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Sphecidae (Hym., Aculeata) recorded from bark beetle pipe traps and some faunal notes from South Norway

TORSTEIN KVAMME AND RUNE AXELSSON

Kvamme, T. and Axelsson, R. 1983. Sphecidae (Hym., Aculeata) recorded from bark beetle pipe traps and some faunal notes from South Norway. *Fauna norv. Ser. B. 30,* 57—59.

Eleven species of Sphecid wasps were recorded from bark beetle pipe traps. It is no reason to believe that the trapped specimens have responded to the synthetic bark beetle pheromones. *Pemphredon lugens* Dahlbom, 1842 and *P. flavistigma* Thomson, 1874, are presented new to the Norwegian fauna.

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The family Sphecidae is poorly investigated in Norway, as shown by Lombholdt (1975, 1976). While 155 species are known to occur in Sweden, only 95 species are known from Norway. About 50 % of these species are arboreal (Lombholdt 1975). Indirectly the low number of species emphesizes the low level of collecting activity in Norway.

It is well known that Sphecids can be recorded in window traps (Axelsson 1982), but catches from drain pipe traps have not been presented.

The present paper deals with specimens caught in bark beetle drain pipe traps and single records representing new faunal divisions. The faunal divisions are in agreement with Strand (1943), and in addition the EIS-grid numbers are added. The specimens are preserved in the collection of the Norwegian Forest Research Institute.

SPHECID WASPS FROM BARK BEETLE DRAIN PIPE TRAPS

During the years 1979 to 1982 an extensive integrated control program for the spruce bark beetle *(Ips typographus)* was carried out in Norway. The methods and trap models are described by Bakke & Strand (1981). All insects trapped in 1979 in a total of 216 traps at 20 localities were carefully examined. Sphecid wasps were found amongst bark beetles at 12 of the localities (Fig. 1). The number of each species at the different sites are presented in Tab. 1. All specimens caught in the traps belonged to species nesting in holes etc., mainly in decayed wood. None of them are known to prey on bark beetles, but prey on Diptera and Hemiptera (Lombholdt 1975, 1976). The hole-nesting habits of this species, the small number of specimens trapped, and the relatively large proportion of females, indicate that the Sphecids were attracted to the traps in search of a suitable breeding place. It is probably a visual stimulus and not a result of kairomone response as known from predators such as *Thanasimus spp.* (Bakke & Kvamme 1978, 1981).

Comments to some of the species presented in Table 1:

Pemphredon lugens Dahlbom, 1842 is hitherto not known from Norway, although this species is widely distributed in Sweden and Finland, and one of the most common species of the genus (Lombholdt 1975). Probably is *P. lugens* widely distributed in Norway, but previously overlooked.

P. montanus Dahlbom, 1842 is new to South Norway, previously known only from Nnø, Fi and Fø. In Sweden the species is recorded from almost the entire country except the coastal areas in the southern parts. All the records are from inland areas (Tab. 1).

P. wesmaeli (A. Morawitz, 1864) is previously known only from western parts of the country (Ri and SFi).

Ceratophorus morio (van der Linden, 1829). This is the second Norwegian record, known only from AK:Oslo. According to Lombholdt (1975), *C. morio* is not common and is sporadically found in Scandinavia.

Passaloecus borealis Dahlbom, 1845 is a poorly known species, in Norway previously found only in NTi:Verdal and not in Nsy (Lombholdt 1975).

Tab. 1. Sphecidae recorded from bark beetle pipe traps, 1979. Black triangles: Records representing new faunal divisions. Black star: New to the fauna of Norway.

SPECIES: / LOCALITIES:	Pemphredon lugubris (Fabricius,1793)	P.montanus Dahlbom,1845	★ P.lugens Dahlbom,1842	P.wesmaeli (A.Morawitz,1864)	P.inornatus Say,1824	Ceratophorus morio (van der Linden,1829)	Passaloecus borealis Dahlbom,1845	Ectemnius lapidarius (Panzer,1804)	E.continuus (Fabricius,1804)	E.borealis (Zetterstedt,1838)	Crossocerus pusillus Lepel.&Brullé,1834
AK:Haga, Nes (EIS:37)		▼ 1♀	▼ 1♀	▼ 1♀							
HEs:Agåsen,Elverum (EIS:55)	▼ 1♀									1♀	
Os:Oksbakken,Jaren (EIS:36)		▼ 2♀♀									
Os:Lillehammer (EIS:55)	▼ 1♀	▼ 1♀									
Bø:Kamplia,Øvre Eiker (EIS:27)	▼ 1♂	▼ 5♀♀				▼ 1♀	▼ 1♀				▼ 1♀
Bø:Torbråten,Krødsherad (EIS:35)		▼ 2♀♀	▼ 2♀♀								
TEy:Jomfruland (EIS:11)	▼ 1♂ 2♀♀		▼ 2♂♂ 4♀♀						▼ 1♂		
TEy:Steinsrød,Skien (EIS:18)	▼ 2♀♀				▼ 1♀			1♂	▼ 2♀♀		
TEi:Hjartdal (EIS:27)		▼ 1♀									
AAy:Gisletveit,Vegårdshei (EIS:10)	▼ 2♀♀						▼ 1♀				
NTi:Leksvik (EIS:97)	13♀♀										
NTi:Hegra, Stjørdal (EIS:93)	1♀										
Σ♂♂	2	0	2	0	0	0	0	1	1	0	0
Σ♀♀	22	12	7	1	1	1	2	0	2	1	1

Single records representing new faunal divisions:

Ammophila sabulosa (Linné, 1758).
HEs:Slettmoen, Eidskog (EIS:38), 1 ♂ in pit-fall trap 14/6-1975.

Pemphredon flavistigma Thomson, 1874.
HEs:Slettmoen, Eidskog (EIS:38), 1 ♀ caught by sweep-netting on bushes 19/6-1978. This species is not previously known from Norway. According to Lombholdt (1975) *P. flavistigma* is rare in Fennoscandia. Nests are known from decayed wood of *Betulae* and others.

Cerceris arenaria (Linné, 1758).
Ø:Ørekroken, Hvaler (EIS:12), 1 ♂ sweep-netted 5/7-1980 on a meadow near by the sea.
Ø:Vikane, Onsøy (EIS:20), 1 ♂ sweep-netted from *Achillea millefolium* 12/7-1980.

C. quadrifasciata (Panzer, 1789).
VAy:Mandal (EIS:2), 1 ♀ sweep-netted on a sandy meadow 19/7-1980.

Oxybelus uniglumis (Linné, 1758).
HEs:Slettmoen, Eidskog (EIS:38), 1 ♀ in pit-fall trap 5/7-1975.

Ectemnius cephalotes (Olivier, 1792).
Ø:Spydeberg (EIS:29), 1 ♀ sweep-netted on a meadow 30/7-1975. The species is rare (Lombholdt 1976), only known from AK and Bø.

Rhophalum coarctatum (Scopoli, 1763).
VAy:Mandal (EIS:2), 1 ♀ sweep-netted on a sandy meadow, 19/7-1980.

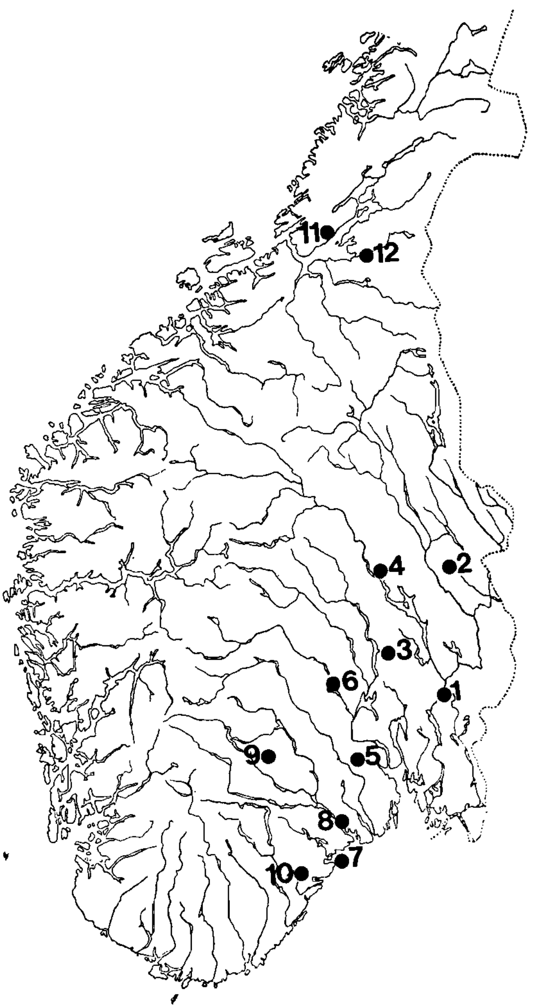

Fig. 1. The localities where Sphecids have been recorded in bark beetle pipe traps. 1: Haga, Nes; 2: Agåsen, Elverum; 3: Oksbakken, Jaren; 4: Lillehammer; 5: Kamplia, Øvre Eiker; 6: Torbråten, Krødsherrad; 7: Jomfruland; 8: Steinsrød, Skien; 9: Hjartdal; 10: Gisletveit, Vegårdshei; 11: Leksvik and 12: Hegra, Stjørdal.

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Primary parasitoids (Hym., Aphidiidae) and hyperparasitoids on aphids from Norway

TROND HOFSVANG AND ELINE B. HÅGVAR

Hofsvang, T. & Hågvar, E.B. 1983. Primary parasitoids (Hym., Aphidiidae) and hyperparasitoids on aphids from Norway. *Fauna norv. Ser. B. 30*, 60–62.

Data on 14 species of Aphidiidae (Hymenoptera), mostly collected at Ås, southern Norway, are given, including 9 species new to the Norwegian fauna. With 7 additional species from literature records, a total of 21 species of Aphidiidae are reported from Norway. Sixteen species from 3 different families of hyperparasitoids on aphids from Norway are also listed.

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The information available on primary parasitoids (Aphidiidae) and on different groups of hyperparasitoids on aphids from Norway is very scarce. During several years study of Aphidiidae as biological control agents on aphids in glasshouses some occational collections of mummified aphids were made.

The species of Aphidiidae that emerged from mummies, most of them collected at Ås, southern Norway, are given in Tab. 1. Nine species are new to Norway. In addition, the following species of Aphidiidae from Norway are reported in the literature: *Ephedrus lacertosus* (Haliday, 1833) in Mackauer (1968). *Ephedrus persicae* Frogatt, 1904 in Mackauer (1968). *Ephedrus plagiator* (Nees, 1811) in Mackauer (1968), Edland (1976), Starý (1981). *Praon abjectum* (Haliday, 1833) in Starý (1981). *Praon gallicum* Starý, 1971 in Starý (1981). *Praon volucre* (Haliday, 1833) in Edland (1976), Starý (1981). *Aphidius rhopalosiphi* De Stephani, 1901 in Starý (1981). *Aphidius uzbekistanikus* Luzhetzki, 1960 in Starý (1981). *Monoctonus caricis* (Haliday, 1833) in Mackauer & Starý (1967). *Trioxys auctus* (Haliday, 1833) in Starý (1981). A total of 21 species of Aphidiidae are now reported from Norway, a very low number compared to 84 species reported from Finland (Halme 1977).

Hyperparasitoids on aphids exist within the following genera: *Dendrocerus* (Megaspillidae); *Alloxysta, Phaenoglyphis* (Cynipidae) and *Asaphes, Coruna, Pachyneuron* (Pteromalidae). The species of hyperparasitoids that emerged from mummies collected at Ås, are given in Tab. 2. In an experiment where the aphidiid *E. cerasicola* was introduced to control *M. persicae* on *Capsicum* in small glasshouses at Ås 1982, more regulary records of hyperparasitoids were made by collecting mummies once a week (Tab. 3).

Literature records exist on the following aphid hyperparasitoids from Norway: *Dendrocerus aphidum* (Rondani, 1877) in Hellen (1966), see Fergusson (1980). *Dendrocerus carpenteri* (Curtis, 1829) in Edland (1976). *Dendrocerus dubiosus* (Kieffer, 1907) in Dessart (1972), see Fergusson (1980). *Dendrocerus laevis* (Ratzeburg, 1852) in Fergusson (1980). *Dendrocerus punctipes* (Boheman, 1832) in Dessart (1972), biology unknown. A number of *Alloxysta*-species from Norway is given by Hellén (1963, 1966): *Alloxysta erythrothorax* (Hartig, 1840), *Alloxysta filicornis* (Cameron, 1889), *Alloxysta flavicornis* (Hartig, 1841), *Alloxysta forticornis* (Giraud, 1860), *Alloxysta fuscipes* (Thomson, 1862), *Alloxysta macrophadna* (Hartig, 1841), *Alloxysta pedestris* (Curtis, 1838) and *Alloxysta victrix* (Westwood, 1833). Edland (1976) has recorded *Alloxysta rubriceps* (Kieffer, 1902). *Asaphes suspensus* (Nees, 1834) and *Asaphes vulgaris* Walker, 1834 are reported by Edland (1976), Compton (1981) and Hedquist (1982).

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We would like to thank Dr. P. Starý for identifying most of the Aphidiidae and Dr. N. Fergusson for verifying some of the *Dendrocerus* sp.

Table 1. Aphidiidae from Norway, primary parasites on aphids. G = glasshouse. The given dates represent the collection of mummies. Species new to Norway are marked with an asterisk.

Species	Aphid host (Host plant)	Locality	Date
Ephedrus cerasicola Starý, 1962	Myzus persicae G	Jeløy, Ø, EIS 19	July 1973 1)
" "	" " G	Ås, AK, EIS 28	July 1974
Ephedrus persicae Frogatt, 1904	Myzus cerasi	Grimstad, AAY. EIS 6	19 July 1975
*Toxares deltiger (Haliday, 1833)	M. persicae G	Jeløy	24 August 1973
*Praon myzophagum Mackauer, 1959	M. persicae G	Ås	24 July 1974, September 1976
*Praon silvestre Starý, 1971	Aphid host? (Brassica field)	Ås	31 October 1975 2)
*Praon volucre (Haliday, 1833)	Aphid host? (Capsicum) G	Ås	September 1975
*Lysiphlebus confusus Tremblay & Eady, 1978	Aphid host? (Matricaria)	Ås	8 July 1970 3)
Aphidius colemani Viereck, 1912	M. persicae G	Ås	1973 4)
" "	Aphid host? (Capsicum) G	Ås	27 November 1975
Aphidius ervi Haliday, 1834	Aphid host? (Host plant?) G	Asker, AK, EIS 28	1968 5)
" "	M. persicae G	Ås	10 September 1973, 10 August 1976
" "	Aphid host? (Trifolium)	Ås	27 May 1982
*Aphidius matricariae Haliday, 1834	M. persicae G	Jeløy	24 August 1973
" "	" " G	Ås	9 August 1982 6)
Aphidius rhopalosiphi De Stephani, 1902	Rhopalosiphum sp. G	Ås	April 1978
*Aphidius rosae Haliday, 1834	Macrosiphum rosae	Ås	18 June 1976
*Diaeretiella rapae (M'Intosh, 1855)	M. persicae	Ås	26 September & 8 November 1976
" "	" " G	Ås	23 August 1975
*Falciconus pseudoplantani (Marshall, 1896)	Aphid host? (Acer)	Ås	26 October 1974, 19 August 1976 7)

1) Biology: Hofsvang & Hågvar (1975a, 1977, 1978). 2) Parasitoid on Periphyllus sp. on Acer (Starý, pers. comm.) 3) Det. P. Starý 1974 as L. ambiguus, now: L. confusus (see Tremblay & Eady (1978)). 4) Biology: Hofsvang & Hågvar (1975 b,c, 1977, 1978). Geographical distribution: Starý (1975). 5) Biology: Hågvar & Hofsvang (1975 b). 6) High percentage parasitization on M. persicae in glasshouses. 7) Parasitoid on Drepanosiphum sp. on Acer (Stary, pers. comm.).

Table 2. Hyperparasitoids on aphids from Ås. Primary parasitoid: Aphidiidae. The given dates represent the collection of mummies.

Hyperparasitoid	Primary parasitoid	Aphid host (Host plant)	Date
Asaphes suspensus (Nees, 1834)	E. cerasicola	M. persicae	5 October 1977, 11 October 1978, 3,5,17 October 1980
" "	A. matricariae	" "	9 August 1982
Asaphes vulgaris Walker, 1834	E. cerasicola	" "	3 October 1980
" "	A. matricariae	" "	9 August 1982
Dendrocerus aphidum (Rondani, 1877)	E. cerasicola	" "	3 October 1980
Dendrocerus carpenteri (Curtis, 1829)	A. matricariae	" "	9 August 1982
" "	?	Aphid host? (Rosa)	14 June 1974
" "	F. pseudoplantani	Aphid host? (Acer)	26 October 1974
Dendrocerus laticeps (Hedicke, 1929)	E. cerasicola	M. persicae	19 August 1977, 11 October 1978, 7 October 1981

Table 3. Emergence of the primary parasitoid *E. cerasicola* and hyperparasitoids from mummifield aphids in glasshouse with *M. persicae* on *Capsicum*, Ås 1982. *M. persicae*/*E. cerasicola* were introduced 18 June.

Collection of mummies	*Ephedrus cerasicola*	*Dendrocerus laticpes*	*Asaphes suspensus*	*Asaphes vulgaris*
22 July	47	1^{x}	1	0
29 July	64	1	5	0
5 August	3	0	7	0
12 August	0	0	36	6
19 August	0	0	1	1
26 August	0	0	0	0
2 September	1	0	2	0
9 September	1	0	0	0
15 September	0	0	0	1

^{x}*Dendrocerus* sp.

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The flight period of Caddis-flies (Trichoptera) on the Island of Osterøy, Western Norway.

TROND ANDERSEN

Andersen, T. 1983. The flight period of Caddis-flies (Trichoptera) on the Island of Osterøy, Western Norway. *Fauna norv. Ser. B. 30*, 63—68.

The flight period of 84 Trichoptera species are given, based on a collection of approximately 75.000 specimens caught on the Island of Osterøy in outer Hordaland. The earliest species taken, *Chilostigma sieboldi* McLachlan, 1876, was flying in March. More species started to fly in May, and maximum number of species, 64, were taken in the beginning of August. *Chaetopteryx villosa* (Fabricius, 1798) was the latest species, flying until mid December. *Rhyacophila nubila* (Zetterstedt, 1840) had the most extended flight period, starting in the beginning of June and lasting until 20 November.

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INTRODUCTION

Records of the flight period of West Norwegian Trichoptera are sporadic and have mostly appeared in connection with faunistic surveys (Andersen 1974, 1976, 1979, 1980a, 1980b, Andersen et al. 1978). Many of the Trichoptera found in Western Norway are widely distributed and information on their flight periods in other parts of Europe can be drawn from the litterature. In this context the flight periods recorded from Sweden (e.g. Göthberg 1970, Olsson 1971, Svensson 1972, Tobias 1969, Ulfstrand 1970) and from the British Isles (e.g. Brindle 1965, Crichton 1960, 1971, Crichton & Fisher 1981, Crichton et al. 1978, Hickin 1967) are of special interest. However, a given species does not necessarily have the same flight period in Western Norway as in Sweden or on the British Isles. Crichton (1971) and Crichton et al. (1978) demonstrated that the flight period of most Trichoptera, with an extended flight period in southern England, have shorter flight periods in Scotland, and that many limnephilids flying in late summer and autumn have their respective median day, i.e. the day when 50 % of the yearly total have been caught, progressively later with lower latitudes.

In the present paper I present flight periods of most West Norwegian Trichoptera, based on collections made on the Island of Osterøy.

STUDY AREA

Osterøy is a large inland island, with an area of 328 km^2, situated northeast of Bergen in outer Hordaland. The central and eastern parts of the island are mountainous, the highest point, Høgafjell, reaching 869 m a.s.l. The main feature of the topography in the western parts of the island is a series of low ridges passing in a north-south direction.

The island present a variety of freshwater localities. Along the coast and in the valleys in the western parts of the island there are a high number of lakes and ponds with rich vegetation. In the central parts of the island there are marshy areas with ponds and small lakes vegetated with sedges and grasses, and even peat-bogs with small ponds. In the more central and mountainous parts there are also clearwater lakes with hardly any vegetation. Several smaller and larger streams come running from the mountains, some fastflowing with coarse bottomsubtratum, others more slowly running with a finer substratum. Several streams and small rivers flow through the lowlands in the western parts of the island, most have stony bottom, but some have sandy or muddy substratum.

Most of the field work was carried out in the western parts of the island. Streams, lakes and ponds in the lowlands in this part of the island yielded a high number of species. In a light trap situated near a lake outlet a total of 64 species were taken. Lakes and ponds in the marshy and boggy areas in the central part of the island had a different fauna and yielded fewer species. Freshwater localities in the mountainous parts were also sampled. A light trap was situated more or less continuously for two seasons at a rather fastflowing stream at 350 m a.s.l. The

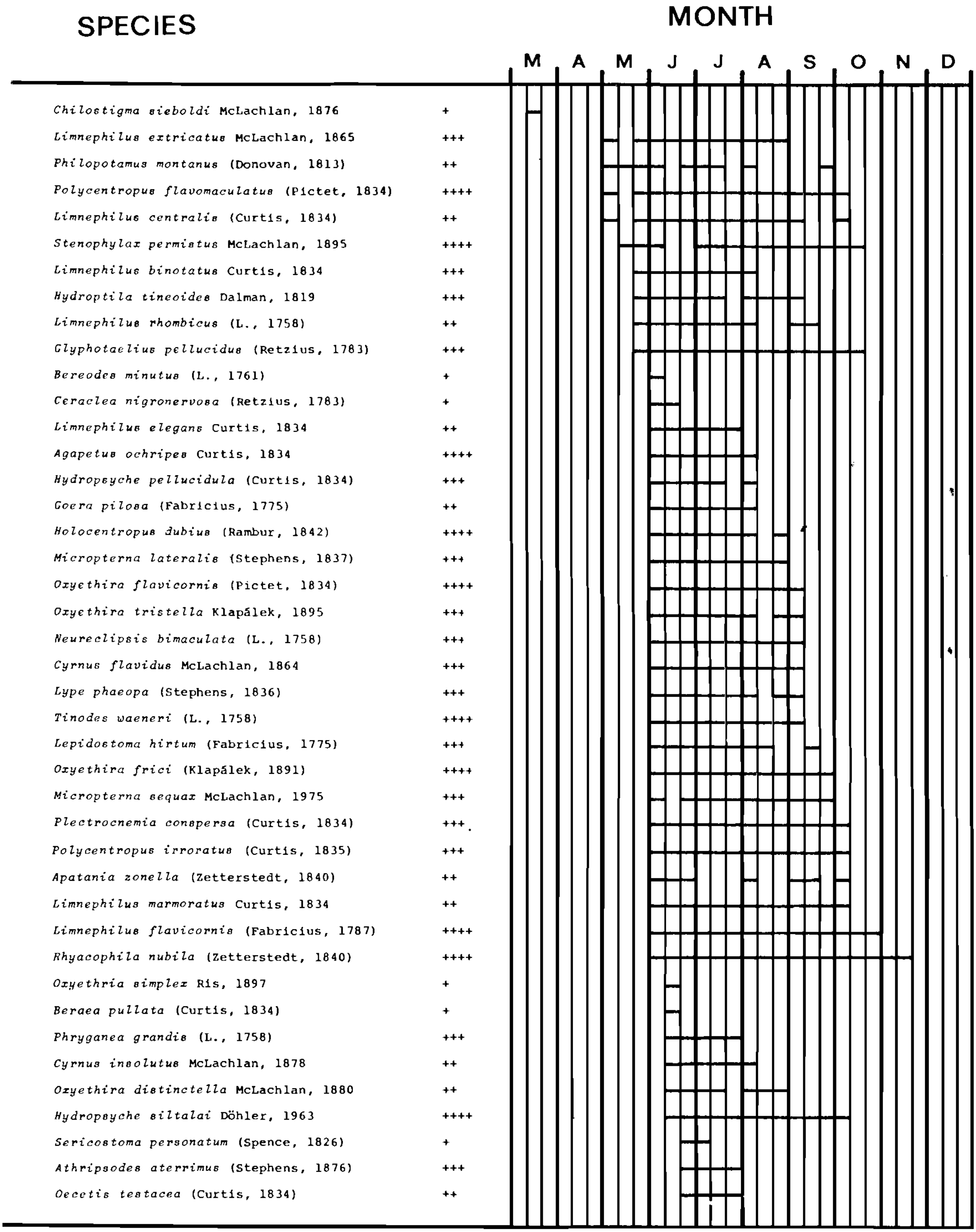
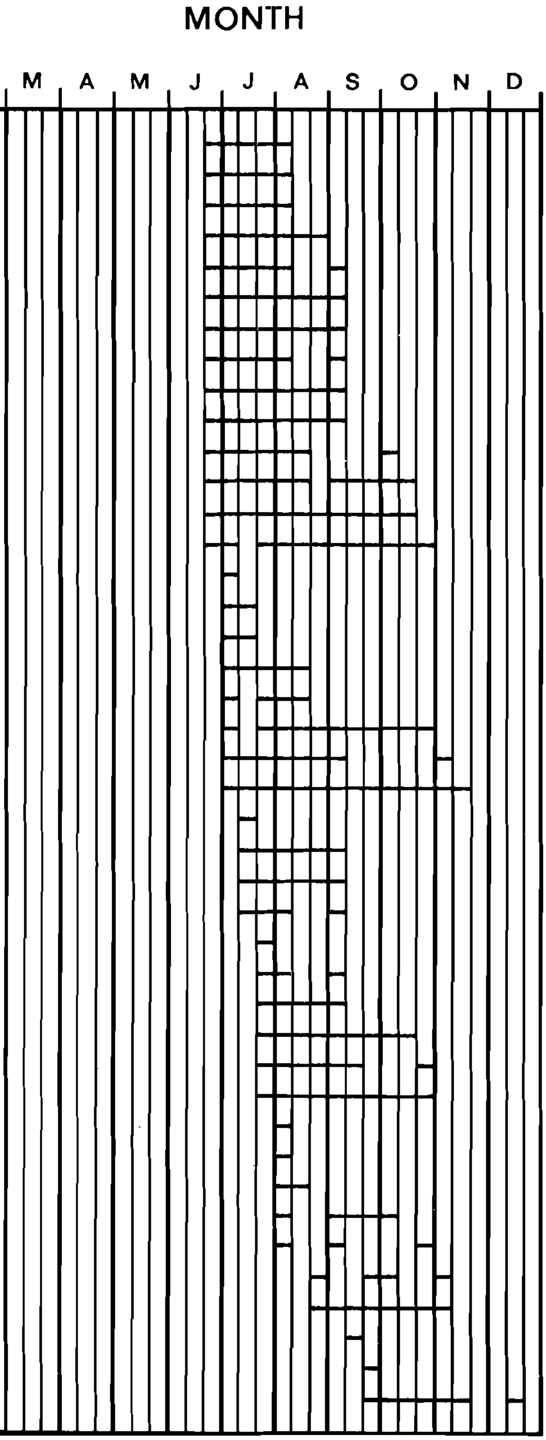


Fig. 1. The flight period of Trichoptera on the Island of Osterøy, Western Norway. Months are divided in ten-day periods. Relative abundance (+ < 10 specimens; + + = 10—100 specimens; + + + = 100—1000 specimens; + + + + > 1000 specimens) of each species are given.

SPECIES	
Ithytrichia lamellaris Eaton, 1873	+++
Athripsodes cinereus (Curtis, 1834)	++
Ceraclea senilis (Burmeister, 1839)	++
Triaenodes bicolor (Curtis, 1834)	+++
Cyrnus trimaculatus (Curtis, 1834)	+++
Agrypnia varia (Fabricius, 1793)	+++
Ceraclea fulva (Rambur, 1842)	+++
Mystacides azureus (L., 1761)	+++
Oecetis lacustris (Pictet, 1834)	++
Melannodes tinctus (Zetterstedt, 1840)	+++
Hydroptila occulta (Eaton, 1873)	++++
Hydroptila simulans Mosely, 1920	++++
Ceraclea dissimilis (Stephens, 1836)	++++
Limnephilus vittatus (Fabricius, 1798)	+++
Oligotricha lapponica (Hagen, 1864)	+
Agrypnia picta Kolenati, 1848	+
Phryganea bipunctata Retzius, 1783	+
Agrypnia obsoleta (Hagen, 1864)	++
Rhadicoleptus alpestris (Kolenati, 1848)	++
Limnephilus coenosus (Curtis, 1834)	+++
Ceraclea alboguttata (Hagen, 1860)	++++
Limnephilus lunatus Curtis 1834	++++
Oxytrichia mirabilis (Morton, 1904)	+
Wormaldia subnigra McLachlan, 1865	+
Apatania stigmatella (Zetterstedt, 1840)	+++
Colpotaulius incisus (Curtis, 1834)	+
Hydroptila forcipata (Eaton, 1873)	+
Potamophylax nigricornis (Pictet, 1834)	+
Limnephilus sparsus Curtis, 1834	++
Limnephilus borealis (Zetterstedt, 1840)	+++
Phacopteryx brevipennis (Curtis, 1834)	++
Potamophylax cingulatus (Stephens, 1837)	++++
Apatania muliebris McLachlan, 1866	+
Silo pallipes (Fabricius, 1781)	+
Limnephilus luridus Curtis, 1834	+
Limnephilus griseus (L., 1758)	++
Limnephilus affinis Curtis, 1834	+
Limnephilus auricula Curtis, 1834	+
Halesus radiatus (Curtis, 1834)	++++
Limnephilus nigriceps (Zetterstedt, 1840)	+
Halesus digitatus (Schrank, 1871)	+
Chaetopteryx villosa (Fabricius, 1878)	+++



most elevated light trap locality was at 530 m a.s.l.

METHODS AND MATERIAL

The study was carried out between 1971 and 1976; with some additional information from later years. Most of the material was taken in light traps fitted with mercury vapour bulbs. A high number of specimens were also netted on the wing or taken with sweep-nets in the vegetation along lakes and streams.

The material consists of approximately 75.000 specimens of 84 species. The flight periods of the different species are given in ten-day periods; each month has been divided into three periods: 1—10, 11—20, 21—30/31. If a species was caught within a certain ten-day period, the whole period is marked as flight period.

RESULTS

The flight periods of the different species are shown in Fig. 1; the species are arranged according to the ten-day period when they were first taken, starting with the early species. The flight period of the different species is given as a continuous or discontinuous bar, the extent of the bar indicating the length of the flight period. The number of specimens on which the recorded flight period are based are given in relative terms. For species taken in low numbers a short bar must be regarded more as an indication of when the species can be expected rather than the actual flight period. No attempt has been made to join adjacent bars referring to the same species. In most cases these gaps indicate absence of records rather than a discontinuous flight period, but, as will be mentioned later, some of these gaps may also be of significance.

No indication of the abundance in the different ten-day periods during the flight period is given, and possible peaks of abundance have thus been masked. In cases were the flight period is long and continuous the most satisfactory way of using the information might therefore be to regard the earlier and later parts as exceptional dates and regard the middle period as the more likely time to encounter the species.

Chilostigma sieboldi McLachlan, 1876 was the earliest species to be taken, flying in the middle of March. More species started to fly in May, and some of these species, like *Polycentropus flavomaculatus* (Pictet, 1834), *Limnephilus centralis* (Curtis, 1834) and *Stenophylax permistus* McLachlan, 1895, have long flight periods lasting until October, the latter species with a distinct gap in the flight period from 10 June to 1 July. *Rhyacophila nubila* (Zetterstedt, 1840) had the most extended flight period, starting in the beginning of June and lasting until 20 November. Most species had started to fly at the end of June. Some of these, like *Athripsodes aterrimus*, (Stephens, 1837) had a rather short flight period lasting less than two months. A lower number of species started to fly in July and August and nearly all species with flight periods starting after mid July were limnephilids. The latest species taken, *Chaetopteryx villosa* (Fabricius, 1798), started to fly in late September and were found until the beginning of December.

The number of species taken in each ten-day period is shown in Fig. 2. Until the beginning of May only *C. sieboldi* had been caught. In May less than 10 species were captured, but in the first part of June the number rose above 30 species, and in the last period of June 50 species were taken. In July the number of species taken in each ten-day period varied between 57 and 59 species and maximum number, 64 species, was reached in the first period of August. At the end of August the number of species were below 45 species and at the end of September below 25 species. In the last period of October 10 species were caught and in the first period of November 5 species. After this date only *R. nubila*, *Limnephilus lunatus* Curtis, 1834, and *C. villosa* were still found.

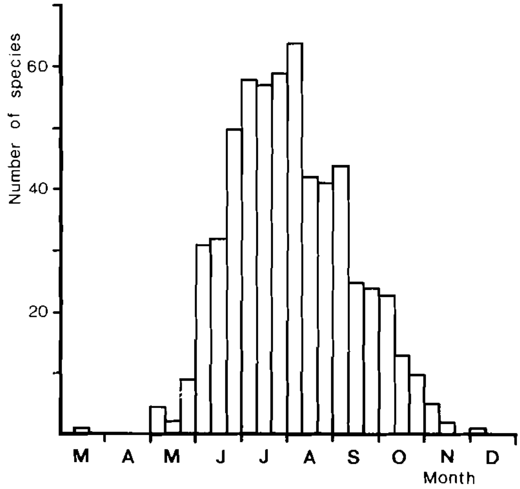


Fig. 2. The number of species taken in each ten-day period.

DISCUSSION

Crichton (1960) distinguished between three types of seasonal occurrence: (1) summer species; (2) autumn species; (3) double-brooded species. He regarded species which are captured in maximum numbers from May to August as summer species, listing a number of non-limnephilids, mainly phryganids, leptocerids and hydropsychids, as species having this type of seasonal occurrence. The autumn species, i.e. species which are caught mainly in the months of September and October, are mainly limnephilids. As double-brooded species he mentioned several small species, mainly belonging to Hydroptilidae. To demonstrate that a species is double-brooded confirmation from studies on larvae is needed. Nielsen (1948) studying the larval growth of *Oxyethira flavicornis* (Pictet, 1834) in Denmark, stated that this species had two distinct generations in one year rather than either a prolonged flight period of one generation or the co-existance of two distinct cohorts with differing flight periods. He also considered other Hydroptilids, like *Hydroptila tineoides* Dalman, 1819, to be double-brooded.

As mentioned above many limnephilids exhibit an extended flight period with peak numbers in September and October and with an additional small peak in May or June. In previous studies (e.g. Winkler 1961) it was suggested that these species also had two distinct broods in the year. However, Novák and Sehnal (1963) demonstrated that in Czechoslovakia females of species with this flight pattern emerge in early summer with immature ovaries and enter an imaginal quiescence of varying length before the eggs mature in late summer or autumn. Crichton (1971) thus proposed that limnephilids might be grouped in: (1) Species with an extended flight period, probably involving a diapause, from spring through summer into autumn; (2) species with a shorter flight period, without a diapause, in spring and summer, and sometimes extending into autumn; (3) species with a short flight period, without a diapause, in autumn. Crichton (1971) and Crichton and Fisher (1981) list British limnephilids belonging to either of the three categories. But Crichton (1971) showed that of many limnephilids exhibiting an extended flight period in southern England, few or none specimens were caught in Scotland in May, June or July and he stated that the diapause might be shorter or absent in Scotland.

On Osterøy most non-limnephilids have their main flight period from May to August and must be considered as summer forms. But the duration of the flight periods varies. Several leptocerids have rather short flight periods, while *R. nubila* and several polycentropodids have more extended flight periods. Among the hydroptilids there are some species, like *Hydroptila occulta* (Eaton, 1873), *H. simulans* Mosely, 1920 and *H. tineoides* Dalman, 1819, that have rather long flight periods, mostly with a strong peak early in the flight period, a period when few or no specimens are taken, and then a shorter period when a smaller number of specimens are caught. However, the larval development must be studied to assert if the latter specimens belongs to a partial second brood.

Among the limnephilids several species, like *Limnephilus flavicornis* (Fabricius, 1787) and *S. permistus,* have an extended flight period with a pronounced bimodality, and hence probably belong to category 1 of Crichton (1971). A few limnephilids, like *Limnephilus elegans* Curtis, 1834 and *Micropterna lateralis* (Stephens, 1837), have relative short flight periods in June, July and August and they probably belong to category 2, while a higher number of limnephilids, like *Halesus radiatus* (Curtis, 1834), and *C. villosa,* have short flight periods in the autumn and thus belong to category 3 of Crichton (1971).

To get a better understanding of the differences observed, the flight periods of the different species must be viewed in connection with their larval development. However, so far only few studies on the larval development of West Norwegian Trichoptera have appeared; the species studied are *R. nubila* (Fjellheim 1976) and *Hydropsyche siltalai* Döhler, 1963 and *H. pellucidula* (Curtis, 1839) (Andersen & Klubnes 1983, Klubnes 1981). On the other hand, a better knowledge of the flight periods might be of significance when the larval development of further species are studied.

Western Norway is a large area with a varying topography, the coastal parts have an atlantic climate, while the climate in the inner parts are more continental. In the coastal parts several of the species, which started to fly in May and June on Osterøy, will therefore undoubtedly start to fly even earlier and thus have a longer flight period. In the inner more montainous parts the opposite trend will be experienced. When studying the Trichoptera along the fjords of inner Hardanger and on the Hardangervidda mountain plateau (1000—1200 m a.s.l.) Andersen (1979) demonstrated that species ranging from sea level up to the mountain plateau generally had a longer flight period in the lowlands than on the plateau, and that species flying during autumn generally started to fly earlier in the mountain areas than along the fjords.

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Identification of the Norwegian larvae of the genus *Potamophylax* Wallengren, 1891 (Trichoptera, Limnephilidae), with data on life histories, habitats and food in the Kongsvoll area, Dovrefjell mountains, Central Norway

JOHN O. SOLEM

Solem, J.O. Identification of the Norwegian larvae of the genus *Potamophylax* Wallengren, 1891 (Trichoptera, Limnephilidae), with data on life histories, habitats and food in the Kongsvoll area, Dovrefjell mountains, Central Norway. *Fauna norv. Ser. B. 30,* 69—76.

A key to the Norwegian larvae of the genus *Potamophylax* is presented. *P. nigricornis* and *P cingulatus* had a one year life cycle, and it is assumed that *P. latipennis* also was univoltine in the area sampled. *P. cingulatus* occurred in all running water habitats, ranging from rivers to small streams. *P. nigricornis* was found only in small streams, and *P. latipennis* only in the main river. Thus *P. cingulatus* coexisted with either *P. nigricornis* or *P. latipennis. P. cingulatus* and *P. nigricornis* were omnivorous, while *P. latipennis* was a shredder. The difference in food habits may be a major factor regulating distribution of the species above the tree line. Growth of *P. cingulatus* and *P. nigricornis* occurred at 0.2 to 0.3°C in late autumn and winter. Adults of *P. cingulatus* collected above the tree line had shorter wings than those collected below the tree line.

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INTRODUCTION

Species of the family Limnephilidae represent a high percentage of caddisflies occurring in northern latitudes, and larvae of the genus *Potamophylax* are widely distributed in running waters, from large rivers to small streams, and at all altitudes. Three *Potamophylax* species, *P. nigricornis* (Pictet), *P. cingulatus* (Stephens) and *P. latipennis* (Curtis) are recorded in Norway. Larvae of the genus *Potamophylax* belong to the group of limnephilids that has single filament gills only, and a key to the Norwegian genera of this group has been presented in another paper (Solem in press). Apart from flight periods of adults (Andersen et al. 1978, Andersen 1979, 1980, Lillehammer 1978, Solem 1978a, b), nothing is known about life histories and very little about the habitats and food of the *Potamophylax* species in Norway. The aquirement of more knowledge, on the above topics, has been hampered by difficulties in identifying the larvae, and by the absence of a detailed investigation into the distribution and abundance of adults in a small geographical area where all three Norwegian species occur. The main objective of the present paper is to give a key to the *Potamophylax* larvae in Norway, but data on life histories, habitats and food are included.

The larvae of *P. cingulatus* and *P. latipennis* are morphologically very similar, but recently Wallace (1980) has given diagnostic characters to separate them. I have used his characters on Norwegian material and found them valid.

STUDY AREA, MATERIAL AND METHODS

Larval collections were taken monthly, from March 1981 to February 1982, in two small streams, Raubekken (UTM grid 32V NQ 324079 and 1100 m a.s.l.) and Blesbekken (UTM grid 32V NQ 323072 and 1000 m a.s.l.), running down the mountainside of S Knutshö, at Kongsvoll, Dovrefjell, Central Norway. A dip net was positioned downstream of an area where stones were washed and the gravel and sand substratum were vigorously disturbed to a

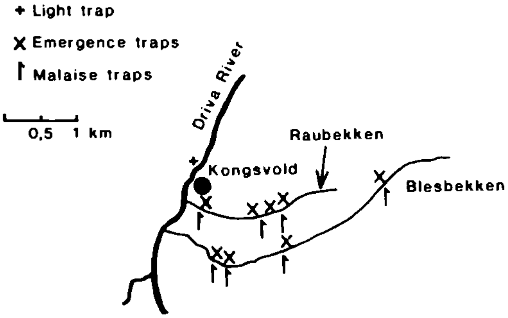

Fig. 1. A map showing the sampling sites at the Raubekken, Blesbekken and the Driva. The highest site sampled in Blesbekken was 1350 m a.s.l.

depth of 5—10 cm. Successively the net was moved upstream until a stretch of 1.5—2.0 m of the bottom of the stream was covered. From each stream 3—4 litres of bottom substrate were taken to the laboratory and sorted under a microscope. During the years 1978—1981 between 10 and 20 emergence traps of the tent type were operated in the Raubekken and Blesbekken. Each trap covered 0.25, 0.5 or 1.0 m^2. Three Malaise traps were working during the summers of 1980 and 1981 at each of the streams. A light trap was in use in the years 1973—75 on the bank of the Driva which is the main river in the valley, and into which the Raubekken and Blesbekken empty (Fig. 1). The several traps for collecting adults were emptied once a week during the whole flight season of Trichoptera.

Larval instars were separated by head width measurements.

Chemical characteristics of the water in the Raubekken and Blesbekken and the Driva are given in Table 1. Data for Raubekken and Blesbekken are based on ten samples of water taken at regular intervals during May 1981 to February 1982. Measurements from the Driva were taken on 20 June 1980.

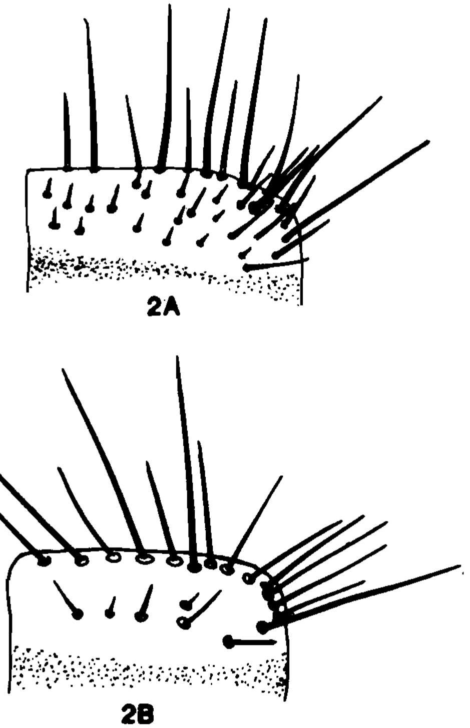

Fig. 2. Anterior third of pronotum; A — *Potamophylax nigricornis;* B — *P. cingulatus.*

Table 1. Water chemistry characteristics of the streams Raubekken and Blesbekken and the river Driva. Data for Raubekken and Blesbekken kindly provided by J. Andersen and J. Steinkjer. Data for Driva taken from Nöst (1981).

Locality		Water temp. °C	pH	°dH	CaO mg/l	Alkalinity meq/l	Conduc. K_{18} µS/cm	$KMnO_4$ mg/l	Cl^- mg/l
Blesbekken	max.	14.0	7.3	2.4	13.5	0.25	22	19.4	0.30
	min.	0.5	6.8	0.7	4.5	0.59	53	1.0	0.15
Raubekken	max.	14.0	7.5	3.3	22.5	0.52	46	25.9	0.30
	min.	0.2	7.1	1.4	9.0	1.20	96	2.8	0.15
Driva		6.8	7.1	0.35	3.5	0.10	18		1.5

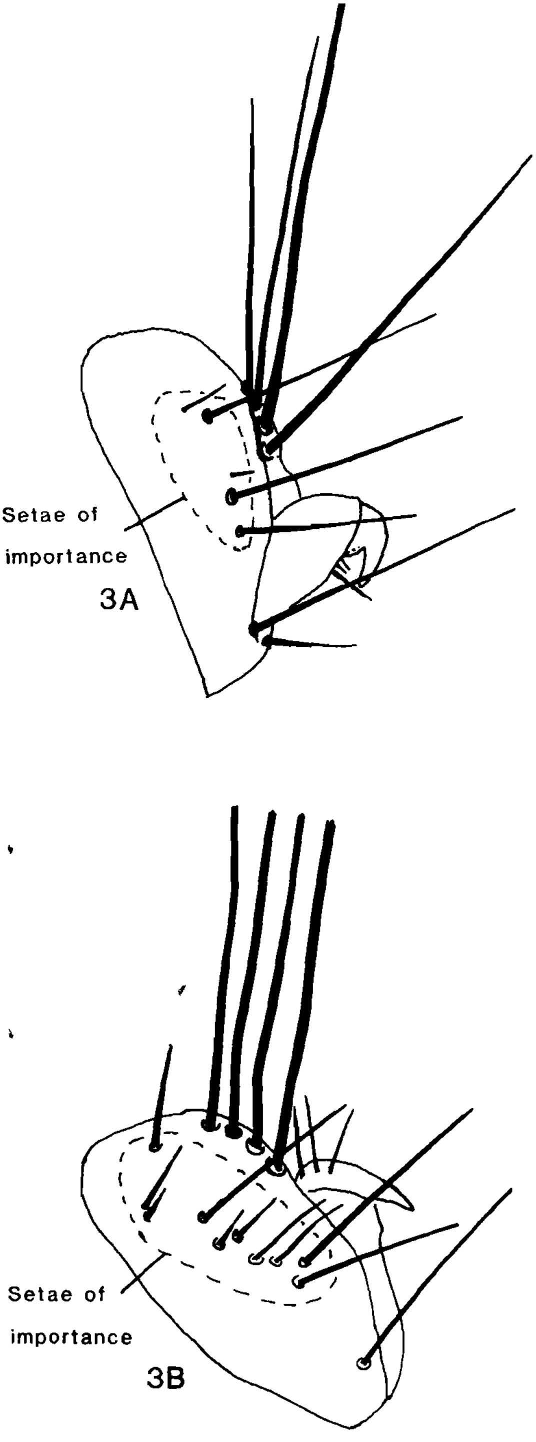

Fig. 3. Setae on anal proleg; A — *Potamophylax nigricornis*; B — *P. cingulatus*.

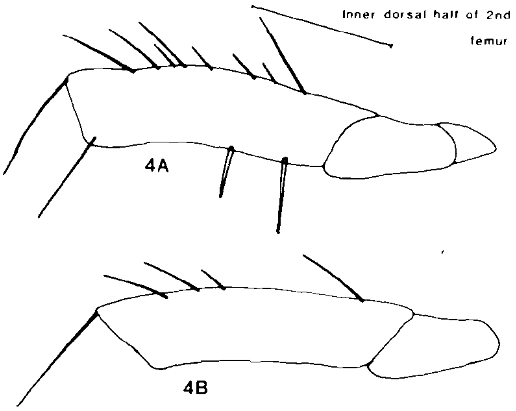

Fig. 4. Dorsal setae of 2nd femur; A — *Potamophylax nigricornis*; B — *P. cingulatus*.

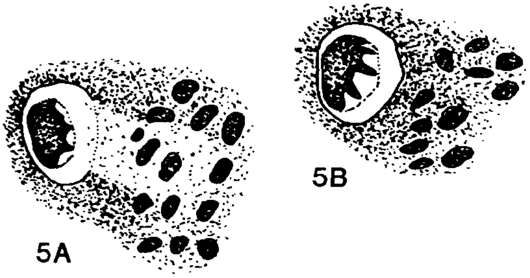

Fig. 5. Head capsule, instar V, area posterior to the eye; A — *Potamophylax cingulatus*; B — *P. latipennis*.

KEY TO THE NORWEGIAN LARVAE OF THE GENUS *POTAMOPHYLAX*

1. Face of anterior third of pronotum densely covered with setae (Fig. 2A). Two to four black setae on the dorsal side of each anal proleg (Fig. 3A). Inner dorsal half of 2nd femur with two or three setae (Fig. 4A) . . . . *Potamophylax nigricornis*

— Face of anterior third of pronotum sparsely covered with setae (Fig. 2B). About 10 black setae on the dorsal side of the anal proleg (Fig. 3B). Inner dorsal half of 2nd femur with only one, fairly large seta (Fig. 4B). 2

2. Head width of 5th instar larva 1.60—2.10 mm; a pale wedge present between the eye and the nearest muscle attachment spots posterior to it (fig. 5A). . . . . *Potamophylax cingulatus*

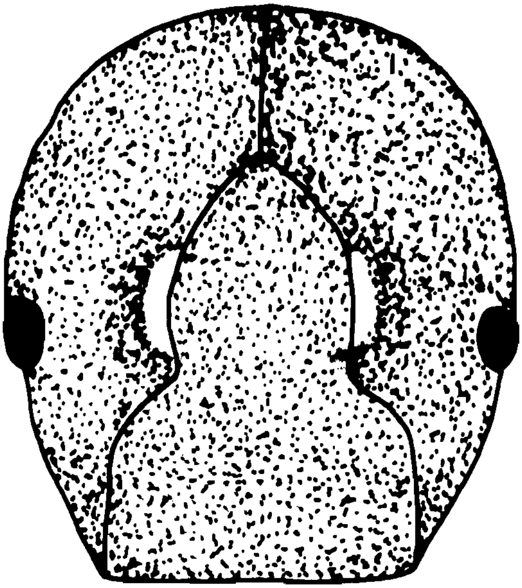

Fig. 6. Dorsal view of head of *Potamophylax cingulatus* showing two pale areas on the parietals.

— Head width of 5th instar larva 1.60—2.10 mm; no pale wedge present between the eye and the nearest muscle attachment spots posterior to it (Fig. 5B)................ .... *Potamophylax latipennis*

COMMENTS ON THE KEY AND ADDITIONAL FEATURES

It is possible to separate *P. nigricornis* from the third instar on (head width > 1.20 mm), using the diagnostic characters in this key. *P. latipennis* and *P. cingulatus* larvae are, however, so much alike morphologically, that only fifth instar individuals can be distinguished. It should also be noted that the whole pronotum of *P. nigricornis* is densely covered with mostly black setae, and differs greatly from *P. cingulatus* and *P. latipennis*. The coloration of the head pattern of *P. cingulatus* varies considerably and several pale areas may be found. Two pale areas (Fig. 6), one on each parietal at the frontoclypeal sutures and between the eyes, were registered in 85 % of a total of 55 *P. cingulatus* larvae. In Britain Wallace (1980) reported 95 % of the individuals to possess these pale areas. Readers who want more detailed information on the larvae of *Potamophylax* should consult Lepneva (1971) and Wallace (1980).

DISTRIBUTION IN THE KONGSVOLL AREA

Emergence trap, Malaise trap, light trap and larval collections showed that *P. cingulatus* in the Kongsvoll area is found in the Driva as well as in the small streams emptying into this river. *P. latipennis* occurs in the Driva, and *P. nigricornis* only in the small streams running down the mountainside of S Knutshö. Only *P. cingulatus* and *P. nigricornis* were recorded above the tree line.

LARVAL GROWTH AND PHENOLOGY OF ADULTS

Larval collection in late winter (March—April 1980) yielded very few larvae of *Potamophylax*. The life histories of *P. cingulatus* and *P. nigricornis* were determined from the other samples.

In May 1980 only 5th instar larvae of *P. cingulatus* and *P. nigricornis* were found (Fig. 7). The main emergence and flight period of *P. nigricornis* was in the second half of July, and that of *P. cingulatus* in early August (Fig. 8). Both species have a flight period of 7—8 weeks in the mountain streams at 900 to 1200 m a.s.l. Despite overlap in the flight periods, *P. nigricornis* is the earlier summer species. Oviposition of *P. nigricornis* and *P. cingulatus* took place during August. With a steadily decreasing water temperature, from a maximum 15°C in August to a minimum 1°C in October, the eggs developed. First, second and third instar larvae were collected in October and November (Fig. 7). The first and second instars were assigned to *P. cingulatus*, but they certainly included some *P. nigricornis* larvae. The majority of *P. cingulatus* and *P. nigricornis* larvae reached 4th and 5th instars by December and January. In October the maximum water temperature recorded was 6°C and at the end of the month it was only about 0.3°C. Water temperatures very close to 0°C continued normally into May (Fig. 9).

The main flight period of *P. latipennis* in the second half of July overlapped with that of *P. nigricornis* (Fig. 10). However, these two species occur as larvae and fly as adults in different habitats in the Kongsvoll area.

The life cycles of *P. nigricornis* and *P. cingulatus* were clearly completed in one year. There was a distinct time during summer when no *Potamophylax* larvae occurred in the samples, and this indicates that none of the populations, of *P. nigricornis* or *P. cingulatus* had a two-year life cycle. The bottom samples taken in the two small streams yielded no larvae of *P. latipennis*,

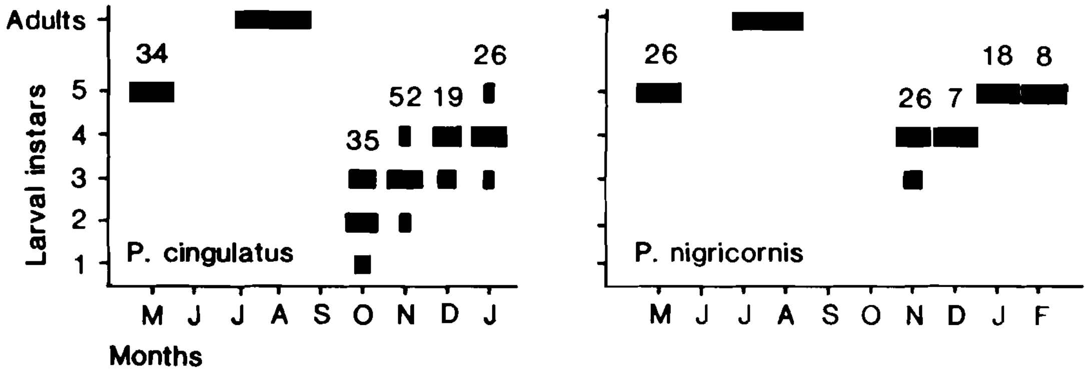

Fig. 7. Larval collections in selected months during 1981—82, and adult flight periods in 1981.

but a few bottom samples from the Driva indicated that *P. latipennis* completed its life cycle in one year.

FOOD

Gut analyses were made on 30 5th instar larvae taken in May 1981 and 18 3rd and 4th instar larvae in November—December 1981 of *P. cingulatus*. In the case of *P. nigricornis*, 15 5th instar larvae from May 1981 and 15 from January 1982 were examined, together with 15 3rd and 4th instar larvae collected in November 1981.

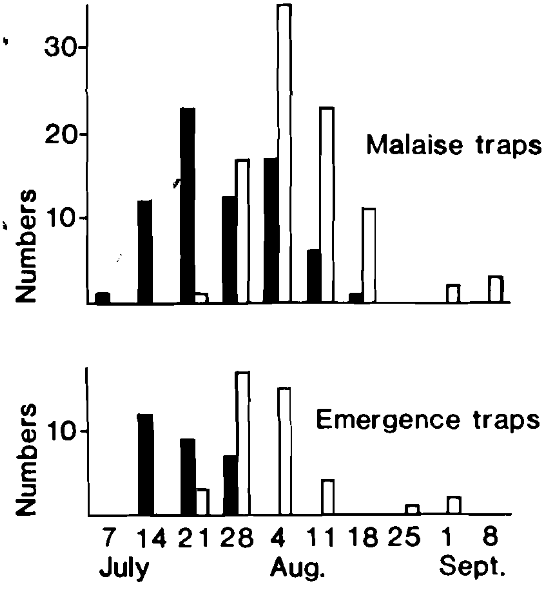

Fig. 8. Collections of adult *Potamophylax nigricornis* and *P. cingulatus* in Malaise traps and emergence traps during summer 1981. *P. nigricornis* — black bars; *P. cingulatus* — white bars.

Plant fragments were identified in nearly every individual examined of each species. About two—thirds of the 5th instar larvae of *P cingulatus* had also animal fragments in the gut, in contrast to only about 10% of 3rd and 4th instar larvae. Fragments of invertebrates were identified in 30—60% of the larvae of *P. nigricornis* ranging from the 3rd to 5th instars. Animal groups and species identified in the gut content were Plecoptera (*Nemurella pictetii* Klapalek), Ephemeroptera (*Baetis* sp.), Trichoptera and Chironomidae. Fragments of Plecoptera were more often found in gut contents than Ephemeroptera, Trichoptera and Chironomidae.

Of 13 5th instar larvae of *P. latipennis*, only three had animal fragments in gut, but all contained plant fragments. Even though no exact measurements of the proportion of plant versus animal fragments were made in the present study, there were conspicuous differences in the amounts of plant and animal fragments registered when comparing *P. cingulatus*, *P. nigricornis* and *P. latipennis*. Animal fragments made up a high percentage of the total gut content in *P. cingulatus* and *P. nigricornis*, but only a very small proportion in *P. latipennis*. Predatory behaviour of *P. cingulatus* has been reported by Gislason (1981a).

DISCUSSION

Potamophylax species have a wide distribution and are common caddisflies in running water. In the area around Kongsvoll, two of the three

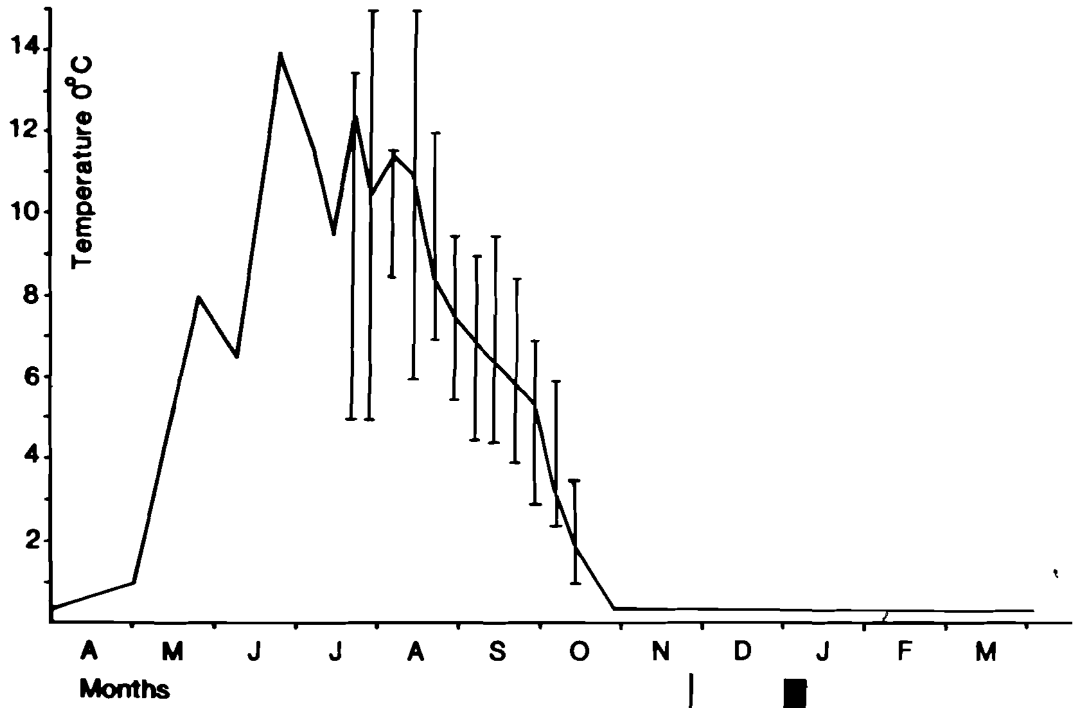

Fig. 9. Water temperature recordings at Raubekken from April 1981 to May 1982. The solid line shows water temperatures taken on selected days between 1200 and 1400 hours. Vertical bars show weekly maximum and minimum temperatures taken from automatic recordings made every hour.

Norwegian species divide the habitats between them. *P. cingulatus* occurs in all habitats sampled in the Driva and the small streams running down the mountainsides into it. *P. latipennis* has only been recorded from the Driva, and *P. nigricornis* only from the small streams. The consequence of this spatial distribution is that only two *Potamophylax* species are common and coexisting in these habitats.

In Scotland the flight period of *P. cingulatus* extended from June to October (Crichton 1981), a period of 20 weeks, with the median week catch at the end of August. Because of altitude and latitude, the flight period is only 7—8 weeks in the Dovrefjell mountains, with the median week catches in early August.

The flight periods of *P. nigricornis* and *P. cingulatus* are clearly separated in south Sweden, with *P. nigricornis* flying mainly in late June and *P. cingulatus* in August—October (Svensson 1972). At Kongsvoll the peak in the number of flying individuals of *P. nigricornis* is

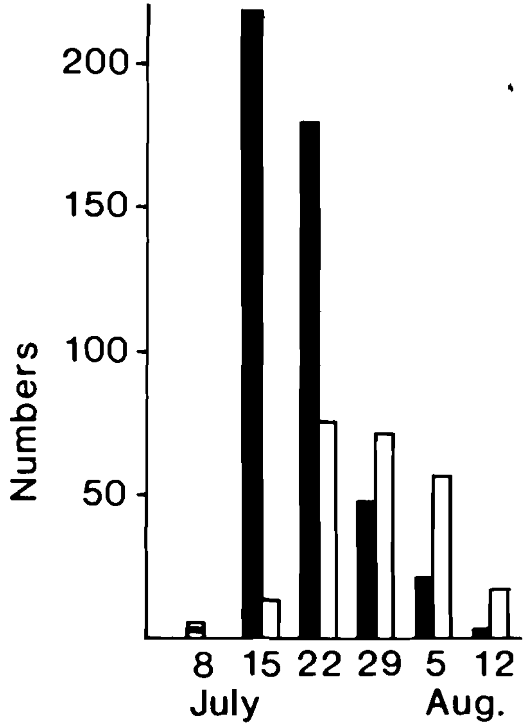

Fig. 10. Collections of adult *Potamophylax latipennis* and *P. cingulatus* in light traps at Kongsvoll over three years, 1973—75. *P. latipennis* — black bars; *P. cingulatus* — white bars.

about two weeks before the peak for *P. cingulatus*, and there is a considerable overlap in flight periods (Fig. 8). A similar partitioning of flight periods also occurs when *P. latipennis* and *P. cingulatus* fly in the same habitats at Kongsvoll (Fig. 10). This temporal separation was constant during the years 1973—75 for *P. latipennis* and *P. cingulatus*, and in 1979—81 for *P. nigricornis* and *P. cingulatus*.

Since high frequencies of animal fragments were detected in the gut contents of larvae of *P. cingulatus* and *P. nigricornis*, these species must be regarded as omnivorous. Lillehammer (1978) reported plant fragments and detritus in the gut contents of *P. cingulatus* from Övre Heimdalsvatn, Jotunheimen. Siltala (1908) and Nielsen (1942) mentioned plant fragments as food for *P. nigricornis*. Identifications of larvae of *P. cingulatus* and *P. latipennis* earlier than 1980—81 must in many cases be regarded with caution, because the first reliable diagnostic characters for separating these two species appeared in Wallace (1980). Larvae of *P. latipennis* should, according to the present investigation, be regarded as shredders. The very low percentage of animal fragments in their gut contents indicates that other invertebrates were not a major food item. This is not so for larvae of *P. cingulatus* and *P. nigricornis*, where other aquatic invertebrates occur with such a high frequency in the gut coentents that they are bound to be major food item. It should also be kept in mind that these frequency counts of animal fragments give minimum frequences. The counts are mostly based on sclerotized fragments, and if soft bodied invertebrates, e.g. oligochaets or soft portions of aquatic invertebrates, are eaten, they will be difficult, if not impossible, to recognize in the gut contents.

The differences found in the diet, between *P. cingulatus* and *P. nigricornis* on one hand, and *P. latipennis* on the other, indicate that care should be taken not to state that all species in a genus have similar food habits. However, the view that the genus is a morphological and ecological unit, used by Wiggins and Mackay (1978) as a general premise, may have a higher validity in the central area of the geographical distribution of a genus, because more optimal conditions occur here than at the periphery. In the present case, high altitudes are the peripherial and thus marginal areas for *Potamophylax* species. A species that is opportunistic in food habits is better adapted to complete its life cycle above the tree line than a shredder. The difference in food habits between *P. cingulatus*, *P. nigricornis* and *P. latipennis* may be a major factor regulating the distribution of *Potamophylax* species at high altitudes, above the tree line.

During autumn and early winter at water temperatures that are constantly close to 0°C (< 0.5°C), the larvae of *P. cingulatus* and *P. nigricornis* developed from 1st to 4th or 5th instars, so that these low temperatures did not retard growth. In autumn the streams receive large amounts of leaves from the bushes and trees (*Salix* spp. and *Betula* spp.) on their banks, and this is a substantial food supply for the larvae. Much of this allochtonous material is transported out of the streams during the spring flood. In the stream above the tree line where bushes are few, the food resources for most aquatic invertebrates are relatively scarce when compared with areas at lower elevations. Less available food, and may be coupled with lower average temperatures on annual basis, are likely the reason that smaller individuals of *P. cingulatus* occur here than further downstream. Measurements of wing length of 27 females and 16 males collected between 1280 m and 1350 m a.s.l. in the low alpine zone, showed the mean length to be 15.2 mm (SD + — 0.9) and 15.1 mm (SD + — 1.1), respectively. Similar measurements of adult individuals collected in the subalpine belt at elevation about 930 m revealed values of 16.3 mm (SD + — 1.1) for the females (N = 69) and 16.3 mm (SD + — 0.8) for males (N = 44).

The life cycles of *P. nigricornis* and *P. cingulatus* were completed in one year, and it is likely that *P. latipennis* has a similar pattern. The growth pattern of the larvae of *P. cingulatus* at Kongsvoll is fairly similar to that found by Otto (1971) in a lowland south Swedish stream. When similar growth patterns of larvae and life cycles occur in such different habitats as a lowland stream in South Sweden and small rapid streams at 1000—1100 m a.s.l. in the Dovre mountains, Norway, it indicates similar life history patterns of *P. cingulatus* populations throughout the whole geographical range of distribution. A one-year life cycle of *P. cingulatus* was also reported from Iceland (Gislason 1981b).

The fixed and rigid life cycle pattern of *P. cingulatus* is similar to that reported for *Asynarchus lapponicus* Zetterstedt and *A. contumax* McLachlan (Solem in press). The larvae of *A. lapponicus* and *A. contumax* occur in temporary vernal pools, and pools that may be permanent for years, but the life cycle is one year in both types of water bodies. The *Asynarchus* species showed life history features well adapted to the demanding physical conditions in the temporary vernal pools. However, both the *Potamophylax* and *Asynarchus* life history patterns differ from the development reported for *Agrypnia obsoleta* (Hagen) (Solem, 1983), which has a one-year life cycle in the lowlands of the Trondheim area, Central Norway, and a two-year cycle in the Kongsvoll area. Similar variations, as for *A. obsoleta*, in the life history patterns of caddisfly species in relation to altitude were also found by Décamps (1967).

ACKNOWLEDGEMENTS

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Contribution to the knowledge of the Norwegian Lepidoptera I

LEIF AARVIK

Aarvik, L. 1983. Contribution to the knowledge of the Norwegian Lepidoptera I. *Fauna norv. Ser. B. 30*, 77—80.

The following species are reported new to Norway: *Coleophora arctostaphyli* Meder, *Aplota palpella* (Haworth), *Depressaria silesiaca* Heinemann, *Monochroa elongella* (Heinemann), *Gelechia hippophaella* (Schrank), *Heinemannia laspeyrella* (Hübner), *Scythris noricella* (Zeller), *Epiblema rosaecolana* (Doubleday) and *Cydia servillana* (Duponchel).

Remarks on diagnostic characters (or a reference to relevant literature), distribution and food-plants are given.

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In the present paper nine species new to our fauna are reported. Most of the species were collected by the author in 1980—81. A few records made by Alf Bakke, Audun Gussgard and Svein Svendsen are also included in the material.

Unless when otherwise stated the material has been collected and identified by the author.

Coleophoridae

Coleophora arctostaphyli Meder, synonym: *C. karvoneni* Kanerva

1 ♂ Leiret, Elverum HEs (EIS 55), 12 June 1980, ex pupa on *Arctostaphylos uva-ursi* (L.), imago 22 June 1980; 1 ♂ Vestad, Elverum HEs (EIS 55), 28 July 1980, in light trap; 2 ♀♀ Vestad 16 May 1981, ex larvae on *A. uva-ursi*, imagines July 1981; 1 ♀ Vestad 28 June 1981, netted at dusk. In addition some vacated mines and larval cases were found in spring both in 1980 and 1981.

The forewings of *C. arctostaphyli* are brown with a white costal streak. The antennae are ringed white and brown. Thus *C. arctostaphyli* closely resembles *C. peri* Svensson and *C. albicostella* (Duponchel). However, the two latter species are not likely to occur in Norway. The genitalia of *C. arctostaphyli* are figured by Kyrki & Viramo (1975) and Patzak (1974).

The biology is dealt with by Kyrki & Viramo (1975). The larva is monophagous on *Arctostaphylos uva-ursi*, and the imago appears from the beginning of June until the end of July.

C. arctostaphyli has been collected in Denmark, Sweden, Finland, USSR (Carelia, Estonia), Poland, Germany, Scotland and Corsica (Kyrki & Viramo 1975, Leraut 1980, Patzak 1974). In Sweden it has been found in Gotland, Östergotland, Bohuslän and Södermanland (Svensson 1974, 1976), and in Finland it is recorded from many provinces north to Kuusamo (Kyrki 1978).

Oecophoridae

Aplota palpella (Haworth)

1 ♂ N. Sletter, Råde Ø (EIS 19), 5 July 1981, ex pupa, imago 14 July 1981. The specimen was reared from moss growing on rock.

A. palpella is characterized by its palpi which has the median joint long, straight and directed forward, terminal joint small and almost concealed by the bushy scaling of the median joint. Forewing blackish brown sprinkled with ochreous yellow scales and with three dark dots. Hindwings blackish brown. Expanse 10—14 mm. The wings are figured by Palm (1978).

In south Finland another *Aplota* species occurs, *A. kadeniella* (Herrich-Schäffer). *A. kadeniella* differs from *A. palpella* as follows: Forewings narrower and wihout ochreous yellow scales. Terminal joint of palpi not hidden by the brushy scaling of the median joint. Toll (1964) figures head, wings and genitalia of both species.

The larvae of *A. palpella* feeds on moss growing on the trunks of different deciduous trees. Palm (1978) also mentions that it has been observed feeding on moss growing on sandstone. The Norwegian locality is a small island in the Oslofjord. Not a single tree is growing there.

A. palpella is on the wing in July and August.

The moth occurs sporadically throughout Europe. In Denmark it is rare and local (Palm 1978). In Sweden it has been collected in Skåne, Halland and Öland only (Svensson 1976, 1978). It has not been found in Finland.

Depressaria silesiaca Heinemann, synonym: *D. freyi* M. Hering

1 ♀ Smestad, Lillehammer Os (EIS 54), 20 August 1978, S. Svendsen leg.; and 1 ♂ Vestad, Elverum HEs (EIS 55), 26 July 1981. Both specimens were captured in light traps.

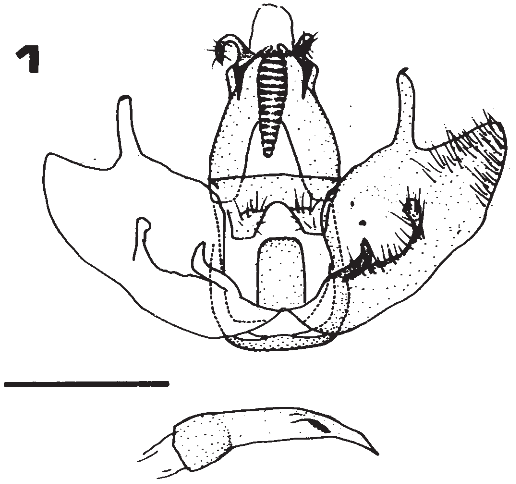

Fig. 1. Male genitalia of *Depressaria silesiaca* Hein. Scale: 0,5 mm.

D. silesiaca (Fig. 2) does not closely resemble any other Norwegian *Depressaria* species. Forewings reddish brown with greyish white scales present especially along costa and on both sides of the curved fascia before termen. Black scales mark the veins in the terminal part of the wing, and form a black line in fold. Black spots in cell are connected with each other by a thin line. Hindwings light grey. Head and thorax reddish brown with many greyish white scales. Expanse 15—18 mm. Male genitalia, Fig. 1.

In Sweden *D. silesiaca* has been reared from *Artemisia vulgaris* L. (Svensson 1976). Ellerton (1970) mentions that in Scotland larvae have been found on *Achillea millefolium* L.

In Sweden *D. silesiaca* has been observed in five provinces from Uppland and Värmland to Norrbotten (Benander 1946, Svensson 1974, 1976, 1980). In Finland it is distributed from the south coast north to Ostrobottnia borealis, southern part (Kyrki 1978). The species is also recorded from Scotland and Poland (Ellerton 1970, Toll 1964).

Gelechiidae

Monochroa elongella (Heinemann), *servella* sensu Benander 1945

1 ♂ Sildebauen, Rygge Ø (EIS 19), 3 July 1980. The specimen was netted in the evening near the sea shore.

M. elongella and related species are dealt with by Benander (1945) who also figure the male genitalia.

The larva lives in flower stems of *Potentilla anserina* L. (Hackman 1941). Flight period last part of June and July.

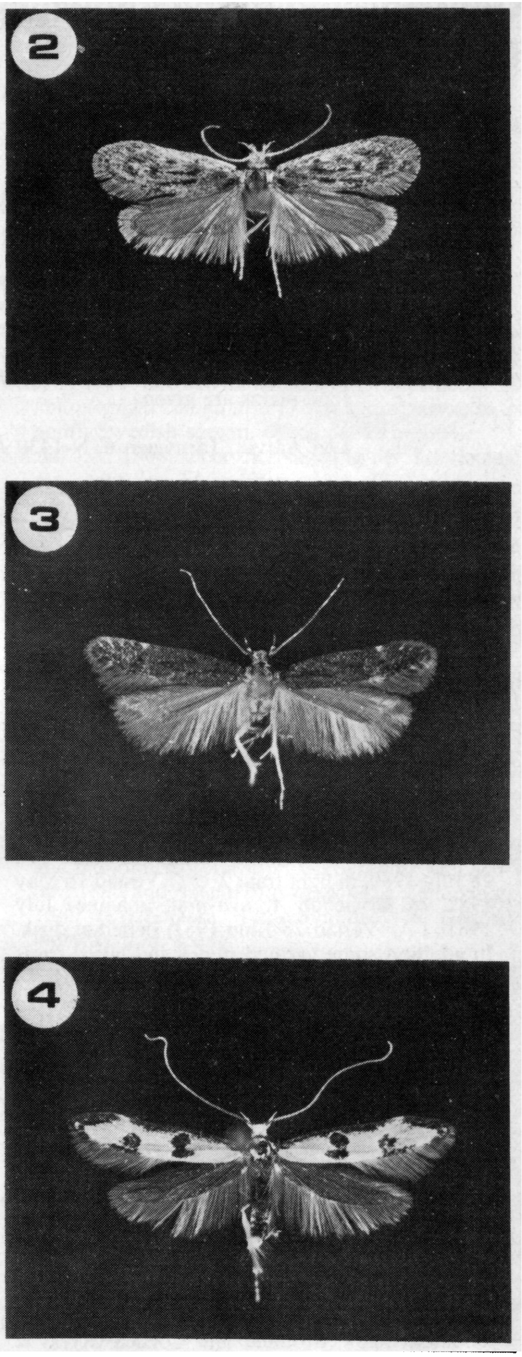

Fig. 2—4. — 2. *Depressaria silesiaca* Hein. — 3. *Monochroa elongella* (Hein). — 4. *Heinemannia laspeyrella* (Hb.).

In Sweden *M. elongella* has been collected in ten provinces fron Skåne to Medelpad (Benander 1946, 1953, Svensson 1974, 1977, 1981). It is recorded from six provinces in south Finland (Kyrki 1978). Odtherwise distributed in Denmark, England, France, Germany, Poland, Lithuania and Latvia (Karsholt in litt.).

Gelechia hippophaella (Schrank)

4♂♂ 1♀ Ås AK (EIS 28), 22 August — 11 September 1981. The specimens were captured in a light trap.

Schnack (1978) figures the wings of *G. hippophaella* and related species, and the genitalia are figured by Sattler (1960).

The food-plant of *G. hippophaella* is *Hippophae* L. which occurs extremely scattered in Norway. However, it is sometimes grown in gardens. There are several trees in a garden not far from the spot where the trap was standing.

G. hippophaella is on the wing during the last part of August and in September.

In Sweden the moth has been collected along the east coast from Uppland to Norrbotten, and in Bohuslän on the west coast (Benander 1946, 1953, Svensson 1974, 1977, 1980). In Finland there are records along the west coast north to the Swedish border (Kyrki 1978). Otherwise *G. hippophaella* is distributed in central Europe including Denmark and Britain (Sattler 1960, Schnack 1978).

Agonoxenidae

Heinemannia laspeyrella (Hübner)

1♂ Brønnøya, Asker AK (EIS 28), 2 July 1980. The specimen was flying in sunshine on the edge of a grove of deciduous trees.

H. laspeyrella is a brilliant insect (Fig. 4); the forewings are bright yellow, edged black along costa and termen, and with three white-edged black spots. The two inner spots form an 8-shaped figure. Hindwings and cilia are grey. Expanse 17—20 mm.

The biology of *H. laspeyrella* is not known. It is on the wing in June and July.

In Sweden this species has been collected in Småland, Öland, Gotland, Västergötland and Dalarne (Benander 1946, Svensson 1974, 1980). It is also distributed in south Finland (Kyrki 1978), but is absent from Denmark. Otherwise found in south and central Europe (Riedl 1969).

Scythrididae

Scythris noricella (Zeller)

1♂ Rambekk, Gjøvik Os (EIS 45), 9 August 1981; 2♂♂ 8 August 1982 (same locality). The specimens were captured in a light trap which was situated in a garden.

S. noricella may easily be separated from other Norwegian *Scythris* species by its larger size (expanse 18—21 mm). The characteristic male genitalia are figured by Wolff (1964).

The larvae of *S. noricella* feeds on *Chamaenerion angustifolium* (L.), and the imago appears in July and August.

S. noricella is a boreo-alpine species which is distributed in the mountains of central Europe, in Fennoscandia and in Greenland (Wolff 1964). In Sweden it has been collected in six provinces from Dalarne and Gästrikland north to Norrbotten (Benander 1946, 1953, Svensson 1981, 1982), and it has been found in five provinces of south and central Finland (Kyrki 1978).

Tortricidae

Epiblema rosaecolana (Doubleday)

2♂♂ Blindern, Oslo AK (EIS 28), 28 July and 17 August 1958, A. Gussgard leg. The specimens were captured in a light trap which was situated in a garden. I discovered the two specimens in the collection of the Norwegian Institute of Plant Protection at Ås. They had been dissected and identified by the collector (the genitalia were mounted on the pins), but for some reason the record was never published.

E. rosaecolana and related species are dealt with by Bradley et al. (1979) who also figure the wings. The genitalia are figured by Bentinck & Diakonoff (1968).

The food-plant of *E. rosaecolana* is *Rosa* L. and it is on the wing in June—August.

In Sweden *E. rosaecolana* has been recorded in Skåne, Blekinge, Öland and Södermanland (Svensson 1974, 1982), and in Finland there are records from three southern provinces (Kyrki 1978). Otherwise distributed from western Europe to eastern USSR, China and Japan. It was introduced into USA (Bradley et al. 1979).

Cydia servillana (Duponchel)

1♂ Kviberg, Lardal VE (EIS 18), May—June 1980, A. Bakke leg. The specimen was captured in a trap fitted with pheromones which were designed to attract *C. strobilella* (L.). Two other *Cydia* species were also trapped: *C. illutana* (Herrich-Schäffer) and *C. corollana* (Hübner).

C. servillana is an unmistakable species and it is figured by Bradley et al. (1979). The genitalia are figured by Bentinck & Diakonoff (1968).

The larva lives internally in one year old twigs of *Salix caprea* L. and *S. cinerea* L., causing a slender gall. In spring the larva pupates within the gall, and the imago appears in May and June (Bradley et al. 1979).

In Sweden there are records of this species from Skåne, Blekinge, Öland, Gotland and Bohuslän (Benander 1946, Svensson 1974, 1976). In Finland there are records from five southern provinces (Kyrki 1978). Otherwise distributed in Europe eastwards to the Ural Mountains (Bradley et al. 1979).

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Piophila (Amphipogon) flava (Zett. 1838) in Norway (Dipt., Piophilidae)

LITA GREVE AND JOHN O. SOLEM

Greve, L. & Solem, J.O. 1983. *Piophila (Amphipogon) flava* (Zett. 1838) in Norway. (Dipt., Piophilidae). *Fauna norv. Ser. B. 30,* 81—83.

In the Dovre mountains near Kongsvoll, Oppdal County, province of S. Trøndelag, 433 males and 421 females of *Piophila flava* (Zetterstedt, 1838) were caught in Malaise traps during 1980 and 1981. Highest numbers occurred in a trap in the subalpine birch belt having grassy areas nearby. Some catches were also made above the tree line in the low alpine zone. The flight period extends July, August, September and early October. Tendency to an upstream flight in males is discussed. The sex ratio was 50.7% males and 49.7% females. The known distribution of *P. flava* in Norway is given.

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INTRODUCTION

Piophila (Amphipogon) flava (Zett. 1838) was recorded from Norway for the first time by Ringdahl (1954). One specimen was found on a birch *(Betula* sp.) trunk during the summer 1926 in Tromsø, Troms province.

The following material can in addition be listed from Norway: HEN: Tynset, Kvikneskogen 18—27. July 1977 1 male coll. et det. V. Michelsen (Museum of Zoology, Univ. of Copenhagen). HOI: Eidfjord, Stigstuv 15. July 1972 1 male on *Salix* sp. coll. et det. A. Fjellberg (Zool. mus., Univ. Bergen). FØ: Sør-Varanger, Gjøkvann 16. July 1969 1 female leg. I. & T. Nielsen det. B.H. Cogan (Zool. mus., Univ. Bergen). Ringdahl (1951) reports *P. flava* to be rare in Sweden, and the species has been recorded from Upland to Lapland. It has been collected from trunks of birch. Hennig (1943) reports the species from Germany, Poland and Czechoslovakia. Hackman (1980) reports the species from Finland.

The *P. flava* males are easy to recognize on account of the many well developed peristomal bristles. The male hypopygium is also fitted with tufts of setae. The trochanters of the median pair of legs carry each one long seta curved at the end. The hind femura carry a row of long hairs. Hennig (1943; Fig. 32, p. 49) has a figure of a male specimen. The female lacks, due to sexual dimorphism, both peristomal bristles and bristles in connection with legs and the abdomen. Both sexes have characteristic dorsal longitudinal stripes on thorax, however, these vary somewhat from specimen to specimen, and in some specimens the thorax is nearly wholly black (Fig. 1).

Malaise traps were operated in three sites in 1980: (1) Blesbekken, 1000 m a.s.l., subalpine birch forest, UTM: 32V-NQ323072; (2) Raubekken, 900 m a.s.l., subalpine birch forest, UTM: 32V-NQ315082; (3) Raubekken, 1100 m a.s.l., lower alpine zone, UTM: 32V-NQ324079. All localities lie in the lower part of the western slope of the mountain S. Knutshø, east of Kongsvoll, Oppdal county, Sør-Trøndelag province. All sites in EIS 79.

Three Malaise traps were in 1981 operated in Blesbekken, two traps at 1000 m a.s.l. in the subalpine birch forest, UTM: 32V-NQ3207. One two-sided Malaise trap was used in 1980 and two in 1981. The traps were positioned across the stream with the prime objective to collect aquatic insects.

RESULTS AND DISCUSSION

Table 1 shows the number of individuals of *P. flava* collected in the various traps during 1980 and 1981. The Malaise trap at Blesbekken 1980 and Blesbekken no 3 in 1981 was positioned at the same site the two years. This trap captured the highest number of individuals during the summers, and our interpretion of this is that this

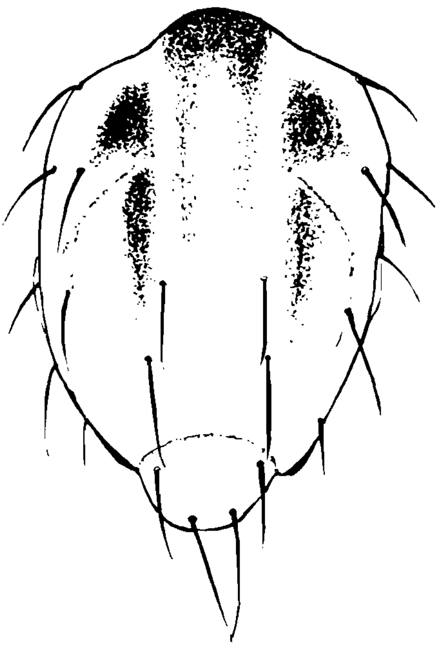

Fig. 1. Thorax, dorsal view, of *Piophila flava*.

trap was positioned close to a good habitat for the species. The biology and habitat of the larvae of *P. flava* are unknown, but the conspicuous difference between Blesbekken no 3 1981 and the other sites, was that Blesbekken no 3 1981 has much more grassy areas nearby. The terrestrial ground at the other sites are either much drier or much more wet, with heather or mosses, respectively. We assume that a good larval habitat in the subalpine birch belt is ground covered with grass.

The total flight period of *P. flava* in the Dovre mountain cover July until early October. The median, or the time when 50% of the summer total catch of individuals occurred was 11 August 1981 and 31 July in 1980. This difference is certainly caused by a much later spring in 1981 than in 1980.

Gøthberg (1973) showed that some terrestrial insects also fly upstream as many aquatic insects do (Müller 1982), and the two sided Malaise traps used at some sites gave data about an upstream or a downstream flight direction. The upstream and downstream catches of females of *P. flava* are not significantly different from each

Table 1. Numbers of individuals of *Piophila flava* collected in Malaise traps during 1980 and 1981, in the area of Kongsvoll, Dovre mountains, Sr-Tröndelag province. D = Downstream side, U = Upstream side of Malaise trap, M = Male, F = Female, * = $p < 0.05$.

1981		July				August				September					October	
		7	14	21	28	4	11	18	25	1	8	15	22	29	6	13
Blesbekken 1	M									1						
	F					1	1		1	3	1					
Blesbekken 2 D	M			1	1		12	2								
	F				6	2	4	5		1	1	1				
Blesbekken 2 U	M		1	1	2		11	3	1			1				
	F			1		3	6	8	4	2	2	1		1	1	
Blesbekken 3 D	M		6	5	5	15	94*	28*	9	1	2					
	F		2	3	2	19	43	18	10	2	1			2		
Blesbekken 3 U	M		3	2	3	17	57	14	13		3	1				
	F		1		1	13	40	26	16	7	6	5	1	1		

1980		July				August					September		October
		10	17	24	31	7	14	21	28	31	4	18	8
Raubekken 1200 m a.s.l.	M		1	1	1					2			
	F					2	1		1				
Raubekken U 900 m a.s.l.	M	1		2	5	2	2						
	F	1			4	7	2			4			1
Raubekken D 900 m a.s.l.	M		2		2								
	F			1	3	4		1		4			1
Blesbekken	M	1	1	2	59	21	5	8					
	F		1	1	51	32	9	15					

other, and no particular flight direction can be figured out. The numbers of males, however, captured 11 and 18 August 1981 on the downstream side of the trap, are significantly higher ($p < 0.-05$; X^2-test) than the corresponding numbers at the upstream side, and the males thus performed an upstream flight behaviour. However, as *P. flava* is a terrestrial insect (it has been suggested that the larvae develop in mushrooms), we cannot see the advantage of an upstream flight of males, if they had not been swept downstream by the wind prior to the catch, and were caught on their way back to the habitat. If we assume that the males are more active fliers at certain times (or may be all the time) than the females, the males will be more vulnerable to be borne by the current of winds than the females. An upstream flight to compensate for that could be the reason for the significance of higher numbers of males flying upstream than downstream at the particular time in August 1981.

When compiling the catches for the two years, the sex ratio was estimated to 50.7% males and 49.3% females.

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Phenology and species composition of Syrphidae (Dipt.) in a meadow habitat

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Hågvar, E.B. 1983. Phenology and species composition of Syrphidae (Dipt.) in a meadow habitat. *Fauna norv. Ser. B, 30,* 84—87.

Species composition of adult syrphids was studied from May to October in a meadow habitat at Gaustad, Oslo, during 1970 and 1971. Duration of flowering in dominant plant species was also recorded. Twenty-eight syrphid species were identified. Species richness culminated in August. Most abundant species were *Syrphus ribesii* (L.), *Sphaerophoria scripta* (L.), *Sphaerophoria taeniata* (Meigen), *Eristalis arbustorum* (L.), *Syrphus vitripennis* Meigen, *Episyrphus balteatus* (DeGeer) and *Syritta pipiens* (L.).

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INTRODUCTION

The main intention of this work was to registrate which syrphid species occur during a season in a meadow habitat in south east of Norway. With the exception of Nielsen's (1971, 1972) studies at Jæren, western Norway, such syrphid investigations have not previously been performed in this country. The sampling technics were inadequate to present a quantitative picture of the fauna.

MATERIAL AND METHODS

Adult syrphids were collected from a meadow habitat at Gaustad, Oslo, in 1970 and 1971. The sampling area measured 10 x 20 m and was part of a larger open area sloping towards east. The vegetation in the sampling area differed somewhat in plant dominance from that of the surrounding meadow.

In 1970 only adult syrphids in the air or exposed on the vegetation were captured, by sweep-netting for 1—2 1/2 hours. In 1971, this method was supplemented by sweep-netting in the vegetation, with 200 strokes at each sampling. Sampling dates in 1970 were: 17, 20, 23 and 29 July; 10, 24 and 26 August; and 7 and 12 September. Sampling dates in 1971 were: 19 May; 4 and 23 June; 3 July; 6, 9, 20 and 31 August; 10 September; and 1 October. On 20 July and 10 August 1970 some syrphid larvae were collected and reared to adults in the laboratory. Because the sampling techniques are not strictly quantitative and may also be selective, additional notes were made about the visual impression of syrphid species dominance in the habitat.

In both years, syrphids were collected mainly on sunny days with little wind.

RESULTS

The vegetation was not quantitatively analysed. However, fig. 1 illustrates the duration of flowering in dominant plant species through a season, based on an average for the two years.

The picture was about the same in both years, except for *Cirsium arvense* (L.) which in 1970 had a somewhat shorter flowering period than in 1971, probably caused by more heavy infestation by the bean aphid, *Aphis fabae* Scopoli.

Bean aphids were also observed on *Matricaria indora* L. The dominant flowering plant species through most of the season were *C. arvense, M. indora* and Achillea millefolium L. *M. indora* obviously served as a valuable pollen source, and adult syrphids were often observed on this plant. Egglaying syrphids were apparently attracted by the heavily aphid infested *C. arvense,* syrphid eggs and larvae being quite commonly observed in July and August on this plant.

Twenty-eight identified syrphid species were collected from the habitat (Fig. 2). No females of *Sphaerophoria* have been identified to species.

The figure illustrates the change in species composition in the habitat for both years. Because of the unreliable quantitative sampling techniques, only the presence of a species and not the number of specimens at each sampling is gi-

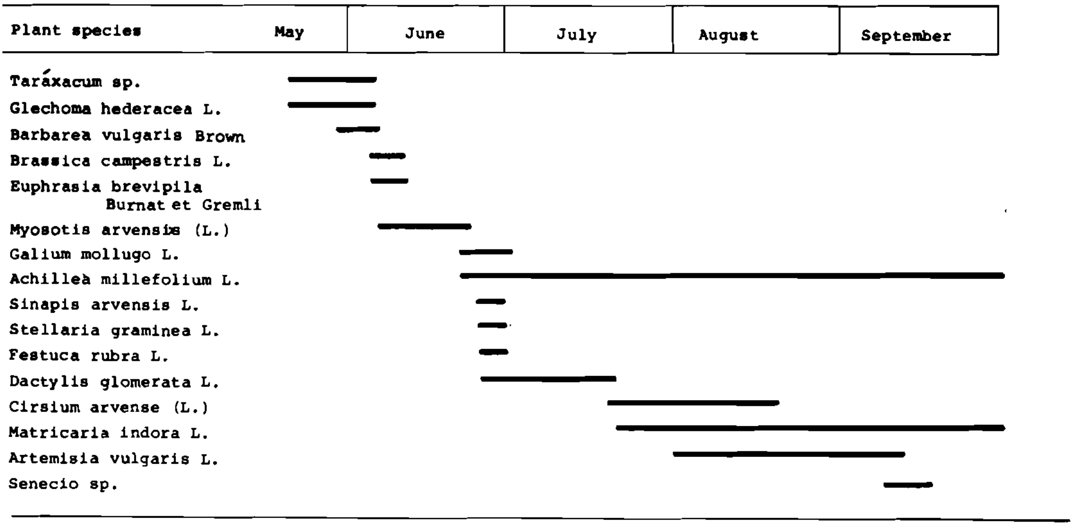

Fig. 1. Duration of flowering in dominant plant species through a season, given as an average picture of 1970 and 1971.

Syrphid species	May	June		July					August							September			
	19	4	23	3	17	20	23	29	6	9	10	20	24	26	31	7	10	12	
Sphaerophoria sp. (♀)	o	o	o				x		o	o	x	o	x	x		x			
Sphaerophoria scripta (L.)	o	o		o					o	o	x			x	o	x	o		
Metasyrphus luniger (Meigen)	o						x		o	o	x					x			
Syrphus ribesii (L.)	o							x	o	o	x	o	x	x	o	x	o		o
Metasyrphus lundbecki (Soot-Ryen)	o								o	o				x		x			
Pipizia bimaculata Meigen		o																	
Platychirus anguetatus (Zetterstedt)		o	o	o															
Metasyrphus latifasciatus (Macquart)		o							o										
Sphaerophoria taeniata (Meigen)		o							o										
Platychirus albimanus (Fabricius)		o													o		o		
Syritta pipiens (L.)					x		x	x				o	x	x			o		
Syrphus torvus Osten-Sacken					x							o			o	x	o		
Eristalis arbustorum (L.)					x		x	x	o		x	o		x	o	x	o		o
Cheilosia sp.						x													
Cheilosia velutina Loew							x												
Cheilosia vernalis (Fallen)							x	x		o		o							
Metasyrphus corollae (Fabricius)							x		o			o							
Episyrphus balteatus (DeGeer)							x		o			o	x	x	o	x		x	
Volucella pelluscens (L.)								x											
Neoascia podagrica (Fabricius)									o										
Dasysyrphus lunulatus (Meigen)										o									
Platychirus clypeatus (Meigen)										o									
Eristalis nemorum (L.)										o		o							
Syrphus vitripennis Meigen										o		o	x	x		x		x	
Phalacrodira vittiger (Zetterstedt)														x					
Volucella inanis (L.)														x					
Heliophilus pendulus L.														x	o	x			
Eristalis tenax (L.)														x					o
Platychirus peltatus (Meigen)															o				
Eristalis pertinax (Scopoli)															o	x			o
Number of identified species	4	6	2	2	3	0	8	5	10	9	4	10	5	11	9	10	6	2	4

Fig. 2. Species composition of adult Syrphidae during two seasons (x: 1970, o: 1971).

ven. Yet some generalization concerning the dominant species can be made, based on Fig. 2 and additional notes made during the samplings: In May to first part of July species of *Sphaerophoria* dominated in number, *Sphaerophoria scripta* (L.) and *Sphaerophoria taeniata* (Meigen) being about equally numerous. In last part of July also *Eristalis arbustorum* (L.) and *Syritta pipiens* (L.) became very common. During the first part of August, *Syrphus ribesii* (L.) increased significantly in number, and dominated among the syrphids during the next month. In the last half of August, *Ephisyrphus balteatus* (DeGeer) became successively more common and was among the dominating species throughout rest of the season together with *S. ribesii*, *Eristalis* species and *Sphaerophoria* species.

Because of the sampling dates, the two years can be compared from August on. The picture was quite similar for the dominating species. Some of the less common species were found in one of the years only.

By the present sampling methods, species richness was greatest in August. During October, the adult syrphids disappeared from the habitat.

In July/August 1970, syrphid eggs and young larvae (1st and 2nd instars) were rather commonly observed among dense bean aphid colonies on *C. arvense*. The majority (70%) of those larvae collected for breeding to adult, died as larvae or parasitized pupae. From the few adults that emerged, it appeared that larvae collected on 20 July belonged to *Metasyrphus corolae* (Fabricius) and larvae collected on 10 August to *S. ribesii*.

DISCUSSION

The present results describe the phenology of syrphids in a particular, small meadow habitat. Absent species may well occur in the surrounding habitats, just as present species may have occurred in the surroundings before they were recorded in the studied habitat.

Several investigations on the syrphid fauna in various habitats also include information on seasonal variation in the occurrence of different species (Schneider 1958, Banks 1959, Bombosch 1963, Belákova 1966, Nielsen 1971, 1972, Pollard 1971, Wnuk 1972, Dušek & Láska 1974, Bánkowska et al. 1975). The syrphid fauna in a certain habitat at a particular time is a result of both the present flora, which offers food and/or oviposition sites, and the developmental biology of each syrphid species, particularly hibernation stage and generation number. Dûsek & Láska (1974) were able to correlate the sequential spring emergence of some dominant syrphid species with the thermal requirements of the hibernating stages.

In the present study, the number of flowering plant species culminated in June, whereas species richness of syrphids in this particular habitat was highest in August. Apparently, life cycle of the flies determine their phenology. However, the rich fauna in August may also be explained by the late summer migration of species into the habitat from the surrounding vegetation and by poor representation of spring species due to small first generation populations.

Because the developmental biology shows geographical variations, the present results are best comparable with those of Nielsen (1971, 1972) from Jæren, Norway. However, his material was sampled from different biotopes, which were described by nourishing flowers for the syrphids. Most abundant species in Fig. 2 were *S. ribesii, S. scripta, S. taeniata, E, arbustorum, Syrphus vitripennis* Meigen, *E. balteatus* and *S. pipiens*. The majority of the listed species have aphidophagous larvae, exceptions are *S. pipiens, Neoascia podagrica* (Fabricius), *Heliophilus pendulus* L. and the species of *Eristalis, Cheilosia* and *Volucella*. The syrphid species listed in Fig. 2, except *S. taeniata, Volucella inanis* (L.) and *Cheilosia velutina* Loew are all recorded from Nielsen's studies on Jæren, where most of these species are characterized as eurytope and common. The occurrences in Fig. 2 fit with the flight periods from Jæren, although last observations of adult *S. ribesii, Phalacrodira vittiger* (Zetterstedt), *Heliophilus pendulus* L. and *Platychirus peltatus* (Meigen) were slightly later than recorded from Jæren, and first observations of adult *S. ribesii* and *S. scripta* slightly earlier.

In the investigation from Jæren, some species occurred most commonly in spring and early summer, as *Syrphus torvus* Osten-Sacken, *Dasysyrphus lunulatus* (Meigen), *P. vittiger, Platychirus albimanus* (Fabricius), *Platychirus clypeatus* (Meigen) and *P. peltatus*. Others were most numerous in late summer and autumn, as *S. ribesii, M. corollae, S. scripta, E. balteatus, Eristalis tenax* (L.) and *Eristalis pertinax* (Scopoli). Only the most abundant species in the present study can be compared with such trends, which fit well for *S. ribesii* and *E. balteatus*. On the other hand, *S. scripta* appeared about equally numerous in May as in the autumn.

Generally, syrphids hibernating as adults are likely to be seen early and/or late in the season.

Fig. 2 illustrates this for *Metasyrphus luniger* (Soot-Ryen) and *E. tenax,* which together with *E. balteatus* and *N. podagrica* apparently hibernate as adults in Norway (Nielsen 1971, 1972). Most syrphid species, however, probably spend the winter as larvae in diapause or quiescence. In the south east of Norway, hibernating as mature larvae has been demonstrated for the 3 common species *S. ribesii, S. vitripennis* and *S. torvus* (Hågvar in prep.). In that study, *S. ribesii* started to pupate in April/May and emerged in May and June. The early record of this species in Fig. 2 supports such development even though adults were not recorded from the habitat in June. Probably, a second generation developed in August.

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Additions to the Norwegian fauna of calypterate Diptera (Tachinidae, Calliphoridae, Muscidae)

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Data on *Linnaemya perinealis* Pandellé, 1895 (Tachinidae), *Boreellus atriceps* (Zetterstedt, 1845) (Calliphoridae), *Helina cilipes* (Schnabl, 1911), *Spilogona puberula* (Ringdahl, 1918), *S. sanctipauli* (Malloch, 1921), *S. trilineata* (Huckett, 1932), *Limnophora scrupulosa* (Zetterstedt, 1845) and *L. sinuata* Collin, 1930 (Muscidae), all recently captured in Norway for the first time, are presented. *S. trilineata* is also reported as new to the Palaearctic Region, and *L. sinuata* as new to the Palaearctic mainland. A new record of *B. atriceps* from Svalbard is presented and its biology discussed.

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Below are reported some rather interesting captures of flies made in Norway mainly during the summer 1982. None of them have been recorded from this country before. Unless otherwise stated the specimens have been caught by the author and are in his collection. Some duplicates have been presented to the British Museum (Natural History), London (BMNH), Museum of Zoology, Copenhagen (ZMC), and Staatliches Museum für Naturkunde, Stuttgart (SMNK). The Norwegian localities are presented according to the system of Økland (1981).

Family Tachinidae

Linnaemya perinealis Pandellé, 1895.

Material: — Oppland, OS, Sør-Fron: Harpefoss, EIS 62, 1 ♂ 14 July 1981, T. Nielsen, Malaise-trap; ON, Nord-Fron: 3 km E of Vinstra, EIS 62, 1 ♂ 17 July 1982, Ø. Rognes; 11 ♂ ♂ 17 July 1982 (2 ♂ ♂ in SMNK).

All specimens from 1982 were mounted with the terminalia partly extended, and one male has been dissected. The genitalia agree with the figures given by Herting (1961), Chao (1962) and Zimin (1954, 1963). The specimens from 1982 were netted in low vegetation during the early part of a sunny day after a night with very heavy rainfall, one of the very few during the extremely dry summer of 1982. The species is very characteristic on account of the two successive pairs of discal setae on T3 and T4, the shape and size of the cercal plate, and the narrowness of the surstyli. Its host is unknown. Benno Herting, Ludwigsburg, has kindly examined my material and agrees with my identification.

The species has been recorded from the Pyrenees (type specimen in Paris revised by Herting 1961, cf. also Herting 1978), USSR (Zimin 1954), Mongolia (Zimin 1954, Mesnil 1972, Herting 1973) and China (Chao 1962).

Family Calliphoridae

Boreellus atriceps (Zetterstedt, 1845).

Material: — Oppland, ON, Lom: 1 km N of Krossbu, 1250 m, lower to middle alpine zone; EIS 60, 2 ♂ ♂ 1 ♀ 22 July 1982; 1 km W of Sognefjellhytta, 1400 m, middle alpine zone, EIS 60, 1 ♂ 3 ♀ ♀ 22—23 July 1982; 1 ♂ 22—23 July 1982, A. Rognes; 3 ♂ ♂ 5 ♀ ♀ 22—23 July 1982, T. Rognes; 1 ♂ 22—23 July 1982, T. Rognes, BMNH; 3 ♀ ♀ 22—23 July 1982, Ø. Rognes; 1 ♂ 22—23 July 1982, Ø. Rognes, BMNH. — Sogn og Fjordane, SFI, Luster: 1,5 km N of Berdalseter, 1300 m, middle alpine zone, EIS 60, 1 ♂ 1 ♀ 23 July 1982, A. Rognes.

All the localities are in the western part of the Jotunheimen mountain massif. Specimens were attracted by and captured with hand net on slices of fresh (2—4 days since frozen condition) liver exposed to the sunshine and observed almost continuously for varying periods of time. One of the males was taken close to the putrid carcass of a hare *(Lepus timidus* L.) teeming with fly larvae. The weather was sunny and clear with a slight breeze. Lemming *(Lemmus lemmus* (L.)) burrows were observed and faecal pellets were abundant

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all over the ground at all localities. Especially the locality W of Sognefjellhytta was obviously the winter-burrows of lemmings. Attempts to attract the species with liver slices in the upper alpine zone near Juvasshytta (ON, Lom, 1841 m) were unsuccessful, despite of good weather conditions. No lemming burrows or faecal pellets were observed in that area, however.

The species was first described by Zetterstedt (1845: 1311, as *Sarcophaga atriceps)* from a single female specimen captured by Dahlbom «ad radicem alp. Mullfjellen . . .» (Sweden, Jämtland) 27 July 1840, now in Museum of Zoology, Lund. In the Swedish Museum of Natural History, Stockholm, is another female which I have been able to examine. It is labelled (1) «Gl.» (2) «P.Wg.», which means that it has been taken on Gotland by the well known entomologist Peter Fredrik Wahlberg, who lived from 1800 to 1877, according to Smith (1981). No other records from Sweden exist, and surprisingly the species was unknown to Ringdahl (1945: 210, «ej känd av förf.»). In Finland *B. atriceps* was recorded by Bonsdorff (1866: 143) from «Lappmarken» and «Tuovilanlaks» (now Tuovilanlahti = Maaninka in Savonia borealis) (specimens not seen). The only modern record in Scandinavia is from above the tree-line on the hill Ailigas in northern Finland (Lapponia inarensis: Utsjoki), where 2 ♂ ♂ and 10 ♀ ♀ were captured in blow-fly traps baited with meat or human faeces (Nuorteva 1964, Hedström & Nuorteva 1971). Outside Scandinavia the species is known from Svalbard (Collin 1925, cf. Nuorteva 1967), the arctic parts of the USSR (Zumpt 1956, Chernov 1959, 1961, 1965, Lobanov 1976), the arctic parts of North America (Hall 1948, McAlpine 1965) and Greenland (Collin 1931). It is a blowfly species to reach very far to the North. According to map given by McAlpine (1965: 78) it occurs well N of 80°N at Ellesmere I., and I have recently been able to examine 3 ♂ ♂ and 2 ♀ ♀ taken at Bockfjorden, Haakon VII Land, Vest-Spitsbergen, a locality at about 79° 30'N 13° 20'E (specimens in Tromsø Museum).

Dead mammals belonging to the following species have been reported to serve as larval food for *B. atriceps:* walrus *(Odobenus rosmarus* (L.)) (Hall 1948), lemming *(Dicrostonyx groenlandicus* (Traill)), arctic hare *(Lepus arcticus* Ross), husky dog *(Canis familiaris* L.) (McAlpine 1965), lemming *(Lemmus obensis* (Brants) = *Lemmus sibiricus* of Walker et al. 1964), Middendorf's vole (probably *Dicrostonyx torquatus* (Pallas)) (Chernov 1965), arctic fox (obviously *Alopex lagopus* L.) (Collin 1925, cf. Nuorteva 1967). McAlpine relates the fantastic number of 1812 adults to have emerged from a single medium sized carcass of *D. groenlandicus.* Dead *Lemmus lemmus* (L.) is probably the main substrate for larval development in Scandinavia, although no direct evidence such as successful breeding has been reported as yet.

McAlpine relates the interesting observation from Ellef Ringnes I. (Canada, NWT) that larvae of *B. atriceps* do not go underneath the carcass or downward under protective soil for pupation, as other blowflies do, but move to the exterior of the carcass and pupate in the hair exposed to the sun to receive the fullest possible benefit of the insolational heat, both directly and indirectly by the heat absorbed by the dead animal's hair. Chernov's (1965:81) observation near Dickson (USSR: western part of Taymyr Peninsula) that the many dead lemmings *(«Lemmus obensis* Brants» = *L. sibiricus)* «lying freely on the ground» were infested to the maximum level with *B. atriceps* larvae is consistent with McAlpine's observations. It is also remarkable that *B. atriceps* was not among the species obtained from carcasses of lemmings (again *L. obensis,* rendered as «Siberian lemming» in the *Ent. Rev. Wash.* translation p. 43, whereas «obskogo lemminga» i.e. obslemming is used in the original) and «short-skulled voles» dead in burrows (Chernov 1965: 81). Nuorteva's citation of Chernov (1961) to the effect that «*Boreellus atriceps* develops in the burrows of *Lemmus lemmus* (L.)» (Nuorteva 1964: 225) is possibly due to a mistranslation of the relevant parts of Chernov's work (1961: 37, lines 22—23 from above). Chernov here reports to have found larvae and puparia of *B. atriceps* in humus nearby burrows, not within as implied by Nuorteva, and states elsewhere (1961: 37, lines 8—9 from below) that the larvae develop in rotting meat. Neither can I find that the specific name «*Lemmus lemmus* L.» is mentioned by Chernov (1961) who only uses the general expression «lemming». *Lemmus lemmus* (L.) does not exist as far east as Anabar Bay (Yakutskaya ASSR) (about 115°E) which was the study area of Chernov (1961), and *Lemmus sibiricus* is probably the species meant (cf. information on distribution in Walker et al. 1964).

Equally problematical are Nuorteva's (1967: 62) statement to the effect that the adults are able «to take shelter in the burrows of lemmings» and Hedström & Nuorteva's (1971: 125) reference to its «occurrence in the burrows of lemmings». In fact I can find no evidence to this effect in the sources cited by these authors (i.e. Chernov 1961, McAlpine 1965), although it may of course be true. However, I think it likely that the adults are able to seek refuge in any space below upper ground level, e.g. also in crevices beneath or between stones, a type of shelter abundantly available in most parts of alpine and arctic habitats, and that the presence of lemming burrows *per se* does not play a decisive role, if a role at all, in the ability of the species to withstand the rigorous conditions of the arctic as implied by Nuorteva and Hedström. Note that *B. atriceps* apparently thrives well at Svalbard where no burrowing rodents occur. The association of *B. atriceps* with lemming burrows observed in other parts of the Arctic (Chernov 1961) and also shown by the Norwegian localities cited above may simply be due to a higher frequency of carcasses in such areas than elsewhere.

McAlpine (1965: 90—91) suggests that the key to the understanding of the success of insects such as *B. atriceps* in the harsh conditions of the Arctic is an ability on their part to tolerate «frequent interruptions of development in various stages», which would result in the extension of «individual life cycles over a period of several years» for some portion at least of the breeding population, assure «continuation of the species regardless of conditions in any single season», and amount to «perenniality in generations, a well known and apparently indispensible characteristic of the plants that grow in such areas». He relates the case of a dead husky at Ellef Ringnes I. on which were present all stages of *B. atriceps* during the whole period of his visit there. He thinks it is a strong possibility that some of the specimens might «have taken several years to complete their life cycles». This may also be the case for the Scandinavian population of this species although no experimental or other evidence is available.

B. atriceps «is one of the earliest insects to appear in the spring in the High Arctic» (McAlpine 1965) and the adults were observed before 13 July on Ellef Ringnes I. (about 79°N). Chernov (1961) lists it is common in the first third of June at the tundra near Anabar Bay (about 73°N). It is not known whether this early appearance is due to survival through the winter of (almost) fully matured larvae, of puparia or of adults.

The adults have been reported to visit meat and faecal matter (Chernov 1961, Nuorteva 1964), and Chernov (1961) lists it as commonly visiting flowers at the study area of Anabar Bay. No observation of flower visits exists from Scandinavia.

B. atriceps adults are well equipped for life in arctic environments by having a very dark shining blue-black integument which to me appears quite identical to that of *Protophormia terraenovae* (Robineau-Desvoidy, 1830) whose skin is well able to absorb radiant heat and probably also protects against ultraviolet radiation (Sýchevskaya & Shaidurov 1965, Sýchevskaya 1966).

Family Muscidae

Helina cilipes (Schnabl in Schnabl & Dziedzicki, 1911).

Material: — Oppland, ON, Skjåk: 2 km W of Nordberg, about 450 m, EIS 70, 8 ♂♂ 21 July 1982; Nord-Fron: 3 km E of Vinstra, EIS 62, 1 ♂ 16 July 1982.

The specimens from Skjåk were taken on the ground or on stones at the edge of an old football-playground in a very dry sandy area with pine forest close to the river Otta. Many more could have been taken. Both localities lie to the E or NE of the Jotunheimen mountain massif and the climate is very dry, especially in the Skjåk area, since the predominantly south-westerly winds over southern Norway gives off all moisture as rainfall to the west of or within the higher mountain areas.

Of the specimens from Skjåk, one was mounted with extended terminalia and another dissected. The genitalia agree closely with the figures given by Hennig (1957). All the specimens have short, rather inconspicuous pale hairs on the underside of scutellum, as described by Fonseca (1968: 44) and Lyneborg (1970: 35).

The species has been recorded from Sweden (Skåne 1 ♂, Småland 1 ♂) (Ringdahl 1952, 1956), Finland (Nylandia 2 ♂♂, Karelia australis 1 ♂) (Tiensuu 1935), Poland, USSR (Lithauen, Leningrad district) (Hennig 1957), England (Dorset, at Studland) (Fonseca 1968) and Spain (Granada 6 ♂♂ 2 ♀♀ 2200—2550 m) (Lyneborg 1970).

Spilogona puberula (Ringdahl, 1918).

Material: — Sogn og Fjordane, SFI, Årdal: Vetti, 230 m, EIS 60, 1 ♂ 24 July 1982.

The specimen was taken on a stone at the bank of the swift-flowing river Utla in Utladalen just below the farm Vetti in the southern part of Jotunheimen. I have compared the specimen with all material of this species present in Ringdahl's collection in Lund, Sweden (7 ♂♂ O. Ringdahl leg, 1 ♂ 1 ♀ H.C. Huckett leg.).

The species has previously only been reported from Sweden (Torne Lappmark: Abisko; Jämtland: Åre) (Hennig 1959) and Alaska (Huckett 1965).

Spilogona sanctipauli (Malloch, 1921).

Material: — Oppland, ON, Lom: Juvasshytta, 1841 m, upper alpine zone, EIS 61, 7 ♂♂ 15 ♀♀ 19 July 1982.

The specimens were taken on the ground or within flowercups on a sunny day within a circumference of 200 m from the lodge Juvasshytta in the Galdhøpiggen mountain massif in Jotunheimen. One male has been dissected and the genitalia agree with the ones figured by Hennig (1959) and Huckett (1965).

The species is widely distributed in the arctic parts of North America and Greenland (Huckett 1965, McAlpine 1965). Together with one named *Spilogona obsoleta* (Malloch, 1920) it was the only muscid fly to occur at Ellef Ringnes I. (Canada, NWT), «the most barren part of the high arctic region» (McAlpine 1965: 73). According to Hennig (1959) it has also been captured in the arctic parts of the USSR (Kolyuchin I., Wrangel I., Taymyr Peninsula). Adrian C. Pont (in litt. 10 May 1981) informs me that he has seen many specimens from Northern Sweden (Torne Lappmark: Mt Nuolja near Abisko).

Spilogona trilineata (Huckett, 1932).

Material: — Oppland, ON, Lom: Juvasshytta, 1841 m, upper alpine zone, EIS 61, 1 ♂ 19 July 1982.

This record from the Galdhøpiggen mountain massif in central Jotunheimen is the first one from the Palaearctic Region. The single specimen which agrees fairly well with Huckett's description (1932: 283) has been dissected and the terminalia agree with Huckett's (1965) figures. Adrian C. Pont has most kindly compared it with two specimens from North America in the collections of the BMNH and he agrees with my identification. Furthermore, I have myself compared it with two males from Canada (NWT: Eskimo Point, G.G. DiLabio leg.; Chesterfield, J.G. Chillcott leg.) (both in my own collection), and one male from USA (Alaska: Anchorage, 11 June 1921, J.M. Aldrich leg.) (in USNM). The holotype was taken at the latter locality 6 June 1921, also by J.M. Aldrich.

The species is very characteristic on account of the hairy eyes, the narrow grey dusted stripe on mesonotum along the *dc* setae, and the deep V-shaped excavation in the cercal plate. In the Norwegian specimen the parafacialia at the base of the antenna are narrower than the third antennal segment, a dusted spot on the middle of the disc of scutellum can hardly be said to be present, though a slightly greyish area is present apically, the spots of the abdomen tend to coalesce, especially on T3, and a darkened area of more or less coalesced spots is present on T5. The Canadian specimens are rather like the Norwegian one in all these respects. The specimen from Alaska, however, has the parafacialia distinctly broader above than below, and in the upper part broader than the third antennal segment. This segment is also narrower than in the other specimens I have seen. The spot on the middle of the disc of the scutellum is rather striking, and the spots on T3 separated by a distinct greyish white dusted line. On T5 no spots are present.

The species is widely distributed in northern North America from Alaska to Quebec and Labrador (Huckett 1965). Even though it has not been recorded from Greenland the presently known range parallels the type of amphi-atlantic distribution presented by e.g. *Carex scirpoidea* Michaux (Cyperacea) whose only known locality in the Old World is Solvågtind in northern Norway (NSI, Saltdal) (Hultén 1958, Gjærevoll 1973).

Limnophora scrupulosa (Zetterstedt, 1845).

Material: — Rogaland, RY, Sandnes: Graveren, EIS 7, 1 ♂ 27 Sept. 1981, 1 ♂ 6 June 1982, 2 ♂ ♂ 30 July 1982, T. Jonassen.

The locality at Graveren lies close to the southern end of Gandsfjorden, and the specimens were taken on clayey ground. Adrian C. Pont has kindly verified the identification of the specimen from 27 Sept. which has the terminalia exposed. They agree with Lyneborg's (1965a: 219) figures.

The species has been reported from Sweden (Skåne), Denmark (Jutland, Zealand), Great Britain (England, Scotland, Wales), Poland's baltic coast (Deep, Stolp), France (English Channel coast: Calvados, Pas-de-Calais; Pyrenees), E. Germany (Blankenburg), and USSR (New'yansk in Ural) (Hennig 1959, Lyneborg 1965a, Michelsen 1977).

Limnophora sinuata Collin, 1930.

Material: — Vest-Agder, VAY, Flekkefjord: 1 km NW of Eikåsgrend at Netlandsvatn, 197 m, EIS 4, 1 ♀ 3 Aug. 1981; Lindesnes: Buhølen, EIS 2, 1 ♂ 7 Aug. 1981. VAI, Sirdal: 2 km S of Tonstad, EIS 8, 15 ♂ ♂ 6 ♀ ♀ 2 Aug. 1981. — Rogaland, RY, Gjesdal: Between Eikjeskog and Mån, EIS 7, 5 ♂ ♂ 6 ♀ ♀ 21 June 1981; Madlandsheia along Fossbekken, 400—490 m, subalpine zone, EIS 7, 6 ♂ ♂ 3 ♀ ♀ 19 June 1982 (1 ♂ 1 ♀ in ZMC); Strand: towards Prekestolen, 300—500 m, subalpine zone, EIS 7, 5 ♂ ♂ 24 May 1981, 1 ♂ 13 June 1981 (in ZMC), 8 ♂ ♂ 9 ♀ ♀ 20 June 1981 (1 ♂ 2 ♀ ♀ in ZMC, 2 ♂ ♂ 2 ♀ ♀ in BMNH), 4 ♂ ♂ 5 ♀ ♀ 23 Aug. 1981. RI, Forsand: Røssdalen, EIS 7, 1 ♂ 5 June 1982; Songesand by Helmikstølen, EIS 8, 3 ♀ ♀ 5 Sept. 1982. — Hordaland, HOY, Bergen: Bjørndalen, subalpine zone, EIS 31, 1 ♀ 4 July 1982; Between Bjørndalen and Redningshytten, below tree-line, EIS 31, 1 ♂ 5 July 1982; Gullfjellet, above tree-line, 450—600 m, EIS 31, 2 ♂ ♂ 5 July 1982; Ulriken, above tree-line, about 500 m, EIS 31, 3 ♂ ♂ 29 June 1982. — Sogn og Fjordane, SFI, Årdal: Svalheim in Utladalen, 50 m, EIS 51, 5 ♂ ♂ 5 ♀ ♀ 25 July 1982; Vetti, by the river Utla, 230 m, EIS 60, 2 ♂ ♂ 1 ♀ 24 July 1982.

Limnophora islandica Lyneborg, 1965 is a junior synonym of *Limnophora sinuata* Collin, 1930 according to Adrian C. Pont (in litt. 9 Sept. 1982).

All the localities are in the western part of southern Norway, and all the material has been captured on stones at the banks of fast-flowing streams or rivers, except for one female taken at the edge of a lake. Several specimens have been dissected and the terminalia agree with Collin's (1930) and Lyneborg's (1965a) figures. I have also examined the male holotype and a male paratype (including genital preparations) of *L. islandica* in ZMC, and found them to be conspecific with the Norwegian specimens.

Ringdahl (1954) reports to have taken «*Limnophora exsurda* Pand.» in Aurland «på stenar invid en mindre fors» («on stones near a small waterfall», my translation) (Sogn og Fjordane, SFI, Aurland, EIS 51). I have been able to examine this material (taken 2 July 1949) which is in Museum of Zoology, Lund. 2 ♂ ♂ 2 ♀ ♀ belong, not unexpectedly, to *Limnophora olympiae* Lyneborg, 1965 (Lyneborg 1965b). A single female belongs to *L. sinuata*.

The species has previously been reported from W. Greenland (1 ♂ Orpiksuit, 68°37'N), E. Greenland (1 ♂ Hekla Havn, 70°27'N) (Collin 1930) and Iceland (1 ♂ Skutils fjördur, 1 ♂ Gránunes W of Hofsjökull, 1 ♂ 1 ♀ Skaftafell S of Vatnajökull) (Lyneborg 1965a). Thus its presently known range is a case of almost maximally restricted amphi-atlantic distribution.

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The tick *Ixodes uriae* (Acari, Ixodides) in seabird colonies in Norway

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Mehl, R. & Traavik, T. 1983. The tick *Ixodes uriae* (Acari, Ixodides) in seabird colonies in Norway. *Fauna norv. Ser. B, 30,* 94—107.

Only one species of ticks, *Ixodes uriae* White, 1852 was recorded in 12 seabird colonies along the coast of Norway. Its principal hosts were puffins *Fratercula arctica* (L.), guillemots *Uria aalge* (Pontoppidan) and kittiwakes *Rissa tridactyla* (L.), but it was also recorded on black guillemots *Cepphus grylle* (L.) and shags *Phalacrocorax aristotelis* (L.) that bred in puffin colonies.

The spatial distribution of ticks in the bird colonies and the prevalence and infestation intensities on the birds were variable. The greatest number of ticks per bird were found on guillemots. The highest prevalence on adult birds was found on puffins, and on young birds on kittiwakes. The majority of the tick population appeared to be associated with puffins. *I. uriae* also attacked man.

I. uriae survive the winter as eggs, larvae, nymphs and adults. Observations from Røst and Runde indicate that the majority of the tick populations have a 4 year life cycle.

Ticks were attached to the head, neck, wings, legs, feet and other places on the bird host. In general, most were attached to the body.

This paper is a part of a project on vectors and arboviruses in Norway, and discusses the isolated viruses from *I. uriae.*

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INTRODUCTION

People engaged in collecting eggs, hunting or studying birds in seabird colonies along the Norwegian coast are well aware of the presence of ticks in these habitats. More than two centuries ago Pontoppidan (1753) included these ticks in faunistic lists and referred to them as «lundelus» or puffin lice. A testimony as to the great numbers of ticks which can occur in seabird colonies was given by Grønlie (1948) who had to terminate a botanical study of the bird cliffs because of infestation with the ticks. Besides these general notes, very little information on seabird ticks in Norway has been published. Tambs-Lycke (1943) identified a few specimens of *Ixodes uriae* White, 1852 which originated from the islands of Røst in Lofoten. Mehl. (1968) published some observations on *I. uriae* from the same islands and Myrberget (1960) from Lovunden.

Investigations on parasitic insects, ticks and mites on seabirds and in their breeding colonies were started by Mehl in 1966. In 1973 we decided to include *I. uriae* and seabirds in our project on arboviruses and vectors (Traavik and Mehl 1975).

In northern Europe four species of ticks are associated with seabirds: *Ornithodoros maritimus* Vermeil & Marguet, 1967, *Ixodes uriae, Ixodes unicavatus* Neumann, 1908 and *Ixodes rothschildi* Nuttall & Warburton, 1911.

O. maritimus is known from the British Isles, Bretagne, Tunisia, Krim and the Aral Sea. It belongs to the *capensis*-group of species which has a world wide distribution. *I. uriae* has a circumpolar distribution in both the Northern and Southern Hemispheres in regions with subarctic and temperate climate. Both of these species live on a number of seabird species. *I. unicavatus* is primarily confined to cormorants and shags on the British Isles and Bretagne, although there is a single record from cormorants from the western coast of Sweden. Specimens from Krim probably also belong to this species. *I. rothschildi* has only been found on the British Isles, mainly on fulmars, puffins and shags (Schulze

1930, Thompson 1957, Arthur 1963, Gilot & Beaucournu 1973, Filippova 1977, Clifford 1979). Various aspects of the biology of *I. uriae* have been studied by Nuttall (1913), Kelly & Walton (1977), and Kelly (1982) on the British Isles, Murray & Vestjens (1967) on the Macquarie Islands to the south of New Zealand, Karpovich (1973) in the Murmansk region, USSR, and Eveleigh & Threlfall (1974, 1975) in Newfoundland.

The aims of the present investigation include the isolation of viruses from ticks, serological surveys in birds for antibodies against these viruses, and to study the distribution, host realtionships and ecology of the ticks.

MATERIALS AND METHODS

Three samples of *I. uriae* were available in the collections of the Zoological Museum in Oslo (ZMO).

Material from the following seabird colonies are included in the present study. The collection dates and the species of birds or their nests are listed below. The localities are shown on the map (Fig. 1).

Hornøya, Vardø, Finnmark. 17 July 1981. *Phalacrocorax aristotelis* (L., 1761).
Syltefjordstauren, Båtsfjord, Finnmark. 20 June 1973. *Rissa tridactyla* (L., 1758).
Kongsøy, Berlevåg, Finnmark. Summer 1974. *Phalacrocorax carbo* (L., 1758).
Gjesvær, Magerøy, Finnmark. 23 and 25 June 1973. *R. tridactyla* and *P. aristotelis* (ZMO).
Nordfugløy, Karlsøy, Troms. 8—9 July 1981. *Fratercula arctica* (L., 1758).
Røst (Hernyken, Trenyken and Vedøy), Nordland. 6—14 August 1968, 5 May 1975, July 1977, 2—8 May 1978, 22—27 July 1979, 7 and 27 June 1980, 1 and 13 July 1980, 12 and 30 July 1981, May and July 1982. *Uria aalge* (Pontoppidan, 1763), *Alca torda* L., 1758, *Cepphus grylle* (L., 1758), *F. arctica, R. tridactyla, Fulmarus glacialis* (L., 1761), *Hydrobates pelagicus* (L., 1758), *Oceanodroma leucorrhoa* (Vielliot, 1817) and *P. aristotelis*.
Borgvær, Vestvågøy, Nordland. 10 June 1982. *P. carbo*.
Lovunden, Lurøy, Nordland, 2. June 1970. *F. arctica*.
Åsvær, Dønna, Nordland. 4 June 1970. *P. aristotelis*.
Runde, Herøy, Møre and Romsdal. 10 June 1950 (ZMO), 28—31 July 1969, 6—9 July 1975, 2—4 June 1978, 24—28 September 1973, 20 June 1967. *F. arctica, R. tridactyla* and *P. aristotelis*.

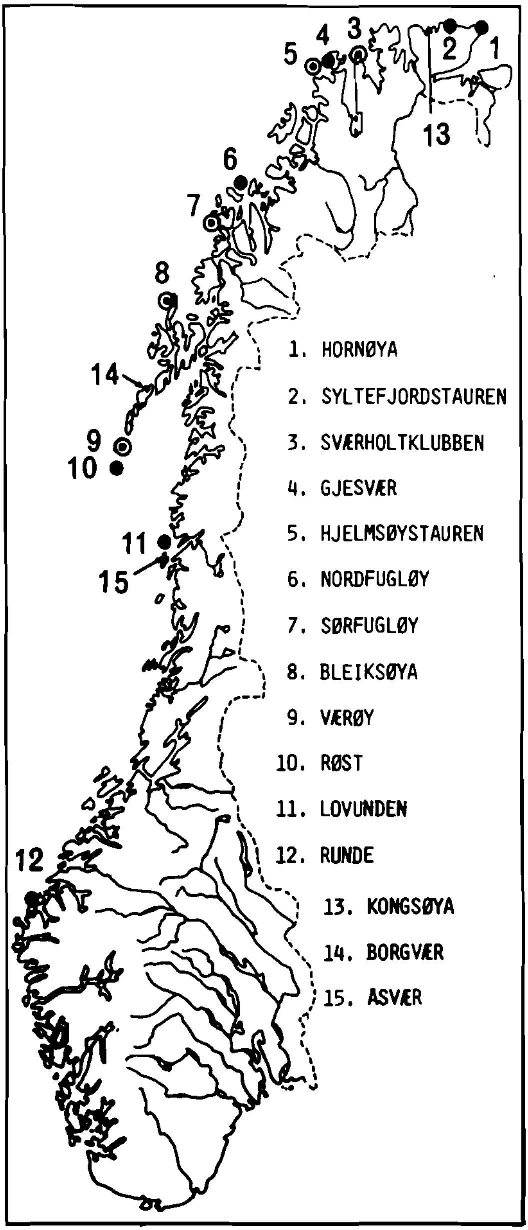

Fig. 1. Map of Norway showing the location of the investigated seabird colonies and the recorded distribution of *Ixodes uriae* White. *I. uriae* was recorded from localities No. 1—12. *Solid circle* = material collected. *Open circle containing a dot* = ticks, «puffin lice», observed.

Gulls *(Larus* spp.), terns *(Sterna* spp.) and marine ducks were also investigated for ectoparasites. This part of the material (28 birds and 29 nests) is described in the publications on fleas associated with seabirds (Mehl in prep.). Information about ticks, «puffin lice», in seabird colonies were obtained from visitors to the islands of Værøy, Bleik, Hjelmsøy and Særholtklubben. We assume that these ticks were *I. uriae.*

The techniques used for collecting ticks were: 1. «Flagging» on stones and vegetation with a piece of terry cloth, 1 x 0.5 m, attached to a stick. 2. Turning stones and other loose objects in colonies of puffins or shags, in rock-strewn slopes and under steep bird cliffs. 3. Visual examination for ticks in teased nest material in a white plastic tray. 4. Maintaining nests and grass in double polyethylene bags and waiting for the parasites to crawl out, as described by Mehl (1970).

Birds, adults and nestlings, were collected by hand, in nets, or were shot. Nestlings from Røst from July 22 and 27 1979 had fallen from their nests in the cliffs during a three hour period in the middle of the night. All birds were placed in separate plastic bags containing a piece of cotton with chloroform and subsequently examined for ticks and other ectoparasites as described by Mehl (1970). Blood samples were obtained by cardiac puncture. The birds were stored frozen. Most of the petrels were examined alive and released.

The examination of seabirds for ticks is difficult and time consuming mainly because of the thick layer of down covering their bodies. Consequently, small ticks are easily overlooked. It was found that ticks were easier to detect when the down was slightly moistened with ethanol.

Thicks used for virus isolation attemps were maintained in glass vials containing moistened plaster of Paris or a green straw, and stored in a refrigerator.

We did not climb the steep bird cliffs and thus the nesting material which we collected comes from the more accessible sites. A total of 63 nests and 246 birds (66 nestlings) were examined.

A total of 1350 ticks were collected, and of these 206 were used for virus isolation.

Ecological aspects of bird cliffs and nests as habitats for ticks

Kittiwakes, *Rissa tridactyla,* fulmars, *Fulmarus glacialis,* razorbills, *Alca torda,* guillemots *Uria aalge,* puffins, *Fratercula arctica,* gannets *Sula bassana,* shags *Phalacrocorax aristotelis* and cormorants *Phalacrocorax carbo* breed in colonies on steep, rugged cliffs along the west and north coast of Norway. These bird cliffs may be occupied by a single species, such as with puffins in Lovunden, or more commonly by several species nesting in their typical habitats. The colonies may number from 20 to more than 100.000 pairs. (Haftorn 1971, Brun 1978, Eldøy 1982, Tschanz & Barth 1978).

The same nesting sites are usually occupied year after year. The birds nest close together, from a few decimeters to a few meters apart.

The birds exert strong modifying effects on their nesting habitats with their nest material, excrements and burrowing acitivites. Furthermore the vegetation on and around the cliffs is strongly influenced by the fertilization effects of the excrements (Goksøyr 1938, Grønlie 1948).

Short descriptions of the nests of birds as habitats for parasites are given below:

The kittiwake constructs a cupshaped structure consisting mostly of terrestrial vegetation and some seaweed, on tiny ledges in the steepest parts of the cliffs. The depression in the nest is deep and dry during the incubation period and when the nestlings are small, but subsequently becomes trampled flat and soiled sith excrements. The original nests are further built upon during several seasons and can become quite large. The incubation period lasts for 21 to 24 days. The fledglings leave the nest around August 10th, when they are about five weeks old. Pairs having neither eggs nor nestlings may occupy their nests for several weeks during the breeding season.

The shag breeds at the foot of sea cliffs and on isolated rock stacks and islands. The nests are situated below rock falls or in rock clefts, and consist mainly of large algae which is lined with fresh grasslike vegetation. The cup of the nest remains dry as long as eggs or small nestlings are present. Thereafter, it becomes trampled and soiled with excrements. The nest and its immediate surroundings are often moist and slimy due to excrements and rotting algae. However, dry nesting material can be found in the cracks and crevices around the well protected nests, and this appears to be the best microhabitat for ticks and fleas. The incubation period lasts for 24—28 days and the young are fledged when they are 4—5 weeks old. Large age variations can occur among nestlings in the same colony.

The puffin lays a single egg at the end of crevices in the rock slides or else in burrows which they have dug in the steep grassy slopes. The nests consist mainly of grass. The floor of the burrows is damp and hardpacked whereas the ceiling is often covered by hanging exposed roots. Egg laying takes place in the middle of May and incubation lasts for 40—43 days. Young puffins leave the nest when they are around 40 days old and able to fly.

The guillemots nest on narrow rocky ledges devoid of vegetation or in rock clefts. No nest materials are used and the birds may breed very close together. Their nests are often located in the same steep cliffs as the kittiwakes. On Vedøy in the Røst islands they occupy the upper part of the cliffs. A single egg is laid around June 1, and it is incubated for 28—30 days. The young leave the nest and take to the water when they are around 14 days old and only half grown.

Razorbills lay a single egg directly on bare rock or in mixtures of gravel and earth in cracks in the rocks or between stones in steep rocky slopes. The egg is laid around June 1 and is incubated for 35—36 days. The young take to sea when they are half grown, about 20 days old.

Several other birds nest on or near the bird cliffs and may therefore serve as hosts for the bird cliff parasites. The most important are: Leach's petrel *Oceanodroma leucorrhoa,* storm petrel *Hydrobates pelagicus,* black guillemot *Cepphus grylle* (L., 1758), herring gull *(Larus argentatus* Pontoppidan, 1763, arctic skua *Stercorarius parasiticus,* (L. 1758), raven *Corvus corax* (L., 1758), hooded crow *Corvus corone* L., 1758, wheatear *Oenanthe oenanthe* (L., 1758), starling *Sturnus vulgaris* L., 1758, white wagtail *Motacilla alba* L., 1758, twite *Acanthis flavirostris* (L., 1758), water pipit *Anthus spinoletta* (L., 1758), blackbird *Turdus merula* L., 1758, fieldfare *Turdus pilaris* L., 1758, ring ouzel *Turdus torquatus* L., 1758. Other bird visit bird cliffs during migration. Herring gulls, crows and ravens are predators on eggs and chicks in the bird colonies.

Gulls form more or less dense colonies on knolls, or on small open areas covered by low grass-like vegetation, along the coast and in the fjords. Their nests are several meters apart and they modify the surrounding habitats to a lesser degree than the auks, puffins, shags and guillemots. The gulls incubate their eggs for 25—27 days and the chicks stay in or close to their nests for about 6 weeks.

RESULTS

Geographical distribution

The only tick associated with seabird colonies was *Ixodes uriae* and its distribution in Norway is shown in Fig. 1. The ticks were only found on colonial cliff-nesting birds, in their nests and on the ground of typical bird cliffs. It was never found on other sea birds such as gulls or ducks or in their nests.

Host relationships

The host relationships of *I. uriae* was studied on relatively small samples of nestlings (66), fledglings (38), and adults (142), and nests (63). (Tabs. 1, 2 and 3).

The highest prevalence among nestlings at the end of July was observed on kittiwakes (83 %), and common guillemots (80%) (Tab. 1). Both nestlings of black guillemot which were examined had ticks, whereas no ticks were found on nestlings of fulmars or shags. The number of ticks per individual showed large variations with 1—6 per individual being most common. Only a few nestlings hosted large numbers of ticks, the maximum being 51 for a common guillemot, and 19 and 18 on a black guillemot and on a kittiwake, respectively.

Only 1 of 24 puffin nestlings had *I. uriae* during July 1—7, 1982. However, the observation on July 23, 1979 that puffin nestlings, which had starved to death, had ticks, indicates that higher prevalences can occur. A quick examination of 27 puffin fledglings which left their nesting burrows on August 7, 1968 failed to reveal ticks.

Recently fledged kittiwakes were captured directly beneath the bird cliffs of Vedøy island, Røst on August 8, 1968 and many of these had ticks. One individual, which was newly deceased, had 97 (89 ♀ 8 nymphs), most of which were fully engorged.

In the beginning of May 1978, during a period with cool weather, only one unattached tick was collected on the puffins. However, during a warm spell, in the beginning of May 1975, there was a high prevalence of *I. uriae* on puffins (Tab. 2).

In July 1979, most puffins left the colony early because nearly all of the nestlings had died of hunger. On July 25, large numbers of puffins returned to the cliffs and only one of the birds which were examined had a single, unattached tick.

During the period July 1—7, 1982, 20 adult individuals of each of the following species were collected: common guillemot, puffin and kittiwake. The prevalence of *I. uriae* on these birds were: puffins 40%, common guillemots 35% and kittiwakes 15% (Tab. 2). Most birds hosted a single tick, common guillemots having 1.4,

Table 1. *Ixodes uriae* from nestlings of seabirds, N = nymphs, L = larvae.

Bird species	Locality	Date of collection	No. birds	No. infested	No. ticks
Uria aalge	Røst	22-27 July 1979	5	4	63 = 3 ♀ 60 N
" "	"	10 Aug. 1968	2	0	
Alca torda	"	8 Aug. 1968	2	0	
" "	"	25 July 1979	1	0	
Fratercula arctica	"	1-7 July 1982	24	1	2 = 2 N
" "	"	12 July 1981	1	1	1 = 1 ♀
" "	"	27 July 1979	1	1	1 = 1 ♀
Cepphus grylle	"	13 July 1980	1	1	1 = 1 N
" "	"	30 July 1981	1	1	19 = 19 ♀
Rissa tridactyla	Runde	6-9 July 1975	3	1	1 = 1 L
" "	Røst	22-27 July 1979	11	9	42 = 3 ♀ 39 N
Phalacrocorax aristotelis	Runde	6-9 July 1975	10	0	
" "	Røst	6-14 Aug. 1968	3	0	
Fulmarus glacialis	Røst	5 July 1982	1	0	
		Total	66		130

puffins 1,0 and kittiwakes 0,5 ticks per individual. The common guillemot had many more female adults but fewer larvae than the other two species. The maximum number of ticks per bird was 6 for kittiwakes, 7 for puffins and 12 for common guillemots.

Seabirds from other areas were also examined for ticks (Tab. 1 and 2). A common guillemot, collected from the Geirangerfjord near Runde in July 1980, had 26 ticks, most of which were nymphs.

Two adult shags from Hornøya and Gjesvær in Finnmark had *I. uriae*. However, we did not find any ticks in the shag colony located on the shady side of the island of Runde despite flagging, stone turning, and examining nest material for 2.5 hours. On the islands of Røst we found two ticks in the nests of shags but in this colony there are also nesting populations of puffins and razorbills, thus the ticks may have come from these species. In a pure colony of shag in Åsvær, we did not find any ticks.

I. uriae was found both in the nests of kittiwakes and from puffin «runways» (Tab. 3). However, these collection techniques do not provide a complete picture of ticks in these places. Both engorged and unfed ticks were found.

Ticks were not found on fulmars or petrels, or from nests of cormorants.

Adult females, nymphs and larvae of *I. uriae* appeared to undergo normal development on common guillemots, puffins, black guillemots and kittiwakes.

The fledged kittiwake which hosted 97 ticks

Table 2. *Ixodes uriae* from adult seabirds. N = nymphs, l = larvae.

Bird species	Locality	Date of collection	No. birds	No. infested	No. ticks
Uria aalge	Røst	8 June 1982	1	1	8 = 8 N
" "	"	26 June 1980	1	1	1 = 1 ♀
" "	"	1-7 July 1982	20	7	28 = 24 ♀ 3 N 1 L
" "	Geirangerfj.	July 1980	2	2	27 = 1 ♀ 22 N 4 L
Fratercula arctica	Røst	5 May 1975	3	3	5 = 5 N
" "	"	5-7 May 1978	28	1	1 = 1 N
" "	"	7 June 1980	1	1	2 = 2 N
" "	Runde	10 June 1950	1	1	3 = 3 ♀
" "	Røst	1-7 July 1982	20	8	19 = 2 ♀ 7 N 10 L
" "	Nordfugløy	8 July 1981	1	1	1 = 1 ♀
" "	Røst	25 July 1979	17	1	1 = 1 N
" "	"	July 1977	4	4	19 = 19 ♀
Rissa tridactyla	Gjesvær	26 June 1878	1	1	6 = 3 ♀ 3 N
" "	Røst	1-7 July 1982	20	3	9 = 2 N 7 L
Phalacrocorax aristotelis	Gjesvær	23 June 1878	1	1	2 = 1 ♀ 1 N
" "	Hornøya	17 July 1981	1	1	3 = 3 N
" "	Røst	24 July 1979	1	0	
Fulmarus glacialis	"	26 July 1979	1	0	
Hydrobates pelagicus	"	10-14 Aug 1968	57	0	
Oceanodroma leucorrhoa	"	10-14 Aug 1968	3	0	
		Total	180		116

Table 3. *Ixodes uriae* from nests and nest material in burrows, N = nymphs.

Bird species	Locality	Date of collection	No. nests	No. ticks
Fratercula arctica	RØst	2-7 May 1978	5	21 = 5 ♂ 8 ♀ 8 N
" "	"	6-14 Aug. 1968	5	10 = 4 ♂ 5 ♀ 1 N
" "	Runde	20 June 1967	1	1 = 1 N
" "	"	28-31 July 1969	2	0
Rissa tridactyla	RØst	6-14 Aug. 1968	3	9 = 7 ♀ 2 N
" "	Runde	7 July 1975	6	5 = 5 N
" "	"	28-31 July 1969	15	11 = 1 ♂ 4 ♀ 6 N
" "	Syltefjord-stauren	20 June 1973	6	9 = 9 N
Phalacrocorax aristotelis	RØst	6-14 Aug. 1968	2	2 = 2 ♀
" "	Runde	8 July 1975	8	0
" "	"	26 Sep. 1973	3	0
" "	Åsvær	4 June 1970	4	0
Phalacrocorax carbo	KongsØya	Summer 1974	2	0
" "	Borgvær	10 June 1982	1	0
		Total	63	68

and the black guillemot nestling which contained most ticks, had recently died. In both cases, therefore, mortality was associated with large numbers of ticks.

Distribution of ticks in seabird colonies

The puffin colonies were situated in steep-rock-strewn slopes or in grass-turf covered slopes and talus.

During the investigation of the puffin colony on Runde during the 24—28 September 1973, no birds were present since they left the colony about three weeks earlier (A. Folkestad, pers.comm.). The ticks normally appeared in aggregations in the cracks between the rocks of the walls (often near the ceiling) of the puffin runways, on dry places 0.5 m or more from the entrance. Engorged larvae and nymphs after detaching from the host, must have wandered upwards along the stones and crept far into the cracks. Many newly-hatched ticks lay in or near the grey exuvia from the preceeding stage. Large amounts of old tick cuticular material, which was yellower in colour, provided evidence that the same microhabitats were used for several years for both molting and overwintering. The floors of the runways are mostly trampled hard, slippery and moist and ticks were not found in such microhabitats.

In the last week of September 1973 no eggs, larvae or engorged females were found. Dead, dried, adult males were often recorded.

The discovery of overwintered ticks among the exposed roots in the ceiling of the puffin tunnels in the grass-turf covered slopes on the islands of Røst on 5 May, 1978 indicates that ticks wander up along the walls in all types of puffin tunnels.

Ticks were collected by flagging from both the grassy slopes and the rocks of the puffin colonies. The largest numbers were obtained by lowering the flag into holes and crevices between the stones. Many ticks were also collected on flags which lay on the ground.

In the kittiwake colonies on Røst and Runde islands, ticks were collected from the nests and from the rocky walls just beneath the nests. In May 1978, overwintered ticks were found under stones and in discarded nest material at the foot of the cliffs, under the kittiwake colonies on Vedøy island. In July 1979 we collected ticks at the same site by flagging and by overturning stones. We found engorged ticks either singly or in aggregations under the stones and the largest aggregation numbered 1 ♀, 75 nymphs and 8 larvae. These ticks must have fallen from the colonies of kittiwakes, puffins and common guillemots which nested above since birds do not nest at the foot of the cliffs.

Seasonal variations in the catchability of *I. uriae*

May During the first week of May 1978 on Røst islands only 1 nymph was captured after three days of flagging. During this period the weather was cold with temperatures of 0—5°C. The ground was partially frozen. There were periods of snowfall but the intermittent sunshine melted the snow and warmed the grass tussocks up to 10°C. In the beginning of May, 1975, when the weather was warm, many ticks (nymphs only) were collected by flagging in the puffin colony on Hernyken island.

June In the puffin colony on Lovunden island, 2 June 1970, we captured an average of 94 nymphs per hour by flagging. In the puffin colony on Runde island, 3 and 4 June 1978, flagging yielded from 4 to 108 nymphs per hour. Nymphs only were collected.

July During the second week in July 1975, flagging yielded 50 ♀ and 240 nymphs in the puffin colony on Runde island. The maximum yield was 13 ♀ and 58 nymphs per hour. On Røst islands, during the fourth week of July 1979 we collected 2 ♂, 26 ♀ and 39 nymphs by flagging for 4 hours. Most ticks were collected from the foot of the bird cliffs where there are no nesting birds.

August On the islands of Røst, no ticks were collected by flagging during the second week of August 1968. However, we did observe a few ticks crawling on rocks.

September We did not manage to collect ticks by flagging in the puffin colony on Runde island during the last week of September in 1973.

Observations on the life cycle

The earliest observation of egg laying are from July 22, 1979 on the islands of Røst. Egg clusters were found under stones on the same day. The latest observation of mating was on August 8, 1968. The egg clusters collected on the same day included a few eggs which contained very early larva stages. On the other hand, on May 7, 1978 two egg clusters containing various larval stages were collected under stones below kittiwake colony. In one of the clusters we observed newly-hatched larvae which stood on or near the egg cases. All egg clusters were found under stones or pieces of wood. Most eggs continued to develop in the laboratory.

There were very few active nymphs in the beginning of May 1978 and 1982 when the weather was cool (five-day means T. = 0.8°C in 1978). On the other hand, when the weather was warmer during the first week of May 1975 (five-day means T. = 5.0°C), many active nymphs were captured by flagging and many attached nymphs were detected on puffins (Tab. 2). Inactive adult males and females were discovered under stones and dry plant materials during the cool first week of May 1978.

During the first week of June, only nymphs were active and collected by flagging in the puffin colony on the island of Lovunden (1970) and Runde (1978), and collected from puffins and common guillemots on Røst in 1980 and 1982. The first time that we observed engorged adult females on puffins was on June 10th. Several females (6) were found on kittiwakes, common guillemots and cormorants during the period 23—26 June (Tab. 2).

In July we observed active larvae, nymphs and adults on the ground and attached to birds. The proportion of larvae, nymphs and adults attached to birds showed large variations, thus no general trends could be seen (Tab. 1 and 2). In the beginning of July 1982, females were the dominant stage on adult common guillemots (86 %) and the relationship between females and nymphs was 8:1. On adult kittiwakes and puffins, on the other hand, larvae were the dominating stage (61%) and the relation between nymphs and larvae were 1:1,9. Towards the end of July 1979, the infestation with the various tick stages on the young of common guillemots and kittiwakes was very similar. Larvae were not found on these and the relation between females and nymphs was 1:16.5. Other samples from the young of black guillemots and kittiwakes revealed a large dominance of females at the end of July and beginning of August. On the other hand, in samples obtained by flagging we found a relation between females and nymphs which was 1:4.8 in the first week of July (Runde) and 1:1.5 in the last week of July (Røst).

It seems as though *I. uriae* disappear from the surface of the ground in the beginning of August. During August 6—14, 1968 only two active females were observed on the islands of Røst. Furthermore, no observations were made of active individuals on Runde island during July 28—31, 1969 and September 24—28, 1973. during July 1982, on the other hand Lid collected 85 females and 18 nymphs, all active but unengorged, whereas he observed only a few individuals in August. The ticks which were removed from kittiwake fledglings on August 8, 1968 on the islands of Røst were all either engorged or nearly so, and had probably attached themselves around August 1.

Fully engorged ticks were found under stones at the foot of the bird cliffs at Vedøy, Røst, on July 22—27, 1979 but not newly hatched individuals were found among them.

During the last week of September 1973 on the island of Runde, inactive females, males, and nymphs were already in their winter quarters, under stones, etc. Unengorged ticks (47 ♂, 42 ♀, and 144 nymphs) together with exuviae under the same stones indicated that the ticks had hatched recently. However, more than 25 engorged nymphs were not ready to moult.

In the beginning of May 1978 we collected 19 ♂, 29 ♀, 9 nymphs and 1 larva in overwintering microhabitats. Seven of the nymphs were engorged and subsequently developed into adults in the laboratory.

Ixodes uriae on birds

Attached ticks were removed from various parts on the hosts. An analysis of 148 ticks on young and adult kittiwakes, puffins and common guillemots revealed the following distribution: head 3%, neck 16%, crop region 5%, breast/abdomen 36%, back/shoulders 3%, wings 18%, legs 16% and tarsus/foot 3%.

Nearly all of the ticks (females) on adult common guillemots were attached around the neck, just below the head. Furthermore, on young puffins we found ticks on the head, throat, tarsus and feet, but no ticks were observed on their bodies. No obvious differences were observed in the sites of attachment on adult and young kittiwakes, adult puffins and young common guillemots. Concerning the sites of attachment we found no obvious differences between the different stages of ticks on these birds.

Most of the ticks which were attached to the wings were found at the base of the primary feathers. The ticks which were found on the body occurred both within and outside of the pterylae.

Ixodes uriae on humans

People visiting bird cliffs often find *I. uriae* crawling on their clothing, yet they seldom attach themselves. Some individuals can visit bird cliffs for years without getting bitten by ticks, whereas other find ticks attached to them after a brief visit. Three individuals (ornithologists) who worked with the bird colonies at Røst in the beginning of May 1975 all found attached nymphs on themselves. Furthermore, around a dozen pupils discovered attached ticks on themselves after a class trip to the bird cliffs in June 1981. Later that summer, July 25 and August 14, individuals who visited the islands also found attached *I. uriae* on themselves.

We reckon with two main possibilities for human infestation: Ticks crawl up onto clothing when people are sitting on the ground, or else they attach themselves to the sleeves of individuals who stick their arms into cracks between the stones or burrows to collect eggs from birds nests.

There does not appear to be any preferantial region on the human body for tick attachment. The recorded sites of attachment include: in beards, on the crown of the head, around the waist, on the scrotum, on forearms and on the legs. Most of the *I. uriae* found on people were nymphs, but females also occurred.

The inhabitants on the islands of Røst have named nymphs of *I. uriae* as puffin lice («lundelus») and the adults are called auk lice («alkelus»). Thus, as the common names imply, these two life stages have been treated as separate species. A plausible explanation for these misnomers is that during puffin hunting in the beginning of May people are infested by nymphs only. Later on it is common to be infested with adult females, especially on the arms, when collectors gather razorbill and guillemot eggs from cracks and crevices in the beginning of June (E. Person pers.comm.).

DISCUSSION

Only a single tick species, *I. uriae* was found during this investigation. The observed distribution of ticks in seabird colonies suggest that this species can occur in all larger colonies of puffins, guillemots and kittiwakes along the entire coast of Norway. The most northern observation of *I. uriae* in the North Atlantic, aside from Norway, are from Iceland, Jan Mayen and the Murmansk region. It has not been observed on Spitsbergen, Novaya Zemlya or the northern coast of Siberia (Lvov et al. 1975, Haarløv 1977, Filippova 1977, Clifford 1979).

I. uriae was found in two seabird colonies on the Varanger penninsula (Fig. I, loc. 1 and 2), which has the most arctic climate in Norway.

On the British Isles three additional tick species occur in seabird colonies. One of these, *Ixodes unicavatus* is found both on the east coast of northern Scotland (Thompson 1957) and on the west coast of Sweden (Schulze 1930). This observations suggest that it may also occur in Norway. It is especially associated with shags and cormorants and has an activity period during the winter season (Kelly 1982). We did not expect to collect this species since the methods were not suitable.

The distribution of *Ornithodoros maritimus* and *Ixodes rothschildi* is of a more limited nature in south western part of the British Isles. Both species have a short activity period during mid summer. Since their distribution appears to be governed by climatic conditions, it is unlikely that these two species occur in Norway.

I. uriae can be transported over great distances with birds. To exemplify this *I. uriae* was found on kittiwakes on the Trondheimsfjord (Schulze 1938) and at Kragerø (Mehl 1983) several hundred kilometers from the nearest seabird colony. *I. uriae* was found on the shore of the newly formed volcanic island Surtsey near Iceland (Lindroth et al. 1973). This observation indicates the ability for rapid spreading to newly established seabird colonies.

I. uriae was only found in typical seabird colonies where one or more of the following species nested; guillemots, razorbills, puffins, kittiwakes and shags. It was never found in connection with *Larus* species, but large colonies of gulls were not investigated. On Newfoundland, *I. uriae* was found on young *Larus argentatus*, but this was probably a consequence of the young gulls seeking cover in puffin burrows (Eveleigh & Threlfall 1974).

Guillemots, puffins and kittiwakes were all found to be good hosts for *I. uriae*. The microhabitat in and around the nests of these three species are very different, but these differences do not appear to be crucial for the distribution of *I. uriae*. This tick species was also occasionally found on shags, but it is questionable whether or not shag or cormorant colonies are good habitats for *I. uriae*. Shags and cormorants soil their nesting places with excrements to a much greater degree than the other species and this may possibly make conditions unsuitable for *I. uriae*. The excessive excrements in and around the shag nests definitely influence the spatial distribution of the flea *Ceratophyllus vagabundus* (Boheman, 1903) which occurs only in the dry microhabitats in and around the shags nest (Mehl unpubl.).

Ticks have not been found on Leach's petrel or storm petrel. The nesting activities of these species occurs from August till December on the islands of Røst (G. Lid, pers. comm.) and thereby do not coincide with the activity period of *I. uriae*.

Other bird species, such as black guillemot and gulls, when nesting in bird cliffs, can be infested by *I. uriae*, but probably will not have their own populations of ticks when their nests are isolated from the bird cliffs. Some migratory birds rest in the bird cliffs during spring and summer, and these may also become infested with this tick species (Thompson 1957).

There are large populations of gannets and fulmars in some Norwegian seabird colonies, and these can be important hosts for *I. uriae*.

The present study revealed a pattern of host preferance by *I. uriae*, but also that some host species appeared to have higher infestation intensities. In general, the greatest numbers of ticks per bird were found on guillemots. Adults had an average of 1,4 and young 12,6 ticks per bird. These observations agree with other studies which conclude that guillemots, *U. aalge* and *U. lomvia*, appears to be the prefered host of *I. uriae* (Karpovich 1973, Eveleigh & Threlfall 1974, 1975). The prevalence of *I. uriae* on guillemots on Newfoundland during two years were 58% and 50%, whereas puffins had 7,8% and 29,5%, respectively. However, we found the highest prevalence on adult birds on puffins and the lowest on kittiwakes. The prevalence on young birds was highest for kittiwakes with guillemots following close behind. The greatest number ticks per individual were found on a kittiwake fledgling. In general, young birds hosted many more ticks than adults, with the exception of puffins.

Relatively few ticks were found on young puffins. This may be an indication that the microclimate in puffin burrows is unsuitable for *I. uriae,* or else that most of the ticks that were present in the burrows fed on adults during the nesting and brooding periods. The latter seems to provide the best explanation since relatively many ticks, including males, were collected from puffin burrows, thus indicating that the conditions are suitable for the development of ticks.

When one considers the numbers of nesting puffins, guillemots and kittiwakes (700.000, 3.000 and 90.000 pairs respectively) on the islands of Røst in relation to the number of ticks collected, an overall evaluation of the data indicates that puffins hosts a much greater proportion of the tick population than the other two bird species.

A feature which is common for all of the bird species which host *I. uriae* is that they all form large persistent breeding colonies with a high nest density. Such conditions enable *I. uriae* to readily find new host individuals. *I. uriae* is an active tick, and apparently searches for a host rather than waits passively until one passes. Another factor which is important for breeding and survival of *I. uriae,* is the presence of well-drained and relatively dry habitats near the nests of the hosts. This provides the ticks with a microhabitat suitable for winter survival, moulting and egg laying. We agree with the conclusions of Murray & Vestjens (1967) that *I. uriae* is not host specific and that its distribution is principally due to factors which influence the survival of the free-living stages of its life-cycle. breeding and moulting behaviour of the hosts may also be involved in its distribution determination.

Both visual observations and collections of ticks on the ground in the puffin colonies gave the impression that the spatial distribution of the ticks was variable and that this was not related to the population density of the puffins. It is likely that a variable distribution on the ground will result to variations in the number of ticks per bird.

A number of factors are involved in determining the spatial distribution of ticks: density of bird host, topography, microclimate, soil conditions, dispersion and aggregation (by pheromons?) of the ticks themselves, or with the aid of birds, and by fully engorged ticks falling down the cliffs. Temporal variation in the tick population can be influenced by climatic conditions, shifting of breeding period, the production and survival of young birds, and a number of other factors (Murray & Vestjens 1967, Karpovich 1973, Kelly 1980, 1982, Lid 1981, Myrberget 1981).

The numbers of ticks which can be obtained by using our collection methods depend greatly on the weather and season of the year. The results of flagging in the beginning of May vividly illustrate this point. Also, under certain conditions large numbers of non nesting birds can visit land for a short period and thus (Myrberget 1959) influence the results of the investigation. This occurred on July 25, 1979.

We regard the quantitative results of the present investigation as reflections of the methods employed and the prevailing conditions. The ecological conditions in seabird colonies are quite complex and variable, and only certain parts of the bird cliffs were included in our studies. We did not, for example, investigate the steepest parts of the bird cliffs. Consequently, the general conclusions from this study must be seen in the light of the limitations imposed. Variations in natural phenomena probably constitute important factors underlying many of the descrepancies encountered in descriptions of the ecology of *I. uriae.*

The observed seasonal abundance of *I. uriae* in Norway corresponds to the descriptions from Murmansk region and Newfoundland. We observed that *I. uriae* survived winter as eggs, larvae and nymphs (unfed and engorged) and as adults (unfed only).

It appears as though all adults and the majority of nymphs overwinter in the unfed state. In late September 1973, we estimated that 22% of the nymphs which had fed during the summer, still were engorged, and most likely would pass the winter in that state. Based on the collection of ticks in early May 1978, we estimated that 13% of the nymphs which fed the previous year, had passed the winter in engorged state. Karpovich (1973) observed mass death of engorged ticks in a cold winter and concluded that only eggs and unfed ticks are well adapted to overwintering.

Nymphs become active earlier in the spring than the adults. This may indicate that a part of the population overwinters in tussocks and cracks near the surface (where engorged larvae have moulted?) and become active at the end of April or beginning of May when their microenvironment has been sufficiently warmed by the sun. Thus, weather is an important factor influencing the initiation of the activity period. The nymphs are most active in May and June, but activity can continue until the end of July and into August.

Females were first observed on birds during the second week of June. The delayed initiation of adult activity as compared to the nymphs, can either be due to adults hibernating deeper in cracks and burrows than the nymphs, where the temperature rises later, or else may be due to some intrinsic mechanism. Adults become inactive at the end of July to the beginning of August.

The life cycle of *I. uriae* was studied by Eveligh & Threlfall (1974) in Newfoundland, and Karpovich (1973) summarized the results of Russian investigations in the Murmansk region. All stages are able to develop at temperatures between 1° and 20°C. In Newfoundland the life-cycle was reported to be completed in 4—5 years, with the majority of the population having a 4 year life-cycle. In the Murmansk region the life-cycle usually lasts 4—6 years, sometimes as long as 7 years, depending on weather conditions and microclimate of various parts of the bird colonies.

In Røst and Runde our observations indicate that the majority of the tick population have a 4 year life-cycle. The general pattern is as follows: Eggs laid during the first summer hatch to larvae in the autumn or the following spring. These larvae feed and develop to nymphs during the second year. Nymphs overwinter, feed and develop into adults during the third year. Adults overwinter and reproduce the fourth year. Low temperature during the oviposition and incubation periods may prolong the life cycle by one year.

The results described by Kaprovich (1973) indicated that the host-seeking activity by the ticks is regulated by some intrinsic mechanism. Only ticks which have overwintered unfed, will begin feeding the same year. Overwintering, engorged ticks that moult during spring or summer will remain inactive until the following spring. Due to this mechanism the life cycle will be prolonged by one year if the tick feeds late in the summer. It also prevents ticks from becoming more than one active stage a year.

We found ticks attached to the head, neck, wings, legs, feet and other places on the bird hosts. In general, most were attached to the body (44%), but individual variation was large. On adult guillemots nearly all adult ticks were located on the upper portion of the neck. These observations are in agreement with the result of Eveleigh & Threlfall (1974, 1975).

Puffins which were one to two weeks old, did not have ticks attached to the body, but we found *I. uriae* on their heads, necks, legs and feet. Similar observations were made by Murray & Vestjens (1967) on young penguins which had ticks attached on their faces, feet and around their cloacal openings. The extremely dense plumage of adult make it impossible for ticks to reach the skin except during certain periods during their moult. In a similar fashion it is conceivable that the dense down plumage on the young puffins protect them against tick infestation on their bodies.

Under laboratory conditions, Eveleigh & Threlfall (1974) found that ticks which were placed on the heads of birds, with few exceptions, attached themselves to the heads. They concluded that little wandering by the ticks occurred in selecting a feeding site. If this generalization is correct, then the site of attachment on the hosts reflect which part of the body which made contact with the ticks. Therefore, the sites of tick attachment will to a certain degree, be influenced by the nature around the nest and the behaviour of the bird.

The bites of *I. uriae* are painful to man (Nuttall 1913). These ticks may be directly harmful to birds and cause the death of a host when heavily infested. (Mehl 1968, Ballard & Ring 1979). The significance of ticks as parasites and vectors for viruses and microorganisms has been discussed by Bourne et al. (1971), Kelly & Walton (1977) and Evans & Bourne (1978).

The first isolation of arboviruses from *I. uriae* were published by Lvov et al. (1970) from Tuleniy Islands, Sea of Okhotsk, and by Clifford et al. (1971) from Three Arch Rocks, Oregon, U.S.A. In recent years *I. uriae* has been actively studied for arboviruses. Viruses, mostly of the Kemerovo group, Sakhalin group, B group and Uukuniemi group, have been isolated in western and eastern North America, Kola Penninsula and eastern USSR, Scotland, Faeroe Islands, Runde and Røst Islands in Norway, Macquarie Islands in the Southern Ocean (Lvov et al. 1975, 1979, Main et al. 1976 a, b, Yunker 1975, Traavik et al. 1977, Main 1978, Clifford 1979).

In Norway, the isolated viruses belong to the Uukuniemi and Kemerovo groups, Tyuleniy virus of B group, and untyped viruses (orbivirus like and coronavirus like, «Runde virus») (Traavik, Mehl & Kjeldsberg 1977, Traavik & Mehl 1977, Saikku et al. 1980).

The infection rate of *I. uriae* with viruses is high in most investigations (Main 1978, Lvov et al. 1979, Saikku et al. 1980). Therefore, the risk of becoming infected by virus is great for infested birds and people. Little is known concerning the effects of *I. uriae* borne virus infections in seabirds. Experimental infections of kittiwakes, herring gulls and brünich's guillemots with Tyuleniy virus produced pathogenic conditions, sometimes with fatal outcome. The virus can cause a general febril condition in man (Lvov et al. 1979).

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Noen nye lokaliteter for Coenagrion armatum (Charp.) (Odonata: Coenagrionidae) på Østlandet

HANS OLSVIK

ABSTRACT

Some new localities for *Coenagrion armatum* (Charp.) (Odonata: Coenagrionidae) in Eastern Norway.

Coeangrion armatum (Charp.) was previously only known from a few localities in Østfold, Hedmark, Akershus and Sør-Trøndelag. Here are listed findings from ten new lakes or ponds in Østfold and Akershus. It is suggested that *C. armatum* may possibly have increased in number and spread to new localities due to the agricultural influence, which has made the waterbodies more eutrophic and better fitted for the species.

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INNLEDNING

Coenagrion armatum (Charp.) ble første gang påvist i Norge av W. M. Schøyen i slutten av det forrige århundre (Sømme 1937) og ble da funnet på Hvaler i Østfold. Siden har den dukket opp ved noen lokaliteter i Østfold og Hedmark (Sømme 1937, Åbro 1966). Tjønneland (1952) fant arten i Orkdal i Sør-Trøndelag, videre påviste Dolmen, Sæther og Aagaard (1975) og Aagaard og Dolmen (1977) den ved flere dammer og småvatn i Gauldalen og Trondheim (Sør-Trøndelag).

Arten er således kjent fra det sørlige Østlandet og Trøndelag, men tidligere finnere har pekt på at den er sjelden og lite tallrik. Det har derfor vært antydet at den burde vernes, særlig på grunn av lokalitetenes utsatte beliggenhet i jordbruksområder (Aagaard og Dolmen 1977).

Totalt er *C. armatum* hittil kjent fra et dusin steder i Norge, hvorav omtrent halvparten ligger på Østlandet.

MATERIALE

Ved undersøkelser sommeren 1982 og 1983 fant undertegnede *C. armatum* ved en rekke nye lokaliteter i Akershus og Østfold. De fleste av funnstedene er eutrofe lavlandsvatn, særpreget av rik vegetasjon som ofte er dominert av sivaks *Scirpus lacustris*, takrør *Phragmites communis* og sneller *Equisetum*.

Følgende funn er gjort:

Østfold (EIS:20): *Våler; Bjørnerødvatn* 19. juni 1983 1 ♂ 2 ♀ ♀ innsamlet. Den var ikke tallrik her, ca. 5 ind. sett i tillegg.

Akershus (EIS: 28): *Oslo; Østensjøvatn* 5. juni 1982 2 ♂ ♂ 2 ♀ ♀ innsamlet, arten forekom i stort antall. 31. mai 1983 6 ♂ ♂ + 1 ♀ innsamlet, tallrik, under klekking.

Oslo; Bogstadvatn 2. juni 1982 1 ♀ (nyklekket) innsamlet, ingen flere å se. 6. juli 1982 1 ♀ innsamlet, ingen flere å se.

Oslo; Gjersrudtjern 8. juni 1983 1 ♀ (nyklekket) innsamlet, flere ind. sett.

Ås; Østensjøvatn 31. mai 1983 1 ♀ (nyklekket) innsamlet, ingen flere å se.

Ski; Midtsjøvatn 31. mai 1983 2 ♂ ♂ + 1 ♀ innsamlet, flere ind. sett.

Ski; Nærevatn 31. mai 1983 3 ♂ ♂ + 5 ♀ ♀ innsamlet, flere ind. sett.

(EIS: 29): *Aurskog-Høland; Hellesjøvatn* 31. mai 1983 1 ♂ + 1 ♀ innsamlet, noen få sett.

Fet; Monsrudvika (Nordre Øyeren) 15. juni 1983 4 ♂ ♂ + 2 ♀ ♀ innsamlet, flere sett i tillegg. 20. juni 1983 1 ♂ + 2 ♀ ♀ innsamlet, arten forekom meget tallrik.

(EIS: 37): *Skedsmo, Ringstilla* 15. juni 1983 1 ♂ + 2 ♀ ♀ innsamlet, arten var ikke tallrik ved lokaliteten.

Coenagrion armatum virket tallrik og så ut til å utgjøre en betydelig del av det observerte individantall av vannymfer ved flere av vatna, mens den andre steder forekom sparsomt og mer tilfeldig iblant andre arter. I størst antall forekom den ved Monsrudvika i Nordre Øyeren og ved Østensjøvatnet i Oslo. Ved førstenevnte lokalitet så arten ut til vesentlig å holde til i snellebeltet (*Equisetum*) i beskyttede små viker, hvor de parvis fløy rundt og la egg (20. juni 1983). *C. arma-*

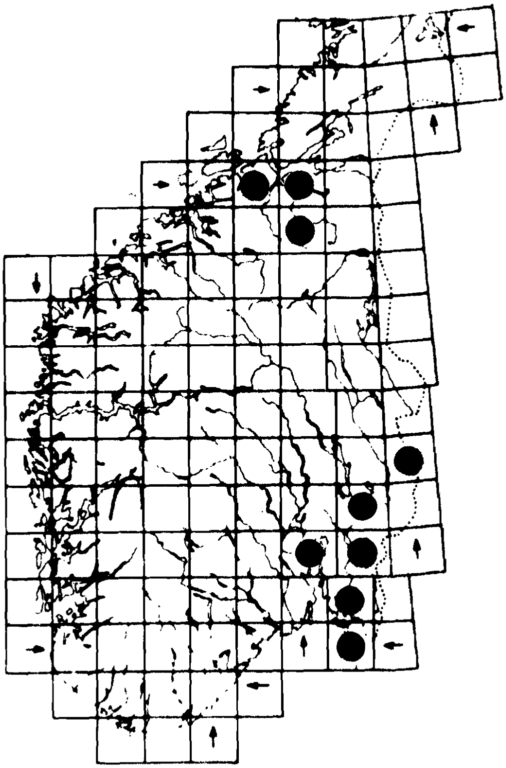

Fig. 1. Utbredelsen av *Coenagrion armatum* (Charp.) i Norge, inkludert de nye funn.

The distribution of Coenagrion armatum (Charp.) *in Norway.*

tum var her den dominerende vannymfeart. I begynnelsen av juni (1982) var arten, sammen med *Coenagrion pulchellum,* V. D. Lind, den mest tallrike ved Østensjøvatnet i Oslo, mens den var langt mer tallrik enn *C. pulchellum* 31. mai 1983. Det siste kan forklares ved at sistnevnte art ennå ikke var kommet i gang med klekkingen på grunn av den sene våren.

DISKUSJON

Et særtrekk ved *C. armatum's* forkomst er den tidlige klekkingen, ofte i månedsskiftet mai/juni i området rundt indre Oslofjord, og den relativt korte flyvetiden. I begynnelsen av juli ser det ut til at de aller fleste er forsvunnet. Den viktigste perioden for parring og egglegging så ut til å være omkring midten av juni i Nordre Øyeren.

Man kan spørre seg hvorfor *Coenagrion armatum* nå ble funnet i større eller mindre antall ved de fleste besøkte næringsrike vann, mens den tidligere ikke var kjent fra mer enn en håndfull lokaliteter i Østfold og Akershus. Artene tidlige og heller korte flyvetid har nok medvirket til at den er forblitt uoppdaget noen steder, men det er også mulig at den har spredt seg og økt i antall de senere år. Økende grad av eutrofiering, som er et velkjent fenomen i jordbruksområder, kan kanskje ha gjort vatn og dammer mer attraktive, slik at arten har fått en sjanse til å etablere seg som ny art enkelte steder. Lokaliteter som Nordre Øyeren og Østensjøvatnet (Oslo) hvor *C. armatum* kan opptre i store mengder, tilsier at artens status i Norge kanskje bør vurderes på ny. Ialt 14 mulige lokaliteter ble undersøkt i flyvetiden i Østfold og Akershus, og den ble funnet ved ti av disse (ugunstig vær ved besøk på minst én av de andre lokalitetene). Flere undersøkelser og oppfølging gjennom en årrekke er nødvendig før artens status i Norge med sikkerhet kan sies å være endret fra tidligere antagelser. Det kan se ut som om *C. armatum* nå er utbredt, men for det meste lite tallrik ved vegetasjonsrike og eutrofe vatn og dammer på det sørlige Østlandet.

Etter Aagaard og Dolmen (1977) er *C. armatum* ikke tidligere påvist i EIS-rutene 28 og 37.

TAKK

Takk til Dag Dolmen for å ha bidratt med opplysninger, til Albert Lillehammer for å ha gjennomgått og kritisert utkastet og til Grethe Garfjeld for maskinskriving.

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Short communications

THREE SPECIES OF STAPHYLINID COLEOPTERA NEW TO SPITSBERGEN

ARNE FJELLBERG

Olophrum boreale (Payk.), *Eucnecosum brachypterum* (Grav.) and *Omalium caesum* Grav. from the Woodfjorden area, N. Spitsbergen, were found in the collections of Tromsø Museum.

Arne Fjellberg, Department of Zoology, Tromsø Museum, N-9000 Tromsø, Norway.

A total number of twelve species of Coleoptera are reported from Spitsbergen so far: *Amara quenseli* (Sch.), *Micralymma marinum* (Strøm), *Philonthus* sp., *Atheta subplana* Sahlb., *A. graminicola* (Grav.), *Simplocaria metallica* (Sturm), *Oryzaephilus mercator* (Fauv.), *Anthicus flavipes* (Panz.), (?) *Phytodecta* sp., *Atomaria atricapilla* s.sp. *angulicollis* Kangas, *A. lewisi* Reitt., *Rhynchaenus flagellum* (Erichs.) (Strand 1942, Bengtsson et al, 1967, Kangas 1967, Hågvar 1971, Kangas 1973, Sømme 1979). The *Philonthus* sp. refers to a fragment of a dead specimen probably brought ashore with ballast from ship (Holmgren 1870). *Oryzaephilus* is introduced in human stockware. (?) *Phytodecta* sp. refers to Elton (1925) who reported a single specimen of a possibly *Phytodecta* collected at the hot springs in Bockfjorden. Unfortunately the specimen was lost, and the record has not been verified. Thus there are only nine species of Coleoptera which could be considered true inhabitants of Spitsbergen.

In Tromsø Museum there is a small collection of Coleoptera from northern part of West Spitsbergen collected by expeditions from the museum in 1958 and 1960. The species are identified by Andreas Strand, but the material has remained unpublished. From the small island of Moffen a single specimen of the well known *Atheta graminicola* is present. More interesting are five specimens from the Woodfjorden area, consisting of three staphylinide species which have not been reported from Spitsbergen so far:

Olophrum boreale (Payk.). Stasjonsøyene, 14 Aug. 1958, 3 ex.

Eucnecosum brachypterum (Grav.). Same data, 1 ♂.

Omalium casum Grav. Bockfjorden, kildene, 8 Aug. 1960, 1 ex.

According to correspondance between Bengt Christiansen — the collector — and Andreas Strand, the two former species appeared in samples from moss and grass growing near the shore of Reinsdyrflya inside the islands Stasjonsøyene. The latter species was collected under grass turf along large stones close to the hot springs in Bockfjorden. Staphylinids were abundant there, but were sought in vain in similar habitats some distance from the springs. Thus the occurrence may be restricted to a fairly small area.

All three species have a fairly northern distribution (Strand 1946), the two former are also reported from Bjørnøya (Strand 1942). But it is remarkable that they are not collected from the well investigated southern parts of Spitsbergen. This may indicate that the fauna of northern Spitsbergen differs somewhat from southern parts of the island. Already Lynge (1933, 1939) suggested that certain lichens are pre-Weichselian relics in N. Spitsbergen. The observation of Christiansen, cited above, indicates that *Omalium caesum* is favoured by high soil temperature near the hot springs. A similar effect is found in the local flora. The three species *Carex capillaris, Sibbaldia procumbens* and *Euphrasia arctica* have their only Spitsbergen occurrence around these springs (Rønning 1961).

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PLATYCEPHALA UMBRACULATA (FABR., 1794) (DIPT., CLOROPIDAE) NEW TO NORWAY

LITA GREVE

219 specimens of the Chloropid flies *Platycephala planifrons* (Fabr., 1798) (69 ♂♂, 61 ♀♀) and *Platycephala umbraculata* (Fabr., 1794) (32 ♂♂, 57 ♀♀) were collected from 7 different localities in Vestfold province, southern Norway. *P. umbraculata* is reported new to Norway. A key is given to distinguish between the adults of these species.

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The fly larvae of the Chloropid genus *Platycephala* live in reeds — *Phragmites communis Trin.,* and the adults are therefore often found among the reed. Large populations are not uncommon. Only one species of *Platycephala* viz. *Platycephala planifrons* (Fabr., 1798) has been reported from Norway by Siebke (1877) from Akershus province.

In 1982 Arild Fjeldså collected a number of *Platycephala* specimens from several localities in Vestfold province. He collected among reeds with sweep-net. Both species *P. planifrons* and *P. umbraculata* were found, in some localities together. The localities are listed below:

P. planifrons (Fabr., 1798).
VE Sem Korten UTM 32 VNL 789719 19 July 1982 18♂♂ 7♀♀
VE Nøtterøy Ekenes UTM 32 VNL 817674 21 July 1982 10♂♂ 11♀♀
VE Tjøme Kolabekk-kilen UTM 32 VNL 806513 24 July 1982 3♂♂ 2♀♀
VE Tjøme Mostranda UTM VNL 800496 22 July 1982 27♂♂ 32♀♀
VE Tjøme Treidene UTM 32 VNL 803498 23 July 1982 10♂♂ 9♀♀

P. umbraculata (Fabr., 1794)
VE Nøtterøy Ekenes UTM 32 VNL 817674 21 July 1982 1♂ 1♀
VE Tjøme Mostranda UTM 32 VNL 800496 22 July 1982 25♂♂ 41♀♀
VE Tjøme Treidene UTM 32 VNL 803498 23 July 1982 6♂♂ 11♀♀
VE Sem Valløy UTM 32 VNL 707853 24 July 1982 4♀♀

1 male specimen of *P. planifrons* from VE: Tjøme (no exact locality given) collected on 1 August 1965 by Arne Fjellberg, was in addition found among undetermined material in Zoological Museum, University of Bergen.

On two occasions both species were collected together viz. at Mostranda and Treidene. The collection at Kolabekk-kilen was done near midnight at 23.00 P.M., otherwise collection was done at daytime. *P. umbraculata* is here reported from Norway for the first time. *P. planifrons* is reported new for Vestfold province.

P. planifrons and *P. umbraculata* have both been reported from Sweden (Wahlgren, 1919), from Finland (Hackman, 1980) and from England (Kloet & Hincks, 1976).

Adults of *P. planifrons* and *P. umbraculata* look superficially much the same and can be separated on the following characters beside the genitalia:

Key to Norwegian *Platycephala*:

1. Larger species. Specimens with bodylength from approximately 6 mm to 9 mm. Frons longer than broad with very distinct black punctures, as distinct as the punctures on the thorax dorsally. Most specimens have distinctly darkened tarsi on the first pair of legs. For figure of the head see Andersson (1977). Note: The smallest specimens are about the same length as the largest specimens of *P. umbraculata* (see below) .... *P. planifrons* (Fabr., 1798).

   Smaller species, approximately from 35 mm to nearly 6 mm in bodylength. Frons somewhat longer than broad, but ratio length/bredth less than in *P. planifrons*. Punctures on frons weak and not very distinct, celarly different from the punctures on the thorax dorsally. Often red markings on frons. Tarsi on all pair of legs yellow .... *P. umbraculata* (Fabr., 1794).

109 of the specimens listed above have been examined by Dr. Hugo Andersson who has kindly verified my determinations. I herewith extend my sincere thanks to him. I am also grateful to Arild Fjeldså who collected the material.

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