond with *Phragmites*, and cultivated fields
7	Ongeltveit	KN793044	1976	Hardwood thicket with *Populus* near small lake

ved to remain fairly constant in the same population despite increasing sample size.

The overall diversity is expressed by the Shannon — Wiener index of general diversity (Odum 1971)

$$H' = -\sum_{i=1}^{s}\left(\frac{n_i}{N}\right)\log_2\left(\frac{n_i}{N}\right)$$

where ni is the number of specimens of the ith species, and N is the Σni. It ranges from 0 to $\log_2 S$. The index combines both the species richness and the equitability components of animal diversity. The equitability component can be separated from the effect of the number of species using Lloyd and Ghelardi (1964) equitability index (E). The degree of equitability is appreciated by comparing the observed diversity, H', to a value H_m, attainable by a community containing the same number of species as the observed one, but with «maximum» equitability, i.e. following McArthur's «broken-stick» model of frequency distribution of the species (Southwood 1975). This is equivalent to the ratio E = S'/S where S' is the number of hypothetical, equitably distributed species that would be needed to produce a species diversity equivalent to the observed one, and S is the actual number of species observed.

The Noctuidae and Geometridae faunas in the two habitats have been compared using two different similarity indices: 1. The Sørensen (1948) quotient of similarity

$$QS = \frac{2j}{a+b}$$

where a is the number of species in habitat A, b is the same in habitat B and j is the number of species found in both habitats, measuring the relative similarity of the two habitats in terms of species composition, with emphasis on the number of species found in both habitats. 2. The Renkonen (1938) percentage of similarity

$$\%S = \Sigma\text{min. } (a,b \ldots\ldots x)$$

places the emphasis on the dominant species. The percentage importance value of each species is calculated in both habitats and the percentage of similarity is given by the summation of the smaller values of each pair of percentages.

RESULTS

The species

The butterflies (Papilionoidea) found in the area are listed in Tab. 2. The indications of abundance on the grassland and in the heath are based on captures and observations. Thirteen of these species were taken more or less regularly, while the record of *Lasiommata petropolitana* (Fabricius, 1787) is based on one larvae only. In addition three notorious migrants or vagrants have been captured or observed on northern Sotra. One specimen of *Nymphalis antiopa* (L., 1758) was observed at Ågåtnes in August 1977 (A. Fjeldså pers. com.). *Cynthia cardui* (L., 1758) was frequent on northern Sotra during the autumn 1978. *Vanessa atalanta* (L., 1758) was not observed in the area during the present study, but several specimens of this common migrant have been taken at Knappskog in August 1937 (coll. Zool. Mus., Bergen).

A total of 174 species were taken in the light traps on the grassland at Austervågen and in the heath at Austre Loftmyra in 1978, Tab. 3. Noctuidae were represented by 91 species, Geometridae by 70 species, and Notodontidae by 8 species. Two species of Lasiocampidae were taken, and Thyatiridae, Sphingidae and Lymantriidae were represented by one species each.

In addition 34 more species were taken on northern Sotra, Tab. 4. These species were either caught in one of the other light traps, with nets, or taken as larvae. Seven families were represented, Geometridae with 15 species, Noctuidae with 14 species, and Lasiocampidae, Saturniidae, Thyatiridae, Sphingidae and Arctiidae with one species each.

Several of the species have an atlanto-mediterranian distribution. The most typical in this respect is *Stilbia anomala* (Haworth, 1812); its range covers the British Isles, Germany, France and Spain and it is also recorded from Syria (Edelsten and Fletcher 1961). *Aporophyla nigra* (Haworth, 1809) is distributed in Northwest-, West-, and Southern Europe; the occurrence along the Western Coast of Norway constitutes the northern border of the range (Opheim 1955). Also *Pachycnemia hippocastanaria* (Hübner, 1799) and *Aporophyla lutulenta* (Denis & Schiffermüller, 1775) have a somewhat similar distribution, but they are recorded from most parts of Denmark inclusive Bornholm and also from Southern Sweden (Hoffmeyer 1966, Nordström et al. 1969). In Norway *Paradiarsia glareosa* (Esper, 1788) is mainly taken along the West Coast, but it has a wider range in Scandinavia, including Southern Finland (Nordström et al. 1969).

A relative large number of migrants have been taken on northern Sotra, viz.: *Vanessa atalanta, Cynthia cardui, Agrotis ipsilon* (Hufnagel, 1766), *Peridroma saucia* (Hübner, 1808), *Myt-*

Table 2. Relative abundance (+ , + + , + + +) of the butterflies (Papilionoidea) inhabiting grasslands and *Calluna* heaths on northern Sotra.

Species	Grassland	*Calluna* heath
Pieridae		
Pieris brassicae (L., 1758)	+	
P. napi (L., 1758)	+ + +	+
Nymphalidae		
Aglais urticae (L., 1758)	+ + +	+
Mesoacidalia aglaja (L., 1758)	+ +	+
Clossiana selene (Denis & Schiffermüller, 1775)	+	
Hipparchia semele (L., 1758)		+
Maniola jurtina (L., 1758)	+ +	
Coenonympha pamphilus (L., 1758)	+ +	
Lasiommata maera (L., 1758)	+	+
L. petropolitana (Fabricius, 1787)	+	
Lycaenidae		
Callophrys rubi (L., 1758)	+ +	+ + +
Lycaena phlaeas (L., 1761)	+	+
Plebejus argus (L., 1758)	+	+ +
Polyommatus icarus (Rottemburg, 1775)	+	+

Table 3. Macrolepidoptera taken in the light traps on the grassland at Austervågen and in the *Calluna* heath at Austre Loftmyra in 1978.

SPECIES	Grassland		*Calluna* heath	
	♂	♀	♂	♀
Lasiocampidae				
Poecilocampa populi (L., 1758)	29	2		
Macrothylacia rubi (L., 1758)			3	7
Thyatiridae				
Tethea or (Denis & Schiffermüller, 1775)	1		3	
Geometridae				
Geometra papilionaria (L., 1758)	2			
Idaea biselata (Hufnagel, 1767)	1			
I. aversata (L., 1758)	1			
Xanthorhoe designata (Hufnagel, 1767)	32	2	4	2
X. montanata (Denis & Schiffermüller, 1775)	20		8	
X. fluctuata (L., 1758)	18	1	6	1
Epirrhoe alternata (Müller, 1764)	1			
Camptogramma bilineata (L., 1758)	4	10	2	2
Entephria caesiata (Denis & Schiffermüller, 1775)	62	13	104	6
Cosmorhoe ocellata (L., 1758)	24	4	62	5
Eulithis testata (L., 1761)	122	12	242	3
E. populata (L., 1758)	133	5	47	3
Chloroclysta siterata (Hufnagel, 1767)	4	1		
C. miata (L., 1758)	10	6	4	1
C. citrata (L., 1761)	3	1		1
C. truncata (Hufnagel, 1767)	2	1		
Plemyria rubiginata (Denis & Schiffermüller, 1775)	1	5		2
Thera obeliscata (Hübner, 1787)	14	8	13	7
T. cognata (Thunberg, 1792)	920	59	1678	184
T. juniperata (L., 1758)	169	2		
Electrophaes corylata (Thunberg, 1792)		1		
Colostygia pectinataria (Knoch, 1781)	4	2	32	3
Hydriomena furcata (Thunberg, 1784)	17	23	6	15
H. impluviata (Denis & Schiffermüller, 1775)		2		

SPECIES	Grassland		*Calluna* heath	
	♂	♀	♂	♀
H. ruberata (Freyer, 1831)	1			
Epirrita dilutata (Denis & Schiffermüller, 1775)	1			
E. christyi (Allen, 1906)		1		
E. autumnata (Borkhausen, 1794)	2			
Operophtera brumata (L., 1758)	10			
Perizoma taeniata (Stephens, 1831)				1
P. alchemillata (L., 1758)	5	4		
P. minorata (Treitschke, 1828)	21	7	2	
P. blandiata (Denis & Schiffermüller, 1775)	1			
P. didymata (L., 1758)	112	5	31	2
Eupithecia tenuiata (Hübner, 1813)			1	
E. intricata (Zetterstedt, 1839)	15	1	48	5
E. satyrata (Hübner, 1813)			3	
E. goossensiata Mabille, 1869	6	7	28	4
E. vulgata (Haworth, 1809)	1			
E. subfuscata (Haworth, 1809)			1	
E. icterata (Villers, 1789)	3			
E. nanata (Hübner, 1813)	14	4	49	7
E. pusillata (Denis & Schiffermüller, 1775)	66	22	159	44
E. tantillaria Boisduval, 1840	1			
Gymnoscelis rufifasciata (Haworth, 1809)	12	1	13	5
Chloroclystis chloerata (Mabille, 1870)	1			
Aplocera plagiata (L., 1758)	5	3	1	2
Venusia cambrica Curtis, 1839	2			
Lobophora halterata (Hufnagel, 1767)	1		1	
Trichopteryx carpinata (Borkhausen, 1794)	1			
Acasis viretata (Hübner, 1799)	1			
Lomaspilis marginata (L., 1758)	3			
Semiothisa liturata (Clerck, 1759)	1		1	
Itame wauaria (Linnaeus, 1758)	18	5	3	3
I. brunneata (Thunberg, 1784)			2	
Pachycnemia hippocastanaria (Hübner, 1799)	34	3	174	31
Opistograptis luteolata (L., 1758)	2			
Odontopera bidentata (Clerck, 1759)	5		13	
Crocallis elinguaria (L., 1758)	36	5	19	
Colotois pennaria (L., 1761)	7			
Agriopis aurantiaria (Hübner, 1799)	3			
A. marginaria (Fabricius, 1777)	4			
Erannis defoliaria (Clerck, 1759)	6			
Cleora cinctaria (Denis & Schiffermüller, 1775)	4		36	
Alcis repandata (L., 1758)	36	5	128	10
Cabera pusaria (L., 1758)	2		3	
C. exanthemata (Scopoli, 1763)	3			
Hylaea fasciaria (L., 1758)	1	1	2	
Gnophos obscuratus (Denis & Schiffermüller, 1775)	11	6	19	1
G. obfuscata (Denis & Schiffermüller, 1775)	12	5	160	11
Sphingidae				
Laothoe populi (L., 1758)	1		2	
Notodontidae				
Cerura vinula (L., 1758)	2		8	
Notodonta dromedarius (L., 1767)		1	1	
Pheosia tremula (Clerck, 1759)	11		2	
P. gnoma (Fabricius, 1777)	4	1		
Pterostoma palpina (Clerck, 1759)	2		1	
Ptilodon capucina (L., 1758)	2		1	
Eligmodonta ziczac (L., 1758)	8		5	2
Clostera pigra (Hufnagel, 1776)			1	

SPECIES	Grassland		*Calluna* heath	
	♂	♀	♂	♀
Lymantriidae				
Dacychira fascelina (L., 1758)	7		4	
Noctuidae				
Euxoa obelisca (Denis & Schiffermüller, 1775)	110	9	60	3
E. nigricans (L., 1761)	4		6	
Agrotis exclamationis (L., 1758)	2			
Ochropleura plecta (L., 1761)		1	3	
Standfussiana lucernea (L., 1758)	2	1		4
Rhyacia grisescens (Fabricius, 1794)	63	12	47	6
R. simulans (Hufnagel, 1766)	1			
Chersotis cuprea (Denis & Schiffermüller, 1775)	107	27	17	8
Noctua pronuba (L., 1758)	280	24	67	10
N. comes (Hübner, 1813)	37	10	133	14
N. janthina (Denis & Schiffermüller, 1775)	5	1	2	1
Graphiphora augur (Fabricius, 1775)				1
Eugraphe subrosea (Stephens, 1829)	1		14	
Paradiarsia sobrina (Duponchel, 1843)	5	1	2	1
P. glareosa (Esper, 1788)	48	14	84	25
Lycophotia porphyrea (Denis & Schiffermüller, 1775)	342	177	1434	110
Peridroma saucia (Hübner, 1808)	1			
Diarsia mendica (Fabricius, 1775)	78	28	265	29
D. dahlii (Hübner, 1813)	1			
D. brunnea (Denis & Schiffermüller, 1775)			5	2
D. rubi (Vieweg, 1790)	11	1	15	1
Xestia baja (Denis & Schiffermüller, 1775)	27	5	17	2
X. castanea (Esper, 1796)	12	1	150	20
X. sexstrigata (Haworth, 1809)	19	10	8	
X. xanthographa (Denis & Schiffermüller, 1775)	85	12	67	5
Eurois occulta (L., 1758)	1			1
Cerastis rubricosa (Denis & Schiffermüller, 1775)	63	2	70	6
Anarta myrtilli (L., 1761)			2	
Hada nana (Hufnagel, 1766)	11		4	
Lacanobia thalassina (Hufnagel, 1776)	2			
L. suasa (Denis & Schiffermüller, 1775)	14			
L. oleracea (L., 1758)			4	
L. biren (Goeze, 1781)	1		11	
Ceramica pisi (L., 1758)	35	1	68	3
Hadena confusa (Hufnagel, 1766)	1			
H. bicruris (Hufnagel, 1766)	1			
Cerapteryx graminis (L., 1758)	688	90	108	18
Orthosia populeti (Fabricius, 1781)	13		4	
O. stabilis (Denis & Schiffermüller, 1775)	23	9	13	7
O. incerta (Hufnagel, 1766)			5	2
O. gothica (L., 1758)	307	36	186	17
Mythimna impura (Hübner, 1808)			1	1
M. unipuncta (Haworth, 1809)	2			
Brachylomia viminalis (Fabricius, 1777)	6	2		1
Dasypolia templi (Thunberg, 1792)	27	4	3	1
Aporophyla lutulenta (Denis & Schiffermüller, 1775)	4	8	14	8
A. nigra (Haworth, 1809)	288	63	166	78
Xylena vetusta (Hübner, 1813)	10		5	
Allophyes oxyacanthae (L., 1758)	1		1	
Blepharita adusta (Esper, 1790)	14	3	22	3
Polymixis gemmea (Treitschke, 1825)	12	1	2	1
Antitype chi (L., 1758)	4	3	15	5
Conistra vaccinii (L., 1761)	1	4		
Agrochola circellaris (Hufnagel, 1766)	3			

SPECIES	Grassland		*Calluna* heath	
	♂	♀	♂	♀
A. lota (Clerck, 1759)	5	1	1	
A. helvola (L., 1758)	2		1	
A. litura (L., 1761)		2		2
Xanthia togata (Esper, 1788)	11		4	2
X. icteritia (Hufnagel, 1766)	2			
Acronicta auricoma (Denis & Schiffermüller, 1775)	1		3	1
A. euphorbiae (Denis & Schiffermüller, 1775)	7		7	
Amphipyra tragopoginis (Clerck, 1759)	33	5	63	19
Rusina ferruginea (Esper, 1785)	22			
Euplexia lucipara (L., 1758)	3		1	
Phlogophora meticulosa (L., 1758)	1			
Cosmia trapezina (L., 1758)	1		2	
Hyppa rectilinea (Esper, 1788)	3			
Apamea monoglypha (Hufnagel, 1766)	145	56	164	68
A. crenata (Hufnagel, 1766)	7	10	1	1
A. lateritia (Hufnagel, 1766)	187	36	93	13
A. furva (Denis & Schiffermüller, 1775)	27	10	55	4
A. remissa (Hübner, 1809)	17	4	5	3
A. sordens (Hufnagel, 1766)				1
A. rubrirena (Treitschke, 1825)	8		23	
Oligia latruncula (Denis & Schiffermüller, 1775)	4		1	1
Mesapamea secalis (L., 1758)	16	2	13	
Photedes minima (Haworth, 1809)	113	1	10	
P. pygmina (Haworth, 1809)	5			4
Amphipoea lucens (Freyer, 1845)	193	30	506	33
A. crinanensis (Burrows, 1908)	482	38	66	8
Hydraecia micacea (Esper, 1789)	51	3	6	2
Celaena haworthii (Curtis, 1829)	16		211	1
Caradrina clavipalpis (Scopoli, 1763)	1	1		
Stilbia anomala (Haworth, 1812)	104	6	124	1
Plusia festucae (L., 1758)	4	1	40	
Autographa gamma (L., 1758)	22	11	8	4
A. pulchrina (Haworth, 1809)	19	8	23	4
A. jota (L., 1758)	3	1	19	
A. bractea (Denis & Schiffermüller, 1775)	1	1		
Syngrapha interrogationis (L., 1758)		1	1	
Hypenodes turfosalis (Wocke, 1850)	2		12	1

himna unipuncta (Haworth, 1809), *Phlogophora meticulosa* (L., 1758) and *Autographa gamma* (L., 1758). All are migrants which follow a north-western route of dispersal. *A. gamma* is by far the most common species, appearing regularly every year, both during summer and autumn. *C. cardui* appear also regularly, but in smaller numbers. The other species occur more sporadically, and of *M. unipuncta* there are only two previous records from Northern Europe, viz.: Kvisker, South Iceland 18 Oct. 1959 (Wolff 1971) and Dueodde, Bornholm, South Baltic 21 Oct. 1969 (Deurs 1971).

Species diversity

The organisation of the Macrolepidoptera communities in the two main heathland habitats is described in terms of species diversity. A total of 125 species were caught in the light traps in the heath in 1978, compared to 161 species on the grassland, Tab. 5. The fact that the trapping in the heath had to be terminated in September probably led to that a few species with late flight periods were not taken in this locality. It concerns, however, at the most 8 or 9 species. Most probably it does not have any serious impact on the calculated diversity indices.

Seven families were represented in the two sets of material, of which Noctuidae and Geometridae were the two important ones. On the grassland 85 species of Noctuidae were taken, and the family constituted nearly 69 % of the total catch. Geometridae were represented by 65 species, making up nearly 31 % of the total. In the heath 74 species of Noctuidae and 40 species of Geometridae were taken, constituting respec-

Table. 4. Additional Macrolepidoptera species taken on northern Sotra between 1975 and 1980. The locality of species taken in lights traps is referred to with the locality number (see Tab. 1). Relative abundance (+, + +, + + +) of species observed (o), netted (n) or taken as larvae (l) in *Calluna* heath and grassland habitats are given.

SPECIES	Light trap loc. no.	Grassland	*Calluna* heath
Lasiocampidae			
Lasiocampa quercus (L., 1758)			+ (o)
Saturniidae			
Saturnia pavonia (L., 1758)			+ (o)
Thyatiridae			
Ochropacha duplaris (L., 1761)	5		
Geometridae			
Anticlea derivata (Denis & Shiffermüller, 1775)	7		
Lampropteryx suffumata (Denis & Schiffermüller, 1775)	5		
Eulithis prunata (L., 1758)	5		
Thera firmata (Hübner, 1822)	3		
Eupithecia plumbeolata (Haworth, 1809)	5		
E. absinthiata (Clerck, 1759)	5		
E. denotata (Hübner, 1813)	5		
Chloroclystis rectangulata (L., 1758)	5		
C. debiliata (Hübner, 1817)		+ (l)	
Plagodis pulveraria (L., 1758)	4,7		
Selenia dentaria (Fabricius, 1775)	4,7		
Ectropis bistortata (Goeze, 1781)	4		
Ematurga atomaria (L., 1758)		+	+ + (o, n)
Bupalus piniaria (L., 1758)	5		
Campaea margaritata (L., 1767)	5		
Sphingidae			
Hemaris tityus (L., 1758)		+ (n)	
Arctiidae			
Parasemia plantaginis (L., 1758)			+ (l)
Noctuidae			
Euxoa cursoria (Hufnagel, 1766)	4		
Agrotis ipsilon (Hufnagel, 1766)	1		
Xestia alpicola (Zetterstedt, 1839)	4		
X. rhomboidea (Esper, 1790)	1		
Mamestra brassicae (L., 1758)	5		
Hadena rivularis (Fabricius, 1775)	5		
Mythimna pallens (L., 1758)	4		
Parastichtis suspecta (Hübner, 1817)	1		
Acronicta megacephala (Denis & Schiffermüller, 1775)	7		
Rhizedra lutosa (Hüner, 1803)	4,7		
Colocasia coryli (L., 1758)	5		
Polychrysia moneta (Fabricius, 1787)	5,6		
Phytometra viridaria (Clerck, 1759)			+ (n)
Hypena proboscidalis (L., 1758)	1,5		

tively 59% and 40% of the total. Of the remaining five families Notodontidae were represented by 7 species in both localities, and Lasiocampidae, Thyatiridae, Sphingidae and Lymantriidae by one species each. Combined, these five families made up less than 1% of the total catch on the grassland, and less than 0.5% in the heath.

The diversity indices used are given in Tab. 5. The species richness, expressed by Menhinick's index (d), was lower in the heath than on the grassland indicating that fewer species actually inhabit the heath. However, while the values for the Noctuidae in the two localities only differ slightly, the value for the Geometridae was much lower in the heath than on the grassland.

Table 5. Number of species and specimens of Macrolepidoptera taken in the light traps on the grassland at Austervågen and in the *Calluna* heath at Austre Loftmyra in 1978, and the various indices used to characterize the two communities.

	Grassland			*Calluna* heath		
	Total	Noctuidae	Geometridae	Total	Noctuidae	Geometridae
Number of species (S)	161	85	65	125	74	40
Number of specimens (N) ..	7436	5088	2277	8636	5130	3466
Menhinick's index (d)	1.867	1.192	1.362	1.345	1.033	0.679
Shannon-Wiener's diversity index (H')	5.237	4.593	3.619	4.662	4.201	2.846
Lloyd & Ghelardi's equitability index (E)	0.351	0.421	0.273	0.301	0.365	0.251

The strongest reduction in species number occurred accordingly among Geometridae, while Noctuidae was relatively better represented in the heath.

The overall diversity, expressed by the Shannon-Wiener diversity index (H'), and the equitability in the apportionment of the specimens among the species, expressed by Lloyd and Ghelardi's equitability index (E), were lower in the heath than on the grassland. The marked difference between Noctuidae and Geometridae also is apparent in these two indices as Noctuidae showed higher overall diversity and equitability than the Geometridae in both habitats.

Similarity

Sørensen's quotient of similarity, (QS), and Renkonen's percentage of similarity, (%S), have been used to compare the similarity between the heath and the grassland faunas of the two important families, Noctuidae and Geometridae. The calculated values of Sørensen's quotient, viz.: s = 0.885 for Noctuidae and s = 0.667 for Geometridae, show that the Noctuidae faunas in the two habitats have more species in common than do the Geometridae. On the other hand, Renkonen's percentage of similarity, viz.: %S = 54.5 for Noctuidae and %S = 70.7 for Ge-

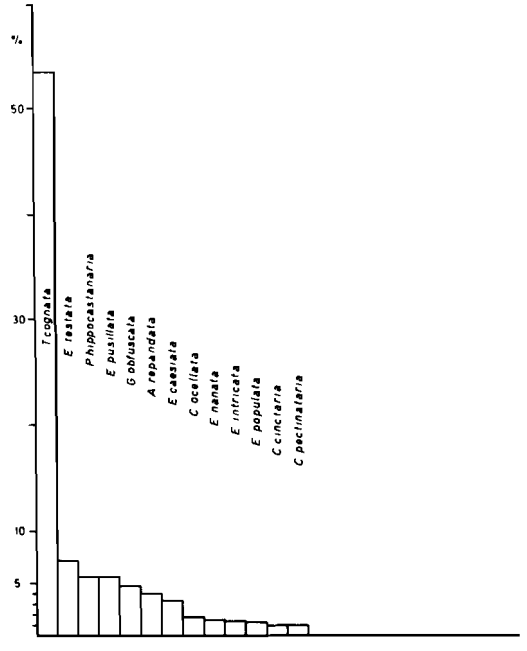


Fig. 2. Abundance of Geometridae species constituting more than 1% of the light trap catches in the *Calluna* heath at Austre Loftmyra in 1978.

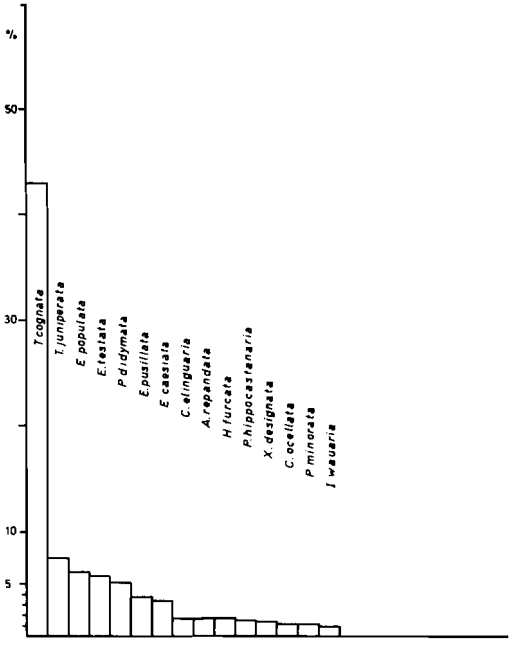


Fig. 3. Abundance of Geometridae species constituting more than 1% of the light trap catches on the grassland at Austervågen in 1978.

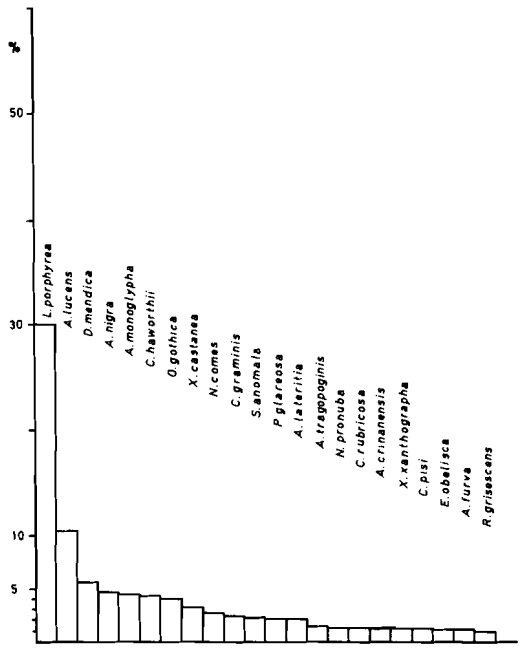


Fig. 4. Abundance of Noctuidae species constituting more than 1 % of the light trap catches in the *Calluna* heath at Austre Loftmyra in 1978.

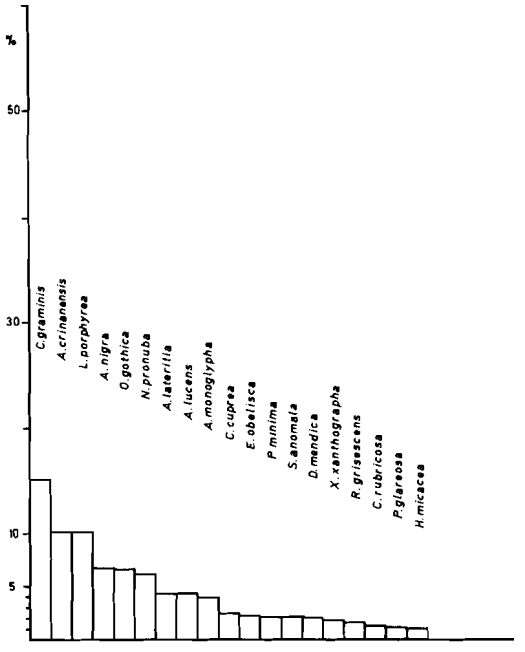


Fig. 5. Abundance of Noctuidae species constituting more than 1 % of the light trap catches on the grassland at Austervågen in 1978.

ometridae, indicates that the ranking of the dominant species in the two habitats is more similar in Geometridae than in Noctuidae.

The dominant species

The ranking of the dominant Geometridae in the heath and on the grassland is shown in Figs. 2 and 3. *Thera cognata* (Thunberg, 1792) was the dominant species in both habitats, constituting 54% and 43% of the Geometridae in the heath and on the grassland, respectively. *T. juniperata* (L., 1758) ranked as no. 2 (8%) on the grassland. The species has a late flight period (see below), and as the trapping in the heath had to be terminated in September the species was not taken in this locality. Catches from other heath localities indicate, however, that the species also would have taken a dominant position in the material from this locality if the trapping had been continued. Both species are common and widespread in Western Norway.

In the heath *Eulithis testata* (L., 1761) ranked as no. 2 (7%), *Pachycnemia hippocastanaria* (Hübner, 1799) as no. 3 (6%), *Eupithecia pusillata* (Denis & Schiffermüller, 1775) as no. 4 (6%), and *Gnophos obfuscata* (Denis & Schiffermüller, 1775) as no. 5 (5%). *E. testata* and *E. pusillata* are common and widespread in Western Norway. *P. hippocastanaria* is common in the coastal heaths, and single specimens have also been taken in the middle part of Hordaland. *G. obfuscata* is common in the lowland in the innermost part of Western Norway, but seems more or less to be absent from the middle part of Hordaland.

On the grassland *Eulithis populata* (L., 1758) and *E. testata* ranked as no. 3 and 4, both constituting about 6% of the material, while *Perizoma didymata* (L., 1758) ranked as no. 5 (5%). The species are all common and widespread in Western Norway.

The ranking of the dominant Noctuidae in the two habitats is shown in Figs. 4 and 5. *Lycophotia porphyrea* (Denis & Shiffermüller, 1775) was the dominant species in the heath, constituting 30% of the material. On the grassland *Cerapteryx graminis* (L., 1758) ranked as no. 1 (15%). Many places in Europe this species is a feared pest, appearing in high numbers at irregular intervals (e.g. Entwistle and Rivers 1974). Both species are common and widespread in Western Norway.

Amphipoea lucens (Freyer, 1845) ranked as

no. 2 (10%) in the heath, and as no. 8 (4%) on the grassland. On the grassland *A. crinanensis* (Burrows, 1908) ranked as no. 2 (10%), while in the heath it only ranked as no. 19 (1%). The different occurrence of these morphologically similar species is probably due to *A. lucens* preference for humid habitats (Hoffmeyer 1962). The wet areas in the heath undoubtedly provide favourable conditions for this species. Both species are common and widespread in Western Norway.

Three species, *Celaena haworthii* (Curtis, 1829), *Xestia castanea* (Esper, 1796) and *Noctua comes* (Hübner, 1813) were taken in large numbers only in the heath. *C. haworthii* ranked as no. 6 (4%) in this locality, *X. castanea* as no. 8 (3%) and *N. comes* as no. 9 (3%). *C. haworthii* is taken in bogs in most parts of Western Norway. *X. castanea* is more restricted to the coast where it is found on heath terrain. *N. comes* is distributed in the lowland all over Western Norway, but seems to be common only along the coast.

Two species, *Chersotis cuprea* (Denis & Schiffermüller, 1775) and *Photedes minima* (Haworth, 1809) were taken in large numbers only in the traps on the grassland. *C. cuprea* ranked as no. 10 (3%) in this locality, while *P. minima* ranked as no. 12 (2%). *P. minima* is common and widespread all over Western Norway. *C. cuprea* is also distributed all over Western Norway, but is most common in the inlands.

Aporophyla nigra (Haworth, 1809) and *Stilbia anomala* (Haworth, 1812) are typical for the coastal areas, allthough single specimens of both species have been taken in inner Hordaland. *A. nigra* ranked as no. 4 in both localities, constituting 7% and 5% of the material from the grassland and the heath respectively. *S. anomala* ranked as no. 11 in the heath and as no. 13 on the grassland constituting approximately 2% of both sets of material.

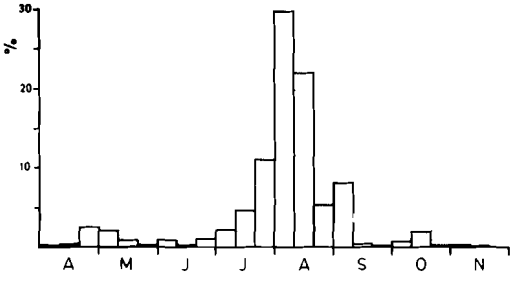


Fig. 6. Light trap catches of Macrolepidoptera, as per cent of whole annual total per ten-day period, on the grassland at Austervågen in 1978.

Flight periods

The light trap catches taken on the grassland at Austervågen in 1978, divided in ten-day periods, are shown in Fig. 6. The first specimens arrived in the beginning of April, and no further specimens were taken after the middle of November. Largest catches were made in early August, with a smaller peak in late April — early May.

The flight periods of Geometridae species taken in more than 100 specimens are shown in Fig. 7; the catches from the heath and the grassland have been combined. Most of the species have flight periods in late summer and early autumn. The duration of the flight periods varied from one and a half to nearly three months. The median day of the flight period of the different species, i.e. the day when 50% of the specimens had been caught, are listed in Tab. 5. For most of the species the median day falls in the last third of July and the first two thirds of August. *Thera juniperata* had a late and very short flight period, lasting from 5 October to 15 November. *Pachycnemia hippocastanaria* is bivoltine on Sotra. The dominant spring generation were on the wing from 15 April to 10 June, while a few second generation specimens were caught in September and October.

Among the Noctuidae species taken in more than 100 specimens there are two species, *Cerastis rubricosa* (Denis & Schiffermüller, 1775) and *Orthosia gothica* (L., 1758), which fly in the spring (Fig. 8). Both had flight periods that lasted for about two months with median days in the last day of April and the first days of May. *Ceramica pisi* (L., 1758) had a very long flight period, lasting from 10 May until 5 August, with the median day in the beginning of June. Several of the species flying during the summer, like *Noctua pronuba* (L., 1758), *Lycophotia porphyrea, Cerapteryx graminis, Apamea monoglypha* (Hufnagel, 1766) and *A. lateritia* (Hufnagel, 1766) also have long flight periods lasting for more than two and a half month, most of them with median days in the beginning of August. The majority of the Noctuidae started to fly in late summer and early spring, and several of these species, like *Euxoa obelisca* (Denis & Schiffermüller, 1775), *Chersotis cuprea, Xestia castanea, X. xanthographa* (Denis & Schiffermüller, 1775), *Amphipoea lucens, A. crinanensis* and *Stilbia anomala,* had rather short flight periods lasting from one and a half to two months, with median days in the middle of August. Three species, *Paradiarsia glareosa* (Esper, 1788), *Apo-*

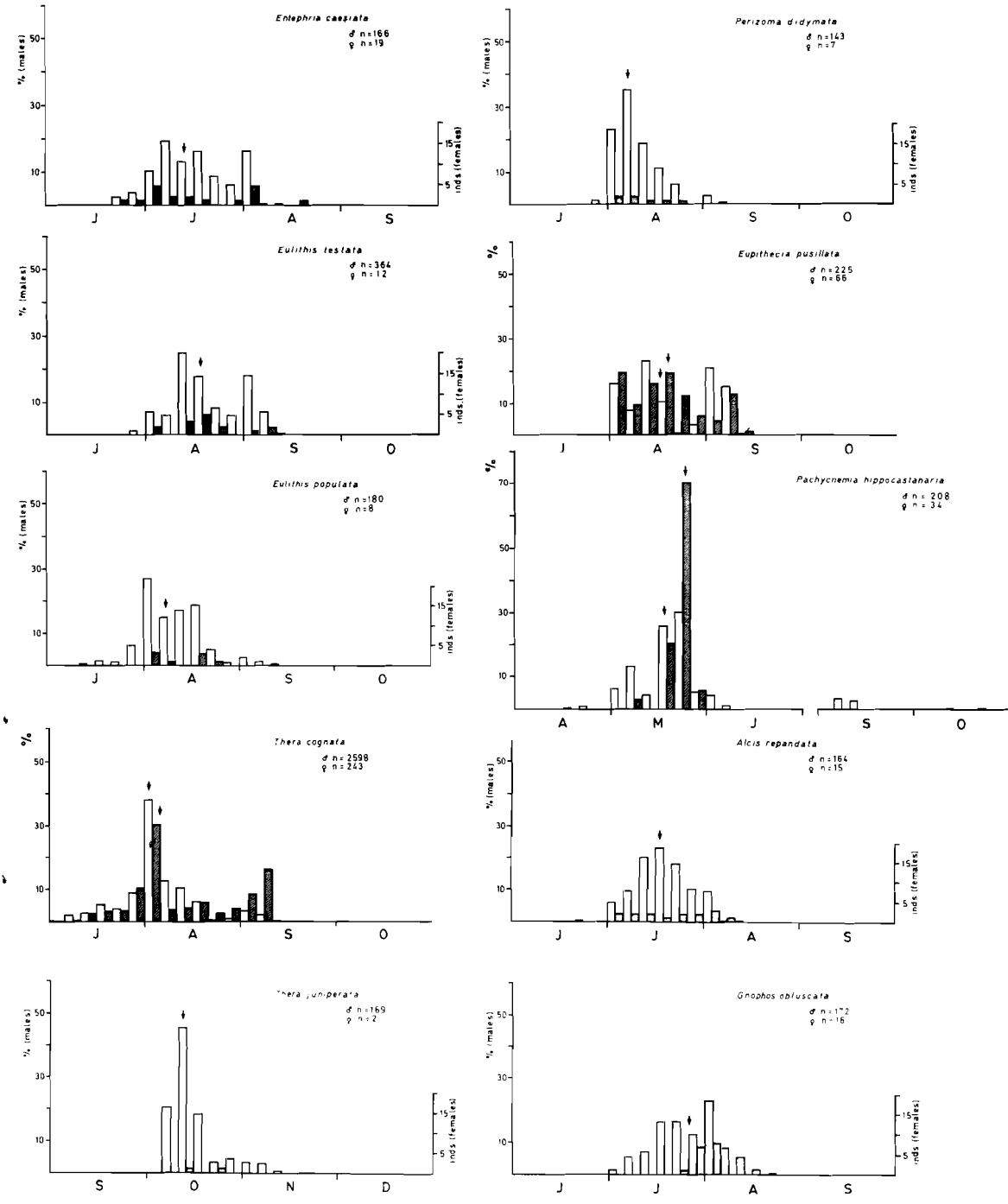
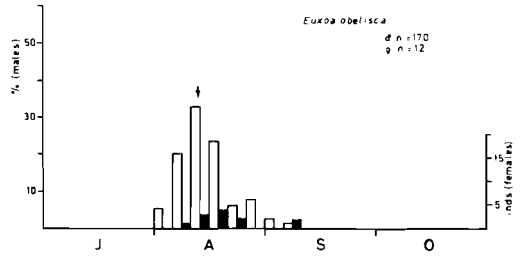
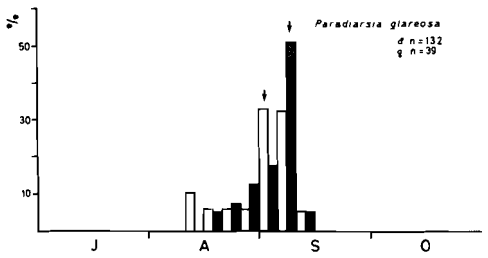
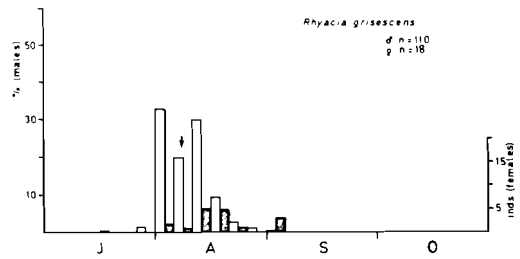
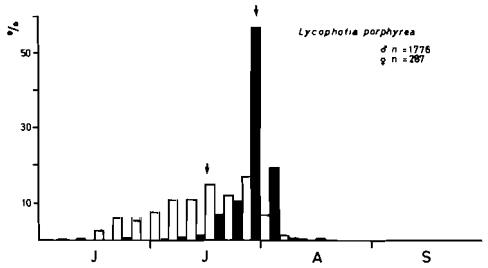


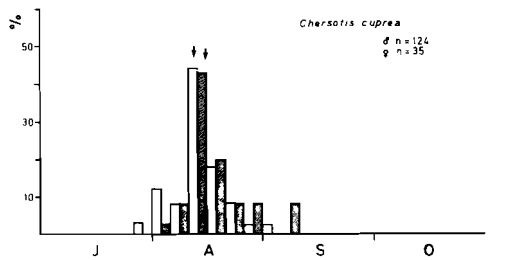
Fig. 7. Flight periods of Geometridae species on northern Sotra in 1978; species taken in 100 specimens or more in the light traps in the *Calluna* heath and on the grassland, combined, are included. Flight periods are expressed either as per cent of whole annual total of the respective sex, or when less than 25 specimens were caught, in absolute number of specimens, per five-day period. Vertical arrows indicate date when 50% of annual total had been caught. White columns: males; shaded columns: females.

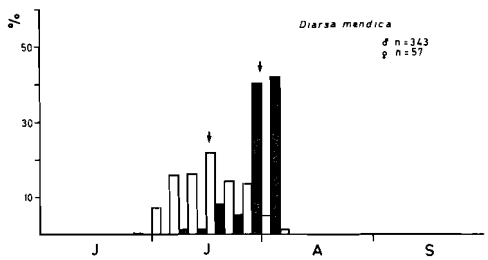

Euxoa obelisca
♂ n = 170
♀ n = 12
% (males)
inds. (females)
J
A
S
O

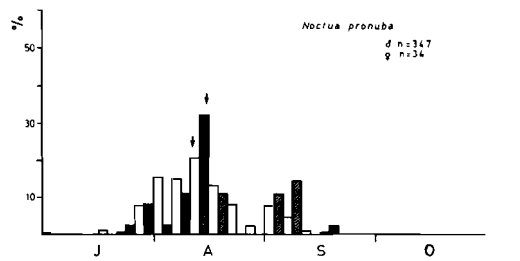

Paradiarsia glareosa
♂ n = 132
♀ n = 39
%
J
A
S
O

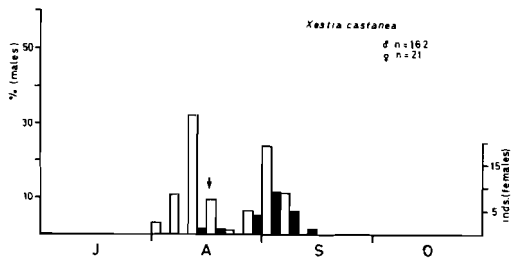

Rhyacia grisescens
♂ n = 110
♀ n = 18
% (males)
inds. (females)
J
A
S
O

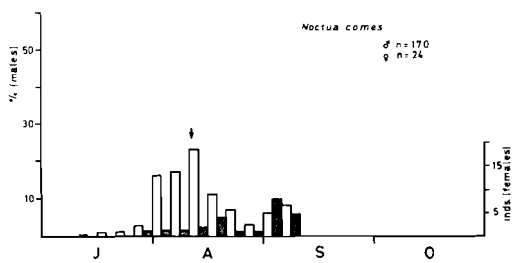

Lycophotia porphyrea
♂ n = 1776
♀ n = 287
%
J
J
A
S

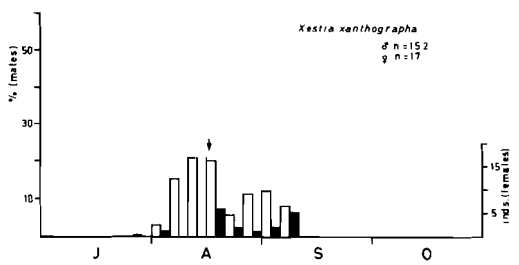

Chersotis cuprea
♂ n = 124
♀ n = 35
%
J
A
S
O

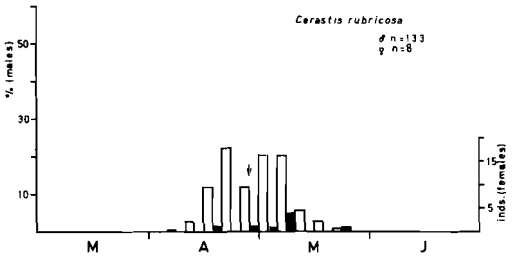

Diarsa mendica
♂ n = 343
♀ n = 57
%
J
J
A
S

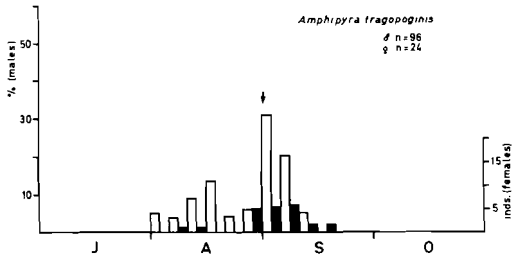

Noctua pronuba
♂ n = 347
♀ n = 34
%
J
A
S
O

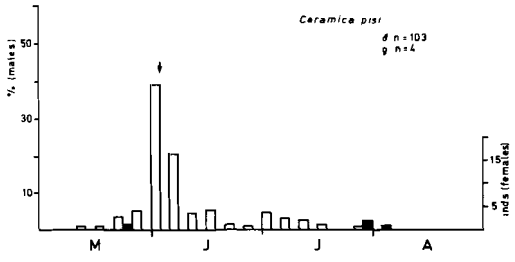

Xestia castanea
♂ n = 162
♀ n = 21
% (males)
inds. (females)
J
A
S
O

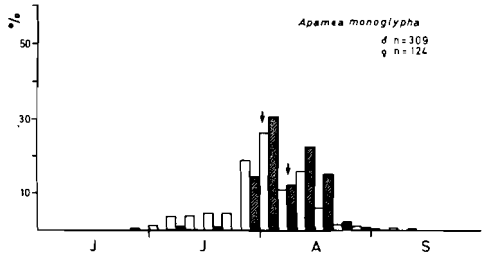

Noctua comes
♂ n = 170
♀ n = 24
% (males)
inds. (females)
J
A
S
O

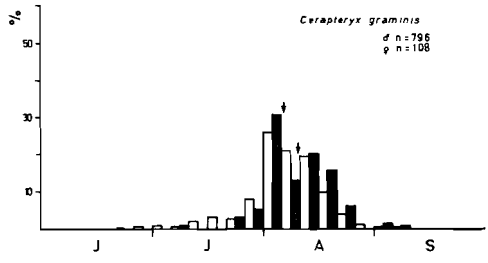

Xestia xanthographa
♂ n = 152
♀ n = 17
% (males)
inds. (females)
J
A
S
O

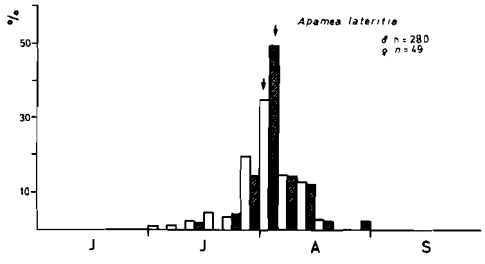

Cerastis rubricosa
♂ n=133
♀ n=8
% (males)
inds. (females)
M
A
M
J

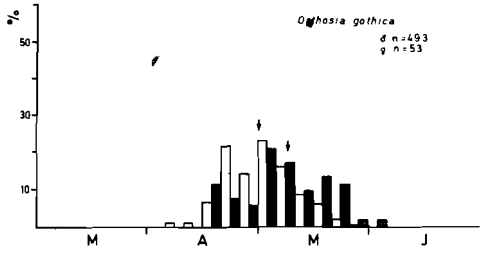

Amphipyra tragopoginis
♂ n=96
♀ n=24
% (males)
inds. (females)
J
A
S
O

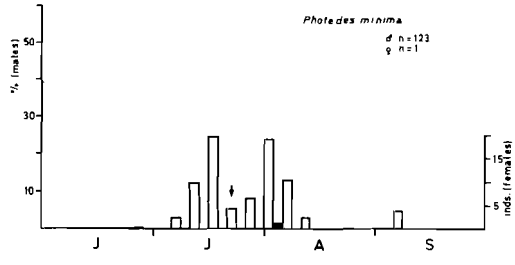

Ceramica pisi
♂ n=103
♀ n=4
% (males)
inds. (females)
M
J
J
A

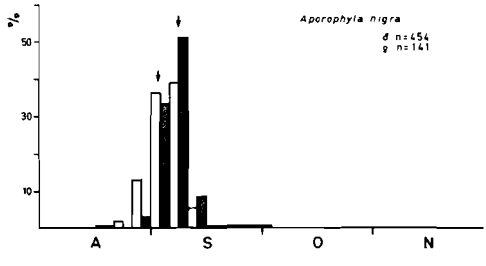

Apamea monoglypha
♂ n=309
♀ n=124
%
J
J
A
S

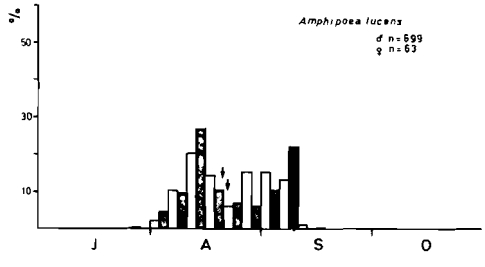

Cerapteryx graminis
♂ n=796
♀ n=108
%
J
J
A
S


Apamea lateritia
♂ n=280
♀ n=49
%
J
J
A
S


Orthosia gothica
♂ n=493
♀ n=53
%
M
A
M
J


Photedes minima
♂ n=123
♀ n=1
% (males)
inds. (females)
J
J
A
S


Aporophyla nigra
♂ n=454
♀ n=141
%
A
S
O
N


Amphipoea lucens
♂ n=699
♀ n=63
%
J
A
S
O

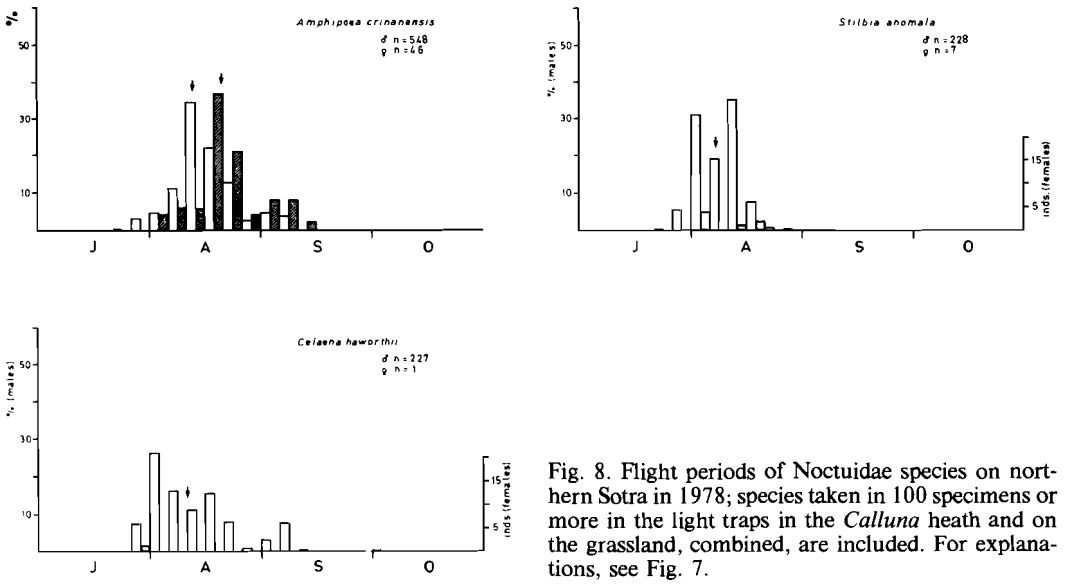


Fig. 8. Flight periods of Noctuidae species on northern Sotra in 1978; species taken in 100 specimens or more in the light traps in the *Calluna* heath and on the grassland, combined, are included. For explanations, see Fig. 7.

rophyla nigra and *Amphipyra tragopoginis* (Clerck, 1759) had median days as late as in the beginning of September. All three species had flight periods that lasted less than two months.

The males were in excess in the catches, Tab. 6. Among Geometridae *Eupithecia pusillata* had 22% females and *Pachycnemia hippocastanaria* had 14%, while the remaining species had 10% females or less. The proportion of females was higher among Noctuidae. *Apamea monoglypha* had the highest share of females, 29%, but in more than half of the Noctuidae species 10% or more of the catches were females. Of both *Photedes minima* and *Celaena haworthii*, however, only one single female was caught.

The median day for the females has been calculated for those species in which more than 25 females were caught, Tab. 6. With one exception, *Amphipoea lucens*, the median day occurred earlier in the males than in the females. Among Geometridae this delay varied from one day in *Eupithecia pusillata* to three days in *Pachycnemia hippocastanaria*. Among Noctuidae the delay reached 13 days in *Diarsia mendica* (Fabricius, 1775).

DISCUSSION

A considerable part of the Macrolepidoptera fauna of Western Norway was taken on northern Sotra. The 105 species of Noctuidae caught makes up more than 75% of the Noctuidae so far taken in outer Hordaland. Correspondingly, the 85 species of Geometridae makes up about 62% of the fauna of outer Hordaland. Most of the species taken on northern Sotra are widely distributed in Scandinavia, but several of the species have a more westernly distribution. Species like *Aporophyla nigra* and *Stilbia anomala* are in Scandinavia exclusively found along the western coast of Norway. A few migrants also seem to be typical elements of the fauna on the Western Coast.

It is, however, difficult to estimate the number of Macrolepidoptera that inhabit the heathlands. A total of 125 species were caught in the light traps in the heath and 161 species on the grassland. But most Macrolepidoptera have a relative high dispersal potential, and some of the species have undoubtedly originated elsewhere, as their foodplants lack in heathland habitats. Neither can *Thera obeliscata* (Hübner, 1787) and *Hylaea fasciaria* (L., 1758) be considered as members of the heathland fauna, as they probably feed on foreign conifers that recently have been planted. On the other hand there were no specimens of the Geometridae *Ematurga atomaria* (L., 1758) taken in the light traps, even though this day-active species is common in the heaths. Several Papilionoidea were also observed regularly on heathlands, of which *Callophrys rubi* (L., 1758) was particularly common.

In the light trap catches in the heath the species richness and equitability among the species

Table 6. Sex ratio and median day of species taken in 100 specimens or more in the light traps in the *Calluna* heath at Austre Loftmyra and on the grassland at Austervågen in 1978. Median day have been calculated for the females only in species were 25 or more females were caught. The median day given for *Pachycnemia hippocastanaria* refer to the spring generation.

SPECIES	n	% ♀	Median day ♂	Median day ♀
Geometridae				
Entephria caesiata	185	10,3	15.7	—
Eulithis testata	379	4,0	18.8	—
E. populata	188	4,3	9.8	—
Thera cognata	2841	8,6	3.8	5.8
T. juniperata	171	1,2	13.10	—
Perizoma didymata	150	4,7	8.8	—
Eupithecia pusillata	291	22,7	16.8	17.8
Pachycnemia hippocastanaria	242	14,0	19.5	22.5
Alcis repandata	179	8,4	18.7	—
Gnophos obfuscata	188	8,5	26.7	—
Noctuidae				
Euxoa obelisca	181	6,6	14.8	—
Rhyacia grisescens	128	14,1	9.8	—
Chersotis cuprea	159	22,0	13.8	15.8
Noctua pronuba	381	8,9	12.8	14.8
N. comes	194	12,4	12.8	—
Paradiarsi glareosa	171	22,8	3.9	6.9
Lycophotia porphyrea	2063	13,9	16.7	27.7
Diarsia mendica	400	14,6	17.7	29.7
Xestia castanea	183	11,5	17.8	—
X. xanthographa	169	10,1	17.8	—
Cerastis rubricosa	141	5,7	30.4	—
Ceramica pisi	107	3,7	5.6	—
Cerapteryx graminis	904	11,9	6.8	9.8
Orthosia gothica	546	9,7	1.5	6.5
Aporophyla nigra	595	23,7	5.9	6.9
Amphipyra tragopoginis	120	20,0	1.9	—
Apamea monoglypha	433	28,6	2.8	6.8
A. lateritia	329	14,9	2.8	3.8
Photedes minima	124	0,8	23.7	—
Amphipoea lucens	762	8,7	22.8	19.8
A. crinanensis	594	7,7	14.8	19.8
Celaena haworthii	228	0,4	10.8	—
Stilbia anomala	235	3,0	8.8	—

were lower than on the neighbouring grassland. This difference is undoubtedly rootet in the fact that the grassland has a richer flora (Øvstedal 1978), and more Macrolepidoptera can hence find suitable foodplants in this habitat.

However, while the species richness among Noctuidae in the heath was only slightly lower than on the grassland, the difference between the two habitats was more pronounced in Geometridae. Sørensen's quotient of similarity also shows that the Noctuidae faunas in the two habitats are more similar than the Geometridae faunas. This difference might be connected with the windy climate. Based on light trap catches Williams (1940) demonstrated a strong negative correlation between wind velocity and the flight activity of insects, and also that Noctuidae are less affected by wind than the average other insects. The generally more slender, broad-winged Geometridae might therefore be more vulnerable than the Noctuidae in the open wind exposed heathlands on northern Sotra, and Geometridae from neighbouring habitats might therefore generally be more reluctant to fly across heath terrain. The higher similarity between the Noctuidae faunas in the heath and on the grassland, as shown by Sørensen's quotient, might accordingly be an expression of a higher dispersal ability of Noctuidae in a windy climate. The flight activity of the Geometridae inhabiting the heaths seems, however, not to be seriously supressed by wind, as the family constituted 40 %

Table 7. Foodplants of the dominant Macrolepidotera on northern Sotra. (P) indicate that a species is polyphagous.

SPECIES	Foodplants
Geometridae	
Xanthorhoe designata	Cruciferae *(Cardamine pratensis)*
Entephria caesiata	Ericaceae
Cosmorhoe ocellata	*Galium*
Eulithis testata	*Calluna, Vaccinium uliginosum* (P)
E. populata	*Vaccinium myrtillus, Salix* (P)
Thera cognata	*Juniperus*
T. juniperata	*Juniperus*
Colostygia pectinataria	*Galium* (P)
Hydriomena furcata	*Vaccinium myrtillus, Salix*
Perizoma minorata	*Euphrasia*
P. didymata	*Vaccinium myrtillus*, herbs (P)
Eupithecia intricata	*Juniperus*
E. nanata	*Calluna*
E. pusillata	*Juniperus*
Itame wauaria	*Ribes*
Pachycnemia hippocastanaria	*Calluna*
Crocallis elinguaria	hardwoods (P)
Cleora cinctaria	hardwoods, herbs, Ericaceae (P)
Alcis repandata	hardwoods, Ericaceae (P)
Gnophos obfuscata	herbs, Ericaceae (P)
Noctuidae	
Euxoa obelisca	herbs, grasses (P)
Rhyacia grisescens	herbs, grasses (P)
Chersotis cuprea	herbs, (P)
Noctua pronuba	herbs, (P)
N. comes	herbs, (P)
Paradiarsia glareosa	herbs, *Calluna, Salix* (P)
Lycophotia porphyrea	*Calluna*
Diarsia mendica	herbs (P)
Xestia castanea	*Calluna, Vaccinium myrtillus* (P)
X. xanthographa	herbs, grasses (P)
Cerastis rubricosa	herbs (P)
Ceramica pisi	herbs, hardwoods, grasses (P)
Cerapteryx graminis	grasses (P)
Orthosia gothica	herbs, hardwoods (P)
Aporophyla nigra	herbs, grasses (P)
Amphipyra tragopoginis	herbs, hardwoods (P)
Apamea monoglypha	grasses (P)
A. lateritia	grasses (P)
A. furva	grasses (P)
Photedes minima	grasses, sedges (P)
Amphipoea lucens	herbs on swampy ground (P)
A. crinanensis	herbs on swampy ground (P)
Hydraecia micacea	herbs and sedges on swampy ground (P)
Celaena haworthii	sedges (P)
Stilbia anomala	Ericaceae

of the catches in this habitat compared to 31% on the grassland.

More likely the high number of Noctuidae species taken in the heath is connected with the fact that many of the West Norwegian Noctuidae are polyphagous and hence have the possibility to find foodplants in the heath. The foodplants of the dominant species, mainly according to Nordström et al. (1941), are listed in Tab. 7. The dominant Noctuidae, *Lycophotia porphyrea,* feeds on *Calluna,* and this plant is also the foodplant for several of the dominant Geometridae species, like *Pachycnemia hippocastanaria* and *Eupithecia nanata,* (Hübner, 1813) and also

Ematurga atomaria. Other species of Ericaceae, *Vaccinium myrtillus, V. vitis-idaea, Erica tetralix* etc., also is important as foodplants for a high number of the Macrolepidoptera inhabiting the heath. Various grasses and sedges serve as foodplants for many of the dominant Noctuidae, like *Cerapteryx graminis, Apamea monoglypha, Amphipoea lucens* and *Celaena haworthii,* while several of the dominant Geometridae, like *Thera cognata, T. juniperata, Eupithecia pusillata* and *E. intricata* (Zetterstedt, 1839) feed on *Juniperus*. *Juniperus* grows abundantly both in the heath and on the grassland and the importance of this plant as a food plant is reflected in the high similarity between the Geometridae faunas in the two habitats, shown by Renkonen's percentage of similarity.

The bimodality in the total catch, with largest catches in spring and late summer might be a result of reduced efficiency of the traps during the short and bright middsummer nights. Light traps catch insects because the high illumination of the traps relative to the surroundings interfers with the normal photic orientation of the insects. Anything that reduces the contrast will have the effect of reducing the catch (Verheijen 1960). In Western Norway light traps must therefore be expected to be more efficient during the long dark nights in the spring and towards the autumn than during the middsummer nights (cf. Ulfstrand 1970, Southwood 1975). High background illumination might also have a direct effect. Moonlight depresses flight activity in insects (Williams 1936, Williams and Singh 1951), and Persson (1971) indicated that also the normal night light in June might lower flight activity. In any case, in the open, flat terrain on northern Sotra the background illumination in middsummer must be particularly noticeable.

The flight periods of the dominant species show a high degree of overlap with the flight periods recorded for the species elsewhere in Southern Norway and in England (e.g. Bakke 1974, Williams 1939). Proceeding from south towards north on the northern hemisphere the flight periods of «vernal» species occur progressively later with increasing latitude, and conversely for the «autumnal» species (Wiltshire 1938, 1941 a,b). Hardwick (1971) has shown that a «phenological date» can be calculated for each species, considering the lenght of the summer in a given locality (actually the number of days with a temperature above 42°F). When comparing the time and duration of the flight periods of the dominant species on northern Sotra with their flight periods in other areas both the locality's northernly possition and the effect of the atlantic climate have to be taken into account.

An uneven sex-ratio is often experienced in light trap catches and most often reflects differences in trappability between the sexes due to variation in phototactism and activity pattern. For some species there also are differences in flight potential between the sexes. The sex-ratio obtained in light trap catches seems, however, to be rather stable for many Noctuidae species. Williams (1939) recorded f. inst. 9% females in *Xestia xanthographa,* 11% in *C. graminis* and 25% in *A. monoglypha*. The corresponding sexratioes in the light trap catches on northern Sotra were 10%, 12% and 28%, respectively.

The tendency of the males to arrive a few days earlier than the females, i.e. protandry, has been experienced in light trap catches of different insect groups (e.g. Svensson 1972). Wiklund and Fagerström (1977) suggested that protandry is the optimal reproductive strategy of males in species maintaining female monogamy, or in species in which sperm from males mating with virgin females on the average fertilizes a larger number of eggs than sperm from males mating with already mated females.

In areas where the heaths are burned regularly *Juniperus* will disappear (Gimingham 1976), and the Macrolepidoptera community in a well tended heath will accordingly contain fewer species than recorded here for the heaths on northern Sotra. However, the altered farming habits in Western Norway have led to the spreading of woody plants in the heaths, and a number of herbs will in time undoubtedly invade the heaths. As a greater variety of plants generally leads to a greater variety of plant-eaters (Murdoch et al. 1972), a gradual higher diversity in the Macrolepidoptera community in the heaths is to be expected as an increasing number of species will find suitable foodplants. On the other hand, if the attempts to vegetate the West Norwegian lowland heaths with foreign conifers is successful, the opposite trend will undoubtedly be experienced.

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Survey of the Pine Beauty Moth *Panolis flammea* in Norway in 1980 and 1981 using traps with synthetic pheromone analogues

ØYSTEIN AUSTARÅ

Austarå, Ø. 1982. Survey of the Pine Beauty Moth *Panolis flammea* in Norway in 1980 and 1981 using traps with synthetic pheromone analogues. *Fauna norv. Ser. B. 29*, 105—109.

Panolis flammea (Denis & Schiffermüller) was recorded from 25 localities of a total of 36 localities surveyed in 1980 and 1981 using traps with synthetic pheromone analogues. The northern distribution was extended from Kvamme in Møre and Romsdal province to Namsos in Sør-Trøndelag. In South-Norway the moth was recorded from several localities further inland compared to previously known records and from several new localities along the west coast. The survey is a part of the internordic project «Pests of *Pinus contorta*». In the nordic countries *P. flammea* has never been reported as a pest of *Pinus contorta* Douglas, but because of heavy infestations in *contorta*-plantations in Scotland during the later half of the 1970's, it was decided to obtain more information about the distribution of the moth in Norway. Other noctuids attracted by the pheromone analogue were *Papestra biren* (Goeze) (= *Mamestra glauca* (Hübner)); *Orthosia gothica* (Hübner), *O. miniosa* (Denis & Schiffermüller) and *Anarta myrtilli* (L.).

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INTRODUCTION

The Pine beauty moth, *Panolis flammea* (Denis & Schiffermüller) (Lepidoptera, Noctuidae) is considered one of the most serious pests of Scots pine, *Pinus sylvestris* L., in Central Europe. Mass attacks are known since the first half of the 18th century, and most likely this moth was responsible for the devastations of the forests at Nürnberg in 1449—1450 (Berwig 1926). Tree mortality is usually the results when the pine is completely defoliated by *P. flammea*.

In the Nordic countries, the Pine beauty has been of little importance as a pest. However, in southern parts of Sweden approximately 8700 ha were heavily attacked during the years of 1947 and 1948, resulting in considerable tree mortality. Until 1947, infestations very seldom occurred. (Lekander 1954). From Norway it is not known that the moth has ever damaged the forest.

In different regions of Scotland heavy attacks of the moth developed in young plantations of Lodgepole pine, *Pinus cortorta* Douglas, during the later half of the 1970's resulting in the death of approximately 300 ha of plantations (Stoakley 1977, 1979). Prior to this the Pine beauty had never occurred as a pest of the pine forests in Great Britain.

As a result of the experiences from Scotland it was decided to obtain more information about the distribution of the Pine beauty in Norway, because *P. contorta* is of interest as a supplementary tree species on particular growing sites in several parts of the country.

The previously known distribution of *P. flammea* in Norway is shown in fig. 1. (After Opheim 1967, 1971, 1975, 1976, Nordstrøm et al. 1969, Berggren 1970, Mehl 1971, Bakke 1974, Svendsen 1976). — For the rest of the Nordic countries, *P. flammea* is recorded in one locality as far north as the Polar circle in Finland, and is fairly common from the south to the middle parts of the country. (Mikkola & Jalas 1977). In Sweden, the northernmost known locality is at the Gulf of Bothnia, and the moth is common in the middle and southern areas of the country. The Pine beauty is locally recorded over the whole of Denmark (Nordstrøm et al. 1969).

SURVEY METHOD

Pheromone traps were used for the survey. The trap is made of a wax impregnated cardboard sheet, folded to the shape of a triangular prism, open at both ends. The trap is developed by Arn

Fig. 1. Distribution of *Panolis flammea* in Norway.

Legend:
Triangles: Previously known records.
Squares: Trap localities 1980.
Circles: Trap localities 1981.
Filled symbols: Positive records.
Open symbols: Negative records.

et al. (1979), and described also by Bogenschütz (1980) (fig. 2). The insects are caught on a separate cardboard sheet covered with sticky glue on one side and placed on the bottom side of the trap. Inside the trap a small rubber capsule is placed, impregnated with a chemical compound which acts as an attractant to the males of *P. flammea* in a similar way as do the pheromones produced by the *P. flammea* females. The pheromone analogue is developed by Priesener et al. (1978) and is composed of two chemical, synthetical components, (Z)-9-tetradecenyl acetate and (Z)-11-tetradecenyl acetate.

The rubber capsules are inpregnated with 100 µg (Z)-9 + 5 µg (Z)-11 (Bogenschütz l.c.).

Table 1. Catches of *Panolis flammea* in 1980. Trapping period: ⊢— —⊣

Region	Locality	EIS grid no.	Altitude, m	Nos. of traps	Nos. of *P. flammea* males	Total
					April 7. 14. 21. 28 / May 7. 14. 21. 28 / June 7. 14. 21. 28 / July 7. 14.	
HEn	Ytre Rendal, Fiskvik	64	400	4	0	0
HEs	Elverum, Starmoen	55	230	5	45 22 0	67
HEs	Stange, Haugen	46	260	5	46 2 0	48
HEs	Grue, Skaslia	47	380	5	13 14 0	27
HEs	Eidskog, Matrand	38	140	5	8 0 0	8
BØ	Kongsberg, Saggrenda	27	270	5	8	8
VE	Lardal, Bergandammen	18	220	5	0	0
AK	Ås, Nordskogen	28	90	3	2 0	2
Ø	Halden, Prestebakke	12	140	4	12 0	12
AAy	Tromøy, Bjelland	6	10	3	3	3

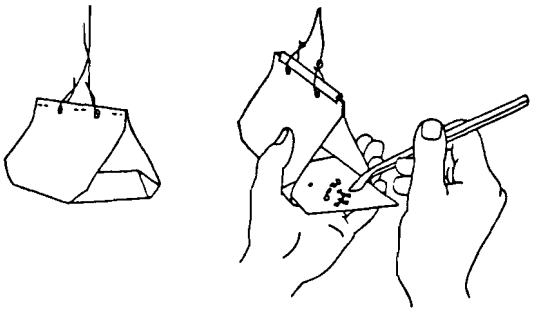

Fig. 2. Trap model. (Copied from Bogenschütz 1980).

TESTING THE METHOD IN 1980

In 1980 the traps were tested in 10 localities (tab. 1 and fig. 1) from two of which the Pine beauty had been previously recorded.

(In both table 1 and 2, region and EIS grid no. are in accordance with Strand (1943) and Heath (1977), respectively).

The number of traps in each locality varied between three and five (tab. 1). The distance between traps was approximately 100 meters. The traps were usually hung on branches of trees, 1.5—2 meters above the ground.

P. flammea was trapped in 8 of the 10 localities. The results are listed in tab. 1 which also shows the trapping periods.

As opposed to the negative results from the Fiskvik locality in Ytre Rendal one would have expected the moth to be caught at the locality in Lardal according to the formerly known distribution of the Pine beauty. However, the negative catches in Lardal can be explained by the fact that the area was stocked by mainly spruce forest.

Because the traps proved to be effective (tab. 1) and since the trapping method is simple it was decided to organize a more extensive survey in 1981.

SURVEY 1981

a) Distribution and control of traps

Traps were placed in 29 localities in natural pine forests (tab. 2 and fig. 1). Three of the localities were the same ones as in 1980.

With a few exceptions (tab. 2) the number of traps was five in each locality, the distance between traps being approximately 100 meters.

The traps were set out when the daily maximum temperature reached 14—15°C even if the ground was partly snowcovered.

The first trap catches were collected one week after the first moth was observed in the trap. The sticky cardboard sheet with the moths was then replaced with a new sheet, which remained in the trap for the next two weeks. Then the traps were taken down and the catches sent to the institute for identification. — In some localities this time-schedule was deviated from. However, the rubber capsule dispensers are effective for at least 6 weeks (Bogenschütz 1981), and therefore the traps have functioned at least for a part of the flight period.

b) Results

Tab. 2 shows the number of Pine beauty males caught in the localities during the various trapping periods. — It should also be mentioned that in most localities the traps caught considerable numbers of two other noctuids, *Papestra biren* (Goeze) = *(Mamestra glauca* (Hübner)) and *Orthosia gothica* (L.).

Largest number of *P. biren* in 5 traps was 58 from Hitra, while accordingly from Grue in 1980 the number was 77. Two specimens of *Orthosia miniosa* (Denis & Schiffermüller) were trapped at Tromøy, the southernmost locality in 1980. In 1981, 8 specimens of *Anarta myrtilli* (L.) were trapped at Kvernesmoen in Ytre Rendal.

COMMENTS

The trapping records show that *P. flammea* in Norway is more extensively distributed than was formerly known.

Previously the northernmost record was from Kvanne in Møre and Romsdal province (Mehl l.c.), while now the moth has been shown to exist at least 1 1/2 degree latitude further north, near Namsos in Nord-Trøndelag province. It should be noted that the records were negative at the northernmost trapping sites, Saltdal and Målselv. Also in East-Norway the distribution was extended northward from Elverum to Kvernesmoen in Ytre Rendal. However, at Kvernesmoen only one specimen was trapped, and at Fiskvik and Engerdalssetra in the adjacent districts the records were negative. This indicates that there is a considerable reduction in abundance between Elverum and Ytre Rendal/Engerdal, possibly due to the increasing altitudes towards the latter localities (tab. 2).

The survey did not aim at elucidating details on the flight periods of *P. flammea*. However,

Table 2. Catches of *Panolis flammea* in 1981. Trapping period: ⊢——⊣

Region	Locality	EIS grid no.	Altitude, m	Nos. of traps	Nos. of *P. flammea* males: April 7. 14. 21. 28. / May 7. 14. 21. 28. / June 7. 14. 21. 28. / July 7. 14.	Total
HEn	Engerdal, Engerdalsetra	73	625	5	0	0
HEn	Ytre Rendal, Kvernesmoen	64	300	5	1	1
HEn	Ytre Rendal, Fiskvik	64	620	5	0	0
HEs	Elverum, Starmoen	55	230	4	23 50	73
HEs	Stange, Haugen	46	260	5	1 7	8
On	Nord-Fron, Kaltrud	62	400	5	0	0
Bv	Gol, Hagaskogen	43	280	5	0	0
Bv	Nore, Bogstrand	35	300	5	0 7	7
Bv	Rollag, Skøllhaug	35	240	5	0 1	1
Bv	Rollag, Deilesmyr	35	230	5	40 7	47
TEi	Vinje, Hovdestadmogen	25	415	5	0	0
AAy	Åmli, Sagtjønn	10	160	5	3 7 6	16
AAi	Evje, Syrtveit	9	250	5	4 5	9
VAy	Mandal, Klev	2	75	5	4 0	4
Ry	Sandnes, Foss-Eikeland	7	50	5	6 1	7
Ry	Jelsa, Berakvam	14	20	5	9 0	9
Ri	Suldal, Vasshus	15	75	5	43 32 0	75
HOy	Stord, Tveitavannet	23	50	5	1 10 3	14
HOi	Ulvik, Bergo-Aurdal	41	300	5	1 0	1
SFy	Hyllestad, Kolgrov	49	250	5	3	3
SFi	Sogndal, Kaupanger	51	210	5	9 2	11
MRy	Volda, Morkaåsen	67	110	5	1 0	1
MRy	Tingvoll, Håkkåshaugen	85	120	5	2 0	2
STy	Hitra, Innerdalen	91	50	5	0	0
STi	Selbu, Store Slindvatn	93	360	5	0	0
NTy	Namsos, Høknesøra	106	5	5	29 0	29
Nsi	Saltdal, Medby	127	113	5	0	0
TRi	Målselv, Divimo	154	90	3	0	0
TRi	Målselv, Ulebergli	154	130	2	0	0

the results indicate certain differences between the various parts of the country. In the southern West-Norway and the coastal parts of the rest of South-Norway, flight activity occurred in general from early April till the end of April/beginning of May. In the northern parts of West-Norway and in the inland parts of the rest of South-Norway, the flight period was about one month later, from the beginning and towards the end of May. Also at the northernmost locality, Namsos, the flight period was in mid-May. Locally, climatic variations may of cource lead to deviations from the general flight periods (e.g. Suldal-Stord).

In many of the Norwegian localities the average catches per trap were greater than corresponding catches in most of 16 trapping localities in Central Europe in 1980 (Bogenschütz 1981).

In several localities in East-Norway considerable catches of *P. flammea* were made in traps placed inside young and older *contorta* plantations. The oldest plantation was 50 years of age. Also in West-Norway there are *contorta* plantations in districts from which the Pine beauty was recorded (Brekken 1968). However, injuries to *contorta* pine by *P. flammea* have never been reported from any part of Norway.

ACKNOWLEDGEMENTS

Without the assistance of the Forest Service in the various districts of Norway, it would not have been possible to carry out the extensive survey in 1981. District officers have been directly engaged in the work, or have arranged with private persons to participate in the survey.

In 1980 the trapped specimens were identified by Mr. Sigurd Andreas Bakke, in 1981 by Mr. Leif Aarvik.

Traps and pheromon analogues were provided by Dr. Hermann Bogenschütz, West-Germany.

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A small collection of calypterate Diptera (Tachinidae Sarcophagidae, Calliphoridae, Muscidae) from the Dovre mountains, Southern Norway

KNUT ROGNES

Rognes, K. 1982. A small collection of calypterate Diptera (Tachinidae, Sarcophagidae, Calliphoridae, Muscidae) from the Dovre mountains, Southern Norway. *Fauna norv. Ser. B. 29*, 110—114.

Data on 23 species of calypterate Diptera collected at Kongsvoll, Southern Norway, during the summer 1980 are given. *Onychogonia cervini* (Bigot, 1881) (Tachinidae) is reported as new to Scandinavia; *Pollenia intermedia* Macquart, 1835, *Protocalliphora chrysorrhoea* (Meigen, 1826) and *Protocalliphora nuortevai* Grunin, 1972 (Calliphoridae) as new to Norway. Some features of the *P. nuortevai* males and females are described.

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During the summer 1980 John O. Solem at The Royal Norwegian Society of Sciences, The Museum, (DKNVS-Museet), Trondheim, ran four Malaise-traps at three localities at Kongsvoll (Sør-Trøndelag: STI: Oppdal), in the Dovre mountains. The traps were placed across small streams primarily to collect aquatic insects. Parts of the captured material, which was conserved in ethanol, was sorted out by Lita Greve Jensen, Museum of Zoology, Bergen, and sent to me for identification. I have pinned and treated it according to a procedure described by Herting (1961), and it is now deposited at DKNVS-Museet, Trondheim, with duplicates in my own collection. The results of the examination are presented below.

The localities (all in EIS 79) are: (1) Blesbekken, 1100 m a.s.l., subalpine birch forest, UTM: 32V-NQ 32.07; (2) Raubekken 900 m a.s.l., subalpine birch forest, UTM: 32V-NQ 31.08; (3) Raubekken 1200 m a.s.l., lower alpine zone, UTM: 32V-NQ 32.07. All localities lie in the lower parts of the western slopes of the mountain S. Knutshø, east of Kongsvoll.

Identifications mostly follow the works of Lundbeck (1927), Séguy (1928, 1941), Mesnil (1944—1975), Hall (1948), Emden (1954), Hennig (1955—1964) and Zumpt (1956). Other works used are cited separately for the species concerned. Benno Herting, Ludwigsburg, has verified my identification of the tachinids. The nomenclature and sequence of treated species largely follow Crosskey and Pont in Kloet & Hincks (1975). Otherwise the presentation follows Rognes (1981). Species marked with an asterisk have not been previously recorded from Norway.

Family Tachinidae

Trichopareia grandicornis (Zetterstedt, 1849).
Previous records: *Tachina laticornis* Zetterstedt, 1838: 637; Zetterstedt 1844: 1071; *Tachina grandicornis* Zett. — Siebke 1877: 83; *Degeeria grandicornis* Zett. — Bidenkap 1901: 56; *Admontia grandicornis* Zett. — Ringdahl 1952: 136—137 No. 112.
Material: Raubekken 900 m 1 ♀ 9 Oct.

Allophorocera ferruginea (Meigen, 1824).
Taxonomy and previous records: Wood 1974; Rognes 1981: 109 (as *Erycilla ferruginea).*
Material: Raubekken 900 m 1 ♀ 31 July.

**Onychogonia cervini* (Bigot, 1881).
Taxonomy: Mesnil 1956: 540 (as *flaviceps);* Herting 1973: 7; Mesnil 1975: 1395.
Material: Raubekken 1200 m 1 ♂ 10 July.
The terminalia have been dissected (G.pr. 46) and agree with the description given by Herting (*l.c.).* For comparative purposes I have also dissected a male *Onychogonia flaviceps* (Zetterstedt, 1838) (the specimen cited in Rognes 1981: 109).

Zoogeographically this is an interesting capture. *O. cervini* Bigot has been known from rather few specimens from the Alps only, among which two that have been bred from *Orodemnias cervini* (Fallou) (Lep.: Arctiidae), the only known host (Herting 1973: 7—8). The above record is the first one from Scandinavia and *cervini* Bigot consequently the second known Palaearctic *Onychogonia* species with boreo-alpine distribution. Most in-

terestingly, the lepidopterous host species has also just recently been captured in Scandinavia for the first time (Sweden: Torne Lappmark, Nissuntjårro, altitude 700—1400 m) (Torstenius 1971, Palmqvist 1981, cf. also Hellberg 1981). Even though the locality is far north of the Dovre mountains, a search for *Orodemnias cervini* there might be successful.

Onychogonia flaviceps (Zetterstedt, 1838).
Taxonomy and previous records: See Rognes 1981: 109—110.
Material: Raubekken 1200 m 1 ♂ 7 Aug.

Family Sarcophagidae

Sarcophaga frenata Pandellé, 1896.
Previous records: *Sarcophaga frenata* Pand. — Ringdahl 1944a: 80; Ringdahl 1944c: 8; Ringdahl 1952: 146—147 No. 294.
Material: Raubekken 900 m 1 ♀ 3 July.

Family Calliphoridae

Calliphora alpina (Zetterstedt, 1838).
Taxonomy: Ringdahl 1931: 172.
Previous records: *Sarcophaga alpina* Zett. — Zetterstedt 1845: 1305; Siebke 1877: 95; *Acrophaga alpina* Zett. — Ringdahl 1944a: 80; Ringdahl 1952: 148—149 No. 353; *Steringomyia alpina* Zett. — Ringdahl 1944c: 7; *Calliphora alpina* Zett. — Zumpt 1956: 16.
Material: Blesbekken 1100 m 2 ♀ ♀ 19 June, 1 ♀ 21 Aug.; Raubekken 900 m 1 ♂ 10 July, 1 ♂ 1 ♀ 31 July; Raubekken 1200 m 1 ♀ 10 July, 1 ♀ 31 July, 1 ♀ 14 Aug.

Calliphora loewi Enderlein, 1903.
Previous records: *Calliphora loewi* End. — Nuorteva & Vesikari 1966: 545.
Material: Blesbekken 1100 m 2 ♀ ♀ 24 July, 1 ♂ 31 July.

Calliphora uralensis Villeneuve, 1922.
Previous records: *Calliphora uralensis* Vill. — Soot-Ryen 1925: 141—142; Lundbeck 1927: 150; Ringdahl 1944a: 80; Ringdahl 1944c: 6; Ringdahl 1952: 148—149 No. 358; Nuorteva & Vesikari 1966: 545; *Calliphora uralense* Villen. — Davies 1954: 72.
Material: Raubekken 900 m 1 ♀ 24 July

Calliphora vomitoria (L.).
Previous records: *Musca vomitoria* L. — Siebke 1877: 98; *Calliphora vomitoria* L. — Bidenkap 1892: 238; Bidenkap 1901: 60; Soot-Ryen 1925: 141; Ringdahl 1944a: 80; Ringdahl 1944c: 6; Ringdahl 1952: 148—149 No. 356; Davies 1954: 72; Brinkmann 1976: 326.
Material: Raubekken 900 m 1 ♀ 14 Aug., 1 ♂ 9 Oct.

Bellardia agilis (Meigen, 1826).
Taxonomy: Schumann 1973; Schumann 1974.
Previous records: *Onesia agilis* Meig. — Ringdahl 1944a: 80; Ringdahl 1944c: 6; Ringdahl 1952: 148—149 No. 365.
Material: Raubekken 900 m 2 ♂ ♂ 26 June, 2 ♂ ♂ 3 July, 1 ♂ 10 July.
The genitalia of one specimen have been dissected (G. pr. 38).

Cynomya mortuorum (L.).
Previous records: *Sarcophaga mortuorum* L. — Zetterstedt 1838: 650—651; Zetterstedt 1845: 1303; Siebke 1877: 95; *Cynomyia mortuorum* L. — Bidenkap 1901: 58; Strand 1903: 7; Soot-Ryen 1925: 141; Ringdahl 1944a: 80; Ringdahl 1944c: 7; Ringdahl 1952: 148—149 No. 355; Nuorteva & Vesikari 1966: 545.
Material: Raubekken 900 m 2 ♀ ♀ 19 June, 1 ♀ 3 July.

Pseudonesia puberula (Zetterstedt, 1838).
Previous records: *Musca puberula* Zetterstedt 1838: 654 (data of syntypes: Troms: TRY: Tromsø, Tromsø 1 ♂ 1 ♀ 24 July 1821); *Dexia puberula* Zetterstedt 1844: 1276; Siebke 1877: 93; Bidenkap 1901: 54; *Pseudonesia pubicornis* Zett. — Ringdahl 1944c: 7; Ringdahl 1952: 148—149 No. 368: Ringdahl 1954: 49.
Material: Raubekken 1200 m 1 ♀ 31 July.

**Pollenia intermedia* Macquart, 1835.
Taxonomy: Mihályi 1976.
Material: Raubekken 900 m 1 ♂ 21 Aug. First Norwegian record.

Pollenia rudis (Fabricius, 1786).
Taxonomy: Mihályi 1976.
Previous records: *Musca rudis* Fabr. — Siebke 1877: 99; Strand 1900: 70; *Pollenia rudis* Fabr. — Strand 1903: 7; Strand 1906: 102; Strand 1913: 324; Bidenkap 1892: 238; Bidenkap 1901: 61; Ringdahl 1944a: 80; Ringdahl 1944c: 5; Ringdahl 1952: 148—149 No. 337.
Material: Raubekken 900 m 1 ♂ 9 Oct.

Protophormia terraenovae (Robineau-Desvoidy, 1830).
Taxonomy: Sabrosky 1956.
Previous records: *Musca groenlandica* Zetterstedt 1838: 657; Zetterstedt 1845: 1330; Siebke 1877: 98; *Phormia groenlandica* Zett. — Soot-Ryen 1925: 145; Ringdahl 1944a: 80; *Phormia terraenovae* R.-D. — Ringdahl 1944c: 5; Nuorteva & Vesikari 1966: 545; *Protophormia azurea* Fall. — Ringdahl 1952: 148—149 No. 342; *Protophormia terrae-novae* R.-D. — Davies 1954: 72.
Material: Raubekken 900 m 1 ♂ 10 July, 1 ♂ 1 ♀ 7 Aug., 1 ♀ 28 Aug. 1 ♂ 1 ♀ 4 Sept., 1 ♀ 9 Oct.

**Protocalliphora chrysorrhoea* (Meigen, 1826).
Taxonomy: Peus 1960.
Material: Raubekken 900 m 1 ♂ 7 Aug., 1 ♂ 4 Sept.
The terminalia of one specimen have been dissected (G. pr. 34). Previously known from Austria, W. Germany (Aachen, Dachau) (Peus 1960) and Finland (Nuorteva 1960, Nuorteva & Järvinen 1961, Grunin & Nuorteva 1969). According to current opinion the larvae are obligatory bloodsuckers of *Riparia riparia* L. nestlings. First Norwegian record.

**Protocalliphora nuortevai* Grunin, 1972.

Taxonomy: Grunin 1972.

Material: Blesbekken 1100 m 3 ♂♂ 1 ♀ 12 June, 3 ♀♀ 19 June, 2 ♀♀ 26 June, 1 ♂ 17 July, 1 ♂ 24 July, 1 ♂ 1 ♀ 31 July, 1 ♂ 21 Aug.; Raubekken 900 m 2 ♀♀ 19 June, 1 ♀ 24 July, 2 ♀♀ 31 July, 2 ♂♂ 7 Aug., 1 ♂ 2 ♀♀ 21 Aug.; Raubekken 1200 m 1 ♂ 10 July, 1 ♂ 24 July. A total of 12 ♂♂ and 14 ♀♀.

The terminalia of 6 males have been dissected (G. pr. 31, 32, 33, 35, 36, 37) and they agree with Grunin's (1972) figures. I have also compared the material with most of the type material (holotype male, 3 male and 6 female paratypes in Zoological Museum, University of Helsinki, Finland). I have not seen the 3 male and 1 female paratypes in Zoological Institute, Academy of Sciences, Leningrad, USSR. Previously the species is known only from Northern Finland (Lapponia enontekiensis: Enontekiö, Kilpisjärvi; Lapponia inarensis: Utsjoki, Karigasniemi), close to the Norwegian border. As host for the larvae are known *Turdus iliacus* L., *Calcarius lapponicus* L. and *Phylloscopus trochilus* L. (Grunin 1972).

Below are given some descriptive notes on the Norwegian specimens, since they are the only ones to have been captured in the wild (the Finnish type material was bred from larvae or puparia), and also a few data on the Finnish material examined.

Both sexes: Apical third or more of second antennal segment (sometimes the whole segment), often basal part of third segment posteriorly, and vibrissal corner with red colour. Third antennal segment short. Peristomal part of gena not broad, subocular part smooth, without rugae. Palpi yellow. *Prst acr* 3 (4), *post acr* 3—4 (5), *prst dc* 3 (4), *post dc* 3 (4), sometimes assymmetrically developed (Finnish material: *prst acr* 3, *post acr* 3—6, *prst dc* 3—4, *post dc* 3—4). Postalar declivity almost always with a few short hairs at middle. Haltere with whitish yellow knob and yellow stalk. Squamae pure white. Basicosta brown to blackish brown, never as dark as epaulet, usually with lighter shade apically.

Males: Frons at narrowest point 0.100—0.137 times head width (mean 0.118, n = 11) (Grunin gives 0.104—0.152, mean 0.128, n = 4, for the males in the type series); frons at narrowest point 1.259—1.545 times distance between outer rims of posterior ocelli (mean 1.422, n = 12) (2 measurable Finnish males give 1.818, 1.810). Parafacialia and parafrontalia most often pure white dusted, sometimes with additional weak bluish or yellowish sheen; parafacialia with weak undulations; parafrontalia relatively broad, usually at least two thirds outside the inclinate frontal setae, with a single row of setulae outside the frontal setae.

Females: Width of frons at vertex 0.284—0.317 times head width (mean 0.299, n = 13) (Finnish females: 0.293—0.330, mean 0.315, n = 6). Width of frons at vertex 0.864—1.000 times distance between anterior ocellus and lunula (mean 0.932, n = 13) (Finnish females 0.878—1.000, mean 0.955, n = 6). Width of frons at vertex 0.487—0.570 times greatest diameter of eye (not in profile view of head) (mean 0.526, n = 13) (Finnish females: 0.500—0.550, mean 0.530, n = 5). Interfrontal stripe 0.469—0.554 times total width of frons (both at level of anterior orbital setae) (mean 0.508, n = 13) (Finnish females: 0.481—0.556, mean 0.513, n = 6). Area between prevertical, outer vertical and inner vertical setae polished black in all specimens except 3 which are dusted in this region. The Finnish females are apparently dusted in this region also, although their heads are rather dirty. Parafrontalia matt brown or greyish brown dusted; parafacialia glistening brown with a slight golden sheen; parafacialia with distinct rugae, at level of base of second antennal segment a very pronounced deep ruga, which in certain lights appears as a black transverse broad band or spot. Interfrontal stripe black as seen from above, brownish dusted as seen from in front, usually becoming narrower forwards, with a row of short hairs on each side («interorbitalborsten» of Peus 1960: 197, Abb. 1). The number of proclinate orbital setae 1—4, most have 2 on each side. The Finnish females have 2 or 3; one specimen has 3 on each side, three specimens have 2 on each side, the remaining two specimens are assymmetric in this respect.

Family Muscidae

Mesembrina mystacea (L.).

Previous records: *Mesembrina mystacea* L. — Zetterstedt 1838: 651; Zetterstedt 1845: 1342; Zetterstedt 1849: 3273; Siebke 1877: 99; Bidenkap 1892: 237; Bidenkap 1901: 61; Strand 1903: 6; *Hypodermodes mystacea* L. — Ringdahl 1928: 9; Ringdahl 1944b: 83; Ringdahl 1944c: 12; Forsslund 1951: 201; Ringdahl 1952: 150—151 No. 383.

Material: Raubekken 1200 m 1 ♂ 10 July.

Eudasyphora cyanicolor (Zetterstedt, 1845).

Taxonomy and previous records: Cuny 1980; Rognes 1979.

Material: Raubekken 900 m 1 ♂ 14 Aug.

Orthellia cornicina (Fabricius, 1781).

Taxonomy: Hennig 1963: 930 (as *caesarion*); Michelsen 1977; Michelsen 1979.

Previous records: *Musca cornicina* Fabr. — Zetterstedt 1838: 655; *Lucilia cornicina* Fabr. — Siebke 1877: 97 (in part; cf. Rognes 1982: 40); Bidenkap 1892: 238; Strand 1900: 70; Bidenkap 1901: 59; *Pseudopyrellia cornicina* Fabr. — Strand 1903: 7; *Pseudopyrellia fennica* Frey — Strand 1913: 324; *Cryptolucilia caesarion* Meig. — Ringdahl 1928: 8; *Orthellia caesarion* Meig. — Ringdahl 1944b: 83; Ringdahl 1944c: 12; Ringdahl 1952: 150—151 No. 373; Ardö 1957: 148.

Material: Raubekken 900 m 1 ♀ 17 July, 1 ♀ 31 July; Raubekken 1200 m 1 ♂ 31 Aug.

Morellia hortorum (Fallén, 1816).

Previous records: *Musca hortorum* Fall. — Zetterstedt 1838: 660; *Cyrtoneura hortorum* Fall. — Siebke 1877: 99; Bidenkap 1892: 239; Strand 1900: 70; Bidenkap 1901: 62; *Muscina (Cyclaneum) hortorum* Fall. — Strand 1906: 102; *Morellia hortorum* Fall. — Ringdahl 1928: 7; Ringdahl 1944b: 83; Ringdahl 1944c: 13; Ringdahl 1952: 150—151 No. 380.

Material: Raubekken 900 m 1 ♀ 17 July; Raubekken 1200 m 1 ♀ 31 July.

Myospila meditabunda (Fabricius, 1781).

Taxonomy: Gregor 1968; Pont 1970.

Previous records: *Cyrtoneura meditabunda* Fabr. — Siebke 1877: 100; *Myospila meditabunda* Fabr. — Bidenkap 1901: 62; *Myiospila meditabunda* Fabr. — Ringdahl 1928: 19; Ringdahl 1944b: 84; Ringdahl 1944c: 18; Ringdahl 1952: 158—159 No. 573.

Material: Blesbekken 1100 m 1 ♀ 17 July; Raubekken 900 m 1 ♀ 14 Aug., 1 ♂ 1 ♀ 28 Aug.

Haematobosca stimulans (Meigen, 1824).

Previous records: *Stomoxys stimulans* Meig. — Siebke 1877: 80; *Haematobia stimulans* Meig. — Ringdahl 1928: 10; Ringdahl 1944b: 83; Ringdahl 1944c: 13; Ringdahl 1952: 150—151 No. 394; Ardö 1957: 149.

Material: Blesbekken 1100 m 1 ♂ 19 June.

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Chironomidae (Dipt.) from Ekse, Western Norway

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A systematic list of the chironomid fauna from Ekse, Western Norway is given. Thirty-two genera and 67 species are listed, of which 13 species, including 3 uncertain, are new to region 20 following Limnofauna Europea, and 4 are previously uncertain recordings. Two species are new to science, while 11 have a more or less uncertain taxonomic status. *Diamesa ursus* Kieffer, 1918, is synonymized with *Diamesa hyperborea* Holmgren, 1869. Figures of 2 species of *Procladius* Skuse are presented.

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INTRODUCTION

The following paper is the result of a first attempt by two of us (G.A.H. & E.W.) to get familiar with the family Chironomidae, and to obtain some knowledge of the chironomid fauna of Western Norway. For this purpose light trap catches taken from May to mid October 1976 at Ekse, HOi: Vaksdal were examined. The catches were part of «The Weir Project», a study of the effects of building weirs in the regulated West Norwegian river Ekso, and collected by various participants of the project.

The river Ekso is situated about 100 km north east of Bergen. The light trap was placed at Ekse (60°50' N6°15' E, altitude 580 m a.s.l.) about 20 m from the river bank, just opposite an artificial weir making a basin with relative slowflowing water. The vegetation in the study area is described in Fredriksen (1980), the river being surrounded by pasture and hayfields, acid bogs and birchwood. The area lies in the subalpine birchwood belt. Apart from mosses, no aquatic macrophyte vegetation was present in the river.

MATERIAL AND METHODS

Most of the material examined consists of the above mentioned light trap catches from May to mid October 1976 at Ekse. While revising *Eukiefferiella* Thienemann, *Tvetenia* Kieffer and *Diamesa* Meigen several collecting trips were made to the same area in the summers of 1979 and 1980 in order to rear specimens for these genera. The larvae were collected mostly from the surfaces of stones and from submerged mosses in the river and in tributary brooks, at most 3 km upstreams from the location of the light trap. However, a few collections were also made in the weir basin and in the bog pools.

The light trap material represents a vast number of specimens. No attempt was made to make a quantitative subsampling or to cover all collecting dates. The specimens were determined to subfamily and grouped with a stereomicroscope and than mounted on slides following the procedure outlined by Sæther (1969). The terminology used follows Sæther (1980). The identified species are listed in alphabetic order under the respective subfamilies with collecting dates, number of identified specimens and systematic remarks when necessary. According to the faunistic aspect we do not designate species new to Norway, but follows the delineation of regions in Limnofauna Europea (Illies, 1978: XIII–XVII). This means that Ekse lies in region 20, together with most of Norway. Østfold is a part of region 14, Troms north of Tromsø and Finnmark are included in region 21, while parts of Sweden are included in region 20.

For identification of the genera Pinder (1978), Brundin (1956) and Fittkau (1962) were mostly used. For many genera such as *Procladius* Skuse and *Orthocladius* van der Wulp no appropriate keys on Palaearctic species exists. For these genera works on Nearctic species have been conferred. The species of the genera *Chaetocladius* Kieffer, *Limnophyes* Eaton, *Orthocladius* and *Parakiefferiella* Thienemann have been identified mainly by means of the descriptions given in Brundin (1947, 1956).

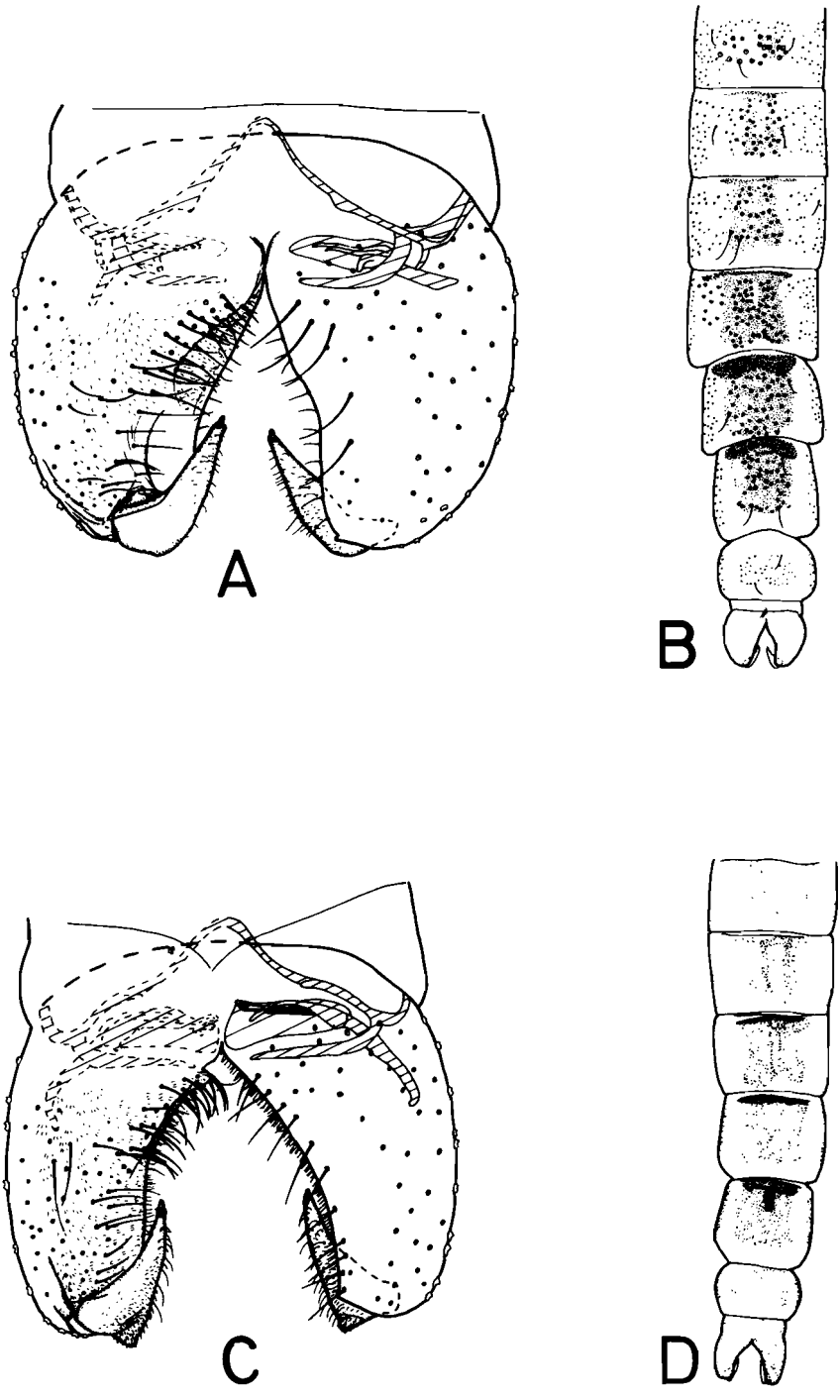

Fig. 1. *Procladius* spp. — A-B *Procladius* sp. *A*, male hypopygium; *B*, tergites — *C-D. Procladius* sp. *B. C*, male hypopygium; D, tergites.

SYSTEMATIC LIST

Podonominae

Parochlus kiefferi (Garret)
2—11 Jun. 1976 2 males, 20—27 Jul. 1976 2 males.

Tanypodinae

Ablabesmyia monilis (L.)
10—26 Aug. 1976 6 males.
Krenopelopia binotata (Wiedemann)
3—10 Aug. 1976 2 males.
Macropelopia goetghebueri (Kieffer)
10—16 Aug. 1976 2 males, 24 Jun. 1980 1 male reared from a bog pool.
Macropelopia nebulosa (Meigen)
8—27 Jul. 1976 2 males, 26 Apr. 1979 1 male reared from the river.
Procladius (Procladius) sp. *A*. (Fig. 1 A-B)
16—23 Aug. 1976 1 male.
The species is characterized by almost total absence of a heel on the gonostylus; the other surface of the gonostylus curved; and tergite VIII and the entire hypopygium light. Wing lenght 3.05 mm. Spur on front tibia with 7 lateral teeth, spurs on mid tibia with 8 and 5 teeth, and spurs on hind tibia with 9 and 6 teeth respectively. ta_1 and ta_2 of front leg with 2 pseudospurs each, ta_1 and ta_2 of mid and hind legs with 3 pseudospurs each, and ta_3 of mid and hind legs with 1 pseudospur.
Procladius (Procladius) sp. *B*. (Fig. 1 C-D)
10—16 Aug. 1976 4 males.
This species has slightly more pronounced heel on the gonostylus, and tergite VIII and the hypopygium are brown coloured. Wing length about 2.60 mm. Spur on front tibia with 3 lateral teeth, spurs on mid tibia with 6 and 4 teeth, and spurs on hind tibia with 5 and 3 teeth respectively. Tarsomeres on front leg without pseudospurs, ta_1 and ta_2 on mid and hind legs with 1 each.
Both species will key out to *Procladius (Procladius) ruris* Roback in Roback (1971). Brundin (1949: 811) has drawn the gonostylus of a specimen questionably determined as *Procladius (Procladius) appropinquatus* Lundstrøm. Roback has examined this specimen and states a possibility for *P. (P.) ruris* being a synonym of *P. (P.) appropinquatus*. The former species is previously known from North America, the latter is known only from region 21.
Psectrotanypus varius (Fabricius)
24 Jun.—10 Aug. 1976 5 males.
Thienemannimyia fusciceps (Edwards)
13—26 Aug. 1976 8 males.
Zavrelimyia cf. *thryptica* (Sublette)
24 Jun.—10 Aug. 1976 4 males, 24 Jun. 1980 1 male reared from the river.
The specimens are determined to *Z.* cf. *thryptica* in Roback (1972) due to the lack of crossbands on the wing. The pupa resembles *Zavrelimyia nubila* (Meigen) in not having a pale area around the plastron plate of the thoracic horn («Hof» in Fittkau (1962)). The thoracic horn is, however, different from that of *Z. nubila* in being wider at the distal end and having a larger plastron plate and a shorter aeropyle. The abdominal segments of the pupa do also differ as they lack narrow, brown bands caudally.
Z. thryptica is previously known from the USA including Alaska.

Diamesinae

Diamesa aberrata (Lundbeck)
10 Aug.—1 Sept. 1976 6 males and 4 females.
Diamesa bertrami Edwards
24 Jun.—26 Aug. 1976 16 males and 11 females, 9 Nov. 1978 1 females reared, 9 Jul. 1979 3 males and 1 female reared.
Diamesa bohemani Goetghebuer
24 Jun.—1 Sept. 1976 about 40 males and females, 9 Nov. 1978 1 female reared.
Diamesa hyperborea Holmgren
Diamesa hyperborea Holmgren 1869: 48 (described from Bear Island); Oliver 1962; 5, 6—7, fig. 4 (designation of lectotype); Serra-Tosio 1971: 227; Serra-Tosio 1973: 74 (as synonym of *Diamesa ursus* (Kieffer) (see below)).
Adiamesa hyperborea (Holmgren).
Kieffer 1918: 106; Kieffer 1919: 42.
Adiamesa ursus Kieffer 1918: 104 (brief description in key); Kieffer 1919: 42—43, figs. 2—3 (improved describtion).
Diamesa ursus (Kieffer). Goetghebuer 1932: 170 *pro parte*, fig. 295 (description of male); Goetghebuer 1939: 15 *pro parte*, Taf. II; fig. 22 (description of male); Pagast 1947: 486—487, fig. 51 (description of male based on Kieffer's material); Oliver 1962: 7 (as probable synonym of *D. hyperborea*); Sæther 1968: 458—460, fig. 25 (description of male from W. Norway); Serra-Tosio 1971: 227—230, figs. 98—99 (description of males from N. Sweden); Serra-Tosio 1973: 74 (ecology and discription).
Diamesa ursa (Kieffer). Sublette and Sublette 1965: 152.
nec. *Diamesa hyperborea* auct., nec. Holmgren. Edwards 1922: 197, 212, fig. 12; Goetghebuer 1932: 169 *pro parte*, fig. 291; Goetghebuer 1939: 13 *pro parte*, Textfig. 19c (description of female based on misdetermination of *Diamesa bertrami*).
nec *Diamesa ursus* auct., nec. Kieffer. Edwards 1922: 197, 211—212, fig. 11; Edwards 1935: 470—471; Goetghebuer 1932: 170 *pro parte*, fig. 296; Goetghebuer 1939: 15 *pro parte*, Textfig. 19d (misdeterminations of female *Diamesa bohemani*).
nec *Diamesa davisi* Edwards, Pagast 1947: 478, 573 (as possible synonym of *D. hyperborea*); Sæther 1968: 441 (*D. hyperborea* sensu Edwards as synonym); Hansen and Cook 1976: 81 (*D. ursus* sensu Edwards as synonym).
1 Sept. – 7 Oct.1976 6 males, 9 Nov.1978 1 male

reared. Additional material studied: W. Norway, Lundeelv, Jölster Sept. 1980, G. A. Halvorsen leg., 1 male; Finse nr. Blåisen, 13 Aug. 1980, E. Willassen leg., 2 males. *Lectotype* and *paralectotypes:* labeled: Beeren Eiland, Holmgren (in addition on lectotype: rev. D.R. Oliver 1959), Riksmuseum Stockholm (numbers 81 382—389), 5 males and 3 females (including 1 female with genitalia missing).

As indicated by the list of synonyms the taxonomic history of *D. hyperborea* is rather confusing. Part of the problems may be traced back to the inaccurate original description of the species. Kieffer's (1918) first description of *D. ursus* from Bear Island was nothing more than a brief differential diagnosis separating *D. ursus* from *D. hyperborea*. One of the characters used was the number of flagellomeres. Holmgren (1869) counted only 10 flagellomeres in the male of *D. hyperborea*, while Kieffer found 13 in *D. ursus*. With a modern microscope Holmgren would have seen that the number of flagellomeres in *D. hyperborea* actually is 13, but adjacent flagellomeres may occasionally be partly fused. Oliver (1962), when examining Holmgren's type series did not make microscopic preparations of the specimens, except for the hypopygium of the lectotype which he designated. He did not comment on the error committed by Holmgren when describing the antenna.

The original description of *D. ursus* was later corrected and improved by Kieffer (1919) himself, and Pagast (1947) redescribed *D. ursus* from Kieffer's material. Sæther (1968) described *D. ursus* from Finse, Norway, and referring to Kieffer (1919), Pagast (1947), and Oliver (1962) pointed out morphological differences between *D. ursus* and *D. hyperborea*. Comparison of the type series of *D. hyperborea* and material from W. Norway shows that these characters are intraspecific variations.

The types of *D. hyperborea* show AR values ranging from 0.28 to 0.35, and LR values of the front leg from 0.54 to 0.59 (Only three specimens could be measured). Specimens from W. Norway show AR values from 0.33 to 0.47 and LR values from 0.60 to 0.63. (The AR values for *D. hyperborea* given by Oliver (1962), from 0.32 to 0.46, must have been measured on the pinned types or on additional material from Bear I. available to him.). Kieffer (1919) states for *D. ursus:* «Vordertibia fast um 4/5 länger als der Metatarsus».

This would give LR about 0.56. The proportions of the front leg were the other main character used by Kieffer to separate *D. ursus* from *D. hyperborea*.

Serra-Tosio (1971) described *D. ursus* from two males collected in N. Sweden. He must have overlooked that Oliver's (1962) treatment of *D. hyperborea* in part was based on the type material because he states that he regards *D. ursus* and *D. hyperborea* as distinct, but that the species described by Oliver actually is *D. ursus* and not *D. hyperborea*. Accordingly, he regards *D. hyperborea* sensu Oliver as a synonym of *D. ursus*.

Paradoxically, when Oliver (1962) suggested *D. ursus* as a synonym of *D. hyperborea* he referred to Edwards (1922) who stated that *D. ursus* is smaller than *D. hyperborea* but otherwise the same. However, the species described as *D. ursus* and *D. hyperborea* by Edwards (1922) were misidentified females of *D. bohemani* and *D. bertrami* respectively. The males of these two species were described and named at later dates.

Pagast (1947) regarded *D. davisi* as a possible synonym of *D. hyperborea*. Sæther (1968) referred to Pagast (1947) and to Edwards (1922: fig. 12) concerning *D. hyperborea*. Hansen and Cook (1976) refer to Edwards (1922: fig. 11) (*D. ursus* sensu Edwards) stating that Sæther (1968) questioned the determination by Edwards. Accordingly, *D. ursus* was regarded as a possible synonym of *D. davisi* by Hansen and Cook (1976).

According to Serra-Tosio (1971) *D. hyperborea* (as *D. ursus)* is distinct from the alpine *Diamesa cinerella* Meigen primarily by antennal characters. *D. cinerella* has an AR about 0.6. The AR alone would place some of the specimens from Ekse (AR 0.33—0.47) between *D. cinerella* and *D. ursus* as described by Serra-Tosio. At least some of the additional characters listed by Serra-Tosio as distinguishing the two species (anal lobe of the wing, setae on the volsella, enlarged part of the gonostylus) are subject to variation in the material available to us. Thus, *D. hyperborea* might show up to be a junior synonym of *D. cinerella*. Specimens of *D. cinerella* have, however, not been examined by us.

Diamesa latitarsis (Goetghebuer) sensu Edwards
8 Jul.—26 Aug. 1976 about 50 males and females, 9 Jul 1979 3 reared mature pupae, 26 Jul. 1976 4 reared mature pupae.

Diamesa lindrothi Goetghebuer
24 Jun—1 Sept. 1976 about 40 males and females.

Diamesa n. sp.
24 Jun.—30 Sept. 1976 53 males and 8 females. The species is a member of the *Diamesa davisi* group and will be described elsewhere.

Diamesa thienemanni Kieffer
24 Jun.—7 Oct. 1976 21 males, 26 Jul. 1979 1 male reared, 24 Jun. 1980 3 reared mature pupae. *D. thienemanni* is possibly a junior synonym of *Diamesa tonsa* (Haliday). Pagast (1947) stated that *D. tonsa* is separable from *D. thienemanni* by lower antennal ratio only. This character is used in the keys to the British species in Pinder (1978), where the hypopygia figured for *D. tonsa* and *D. thienemanni* appear very different. Putative types of *D. tonsa* have been examined, and the relationships between the two species will be discussed elsewhere.

Pseudodiamesa branickii (Nowicki)
10 Aug. 1976 1 male, 1 Sept. 1976 1 male.

Prodiamesinae

Prodiamesa olivacea (Meigen)
24 Jun. 1976 1 male.

Orthocladiinae

Chaetocladius dissipatus (Edwards)
2 Jun.—26 Aug. 1976 29 males.
This species is previously not recorded from region 20. It is among other found in Finland, Germany and England. The genus is, however, poorly known and in need of revision.

Corynoneura celtica Edwards
3 Aug. 1976 1 male.

Corynoneura lacustris Edwards
8—27 Jul. 1976 2 males.

Corynoneura lobata Edwards
3 Aug. 1976 2 males.
The inferior volsella of the examined specimens is very typical, the sternapodeme is broader than figured in Schlee (1968: 118, fig. 24). This is, however, a variable character in several *Corynoneura* spp.
The species is previously not recorded from region 20.

Corynoneura scutellata Winnertz
20 Jul. 1976 1 male.

Cricotopus (Cricotopus) annulator Goetghebuer
20 Jul. 1976 1 male.

Cricotopus (Cricotopus) gelidus Kieffer
24 Jun. 1976 2 males.
The species is previously known from Novaya Zemlya only.

Cricotopus (Cricotopus) pulchripes Verrall
20 Jul.—26 Aug. 1976 5 males.

Cricotopus (Cricotopus) septentrionalis Hirvenoja
10 Aug. 1976 1 male
Previously not recorded from region 20, known from Finland only.

Eukiefferiella boehrensis Brundin
20—27 Jul. 1976 7 males and 2 females.

Eukiefferiella brevicalcar (Kieffer)
24 Jun. 1976 1 male, 26 Apr.—9 Jul. 1979 2 reared females and 5 reared mature pupae.

Eukiefferiella claripennis (Lundbeck)
20 Jul.—10 Aug. 1976 4 males and 15 females, 21 Jun.—26 Sept. 1979 about 20 reared males, females and mature pupae.

Eukiefferiella dittmari Lehmann
20 Jul.—3 Aug. 2 males and 20 females, 9—26 Jul. 1979 1 male, 2 females and 3 mature pupae, all reared.
The reared specimens, identified by the pupa, keys out to *E. dittmari* in Lehnmann (1972). The males are, however, identical with *Eukiefferiella devonica* (Edwards) sensu Lehmann. The taxonomy inside the *E. devonica* group is not clear, and a revision is under preparation. *E. dittmari* is previously known from Germany and Ireland only, while *E. devonica* is previously recorded from region 20.

Eukiefferiella minor (Edwards)
3—10 Aug. 1976 3 males, 21 Jun.—6 Sept. 1979 1 reared male and 6 reared mature pupae.

Heterotrissocladius marcidus (Walker)
10—16 Aug. 1976 13 males, 26 Apr.—15 May 1979 1 reared male and 1 mature pupa.

Limnophyes cf. *borealis* Goetghebuer
24 Jun.—24 Aug. 1976 6 males.
These speciemens have lower AR values than what Oliver (1962) described for *L. borealis*, 0.67—0.75 compared to 0.87—1.05. The Ekse population have also fewer dorsocentrals medially and posteriorly, shorter wing length (about 1.25 mm against 1.5—1.8 mm) and about 10 setae on epimeron II (about 6 in Oliver's description), otherwise as in *L. borealis* sensu Oliver.
L. borealis is previously recorded from Spitsbergen, Bear Island and Germany, with a questionable recording from region 20.

Limnophyes jemtlandicus Brundin
2 Jun.—10 Aug. 1976 2 males.
The species is previously not recorded from region 20.

Limnophyes cf. *nudiradius* Sæther
24 Jun.—3 Aug. 1976 2 males.
L. nudiradius is previously known from South Dakota, USA and the Lake Winnipeg area, Canada (Sæther, 1975)

Limnophyes smolandicus Brundin
24 Jun.—10 Aug. 1976 2 males.
The species is previously not recorded from region 20.

Metriocnemus fusciceps (Meigen)
24 Jun. 1976 1 male.

Metriocnemus hygropetricus Kieffer
8 Jul.—16 Aug. 1976 4 males.

Orthocladius (Eudactylocladius) mixtus (Holmgren)
3—16 Aug. 1976 10 males.

Orthocladius (Eudactylocladius) obtexens Brundin
3—26 Aug. 1976 4 males.

Orthocladius (Euorthocladius) frigidus (Zetterstedt)
11 Jun.—10 Aug. 1976 2 males.

Orthocladius (Euorthocladius) rivicola (Kieffer)
Summer 1976 4 males.

Orthocladius (Euorthocladius) cf. *thienemanni* (Kieffer) 3—10 Aug. 1976 4 males.

Orthocladius (Euorthocladius) n. sp?
Summer 1979 4 reared specimens.
The subgenus *Orthocladius (Euorthocladius)* is under revision by Dr. A.R. Soponis. Most of the material is sent to her. The possible new species has a hypopygium close to *O. (E.) frigidus*. The pupal exuvia, however, keys out to *Orthocladius s. str.* in Soponis (1977).

Orthocladius (Orthocladius) dentifer Brundin cf. nec Soponis 15 Apr.—9 Jul. 1979 1 reared male and 1 mature pupa.
The male keys out to *O. (O.) dentifer* in Soponis (1977). The pupa does not key out to *O. (O.) dentifer* due to the presence of frontal setae, Soponis, however, states that the species might have frontal setae, as her pupal material was in a bad condi-

tion. The figures in Soponis (1977: 132, figs. 30 and 31) of the hypopygia shows small differences in the anal points and the superior volsella between the lectotype and the Nearctic material. The anal point of the former is shorter and more triangular and the superior volsella is more protruding, appearing right-angled, than in the Nearctic specimens. Further examination of Nearctic material is necessary in order to confirm this species as Holarctic.

O. (O.) dentifer is previously not recorded from region 20.

Parakiefferiella (Rheosmittia) languida Brundin
20—27 Jul. 1976 2 males, 26 Jul. 1979 1 male and 1 female. These specimens are treated in Cranston & Sæther (in MS).

Parametriocnemus boreoalpinus Gowin
3 Aug. 1976 1 male.

Smittia aterrima (Meigen)
24 Jun.—10 Aug. 1976 5 males.

Smittia nudipennis Goetghebuer
3 Aug. 1976 1 male.
This species is previously not recorded from region 20.

Thienemanniella cf. *vittata* Edwards
9 Jul. 1979 2 males reared.
This species has 12 flagellomeres and a hypopygium that resembles *T. vittata* as figured in Pinder (1978). *T. vittata* is previously questionably recorded from region 20.

Thienemanniella n. sp. near *morosa* Edwards
8—27 Jul. 1976 2 males, 9 Jul. 1979 1 male reared. This species has 10 flagellomeres. The only species described with definitely that number is *Thienemanniella clavicornis* Kieffer. The inferior volsella, however, resembles that of *T. morosa*. The genus is in need of a revision. Of the European species, only those described in Schlee (1968) are recognizable.

Tvetenia calvescens (Edwards)
2 Jul.—27 Jul. 1976 2 males and 7 females, 15 May—9 Jul. 1979 4 males, 3 females and 9 mature pupae reared.

Chironominae

Tanytarsiui

Micropsectra fusca (Meigen)
24 Aug. 1980 2 males
The species is previously not recorded from region 20.

Micropsectra groenlandica Andersen
26 Aug. 1976 1 male.

Parapsectra nana (Meigen)
8 Jul.—10 Aug. 1976 2 males.

Stempellinella brevis Brundin
20 Jul. 1976 1 male.

Tanytarsus brundini Lindeberg
20 Jul. 1976 1 male.

Chironomini

Chironomus longistylus Goetghebuer
9 Nov. 1978 1 mature pupa reared, 15 May 1979 1 male reared from the weir basin.
The male will key out to *C. longistylus* in Pinder (1978) and in Lindeberg & Wiederholm (1979). Three mature female pupae with corresponding larval exuviae may also belong to this species. Previously not recorded from region 20.

Chironomus sp. *thummi* group
15 Jul. 1976 1 male.
The species keys out to the *thummi* group in Lindeberg & Wiederholm (1979). The hypopygium agrees well with *Chironomus riparius* Meigen as figured by Pinder (1978) and Townes (1945).

Chironomus sp.
30 Jun.—15 Jul. 1976 2 males.
The hypopygium resembles that of *Chironomus annularius* Meigen sensu Edwards. The specimens are, however, lacking the frontal tarsomeres, which makes them difficult to identify.

Endochironomus lepidus (Meigen)
15 Jul. 1976 1 male.

Polypedilum albicorne (Meigen)
3 Aug. 1976 2 males.

Polypedilum cultellatum Goetghebuer
3 Aug. 1976 1 male.
The specimen has only 3 setae on the posterior lobe of the superior volsella. Pinder (1978) mentions 4—5.

Stictochironomus pictulus (Meigen)
20 Jul. 1976 2 males.

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On the Norwegian Harvestmen (Opiliones). Contribution to ecology, morphological variation and distribution

INGVAR STOL

Stol, I. 1982. On the Norwegian Harvestmen (Opiliones). Contribution to ecology, morphological variation and distribution. *Fauna norv. Ser. B. 29*, 122—134.

During the period Sept. 1976—Sept. 1977 Opiliones were collected at 32 localities in Southern Norway. In addition museum material in Bergen and Oslo were checked. Two species found are new to Norway — *Oligolophus hanseni* (Kraepelin, 1896) and *Nelima gothica* Lohmander, 1945. *Leiobunum rupestre* (Herbst, 1799) is with certainty found in Norway, and *Opilio parietinus* (De Geer, 1778) is recommended to be excluded from the Norwegian fauna-list. 14 Opiliones species are known from Norway. Distributional maps, notes on ecology and morphological variation and comments to author names and dates of taxa are included

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INTRODUCTION

The knowledge of Norwegian Opiliones is small. This is true both for distribution, ecology and morphological variation. With assistance from The University of Bergen I visited 32 localities in Southern Norway in the period Sept. 1976—Sept. 1977, with the intention of throwing light primarily on the distribution.

The material at the museum of Bergen and Oslo also have been investigated.

At about 1900, 9—10 species were known from Norway. Professor Kauri has found 3 further (1966—1977), and after the present work 14 species of Opiliones are known from Norway.

Some notes on ecology, morphological variation and author names and dates of taxa are also given.

MATERIAL AND METHODS

The fieldwork at 32 localities in Southern Norway was carried out in the period Sept. 1976—Sept. 1977.

Most of the 23 localities on Vestlandet (SW Norway) were continually investigated throughout almost one year. One locality on Sørlandet (S Norway) and 8 localities on Østlandet (E Norway) were visited twice.

Altogether 7730 specimens were collected and identified. In addition most of the material at the zoological museums of Bergen and Oslo were controlled, identified or revised.

The localities were classified into 6 biotope types based on the vegetation: (A) coniferous wood, (B) deciduous wood, (C) grazing land, (D) garden/park, (E) heather and (F) beach.

Some types are underrepresentated or overrepresentated. Two sampling methods have been employed: (I) pitfall traps and (II) handpicking.

The Opiliones collections from these 32 localities are preserved at Museum of Zoology, University of Bergen.

Detailed locality descriptions are given in Appendix I. Geographical positions of localities are shown in Fig. I.

SYNOPSIS OF THE SPECIES

Kauri (1977) mentions the 13th species from Norway. This fieldwork with its literature studies, resulted in further 2 additonal species of Opiliones, *Oligolophus hanseni* and *Nelima gothica*.

In addition one species *Opilio parietinus* should be removed from the Norwegian fauna-list.

In the species-list also localities from unpublished material at the zoological museums of Bergen (= ZMB) and Oslo (= ZMO) are given.

Not all museum material had got a number, and almost all museum material was previously unpublished.

Long journal-lists with reports of one species at the same locality are here shortened (i.e. — A568-14N-A2376-ZMB, means that fourteen numbered journal reports are dropped in this context. First and last number only are mentioned).

In the species-list previously publications, revisions and the occurrence in Iceland (Ic), The Faroes (Fa), Denmark (Da), Sweden (Sw), Finland (Fi) or Norway (No) if any also are given.

Distributions may be found in Ellingsen (1894), Strand (1900), Tullgren (1906), Henriksen (1938), Heinäjoki (1944), Lohmander (1945), Meinertz (1962), Kauri (1966, 1977, 1980) or Martens (1978).

Province initials and subdivisions follow Strand (1943).

Family Nemastomatidae Simon, 1872

Nemastoma bimaculatum (Fabricius, 1775). (= *Phalangium bimaculatum* Fabricius, 1775).

Found at localities 1,2,3,4,5,6,7,8,10,11,12,13,-14,15,16,17,18,19,21,32.

Museum material: HOy: Bergen 40499, A3, A2114-43N-A2581, A3646, A3540, A3555-ZMB. Os A3554-ZMB. Stord C1476-40N-C1559-ZMB. Tysnes A3138, A4456-ZMB. Bømlo C273-5-ZMB. HOi: Kvinnherad A457, A188, A3621, C2053-ZMB. Strandebarm C276-ZMB. Kvam A3307-ZMB. Jondal A3308-ZMB. Kinsarvik A182, A467-ZMB. Varaldsøy-ZMB. Ry: Nedstrand-ZMB. Stavanger-ZMB. Sandnes-ZMB. Nærbø-ZMB. Ri: Sauda-ZMB. SFi: Aurland A3791, A3817, A3824-ZMB. STi: Byneset-ZMB. Nnv: Moskenes C287-ZMB.

Wunderlich (1973) reports the species from SFi: Skjolden. Occur in Ic, Fa, No.

Nemastoma lugubre (Müller, 1776). (= *Phalangium lugubre* Müller, 1776).

Found at localities 24,25,26,28,30,32.

Museum material: VE: Nøtterøy-ZMB. Ramnes-ZMB. Ø:Torsnes-ZMB. Os: Sør-Aurdal-ZMB. MRi: Rindal-ZMB. STi: Støren-ZMB. Orkdal-ZMB. Byneset-ZMB. Selbu-ZMB. NTi: Snåsa-ZMB.

Ellingsen (1894) reports it from TEy: Kragerø and Ø: Fredrikstad. Strand (1900) from VE: Sande, Botne. Kauri (1977) mentions HEs: Eidskog.

Revision: The material from SFi: Aurland, determined as *N. lugubre*, Kauri (1966), was revised to *N. bimaculatum*.

Occur in Da, Sw, Fi, No.

Family Phalangiidae Latreille, 1802

Subfamily Phalangiinae Latreille, 1802.

Phalangium opilio L., 1761. (= *P. brevicorne* (C.L. Koch, 1839). = *P.ophilio* Storm, 1898. = *P. cornutum* L., 1767).

Found at localities 2,5,6,8,18,20,24,27,28,29.

Museum material: HOy: Bergen 39722, 39723, A1661, A1671, A1864-ZMB. Herdla 39843, 39847-ZMB: Os 40146-ZMB. Haus A3124b, A3125, A3224-ZMB. Lindås A3339-ZMB. Stord C1539, C1484-ZMB. HOi: Kvinnherad A2334-ZMB. Granvin A259-ZMB. Odda A3083-ZMB. TEi: Seljord A655, A656-ZMB. Ø: Hvaler A550, A575-ZMB. Rygge Op-46-47-48-50-51-ZMO. AK: Ås A3164-ZMB. Oslo A1663-ZMB, Op-27-31-ZMO. Bærum Op-19-ZMO. SFy: Kinn A613-ZMB. SFi: Aurland 39805, 39815, 40213-ZMB. Leikanger 39801-ZMB.

Ellingsen (1894) reports it from TEy: Kragerø, Ø: Fredrikstad. Storm (1898) from STi: Trondheim. Kauri (1977) from HEs: Eidskog.

Occur in Da, Sw, Fi, No.

Opilio parietinus (De Geer, 1778). (= *Phalangium parietinum* De Geer, 1778).

Not found at any locality.

Strand (1900) mentions only one individual from AK: Oslo. Revision: All the material at ZMB, determined as *O. parietinus* is revised to *Mitopus morio* (Fabricius, 1779) -juveniles. This is: HOy: Bergen 40664-ZMB. HOi: Jondal A3340, A3341-ZMB. SFi: Leikanger 39800-ZMB. Aurland 39806, 39821-ZMB.

This species should be taken out of the Norwegian fauna-list.

Occur in Da, Sw, Fi.

Megabunus diadema (Fabricius, 1779). (= *Phalangium diadema* Fabricius, 1779).

Found at localities 1,10,12,14,22,23.

Museum material:HOy: Bergen 40498, A2, A2441, A2160, A2170-ZMB. Os A3558, A4443-ZMB. Haus A3223-ZMB. Meland A4757-ZMB. Tysnes A4447-ZMB. Stord C1468-2N-C1509-ZMB. HOi: Kvinnherad A7-11N-A3024, A326, A331-ZMB. Granvin A283-ZMB. Jondal A3304-5-ZMB. Kvam A3306-ZMB. Ry: Stavanger-ZMB. Sandnes-ZMB. SFy: Kinn A618-ZMB. SFi: Aurland 39803, 39826-ZMB.

Strøm (1765) drew the species from MRy, but Fabricius (1779) gave it name — also based on a specimen from MRy: Sunnmøre. Økland (1939) reports it from Ry: Karmøy. Hauge (1972) mentions MRy.

Occur in Ic, Fa, No.

Rilaena triangularis (Herbst, 1799). (= *Platybunus corniger* (Herman, 1804). = *P. triangularis* (Herbst, 1799)).

Found at localities 18,19,21,28,32.

Museum material: HOy: Os 40693-ZMB. AK: Bærum Op-7-12-21-ZMO. NTi: Snåsa-ZMB. Steinkjer-ZMB.

Ellingsen (1894) reports it from TEy: Kragerø, Os: Svartsum. Storm (1898) from STi: Trondheim. Strand (1900) from AK: Oslo, Bø: Ringerike, VE: Sande. Ø: Fredrikstad, Nsi: Hattfjelldal, Vefsn. Hauge (1972) from MRy. Solem & Hauge (1973) from STi. Kauri (1977) from HEs: Eidskog.

Occur in Ic, Fa, Da, Sw, Fi, No.

Lophopilio palpinalis (Herbst, 1799). (= *Odiellus palpinalis* (Herbst, 1799)).

Found at localities 1,3,4,7,10,11,12,13,14,15,-16,17,18,19,21,22,23,25,26,27,28,31.

Museum material: HOi: Kvinnherad-ZMB. Ry:

Tysvær-ZMB. Nedstrand-ZMB. VE: Tjøme-ZMB. Ø: Torsnes-ZMB. MRi: Rindal-ZMB.

Kauri (1977) reports it from HEs: Eidskog.

Occur in Da, Sw, No.

Subfamily Oligolophinae Banks, 1893.

Oligolophus tridens (C.L. Koch, 1836).

Found at localities 1,2,3,4,5,6,7,8,9,10,11,12,-13,14,15,16,17,18,19,20,21,-24,25,26,28,30,31,32.

Museum material: HOy: Bergen A125, A1766, A2136-3N-A2156-ZMB. Lindås-ZMB. Stord C1482-4N-C1538-ZMB. HOi: Kvinnherad A450, A100, A126, C2052-ZMB. Ry: Tysvær-ZMB. Nedstrand-ZMB. Ri: Sauda-ZMB. VE: Botne A3573-ZMB. Tjøme-ZMB. Ø: Torsnes-ZMB. Rygge Op-46-47-48-49-52-ZMO. SFi: Aurland A3844, A3869-ZMB. Sogndal C7281-ZMB. MRi: Rindal-ZMB. STi: Støren-ZMB. Orkdal-ZMB. Byneset-ZMB. Selbu-ZMB. NTi: Steinkjer-ZMB. Snåsa-ZMB.

Ellingsen (1894) reports it from Ø: Fredrikstad. Storm (1898) from STi: Trondheim, NTi: Mostad. Strand (1900) from Nsi: Hattfjelldal, Nsy: Sandnessjøen, Dønna. Kauri (1977) from HEs: Eidskog.

Occur in Ic, Da, Sw, Fi, No.

Oligolophus hanseni (Kraepelin, 1896).

Found at localities 2,20,21.

Previously not known from Norway.

Occur in Da, Sw, No.

Paroligolophus agrestis (Meade, 1855). (= *Oligolophus agrestis* (Meade, 1855)).

Found at localities 1,2,3,4,5,6,7,8,10,11,12,13,-14,15,16,17,18,19,20,21,24,28.

Museum material: HOy: Bergen 40497, A2137-5N-A2162-ZMB. Herdla 39834, 40783-ZMB. Lindås-ZMB. Stord C1504-1N-C1518-ZMB. HOi: Kvinnherad A244-ZMB. Kinsarvik A172-ZMB. Ry: Tysvær-ZMB. VE: Borre A3572-ZMB. Tjøme-ZMB.

Ellingsen (1894) reports it from TEy: Kragerø, Ø: Fredrikstad.

Occur in Da, Sw, No.

Lacinius ephippiatus (C.L. Koch, 1835).

Found at localities 1,2,3,4,5,6,7,8,9,10,11,14,-15,16,17,18,19,21,22,24,25,26,28,30,32.

Museum material: HOy: Bergen A2130-33N-A2606, A3546, A1753-ZMB. Os A585-ZMB. Haus A3089-ZMB. Stord C1506-ZMB. HOi: Kvinnherad A198-3N-A279-ZMB. Strandebarm C269-ZMB. Voss-ZMB. Ry: Tysvær-ZMB. Sandnes-ZMB. Nærbø-ZMB. Ri: Sauda-ZMB. TEi: Seljord A659-ZMB. VE: Tjøme-ZMB. Ø: Rygge Op-47-49-ZMO. SFi: Aurland 39816, A3842-ZMB. MRi: Rindal-ZMB. STi: Byneset-ZMB. Selbu-ZMB. NTi: Snåsa-ZMB. Steinkjer-ZMB. Nsi: Nordrana A1692-ZMB. Beiarn-ZMB. Nnv: Moskenes C286-ZMB.

Kauri (1966, 1977) reports it from SFi: Aurland, HEs: Eidskog.

Occur in Ic, Fa, Da, Sw, Fi, No.

Mitopus morio (Fabricius, 1779). (= *Phalangium morio* Fabricius, 1779. = *Oligolophus alpinus* Herbst, 1799. = *Oligolophus morio* (Fabricius, 1779). = *Oligolophus kulczynskii Strand,1900*. = *Oligolophus vagans* Strand, 1900).

Found at all localities (1—32).

Museums material: HOy: Bergen 40496, 39672, 39724, 40758, A104, A668, A3161, A2602, A1759, A1670, A3136-ZMB. Herdla 39842-ZMB. Os 40692, 40145-ZMB. Haus A3070-5N-A3111-ZMB. Lindås A3087-ZMB. Meland A3566-ZMB. Op-5-ZMO. Stord C1469-29N-C1549-ZMB. HOi: Kvinnherad A90-1ON-A462, A328, A330-ZMB. Granvin A261-ZMB. Eidfjord A158, A637, C6155, C6156-ZMB. Kinsarvik A638-34N-C2869-ZMB. Ulvik A2482-4N-C7277-ZMB. Voss A2491-ZMB. Ullensvang C1916-25N-C6144, C2258-29N-C6151, C2635-13N-C6153, C6157, C6158-ZMB. Ry: Kvitsøy 39694-ZMB. Stavanger-ZMB. Sandnes-ZMB. Nærbø-ZMB. Ri: Suldal A13-ZMB. VAi: Sirdal 39748-ZMB. VAy: Lista-ZMB. TEi: Seljord A654-ZMB. VE: Borre A3397-ZMB. Bv.? 40489-ZMB. Hol 40683, A2480, A3888-4N-A3894, A3891-ZMB. Ø: Hvaler A551-2-ZMB. Kråkerøy-ZMB. Rygge Op-49-ZMO. AK: Bærum Op-10-11-16-18-20-21-22-23-24-ZMO. Os: Nord-Aurdal Op-36-ZMO. On: Øystre Slidre Op-8-9-14-28-32-33-37-38-39-ZMO. Vågå Ø. Op-35-ZMO. Lom A4783-ZMB. HEs: Elverum Op-29-30-ZMO. HEn: Rendal Op-6-25-ZMO. SFi: Aurland 39804, 39817, 40214, A3875, A2481, A3635, A3784, A3792-4, A3860, A3803, A3826-ZMB. Vik 40752, A2442-3, 40753, A45, A46, A3604-ZMB. Sogndal A108-ZMB. MRy: Åsskard-ZMB. MRi: Rindal-ZMB. STi: Orkdal-ZMB. Byneset-ZMB. Selbu-ZMB. NTi: Ogndal A1677-ZMB. Snåsa-ZMB. Steinkjer-ZMB. Frosta Op-13-ZMO. Nsi: Beiarn C292-ZMB. Nordrana A1675, A1708, A1717, A1720, A1808-ZMB. Mo i Rana-ZMB. Nnv: Røst A1688-ZMB. Moskenes C288-2N-C296, C293-ZMB. Hol C289, C294-5-ZMB. Andenes-ZMB. Nnø: Tysfjord A1672, A1678-ZMB. Ankenes C3479-23N-C4989, C4990-ZMB. TRy: Tromsøysund A1718-ZMB. TRi: Målselv A1681, A1719-ZMB. Bardu A1683, A1689-ZMB. Lyngen C1832-6N-C1893-ZMB. Fi: Kautokeino Op-44-45-ZMO.

Fabricius (1779) describes it from Norway. The species is also found on Svalbard (Spitsbergen) as noted by Henriksen (1938).

Occur in Ic, Fa, Da, Sw, Fi, No.

Subfamily Leiobuninae Banks, 1893.

Leiobunum rotundum (Latreille, 1798).

Found at localities 5,8,10,14,17,22,23,24,28.

Museum material: HOy: Bergen A1754-ZMB. Os A618-ZMB. HOi: Kvinnherad A220, A273, A395, A224-ZMB. Jondal A3333-ZMB. Granvin A258-ZMB. Kinsarvik A171-ZMB. Ry: Stavanger-ZMB: Sandnes-ZMB. Ø: Kråkerøy-ZMB. SFi: Aurland 40212, A3779, 39807, 39813-ZMB. Leikanger 40765-ZMB.

Kauri (1966) mentions it from SFi: Aurland.
Occur in Da, Sw, No.

Leiobunum rupestre (Herbst, 1799). (=*Liobunum norvegicum* Strand, 1900).
Found at localities 1,2,4,20,28.
Museum material: HOy: Bergen C270-ZMB. VE: Botne A3575-ZMB.
Previously not known with certainty from Norway. *L. norvegicum* may be a junior synonym for *L. rupestre* Martens (1969).
Occur in Da, Sw, Fi, No.

Nelima gothica Lohmander, 1945.
Found at localities 4,5,6,8,10,11,18,21,24.
Museum material: HOi: Ullensvang A516-ZMB. Previously not known from Norway.
Occur in Da, Sw, No.

DISCUSSION

DISTRIBUTION

In Norway 14 species of Opiliones are known when *O. parietinus* is excluded from the list. *O. hanseni* and *N. gothica* are recorded for the first time. In addition *L. rupestre* is found with certainty in Norway. Strand (1900) described *L. norvegicum* from Oslo. This species seems to be a junior synonym for *L. rupestre*, as noted by Martens (1969).

Western distributed species seem to be *N. bimaculatum* and *M. diadema*, while *N. lugubre* appears to be eastern distributed. *O. hanseni, P. agrestis, N. gothica, L. rupestre, L. rotundum* apparently are coastal distributed species.

Widely distributed species seem to be *P. opilio, R. triangularis, L. palpinalis, O. tridens, L. ephippiatus, M. morio.*

The following species appear the ones most abundant in Norway. *O. tridens, L. palpinalis, N. bimaculatum, P. agrestis, M. morio, L. ephippiatus, N. lugubre* (a species taken in many localities and great number).

Six species are reported north of Trondheim: *N. bimaculatum, N. lugubre, R. triangularis, O. tridens, L. ephippiatus, M. morio.*

Only *M. morio* is reported from Troms and Finnmark. Maps are found in Appendix II.

The previously existing distribution maps (Gruber & Martens, 1968, Starega, 1976, Martens, 1978), showing the distribution of *N. bimaculatum* and *N. lugubre* in Norway, should be considered as incorrect.

Martens (1978) writes about *O. parietinus*: «. . . . für Norwegen und Schweden nicht genannt». The species, however, is published from Sweden by Tullgren (1906) and from Norway by Strand (1900). From Norway, however, it is perhaps incorrectly reported.

Martens (1978) does not mention *R. triangularis* from Iceland and The Faroes although it is reported by Henriksen (1938).

Martens (1978) writes about *L. palpinalis*: «Keine Nennungen für Finnland und Norwegen». *L. palpinalis*, however, is known from Norway in great number and is published by Kauri (1977).

Martens (1978) does mention *L. ephippiatus* from Iceland and The Faroes although it is reported by Henriksen (1938) and later by Kauri (1980).

The occurrence of *Nelima silvatica* (Simon, 1879) in Denmark and England as written by (Brown & Sankey, 1949, Meinertz, 1962, 1964, Sankey & Savory, 1974) is incorrect. It seems to be *Nelima gothica* as noted by Martens (1969, 1978).

ECOLOGY

Adults of *N. bimaculatum* were found throughout the year. Table I. Meinertz (1964) reports the same to be true for *N. lugubre*. Adults of other species seem to be present 2—5 months a year. None adult *R. triangularis* was taken. Meinertz (1964) reports it, however, to be a summer form.

One species is a spring form: *M. diadema.*

Five species are summer forms: *N. lugubre, P. opilio, R. triangularis, L. ephippiatus, L. rotundum.*

Eight species are autumn forms: *N. bimaculatum, O. tridens, M. morio, L. rupestre, N. gothica* (early in autumn) and *L. palpinalis, O. hanseni, P. agrestis* (late in autumn).

Nearly the same occurrence is reported from Denmark by Meinertz (1964).

Most of the species prefer deciduous wood. Deviations here seem to be *M. diadema*, preferring coniferous wood (based on few specimens). *L. palpinalis* seems to prefer heather. *O. hanseni* is mostly taken in garden/parks. *P. opilio* and *P. agrestis* seem to prefer both garden/parks as well as grazing land.

MORPHOLOGICAL VARIATION

Nongenetic age variation and genetic sex variation (secondary differences) were frequently discovered, Table 2.

Age variation may affect important identification and classification attributes and characters, phenotypically manifested in absence of structures in juveniles. There are also absence of pigments and pigment patterns in juveniles.

Regarding secondary sex variation the greater body size of females are not here offered attention. The males, however, may have extra structures, heavier spines, darker pigments or different pigments.

Genetic (non-sex associated) continuous variation is representated by gradually disappearance of structures or pigment spots in adult specimens of the same species, (for instance gradually disappearance of two dorsally light spots in *N. bimaculatum).* Allometric variation (nongenetic) is found in *R. triangularis.*

Here the juveniles have a very great tuberculum oculorum related to the body size. This relation changes with growth.

Habitat variation is perhaps found in *L. palpinalis.* All individuals in some populations are sometimes covered with numerous, dark pigment dots on the body.

One rare chromosome mutation was discovered in a specimen of *O. tridens.* The whole tuberculum oculorum was gone. The same was an ocellus. Since so great parts of the phenotype are changed, and since in theory a simple attribute may be governed by several genes (polygenic), and one gene may be pleiotrophic (Mayr, 1975), it is possible that parts of a chromosome were destroyed. Physiological attributes may also have been changed. One could suggest that this genotype will be selected against by the environment.

DATES AND AUTHOR NAMES OF TAXA

Comments to the author names and dates of some taxa: Phalangiidae and Phalangiinae are sometimes referred to as Simon, 1879 (Roewer, 1923, Sankey & Savory, 1974, Martens, 1978). I have, however, adopted Latreille, 1802 as done by Starega (1976). Sankey & Savory (1974) refer Opiliones to Sundevall, 1832. I have, however, adopted Sundevall, 1833 as done by Roewer (1923) and Starega (1976).

Nemastomatidae is sometimes referred to as Simon, 1879 (Sankey & Savory, 1974, Martens, 1978). I have, however, adopted Simon, 1872 as done by Roewer (1923) and Starega (1976).

Sankey & Savory (1974) refer Leiobuninae to Banks, 1895. I have, however, adopted Banks, 1893 as done by Roewer (1923), Starega (1976) and Martens (1978).

Martens (1978) writes «*Mitopus morio* (Fabricius, 1799)». This should be regarded as a misprint. I have adopted «1779» as the correct date, as done by Fabricius (1779), Sankey & Savory (1974) and Starega (1976).

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APPENDIX I

List of the 32 localities in Southern Norway visited 1976—1977. The data show number and name of localities, geographical positions (province initials and UTM), biotope type, altitide, number of pitfall traps, trapping period, number of emptyings, other sampling methods and further locality notes.

The localities are classified into 6 different biotope types based on the vegetation. These are given below. Names of plants are taken from Lid (1974).

Geographical positions of localities are shown in Fig. 1.

A: Coniferous wood. The vegetation often characterized by plants as *Picea abies (L.) Karst., Pinus sylvestris* L., *Athyrium filix-femina* (L.) Roth., *Blechnum spicant* (L.) Roth., *Vaccinium vitis-idaea* L., *Vaccinium myrtillus* L., *Calluna vulgaris* (L.) Hull., moss. Soil often hard. Scanty organic dead material.

B: Deciduous wood. Plants as *Betula pubescens* Ehrh., *Corylus avellana* L., *Sorbus aucuparia* L., *Quercus robur* L., *Populus tremula* L., *Alnus incana* (L.) Moench., *Agrostis tenuis* Sibth. Soil often loose. Much dead organic material.

C: Grazing land. Plants as *Agrostis tenuis, Festuca rubra* L., *Trifolium repens* L., *Cirsium palustre* (L.) Scop., *Potentilla erecta* (L.) Räusch., *Poa pratensis* L., *Poa annua* L..Soil hard with gravel. Scanty dead organic material.

D: Garden/Park. Plants often introduced and unnatural. Food- and berry-plants. Soil loose and treated, rich in dead organic material.

E: Heather. Plants as *Calluna vulgaris, Erica tetralix* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Empetrum nigrum* L., *Molinia coerulea* (L.) Moench., *Salix aurita* L., *Potentilla erecta, Vaccinium vitis-idaea,* moss. Soil often hard, humid and organic. Scanty dead organic material.

F: Beach. Plants as *Elymus arenarius* L., *Filipendula ulmaria* (L.) Maxim., *Atriplex latifolia* Wahlenb., *Plantago lanceolata* L., *Plantago maritima* L., *Potentilla anserina* L., *Holcus lanatus* L., *Galium aparine* L. Soil loose, unorganic sand. Very scanty organic material.

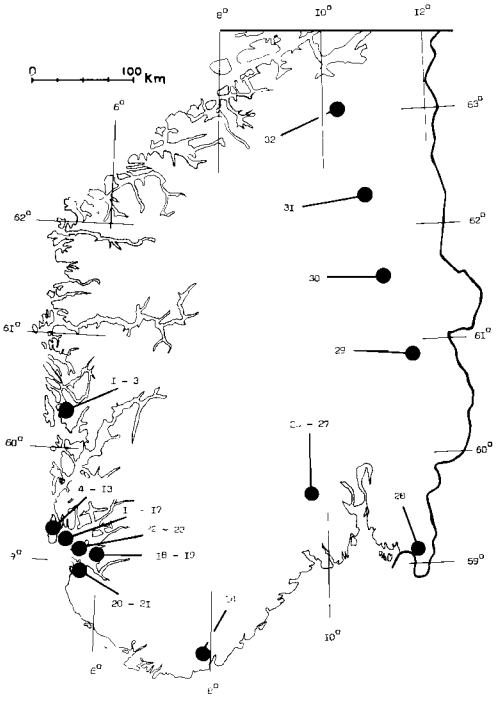


Fig. 1. Map showing the geographical position of the localities visited 1976—1977. Numbered as in the locality list given in Appendix I.

LOCALITY	PROVINCE	UTM	BIO-TOPE	ALTITUDE (m.a.s.l)	NUMBER TRAPS	TRAPPING PERIOD	NUMBER OF EMPTYINGS	OTHER COLL-ECTING METH.	LOCALITY NOTES
I. Fantoft	HOy	KM988949	B	100	15–11	9 Oct–30 Mar	2	Hand	5 km south of Bergen C.SW facing sl.
2. Jonas Lie Vei	HOy	KM98799I	O	50	5–3	7 Oct–2 Aug	5	Hand	2 km south of Bergen C. Flat.
3. Alvøy	HOy	KM90I969	B	50	I0	I Oct–I9 Nov	I	—	I0km sw of Bergen C.SW facing slope.
4. Avaldsnes	Ry	KL893858	C	20	3–2	4 Sep–9 Apr	3	—	7km s of Haugesund C.on Karmøy.E f.sl.
5. Stol	Ry	KL8287I7	D	20	4–I	4 Sep–I4 Aug	I0	Hand	SW Karmøy. Flat.
6. Stol	Ry	KL8307I6	O	20	2–I	4 Sep–I3 Jul	9	—	SW Karmøy. Flat.
7. Stol	Ry	KL8387I5	C	30	5–I	7 Nov–28 Jul	7	—	SW Karmøy.Wet parties.Flat.
8. Ferkingstad	Ry	KL823723	C	5	4–I	4 Sep(–76)–7 Sep(–77)	8	Hand	SW Karmøy.Flat.Near a Phragmites-area.
9. Stava	Ry	KL825724	F	2	3–I	7 Nov–7 Sep	7	—	SW Karmøy.Flat.
I0.Blikshavn	Ry	KL902705	B	I0	2	4 Sep–26 Jun	3	Hand	SE Karmøy.E facing slope.Many stones.
II.Skitnadal	Ry	KL888652	C	I0	3	4 Sep–9 Apr	3	—	SE Karmøy.Flat.
I2.Sandvatn	Ry	KL853705	A	50	2–3	7 Nov–26 Jun	6	Hand	S Karmøy. Flat.
I3.Stiklene	Ry	KL869699	E	60	3	7 Nov–26 Jun	4	Hand	S Karmøy. Flat.
I4.Haaland	Ry	KL972688	B	40	4–3	5 Sep–4 Sep	6	Hand	W Bokn. E facing slope.
I5.Haaland	Ry	KL973685	A	60	3–I	5 Sep–4 Sep	6	Hand	W Bokn. Flat.
I6.Hatlefjell	Ry	KL975684	E	90	3–2	I0 Oct–4 Sep	5	Hand	W Bokn. NE facing slope.
I7.Vatnaland	Ry	KL97I678	C	40	2	I0 Oct–4 Sep	5	Hand	W Bokn.Flat.Wet parties.
I8.Tau	Ry	LL229519	B	70	6–3	6 Sep–28 Jul	5	Hand	I5km ne of Stavanger C.S facing sl.
I9.Tau	Ry	LL228520	C	90	4–3	6 Sep–28 Jul	5	Hand	I5km ne of Stavanger C.E facing sl.
20.Stavanger	Ry	LLI284I5	O	20	–	—	–	Hand	Near St.Joh.Church, N facing slope.
2I.Gausel	Ry	LLI2I343	B	40	7–4	I6 Oct–28 Jul	3	Hand	6km s of Stavanger C.E facing slope.
22.Kaada	Ry	LL08I544	B	30	–	—	–	Hand	N Mosterøy. Flat.
23.Austbøstemmen	Ry	LLI2457I	A	80	–	—	–	Hand	NE Rennesøy.Undulating.NW fac.sl.
24.Mosby	VAy	MK369529	B	80	4	I9 Aug–II Oct	I	Hand	8km nw of Kristiansand C.Near Otra.
25.Saggrenda	Bø	NM34II05	B	2I0	3	I5 May–2 Oct	I	Hand	5km s of Kongsberg C.Undulating.Gravel
26.Skollenborg	Bø	NM365I02	C	I60	3	8 Jul–2 Oct	I	Hand	6km se of Kongsberg C.S fac.sl.Trees
27.Gomsrud	Bø	NM369I25	A	200	3	8 Jul–2 Oct	I	Hand	2km se of Kongsberg C.Undulating.
28.Tistedalen	Ø	PL4I9572	B	80	4	22 Aug–I4 Oct	I	Hand	5km e of Halden C. Flat.Soil hard.
29.Elverum	HEs	PN38I5I3	A	I90	4	24 Aug–I4 Oct	I	Hand	2km w of Elverum C. Sandy soil.
30.Koppang	HEn	PP083294	A	350	3	25 Aug–I5 Oct	I	Hand	Ikm n of Koppang C. W facing slope.
3I.Tynset	HEn	NQ9I9067	B	480	2	26 Aug–I6 Oct	I	Hand	½km sw of Tynset C. Soil clayey.
32.Støren	ST1	NQ653902	B	70	3	28 Aug–I6 Oct	I	Hand	2km s of Støren C. In a ns valley.

Table I. Ecological notes. Material collected in Southern Norway 1976–1977. Several localities in Western Norway have been continuously investigated throughout one year. ● – means found in a biotope. Abbreviations: P=primo. M=middle. ( )[I] = In the distribution area of N.lugubre investigations have only taken place over 2 months. Further comments are given in discussion and Appendix I.

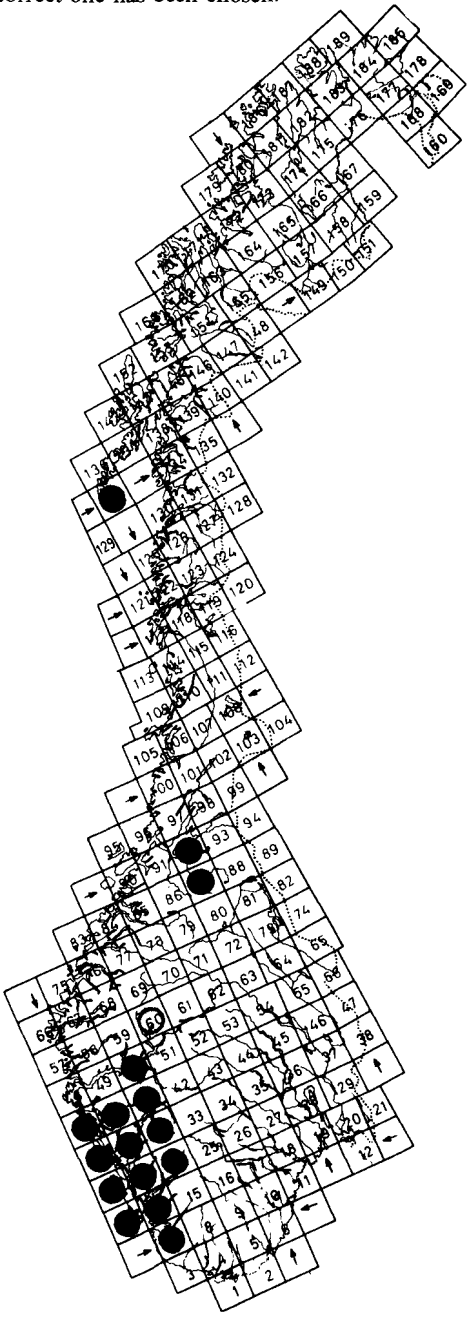
SPECIES	NUMBER OF MONTHS PRESENT (ADULTS)	MAXIMUM ABUNDANCE (ADULTS)	TAKEN IN BIOTOPES A	B	C	D	E	F	AVERAGE MOST IN:
I. Nemastoma bimaculatum	12	P.Sept – M.Nov	●	●	●	●	●	–	B
2. Nemastoma lugubre	(2)[I]	(M.Aug – P.Oct)	●	●	●	–	–	–	B
3. Phalangium opilio	4	P.Aug – M.Oct	●	●	●	●	–	–	C D
4. Megabunus diadema	3	P.May – M.Jul	●	●	–	–	–	–	A
5. Rilaena triangularis	0	–	–	●	●	–	–	–	B
6. Lophopilio palpinalis	5	M.Oct – P.Des	●	●	●	–	●	–	E
7. Oligolophus tridens	4	M.Sep – M.Nov	●	●	●	●	●	●	B
8. Oligolophus hanseni	4	P.Oct – P.Des	–	●	–	●	–	–	D
9. Paroligolophus agrestis	5	M.Nov – P.Jan	●	●	●	●	●	–	C D
10. Lacinius ephippiatus	4	P.Jul – M.Sept	●	●	●	●	●	●	B
11. Mitopus morio	4	P.Sept – M.Oct	●	●	●	●	●	●	B
12. Leiobunum rotundum	2	P.Aug – M.Sept	●	●	●	●	–	–	B D
13. Leiobunum rupestre	4	M.Sept – M.Oct	–	●	●	●	–	–	B
14. Nelima gothica	3	P.Sept – P.Nov	–	●	●	●	–	–	B D

Table 2. Morphological variation. Only a short summary of the most conspicuous ones found in the material from Southern Norway sampled 1976–1977 are given. ● – means found in a species. Comments are given in discussion.

SPECIES	NUMBER OF ADULTS/JUVEN.	NONGENETIC VARIATION AGE	HABITAT	ALLOMETRIC	GENETIC VARIATION SEX	CONTINUOUS	MUTATION
I. Nemastoma bimaculatum	580/25	●	–	–	●	●	–
2. Nemastoma lugubre	62/5	●	–	–	●	–	–
3. Phalangium opilio	48/5	●	–	–	●	●	–
4. Megabunus diadema	8/3	–	–	–	–	–	–
5. Rilaena triangularis	0/27	–	–	●	–	–	–
6. Lophopilio palpinalis	1009/42	–	●	–	–	–	–
7. Oligolophus tridens	3913/203	–	–	–	–	●	●
8. Oligolophus hanseni	39/0	–	–	–	–	–	–
9. Paroligolophus agrestis	705/49	●	–	–	●	–	–
10. Lacinius ephippiatus	280/92	●	–	–	●	–	–
11. Mitopus morio	319/154	●	–	–	●	●	–
12. Leiobunum rotundum	29/27	●	–	–	●	–	–
13. Leiobunum rupestre	24/9	–	–	–	●	–	–
14. Nelima gothica	55/16	–	–	–	–	–	–

APPENDIX II

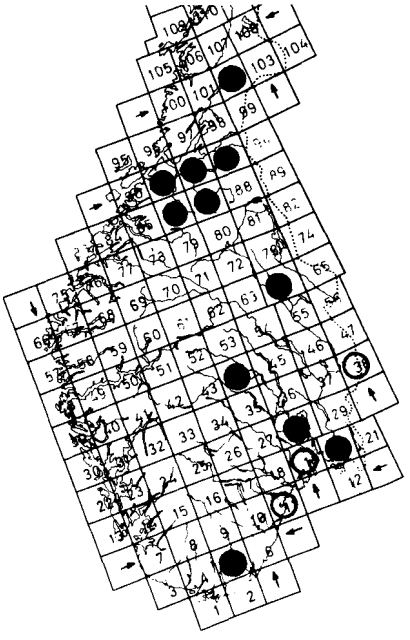
Maps showing the distribution of Opiliones in Norway follow. Number indicates sequence in the text of a species. *O. parietinus* has got no number. Open circles mean unchecked material — published or museum material. Some records were situated on the border between two squares. Then the most probably correct one has been chosen.



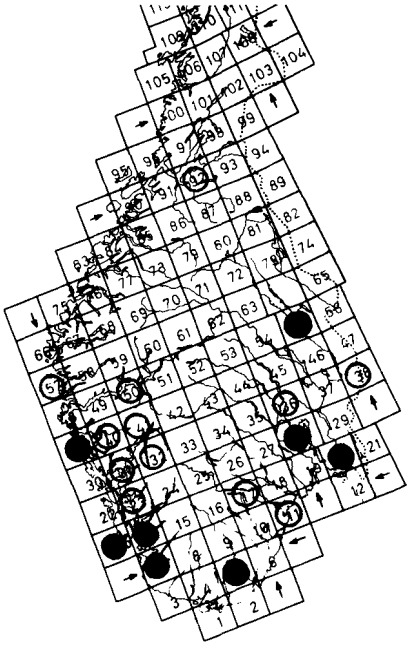
1. NEMASTOMA BIMACULATUM

ADDENDUM

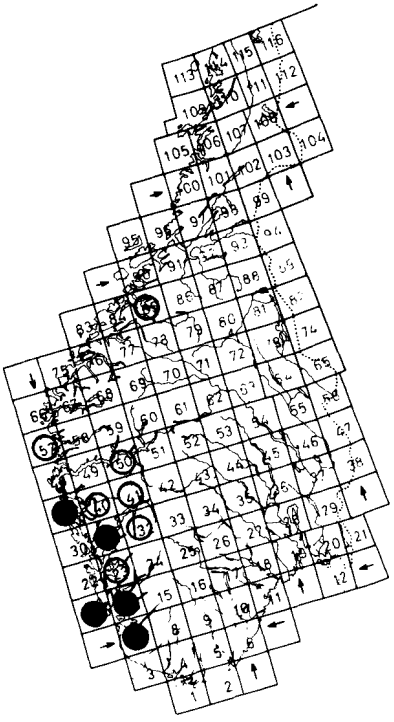
The 15th Opiliones-species has lately been reported from Norway. This is *Trogulus tricarinatus* (L., 1767), Trogulidae, from Southern Norway. (Solhøy, T. 1982. *Fauna norv. Ser. B. 29*, 48).



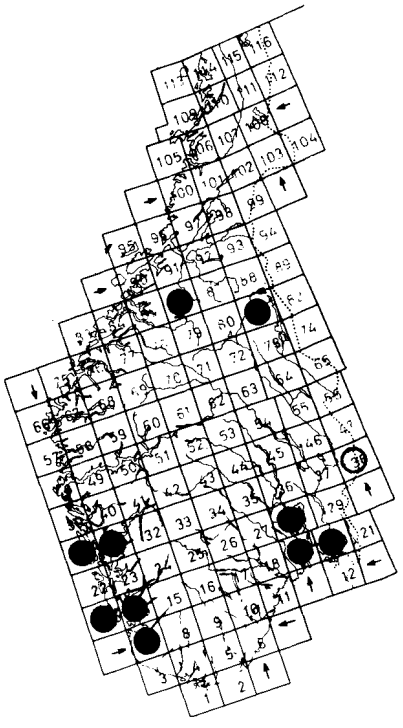
2. NEMASTOMA LUGUBRE



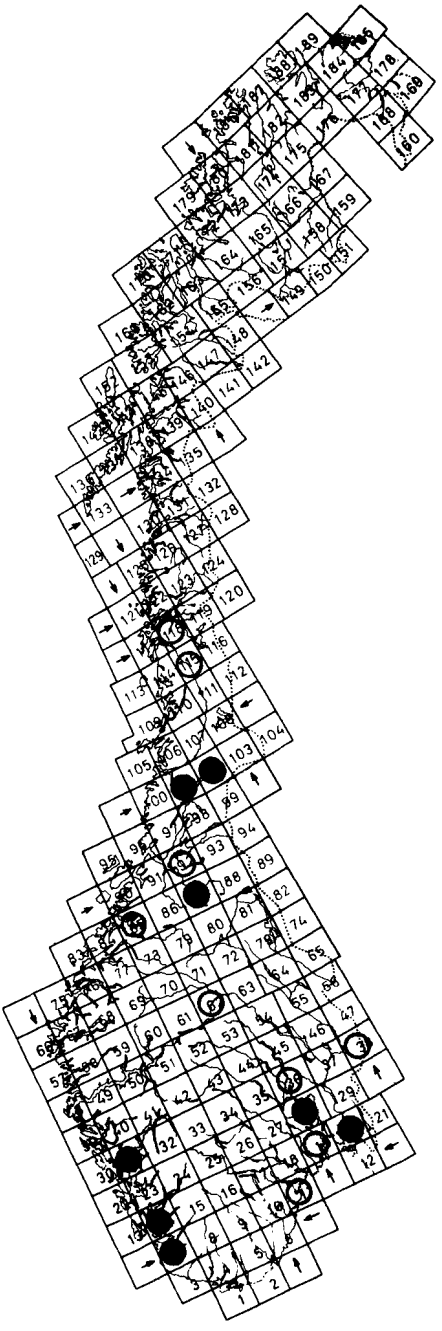
3. PHALANGIUM OPILIO



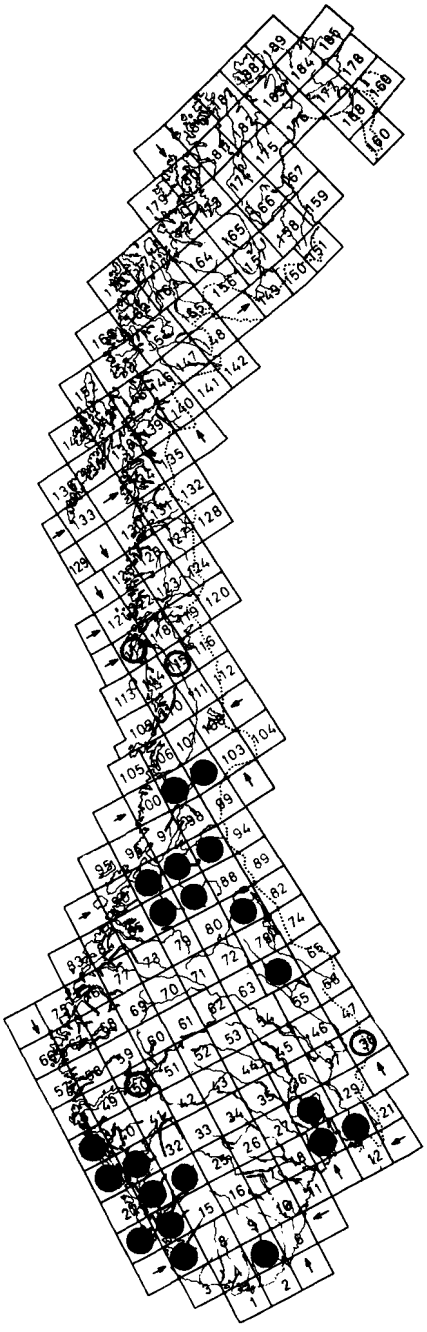
4. MEGABUNUS DIADEMA



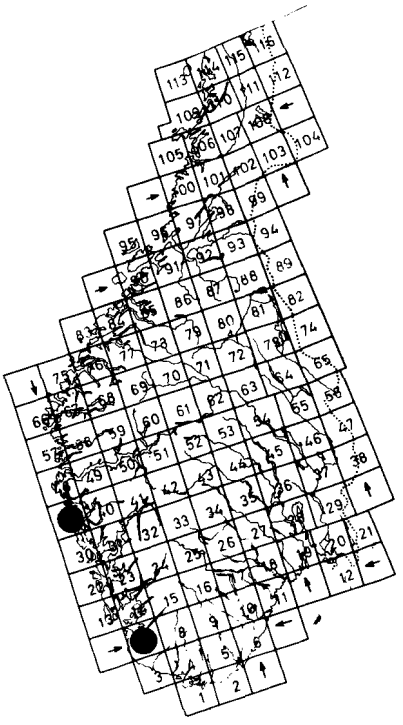
6. LOPHOPILIO PALPINALIS



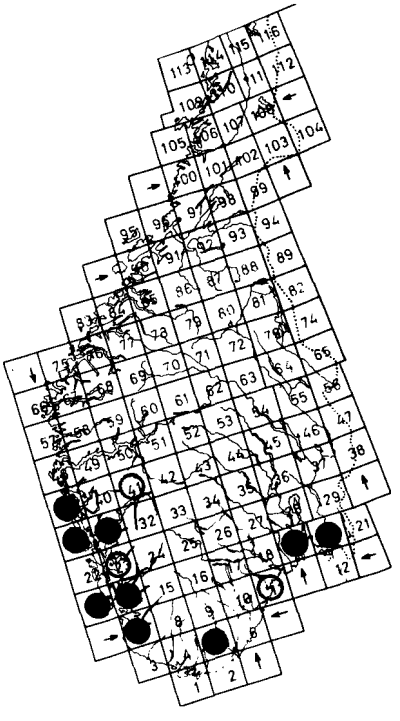
5. RILAENA TRIANGULARIS



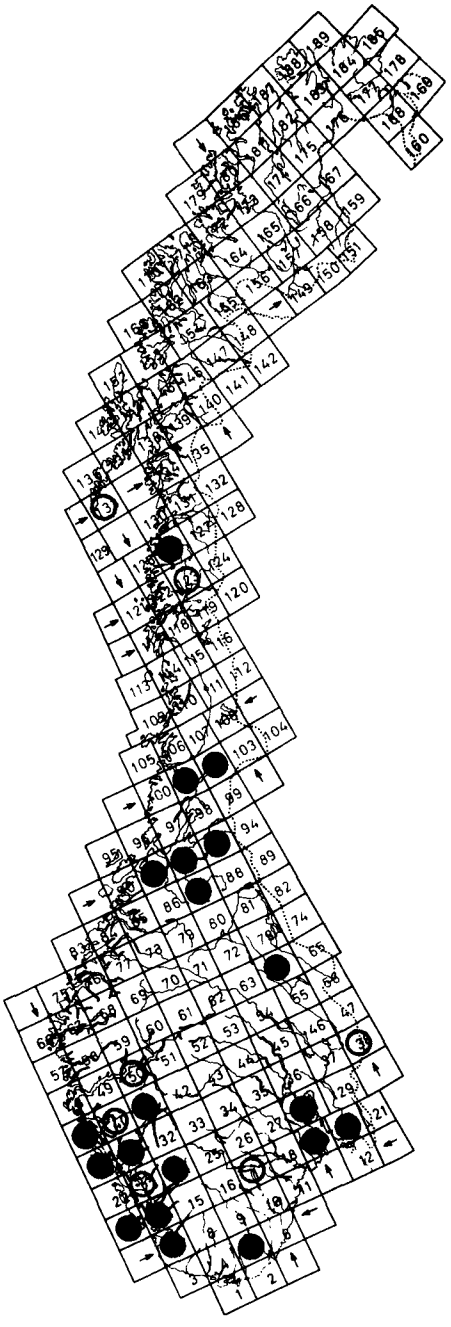
7.OLIGOLOPHUS TRIDENS



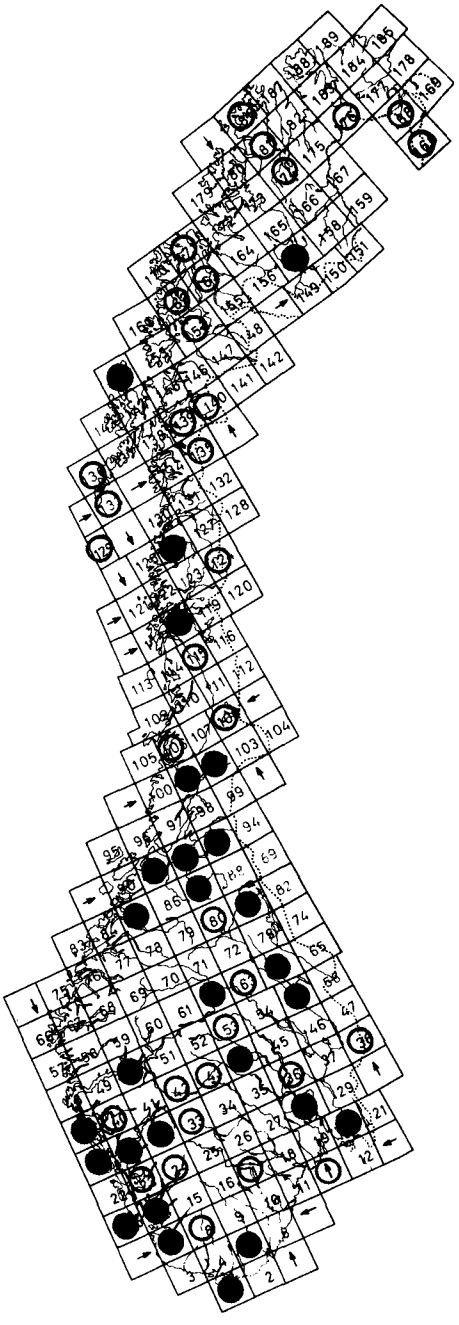
8.OLIGOLOPHUS HANSENI



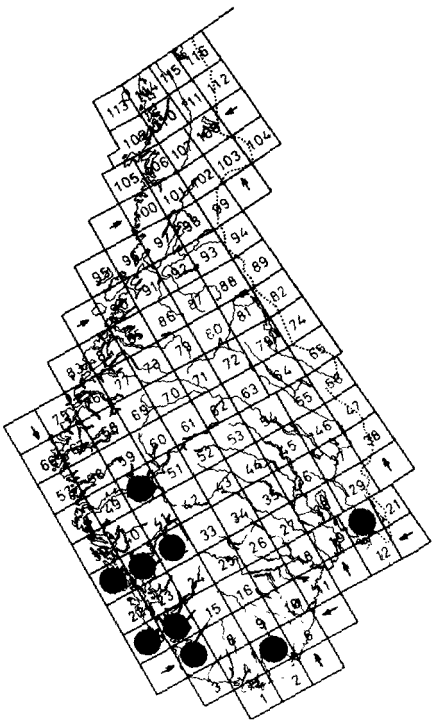
9.PAROLIGOLOPHUS AGRESTIS



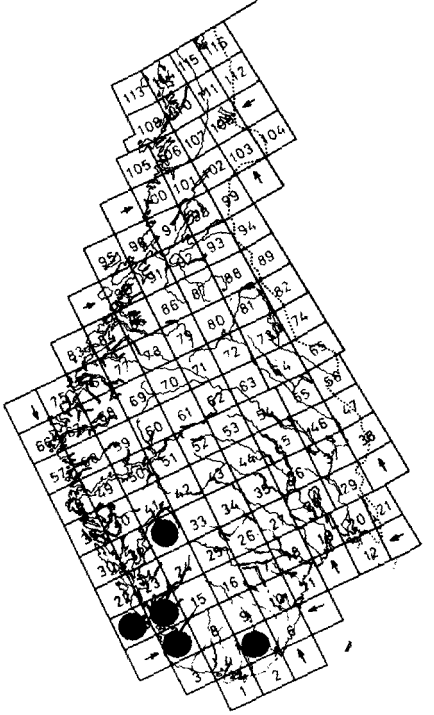
IO.LACINIUS EPHIPPIATUS



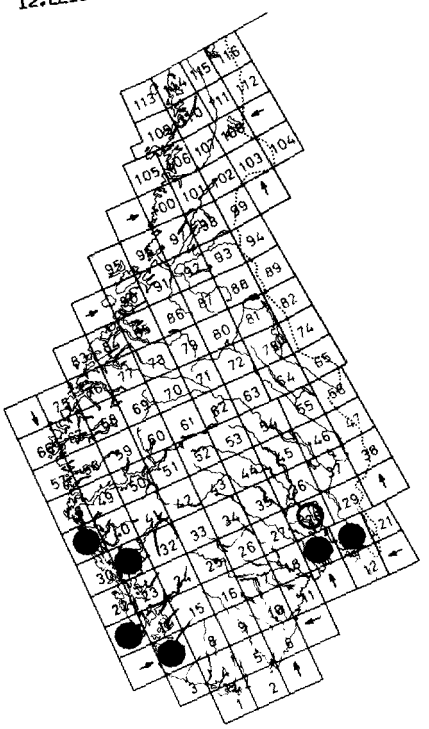
II.MITOPUS MORIO



I2.LEIOBUNUM ROTUNDUM



I4.NELIMA GOTHICA



I3.LEIOBUNUM RUPESTRE

Short communications

THE FUNGIVOROUS MOTH *SCARDIA POLYPORI* (ESPER) (LEPIDOPTERA, TINEIDAE) NEW TO NORWAY

LEIF AARVIK & FRED MIDTGAARD

The moth *Scardia polypori* (Esper) is recorded new to Norway. Several specimens were reared from the fungus *Fomes fomentarius* (L. ex Fr.) Kickx. growing on birch logs at Noresund in Buskerud. Remarks on distribution and a brief diagnosis of the species are given.

Leif Aarvik, Tårnveien 6, N-1430 Ås, Norway. Fred Midtgaard, Norwegian Forest Research Institute, P.O. Box 61, N-1432 Ås-NLH, Norway.

Members of the family Tineidae feed on different kinds of dead matter like wool, feather, fur, and rotting wood. However, many species of the subfamilies Scardiinae and Nemapogoninae have specialized in feeding on fungi.

One of the most striking fungivorous tineids is *Scardia polypori* (Esper) which is herewith reported new to Norway.

Fungi containing larvae of *S. polypori* were collected from birch logs at Noresund, Krødsherad, Bø (EIS 35) on 21.II.1981. The logs which measured 20—60 cm. in diameter were heavily infested with the fungus *Fomes fomentarius* (L. ex. Fr.) Kickx.

The green larvae of *S. polypori* were not only utilizing the fungi, but were also seen feeding on the rotting wood. During 1981 4 ♂♂ and 2 ♀♀ were reared. Several specimens of *Archinemapogon laterellus* (Thunberg) which is another fungivorous tineid also emerged. In addition the beetle *Bolitophagus reticulatus* (L.) was reared from the fungi.

S. polypori is the largest representative of the Tineidae in our fauna. The expanse of our specimens is 43—46 mm. Its size and characteristic wing pattern makes *S. polypori* an unmistakable species. The forewings are blackish brown except along dorsum and termen where the ground colour is pale yellow with small dark markings.

S. polypori occurs in Sweden and Finland but is absent from Denmark. In Sweden it has been recorded from nine provinces from Skåne north to Hälsingland (Benander 1946, Svensson 1976, 1977, 1981), and in Finland from ten provinces ranging from the south coast to the provinces Savonia borealis and Karelia borealis (Kyrki 1978, 1979). Otherwise *S. polypori* has been found in central Europe including Bavaria, Hungary, Austria, and the USSR. In central Europe it is a mountain species (Hannemann 1977).

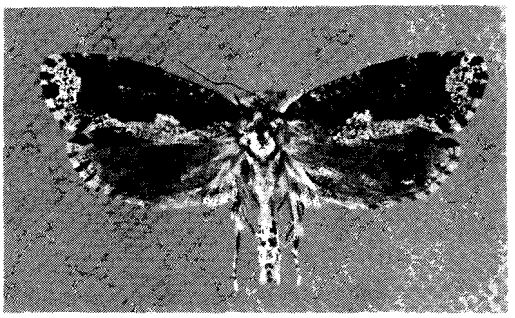


Fig. 1. *Scardia polypori* from Noresund.

ACKNOWLEDGEMENTS

We would like to than Mr. Tor Gulliksen for taking the photograph.

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Received 2 Apr. 1982.

ERRATUM

The fauna of predatory bugs (Heteroptera, Miridae and Anthocoridae) in Norwegian apple orchards. *Fauna norv. Ser. B 27,* 3—8. 1980.

Marit Presthegge Austreng & Lauritz Sømme.

In the paper referred to above we published a list of species including *Anthocoris butleri* LeQuesne and *A. visci* Douglas. Later Dr. C.-C. Coulianos. The University of Stockholm, has kindly checked the material, and conclude that our identification was wrong. The two species should still be considered as unknown to the Norwegian fauna. The erroneous identification is the responsibility of the authors, not of colleagues acknowledged in the original paper.

Book reviews

Turin, H. 1981. Provisional checklist of the European ground-beetles (Coleoptera, Cicindelidae & Carabidae). Monographieën van de Nederlandse Entomologische Vereniging No. 9, 249 pp. Price: Dutch Guilders 60,— (Can be obtained from Ned. Ent. Ver., Plantage Middenlaan 64, 1018 DH Amsterdam, Nederland).

The main part of this extensive work on the distribution of European ground-beetles is a list of more than 2500 alphabetically ordered species within systematically arranged genera. For each species the geographical distribution is given for 20 European regions (that may overlap). The data have been compiled from the most recent treatments of the faunas in each region. Fennoscandia is treated as one region. In addition Sweden and Denmark are treated as two separate regions. For Fennoscandia the data is taken from C.H. Lindroths «Die Fennoscandischen Carabidæ» and «Catalogus Coleopterorum Fennoscandiae et Daniae» with corrections in 1970 by A. Strand. (Later corrections could not be taken into account). Unfortunately this makes it impossible to say if a species is found in Norway, only if it is found in Fennoscandia. Two indices containing all generic, specific and subspecific names (including commonly used synonyms) makes it easy to find ones way to the wanted name. I presume this list will be of great help for everyone interested in which ground-beetle to find where, whether it is from a purely scientific or a collectors point of view.

A table with the numbers of species for each of the 199 genera which occur in the respective regions (plus North America) gives an interesting comparison between faunas. Here you might for instance find that Italy holds 76 *Trechus*-species!

You will find a lot of additional interesting information in this book, as for instance an extensive list of valuable catalogues, atlases and checklists for each region, and references to where species and genera are described for the first time. I will recommend this book to everyone interested in European ground-beetles.

Arild Andersen

Lange, R. H. & J. Blödorn, 1981.
Das elektronen mikroskop TEM + REM. Leitfaden für Biologen und Mediziner. (in German),
G. Thieme, Stuttgart. 327 pp. DM. 28.80 (Flexibles Taschenbuch) ISBN 3 13 597001 9.

The authors state that their book treats the instrumental technique more thoroughly than the preparation techniques, and this is certainly true. About 90% of the text is concerned with the prinsiples of instrumental construction and operation.

Introductory chapters on vacum-technology, electron emission, interaction between electron beam and matter and electron lenses provide a very useful background knowledge often missed by biologists. The transmission and scanning electron microscopes and their constituent parts are then described in detail, as are the most important steps in the operation of their electron optics and detector systems. Detailed accounts on electron diffraction in general, on the assembly of asymetrical biological building blocks and on the quantitative evalution of various samples are also presented. Brief summaries of specimen preparation techniques for TEM and SEM and a survey of electron microscopic literature complete the book.

It is my opinion that most biologists, even those with long practise in electron microscopy, will find many valuable informations in most chapters of this book, information which in many cases will enable them to get better results of their instruments.

Tow minor drawbacks should not alter this overall positive impression of the book; I find no justification for almost twenty pages of mainly technical specifications of partly outdated commercial TEM-models in a book like this and I find the German text at places to be unnecessarily heavy and difficult to understand.

Per R. Flood
Assoc.prof. of anatomy

GUIDE TO AUTHORS.

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Manuscripts should be submitted to one of the members of the editorial committee or directly to the Editor-in-Chief. Send two copies. They must be typewritten, double spaced throughout, on one side of the paper, and with wide margins, 5-6 cm on the left. Separate sheets should be used for the following: 1) Title page, with author's name. 2) An abstract, with the name and full postal address of the author underneath. 3) Tables with their headings. 4) Legends to figures.

Dates should be referred to as 10-20 Aug. 1970.

Only Latin names should be underlined. Other underlinings should be left to the editor. Approximate position of figures and tables in the text should be indicated in the margin. All acknowledgements should be given under a single heading at the end of the text, but before the references.

Figures and Tables. Send two copies. All illustrations should be identified lightly with the author's name and the figure number. The figures and tables should be constructed in proportion to either the entire width of the typed area (140 mm) or to the column width (67 mm).

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Book:

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Fittkau,E.J. 1962. Die Tanypodinae (Diptera, Chironomidae). Die Tribus Anatopyniini, Macropeloponi und Pentaneurini. *Abh. Larvalsyst. Insekten* 6, 453 pp.

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Content

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