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Odonata in Hallingdal, Norway

ASLE BRUSERUD

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The article presents a list of fourteen dragonfly species new to Hallingdal. Furthermore, previous records are surveyed. Among the new records the presence of *Lestes dryas* Kirby and *Sympetrum flaveolum* L. are of special interest.

Asle Bruserud, Brumunddal videregående skole, Box 147, N-2381 Brumunddal.

INTRODUCTION

Although our knowledge of the Norwegian dragonfly fauna is fairly good compared to many other insect groups, there are still regions of our country where observations are few and scanty. Such a region is Hallingdal, where so far only three species have been recorded (Sømme 1937, Tjønneland 1952). During the summers 1983—1986 I visited several new localities in the region and found another fourteen species. This article presents these new records, and additionally previous records are surveyed.

MATERIAL AND METHODS

The localities visited are presented in Table 1.

The field work was concentrated to the lower situated districts since the purpose of the investigations was to find as many new species as possible and not so much to map the detailed distribution of each species within the region. The localities were visited twice a year in the period 1983—1986.

Localities no. 8, 9, 11, 12 and 14 are situated in the sub-alpine zone.

In addition to imagines also larvae were collected on some localities, and all specimen were identified by using Hammond (1977) and Stresemann (1978).

RESULTS AND DISCUSSION

Previous records:

Aeschna caerulea: (Strøm): Bv, Ål: Reine; Breistølen, EIS 43 (Tjønneland 1952).
Somatochlora arctica (Zetterstedt): Bv, Nes: Bromma, EIS 44 (Sømme 1937).
Somatochlora alpestris (Selys): Bv, Nes: Bromma, EIS 44 (Sømme 1937).

Table 1. Localities in Hallingdal visited 1983—1986

Loc. no.	Locality	EIS Ref.	Altitude m a.s.l.	Description of locality
1	Flå, Trolltjern	44	190	Large tarn in pine-wood
2	Flå, Ruud	44	150	Lakelet in open grassland
3	Flå, Gislerud	44	140	Shallow tarn in open grassland
4	Nes, Rauk	44	160	Large tarn fringed with rushes
5	Nes, Kvarteig	44	152	Shallow lakelets. Plenty of marginal vegetation
6	Nes, Åstjern	44	400	Wood tarn with a small bog
7	Gol, Eiklid	44	200	Small tarn in open grassland
8	Gol, Lyseren	43	830	Two boggy pools
9	Gol, Bjørnetjern	43	903	Wide canal with slowly running water
10	Hemsedal, Mythe	43	605	Boggy pool in pine-wood
11	Hemsedal, Helsingvn.	43	830	Shallow lake with large peat-bogs
12	Ål, Skrindehaugen	43	895	Boggy pool in pine-wood
13	Ål, Jegermoen	43	440	Small tarns in pine-wood. No boggy areas or marginal vegetation
14	Hol, Pålgårdtjern	43	801	Large tarn in open grassland

Table 2. Odonata recorded in Hallingdal 1983—1986

Locality no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ZYGOPTERA														
Lestes dryas Kirby					x									
L. sponsa (Hansemann)	x	x	x	x	x								x	
Erythromma najas (Hansemann)	x													
Pyrrhosoma nymphula (Sulzer)													x	
Coenagrion hastulatum (Charpentier)	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Enallagma cyathigerum (Charpentier)	x	x	x	x	x	x	x			x	x			x
ANISOPTERA														
Aeschna juncea (L.)	x	x	x		x	x		x	x		x	x	x	
A. grandis (L.)	x				x	x								
A. caerulea (Strøm)						x							x	x
Libellula quadrimaculata L.	x	x	x		x	x								
Cordulia aenea (L.)	x		x			x				x				
Somatochlora metallica (van der Linden)	x	x	x	x	x	x		x	x	x	x	x	x	
Leucorrhinia dubia (van der Linden)	x		x	x		x	x	x		x	x	x		x
Sympetrum danae (Sulzer)			x		x									
S. flaveolum (L.)			x		x	x								

New records:

The dragonfly fauna on fourteen selected localities is presented in Table 2.

Notes on species:

Lestes dryas

In Scandinavia this species has a predominantly south-eastern distribution (Valle 1954), and in Norway it has only been found in Akershus and southern parts of Hedmark (Sømme 1937, Aagaard & Dolmen 1977). My record is therefore so far the westernmost in Scandinavia.

At Kvarteig *L. dryas* was found together with *L. sponsa,* the latter definitely being the most numerous. Both species emerged on the first days of July, but *L. dryas* seemed to have a much shorter flight period since it disappeared already in the end of July.

L. sponsa

This typical late-summer species was very numerous in the lower situated regions. At Jegermoen *L. sponsa* was very rare, and this is probably the highest location in Norway for this species so far.

Pyrrhosoma nymphula

According to Sømme (1937) and Tjønneland (1952) this is possible a coastal form in Norway since the number of inland records is very low (Aagaard & Dolmen 1977). This is however not the case neither in Finland (Valle 1954) nor in England (Hammond 1977), where the species is widely distributed in all districts.

Anyhow, my record represents one of the first truely inland localities for this species in Norway.

Enallagma cyathigerum

As expected this very common species was found on most of the localities. Of particular interest is the fact that at locality no. 5 I collected two females with blue colour and restricted black markings instead of the normal grey-brown colour. This feature is also noted by Hammond (1977).

Sympetrum flaveolum

This species has an eastern distribution in Norway (Tjønneland 1952) and Scandinavia (Valle 1954). My record is among the westernmost in Scandinavia so far.

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Eight species of Tephritidae (Dipt.) new to Norway, with a note on the distribution of *Vidalia superciliata* (Frey, 1935)

LITA GREVE

Greve, L. 1987. Eight species of *Tephritidae* (Dipt.) new to Norway, with a note on the distribution of *Vidalia superciliata* (Frey, 1935). *Fauna norv. Ser. B, 34,* 99—104.

Eight species of *Tephritidae* (Dipt.) are reported new to Norway: *Myoleja lucida* (Fallén, 1826), *Vidalia spinifrons* (Schroeder, 1913), *Cerajocera plagiata* (Dahlbom, 1850), *Chaetorellia jaceae* (Robineau-Desvoidy, 1830), *Acanthiophilus helianthi* (Rossi, 1790), *Paroxyna achyrophori* (Loew, 1869), *Tephritis dilacerata* (Loew, 1846) and *Sphenella marginata* (Fallén, 1814). *A. helianthi* is also reported for the first time from Scandinavia while the others have earlier been reported from one or more of the Scandinavian countries. The new record for *V. superciliata* (Frey, 1935) is the second from Norway. The distribution of this species is mapped.

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

INTRODUCTION

The fly family *Tephritidae* is still insufficiently known in Norway. The last survey of this family in Norway goes back to Siebke (1877) and a summary of species published from the country (Greve 1985) gives the total number of 36. The number of species in other countries in Northern Europe is much higher; England has approximately 80 species (I.M. White, in press) and Finland 62 (Hackman 1980), and it is therefore reasonably to assume that the total number of species in Norway is much higher than 36. The author has checked the collections in the following museums: Zoological Museum, University of Oslo (= ZMO), The Museum, University of Trondheim, Rana Museum, Mo i Rana (= RM), Tromsø Museum, University of Tromsø and Zoological Museum, University of Bergen (=) ZMB). Only in ZMO the material is fairly large, but the records are mostly very old. The Museum in Bergen has mostly new material collected after 1980.

Below are a list of species new to the country. One species, *Vidalia superciliata* Frey, has been recorded once from Norway. The material has mostly been collected at random. Some duplicates have been given to British Museum (Natural History) = London BMNH. Unless otherwise stated, the material is in the collection of ZMB. The Norwegian localities are presented according to the system of Økland (1981).

Nomenclature follows Foote (1984)

LIST OF SPECIES

Sub. fam. Trypetinae.

1. *Myoleja lucida* (Fallén, 1826)
New records: AK 0219 Bærum: Ostøya, EIS 28, Malaisetrap B 30 May—10 Jun. 1984, 1 ♀, 1—24 Jul. 1984 1 ♂ 2 ♀♀, Malaisetrap C 10 Jun.—1 Jul. 1984 2 ♀♀.

M. lucida is reported for the first time from Norway. For a detailed description of the two localities at Ostøya see Greve & Midtgaard (1986). *M. lucida* is recorded from several provinces in southern Sweden, and the species is also included in Hackman's 1980 list from Finland. Foote (1984) gives the distribution as Northern and Central Europe. *M. lucida* is hitherto not published from the British Isles.

2. *Vidalia spinifrons* (Schroeder, 1913)
New records: VAY 1402 Mandal: Marnarveien near road to Valand, EIS 2, Malaisetrap 6—22 Jul. 1982 1 ♀, 1404 Flekkefjord: Hidra, Dragøy, EIS 4 Malaisetrap 19—22 Jul. 1982 1 ♀, 22—25 Jul. 1982 1 ♀, HOY Samnanger: Ådland, Malaisetrap 29 May—5 Jun. 1982 1 ♂.

V. spinifrons is reported for the first time in Norway. The localities are very different from each other. The Malaisetrap at Ådland was placed at the rim of a rich decidious forest near an open meadow. At Marnarveien the locality was an oligotrophic bog and at Dragøy the trap was positioned not far from the open sea (see also below under *A. helianthi*). Foote (1984) gives the distribution in Europe. *V. spinifrons* is listed by Hackman (1980) from Finland. The species is probably rare in Sweden since it has been reported by Persson (1958) from one locality only.

3. *Vidalia superciliata* (Frey, 1935)
New record: NSI 2933 Rana: Straumdalen, UTM 32 VVP 4755 10 Aug. 1974 (RM 1070). Persson (1958) in his revision of Zetterstedt's collection in the museum of University of Lund, reported *V. superciliata* from Norway for the first time. This fact, however, is not particularly mentioned in his article in contrast to species which were found new to the Swedish fauna, and might therefore be overlooked. One male *V. superciliata* was caught at NNØ 3035 Evenes: Evenes 18 Jun. 1821, seen and determined by Zetterstedt (1838) as *Trypeta zoe* Meigen, 1826. Thus more than 150 years separate the two Norwegian records. Curator Per Straumfors who collected the specimen in Straumdalen describes (pers. comm.) the locality as at edge of river, some scattered birch forest, herbage consisting of *Salix* spp., ground vegetation: *Geranium silvaticum, Alchemilla* sp. (*vulgaris* group), *Trollius europaeus* and various Gramineae. Ringdahl (1949) reported the hitherto single published record from Sweden from Njunjes west of Kvikkjokk, Swedish Lappland, in July 1948.: «Stackelberg (1965) published one record from the Leningrad district (*not* included in the map). These are the only published records since Frey (1935) described the species from Rytty in the Sortavala region, today in the USSR. See the distribution mapped on Fig. 1. The male genitalia Fig. 2. They are similar to genitalia of the genus *Trypeta* (Richter & Kandybina, 1985) which is closely related to *Vidalia.* More material is needed, however, to discover eventual variation in the different parts. No spines on R 4 + 5, as also noted by Frey (1935) for his specimens.

The host plant of the larvae is unknown. A hostplant belonging to the Asteraceae could be expected, and therefore it is noteworthy that the locality described by Ringdahl was an area with *Cicerbita alpina* (L.) No *C. alpina* was noted near the locality in Straumdalen.

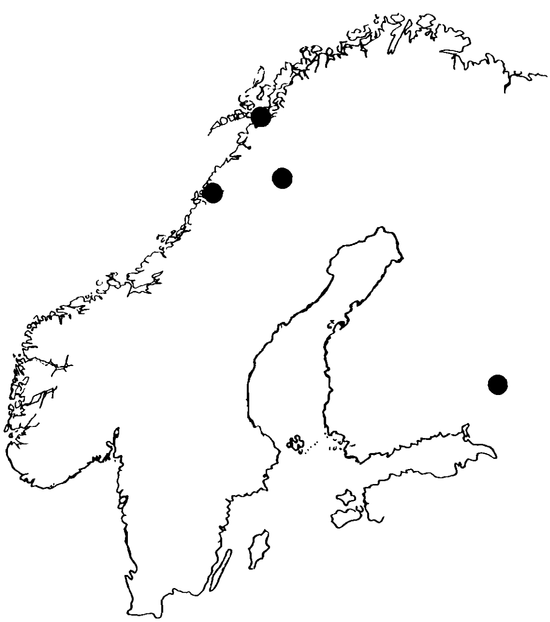

Fig. 1. *Vidalia superciliata* (Frey, 1935). The known distribution.

4. *Cerajocera plagiata* (Dahlbom, 1850)
New records: BV 0833 Nore & Uvdal: At Norefjord south of Lintveit, 4 Jul. 1980 1 ♂ netted on *Centaurea* sp., VE 0926 Brunlanes: Stavern, UTM 32VNL 597397 5 Jul. 1980 1 ♂ , Oddane, UTM 32VNL 494363 7 Jul. 1980 1 ♂ (2 ♀♀).

C. plagiata is very closely related to *C. ceratocera* (Hendel, 1913). Characters used for separating the two species are: 1. Length of pedical extension compared to length of 1. flagellomere; and 2. Whether the wingbands are distinct behind vein M or not. The males recorded above have the pedicel short, approximately 1.5 times as long as 1. flagellomere, and indistinct wing crossbands behind vein M.

According to various authors (Hering 1935, Niblett 1947, 1955) the larvae of *C. plagiata* live in the stem of *Centaurea scabiosa* L. while *C. ceratocera* lives in the flowerheads. None of the specimens recorded here have been hatched from the plant, however.

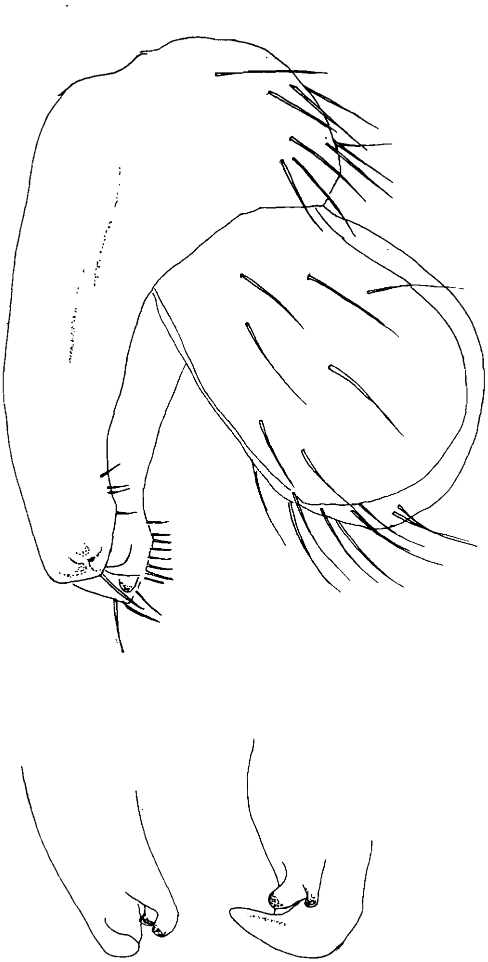

Fig. 2. *Vidalia supercilíata* (Frey, 1935) ♂ genitalia. Epandrium with surstyli (above), teeth at ends of surstyli (below).

C. plagiata is here reported for the first time from Norway. *C. plagiata* is known from Sweden (Persson 1958) and from Finland (Hackman 1980). Foote (1984) gives the distribution as parts of Europe.

5. *Chaetorellia jaceae* (Robineau-Desvoidy, 1830)
New records: AK 0219 Bærum: Ostøya, EIS 28, Malaisetrap A 10 Jun.—1 Jul. 1984 1 ♂ 1 ♀, VE 0903 Horten: Karl Johansvern 9 Jul. 1985 6 ♀♀, 0923 Tjøme: 10 Jul. 1965 1 ♂, 24 Jul. 1982 5 ♂♂ 4 ♀♀, 24 Jul. 1983 1 ♂, Moutmarka, 24 Jul. 1982 3 ♂♂ 2 ♀♀, 8 Jul. 1983 14 ♂♂ 8 ♀♀, 9 Jul. 1983 2 ♂♂ 4 ♀♀ 20 Jul. 1983 1 ♀, Verdens ende, 28 Jul. 1984 4 ♂♂ 1 ♀, TEY 1014 Bamble: Langesund, Krokhavn 11 Jul. 1986 2 ♂♂, VAY 1402, Mandal: Near Tregde UTM 32 VMK 148315, 6 Jul. 1978 2 ♂♂ 1 ♀.

C. jaceae is here reported from Norway for the first time. Only localities where males have been caught are included here. Wahlgren (1919) reported *C. jaceae* from Central and Southern Sweden, and Hackman (1980) listed it from Finland. Foote (1984) gave the distribution as Europe and parts of Asia and North Africa.

Sub. fam. Tephritinae

6. *Acanthiophilus helianthi* (Rossi, 1790)
New record: VAY 1404 Flekkefjord: Hidra, Dragøy, EIS 4, Malaisetrap 17—19 Jul. 1982 1 ♀.

A. helianthi is here recorded for the first time from Norway, and this is also the first record from Scandinavia. The locality (see above under *V. spinifrons*) is an oligotrophic bog near the sea. The forest around the bog is mostly birch and pine. The trap was opened at 24 March, and closed at 11 Sept. 1982. It was emptied nine times. The female was newly hatched since the ptilinum was not withdrawn. *A. helianthi* is rare and occurs in Southern parts of the British Isles only. (L.M. White pers. comm.). According to Foote (1984) the distribution of the species is wide, covering Europe, parts of Africa and Asia including the Atlantic Isles like Madeira and the Canary Islands.

7. *Paroxyna achyrophori* (Loew, 1869)
New record: HOY 1801 Bergen (Fana): Store Milde, Geitanesset, UTM 32 VKM 941859, EIS 30 15 ♂♂ 16 ♀♀ hatched from *Hieracium aurantiacum* L. between 18—25 Jul. 1984, (2 ♂♂ 2 ♀♀ deposited in BMNH).

P. achyrophori is here recorded for the first time from Norway. Two small bunches of *Hieracium aurantiacum* L. were taken (indoors) at around 1 July. The bunches were placed in the windows of two separate rooms. From one bunch 11 males and 12 females were hatched, from the second bunch 4 males and 4 females were hatched, all specimens between 18-25 Jul. 1984. *H. aurantiacum* is (on account of the red flowers) used as a garden plant in Norway. *H. aurantiacum* was planted, a few plants only, about twentyfive years ago. *P. achyrophori* has not been collected from *Hieracium* spp. from other localities in the vicinity.

Ringdahl (1949) and Persson (1958) have recorded *P. achyrophori* from Sweden and the species is also listed from Finland by Hackman (1980). Foote (1984) gave the distribution as Northern and Central Europe.

8. *Tephritis dilacerata* (Loew, 1846)
New records: Ø 0104 Moss: Jeløy, SE Jeløybukt, 5 Jul. 1982 4 ♂♂ 3 ♀♀, AK 0214 Ås: Vollebekk 27 Jul. 1955, 2 ♀♀, 0219 Bærum: Ostøya 3 Jul. 1983 1 ♂, VE 0903 Horten: Karl Johansvern 9 Jul. 1985 1 ♂ 1 ♀, 0905 Tønsberg: Horten 19 Jul. 1982 1 ♂, 0906 Sandefjord: Sørbyøya 22 Jun. 1984 2 ♂♂, Vestøya 22 Jun. 1984, 1 ♂ 1 ♀, 0922 Nøtterøy: Ekenes 21 Jul. 1982, 4 ♂♂ 3 ♀♀, 0923 Tjøme: Hønø 23 Aug. 1980 2 ♀♀, Moutmarka 8 Jul. 1983 4 ♂♂ 1 ♀, Mostranda, 22 Jul. 1982 1 ♀, 30 Jun. 1985 1 ♂, Sunnane, 5 Jul. 1983 3 ♂♂, 10 Jul. 1985 6 ♂♂ 1 ♀, Sønstegård, 9 Jul. 1983 12 ♂♂ 15 ♀♀, Verdens Ende, 28 Jun. 1984 15 ♂♂ 15 ♀♀, 0925 Tjølling: Rønningen 8 Jul. 1980 1 ♂ 1 ♀, TEY 1005 Porsgrunn: Skjelvik, Kohtøya 31 Jul. 1983 1 ♂.

T. dilacerata is here reported from Norway for the first time. Foote (1984) gave the distribution as Northern and Central Europe. *T. dilacerata* was reported from Sweden by Wahlgren (1919) and Janzon (1983) and listed by Hackman (1980) from Finland.

9. *Sphenella marginata* (Fallén, 1814)
Revised material: AK 0201 Oslo: 1 ♂ 1 ♀ (ZMO 9783, 9781), Juliushaugen 11 Jul. 1846 1 ♂ (ZMO 9784), Rosenberg 26 Jul. 1846 1 ♂ (ZMO 9782).Revised from *Ensina sonchi* (L.)

New records: VE 0923 Tjøme: Moutmarka 20 Jul. 1983 1 ♂, TEY 1005 Porsgrunn: Skjelvik, Kohtøya 31 Jul. 1983 1 ♂, VAY 1429 Lindesnes: Spangereid 8 Aug. 1983 2 ♂♂.

S. marginata is here recorded for the first time in Norway. The locality at Moutmarka was a bog with *Phragmites australis*, the specimen from Spangereid was netted on plants at the beach. *S. marginata* is mentioned as rare in Sweden (Wahlgren 1919). It is also listed from Finland by Hackman (1980). Foote (1984) gives a very large distribution area including whole Europe with parts of Asia and Africa.

DISCUSSION

Since the Tephritidae fauna of Norway has not been surveyed in recent times, it is natural to expect species new to the fauna of Norway. Several species and genera have been revised since the time of Siebke (1877). More species will surely be discovered in the future.

It is somewhat prejudical, but the species *C. plagiata, A. helianthi, V. spinifrons* and *V. superciliata* are probably fairly rare in Norway. *A. helianthi* is here reported new to Scandinavia, and it is also very rare on the British Isles. Since it has not been published from Sweden or Denmark it should be correct to assume that it is rare in Norway. Both *Vidalia* species have males with very strong orbital bristles looking actually as horns on the head of the fly. These bristles are remarkable to the eye even in the field, and these flies no doubt would have been well represented in Norwegian entomological collections had they been common.

V. superciliata is also very rare in Sweden and Western USSR. This species seems to have a northern distribution, rarely found in the family Tephritidae, see Fig. 1. *V. spinifrons,* on the contrary, found on three widely separated localities along the coast, and compared with the distribution elsewhere in Scandinavia, is probably a southern species in Norway. The species *C. plagiata* is not by far as common as the closely related *C. cerajocera. C. cerajocera* is fairly well represented in ZMO and ZMB. The two other species *M. lucida* and *P. achyrophori* might be rare since they have been collected from one or two localities. *M. lucida* can not be common in the Oslo area since it is not represented in the collection in ZMO. The species was not collected in outer Vestfold (see below). It is also fairly rare in Sweden. The same can be said for *P. achyrophori* which was reported from Sweden as late as 1949 (Ringdahl, 1949).

The three species *C. jaceae* (63), *T. dilacerata* (103) and *Spenella marginata* (8) (number in brackets = number of specimens) are probably fairly common, at least in some areas. *C. jaceae* and *S. marginata* have both a south-eastern distribution which extends to West-Agder province, *T. dilacerata* has hitherto been found in a more restricted area in the inner Oslofjord. The community Tjøme in Vestfold has in the last years been subject to much collection with sweepnets, Malaise-traps, Barbertraps and Yellow water trays.

All *Tephritidae* from these collections has been taken care of and based on this information it is clear that *C. jaceae* and *T. dilacerata* are both locally very common. *S. marginata* on the other hand has been collected as single specimens only. The distribution of these three species is well inside the distribution of the host-plants: Sonchus *arvensia*/T. dilacerata, *Senecio* sp./S. marginata and *Centaurea* sp./C. jaceae.

Some older localities for *S. marginata,* Julius-haugen and Rosenborg in central Oslo, must today be considered lost for future collections.

With the eight species of Tephritidae new to the country as listed above, and the four species recorded by Greve (1986 A and B) the number recorded from Norway is 48.

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Several collectors have put material of *Tephritidae* to my disposal: Fred Midtgaard, Norwegian Forest Research Institute (material from Ostøya), Per Straumfors, Rana Museum (material from Straumdalen), curator Jan E. Raastad, Zoological Museum, University of Oslo, Alf-Jacob Nilsen, Hidrasund (material from several Malaisetraps in Southern and Western Norway) and last but not least my collegue Arild Fjeldså, Zoological Museum, University of Bergen.

I am in dept to Dr. I.M. White, The Commonwealth Institute of Entomology who has verified my determination of *P. achyrophori, A. helianthi* and some of the *T. dilacerata* material.

Dr. Hugo Andersson, Lund has given me information on the Swedish record of *V. superciliata.*

Moutmarka, Tjøme, Vestfold province, where three of the species, *Chaetorellia jaceae* (Rob.-Desv.), *Tephritis dilacerata* (Loew) and *Sphenella marginata* (Fallén) were collected. The area is partly open meadow with some juniper and mixed herbage as shown on the picture. Photo Trond Andersen.

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Pitfall trapping of the carabid fauna in alpine and subalpine habitats at Saltfjellet, North Norway

PER GUSTAV THINGSTAD

Thingstad, P.G. 1987. Pitfall trapping of the carabid fauna in alpine and subalpine habitats at Saltfjellet, North Norway. *Fauna norv. Ser. B, 34,* 105—116.

The carabid fauna at Saltfjellet was investigated by means of pitfall traps during the active periods of the animals in 1975 and 1976. 1975 was a cold and humid summer, giving many specimens of the hydrophile species as *Dyschirius septentrionum, D. globosus* and *Pterostichus adstrictus.* 1976 had an average temperature, and was far drier than the year before. This year, 11 study plots were used at different localities of the Saltfjellet area, whereas only 7 study plots all close to Kvitbergvatnet were used in 1975.

According to the similarity and correlation analyses, the ombrotrophic hummock bog species *Pelophila borealis* and *Diachila arctica* are greatly associated. Another group constitutes the beach species; and highly connected are also *Leistus rufescens, Patrobus atrorufus, Calathus micropterus* and *Agorum fulginosum,* all requiring shady and humid localities. For the rest of the species, there is less agreement. The analysis of the study plots, however, shows that there are close associations between the plots in the different shapings of the *Vaccinium myrtillus* birch forest. The damp *Dryas octopetala* heath is associated with these birch forest plots, whereas the drier, exposed *Dryas* heath more firmly is connected to the mixed *Empetrum* and *V. myrtillus* heath.

There is not always a correlation between the vegetation types and the carabid communities in this material. The carabids which mainly are carnivorous are, however, under the influence of the same abiotic factors as the vegetation, giving some correlation between the vegetation and the animal communities.

The 10 specimens of *D. arctica* in the material from Saltfjellet, is the first Norwegian record outside Finnmark. Both *D. arctica* and *Elaphrus lapponicus* were caugt relatively late in the summer at Saltfjellet. *Amara brunnea* was most active during the period late July to early August in 1975, and in the first part of July in 1976. These early differences were correlated with later development of the leaves of *Betula pubescens* and *V. myrtillus* the last year.

Altogether 4488 specimens distributed on 31 species were collected at Saltfjellet the two years in question. This material is compared with collections from five other Fennoscandian mountain areas. The number of species are highly correlated with the used collecting methods and how many different habitats the material are collected from. Comparing the carabid fauna from the other alpine and subalpine localities, it seems to be mainly the tribe Bembidiini that is under-estimated in the material from Saltfjellet. The other actual tribes seem to be more abundantly represented. Altogether the alpine carabid fauna seem to be equally abundant in the more northern altitudes as in the more southern mountain areas.

Per Gustav Thingstad, University of Trondheim, The Museum, Erling Skakkesgt. 47A, N-7004 Trondheim, Norway.

INTRODUCTION

In Norway topographical and climatic conditions differ markedly over relatively short distances, these might give corresponding dramatic changes in the animal communities. The carabid beetles are highly mobile, they react quickly to changes of the environment (Thiele 1977), many of the species are connected with special habitat requirements (Lindroth 1945—49), and they can be trapped by a simple method (Barber 1931), and adequate keys for their determination are supplied (Lindroth 1942, 1985). Therefore, they constitute a suitable object for ecological studies.

STUDY AREA

The Arctic Circle runs through the investigated area, the Saltfjellet in Nordland, northern Norway. The central vallies and great parts of the glacier Svartisen, altogether 2250 km^2, are proposed as a new national park, and in addition to this, 673 km^2 as protected areas. Large parts of Saltfjellet have an alpine character. However, the geological and topographical relations are varied, creating many different landscape formations. Most of the collected specimens stem from the areas around the Kvitbergvatnet in Saltdalen. The lake itself has previously been regulated, but as the dam broke more than 30 years ago, the vegetation has now recolonized the previously regulated areas (see Tab. 1 for further details). One study plot was situated at the summit between Skjerstad and Beiarn, and one at the pine moors at Beiarn. Two of the study plots were situated at the Stormdalen, to the very south of Saltfjellet. None of the used plots were located at the high alpine zone in the area.

Table 2 gives the mean temperature and the number of days with precipitation in the four «summer months» (May to August) at Saltfjellet, the period of carabid activity in the area. 1975 was a particularly cold and humid summer, with June and July temperatures around 2.5°C below average. The summer of 1976 was drier, and the temperature was closer to the normal. The climatic data were obtained from the annual reports published by the Norwegian Institute of Meteorology, and the Saltdal meteorological station was used, being the one situated closest to the study plots that were used both years (cf. Tab. 1).

MATERIAL AND METHODS

The field work was carried out during the periods 14 June—4 Sept. 1975 and 22 May—10 Aug. 1976. The carabids were collected from 18 different study plots (Table 1) by means of pitfall traps (Barber 1931) containing 4% formaldehyde. Each trap had an inner diameter of 62 mm, and they were placed in rows spaced two meters apart. The intervals between the collections are shown in Fig. 1.

Study plots 1 to 7 were used in 1975, while the rest of the plots were used the year after. Three of the plots were used both years; study plot 11 in 1976 was located at the same place

Table 1. Location of the 18 study plots, their UTM-reference, altitude, and dominant types of vegetation.

Study plot	UTM-reference	Altitude (m)	Vegetation type
01	33WWQ 042253	475	Damp *Vaccinium myrtillus* birch forest
02	33WWQ 043256	500	Mixed *Vaccinium myrtillus* sub-type of mesotrophic birch forest and low herb birch forest
03	33WWQ 039243	460	Oligotrophic birch forest
04	33WWQ 048268	830	Dry, exposed *Dryas octopetala*-heath
05	33WWQ 048264	660	Damp *Dryas octopetala*-heath
06	33WWQ 040255	455	Pioneer vegetation on calcareous sand beach (earlier regulated)
07	33WWQ 041255	456	Low herb meadow, with some *Betula pubescens* and *Salix* spp. on calcareous sand beach (earlier regulated)
08	see 05		
09	33WWQ 047264	660	Gravel scree without vegetation
10	33WVQ 956356	630	Mixed chionophobous *Empetrum* heath and chiono philous *Vaccinum myrtillus*-heath
11	see 02		
12	33WVP 893773	340	Tall herb birch forest
13	33WVP 897772	315	Rich damp meadow with *Salix* spp.
14	33WVQ 924279	35	Oligotrophic pine forest
15	33WWQ 042258	480	Mixed rich damp meadow and open extremely rich fen
16	33WWQ 034222	515	Open rich *Carex* fen
17	33WWQ 034221	515	Ombrotrophic hummock bog
18	see 06		

Table 2. The mean temperature and the number of days with precipitation from Øvre Saltdal meteorological station in May, June, July, and August 1975 and 1976. The variations from the mean temperature the last 30 years are given in parentheses, and so is the number of days with more than 1 mm precipitation.

Month	1975 Temp.	1975 Precip.	1976 Temp.	1976 Precip.
May	6.6 (-0.2)	18 (15)	8.4 (1.6)	4 (3)
June	8.8 (-2.2)	15 (11)	11.1 (0.1)	8 (4)
July	11.6 (-2.6)	16 (11)	13.4 (-0.8)	15 (12)
August	11.5 (-0.9)	18 (14)	11.4 (-1.0)	15 (9)

as study plot 2 the year before, and the same was study plot 5 in 1975 and study plot 8 in 1976, and 6 in 1975 and 18 in 1976 (cf. Tab. 1).

Altogether 4488 individuals and 31 species were collected. In 1975 3042 carabid beetles were trapped during 12211 trap-days, and 1464 individuals were collected the next year during 11640 trap-days. A complete survey of the data collected is given in Tab. 3.

The usefulness of the pitfall traps, for collecting the surface active invertebrate groups, has been discussed in many papers, e.g. Mitchell (1963), Greenslade (1964), Luff (1975) and Thiele (1977). These show that the method is not suitable for doing quantitative studies of the populations. The number of trapped animals depends both on the density of the populations and the activity of the individuals. Greenlands (1964) has shown that the structure of the vegetation has a significant impact upon the collected material. When cleaning the area around each trap for vegetation, more numbers of the greater species were trapped. In this study, no vegetation was removed around the traps. An additional problem is connected with different activity patterns; some of the species do not only move on the ground, but also have a three-dimensional activity in the vegetation (e.g. *Dyschirius*). The size of the traps has also influence upon the collected material. The bigger species are most effectively trapped when using relatively great traps (Luff 1975).

Whatsoever, the pitfall traps are so cheap and easy to handle that this method has been a valuable tool in many works (e.g. Hågvar et al. 1978, Hauge & Refseth 1979, Refseth 1980). It has proved to be useful for studying the seasonal variability, the population distribution, the relative abundance in different vegetation types, habitat preference, and activity patterns of the species (Thiele 1977). However, one has to bear in mind the earlier mentioned problems connected with this sampling method, when reading the results

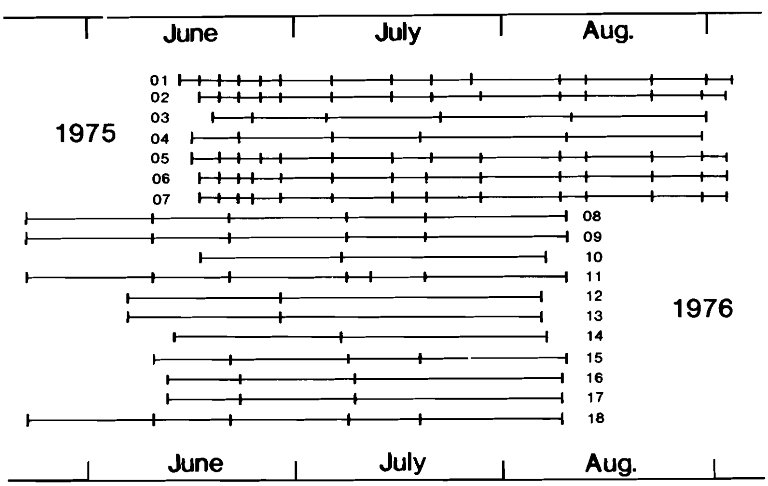


Fig. 1. The horizontal lines show the total catch period for each of the study plots. The vertical marks represent the checking dates; the first one on each line represents the day when the catching period started.

from investigations based upon pitfall traps. For example, the relative abundance of the species in the collected material will not reflect the real situation in the carabid habitats, due to, among other things, the overrepresentation of greater, highly mobile species.

The material was statistically analysed by means of the coefficients of similarities, that o.a. Schoener (1968) has used:

$$(\alpha_{xy} = 1 - 1/2 \sum_{i=1}^{n} p_{xi} - p_{yi}\text{, where}$$

α_{xy} = degree of similarity between species x and y,
p_{xi} = the relative occurrence of species x in study plot i,
p_{yi} = the relative occurrence of species y in study plot i,
n = number of study plots)

This formula gives an expression for the niche overlap between the sampled species. On basis of the similarity indexes dendrograms can be made by the procedure described by Cody (1974). The correlation between the actual variables were also comp-

Table 3. Total number of specimen of each species caught in the 18 study plots. (The numbers of the plots ar according to Table 1.) Each species is given a number used in this paper. The ranking of species is according t Lindroth (1942).

Species	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	Total
01 *Cychrus caraboides* L.	2	2			19						10		1	1					36
02 *Carabus glabratus* Payk.	40	87			1	1					20			16	7			1	173
03 *C. violaceus* L.	16	3			26	3	6	7						9	29			1	100
04 *Leistus rufescens* Fbr.												7	1						8
05 *L. ferrugineus* L.		8			1						1								10
06 *Pelophila borealis* Payk.																	27		27
07 *Notiophilus aquaticus* L.	3	6		40	14	40	25	5		7	14			1	1				156
08 *N. biguttatus* Fbr.		8			1							6	1						16
09 *Diachila arctica* Gyll.																	10		10
10 *Elaphrus lapponicus* Gyll.	1				8														9
11 *Loricera pilicornis* Fbr.						1	2					1	4						8
12 *Dyschirius septentrionum* Munst.						25	13												38
13 *D. globosus* Hbst.						48	29								4			1	82
14 *Miscodera arctica* Payk.			3	5	1	6	9	5		10									39
15 *Asaphidon pallipes* Dft.						158	44											24	226
16 *Bembidion bipunctatum* L.						15	3											2	20
17 *Patrobus septentrionis* Dej.				13	3	1	2			5					1	1	10		36
18 *P. assimilis* Chaud.	16	64	4		13	2			1	80	23	39	6		6	3	2		259
19 *P. atrorufus* Strøm												140	5						145
20 *Trichocellus cognatus* Gyll.						22	18											2	42
21 *Amara lunicollis* Schiø.													24						24
22 *A. Quenseli* Schönh.				17		99	15	32	68									37	268
23 *A. brunnea* Gyll.	569	776	23	20	99	12	43	77	1	9	419				10			3	2061
24 *A. torrida* Ill.						6	45			1								5	57
25 *A. alpina* Fbr.	1		1	74	4			6		57									143
26 *Pterostichus adstrictus* Eschz.						11	5												16
27 *P. diligens* Sturm.												1			1				2
28 *Calathus melanocephalus* L.	76	161		1	30	21	23	8			16	2	41		3			7	389
29 *C. micropterus* Dft.						3	2					42	6					1	54
30 *Agonum fuliginosum* Panz.												5							5
31 *Cymindis vaporariorum* L.			5	1				10		12					1				29
Total	724	1115	36	171	220	474	284	151	70	181	503	243	89	27	63	4	49	84	4488
Trap-days	3300	1494	1460	1500	1515	1471	1471	1600	960	1020	960	1220	1220	1100	1220	696	696	948	23851

uted by means of Spearman rank-order correlation coefficients, which is a nonparametric correlation analysis (see Nie et al. (1976) for further details).

RESULTS AND DISCUSSION

The carabid communities

As Tab. 3 shows, both species diversity and relative occurrence varies greatly from study plot to study plot. Some of the registered species are clearly euryoecious, e.g. *Carabus ciolaceus, Patrobus assimilis, Amara brunnea,* and *Calathus melanocephalus,* while others, e.g. *Pelophila borealis* and *Agonum fuliginosum* both are found in one study plot only. The most numerous species was *A. brunnea,* a characteristic species for the alpine birch forest and the lower alpine zone, while the mesophile *Pterostichus diligens* only was found in one specimen in two different study plots.

The dendrogram drawing on the basis of the results from the similarity index analysis between the species are shown in Fig. 2. As the clusters show, the association between the two hydrophile species *Pelophila borealis* (6) and *Diachila arctica* (9) is great. Another, somewhat less hydrophile group, constitutes the association between *Dyschirius septentrionum* (12), *Dyschirius globosus* (13), *Asaphidion pallipes* (15), *Bembidion bipunctatum* (16), *Trichocellus cognatus* (20), and *Pterostichus adstrictus* (26). Some of these species are more associated with the sparse vegetation on the beach than to the water itself. The same is the situation for *Amara Quenseli* (22) and *Amara torrida* (24), which both are, according to the correlation analysis (see Fig. 3), linked to the last mentioned hydrophile association of species. Still another highly connected group of species constitutes *Leistus rufescens* (4), *Patrobus atrorufus* (19), *Calathus micropterus* (29), and *Agonum fuliginosum* (30). These species require shady and humid localities. According to the correlation analysis (Fig. 3), also *Loricera pilicornis* (11), which require organic material at the surface, is connected to this association. For the rest of the species, there is less agreement between the two analyses. Probably, this is due to the fact that these species are prodominantly distributed within so many of the studied habitats. The analyses of the study plots, however, give more information about these beetle communities.

Fig. 4 shows the cluster analysis of species composition between the study plots, and Fig. 5 the correlation indexes between the same ones. One group contains the sand beach plots (6, 7 and 18). According to the same analyses, the *Vaccinium myrtillus* birch forest plots (1, 2 and 11), are highly associated. The damp *Dryas octopetala* heaths (5 and 8) represent a somewhat more divergent result. According to the similarity indexes (Fig. 4), these last two plots also are associated with the *V. myrtillus* and the oligotrophic birch forests (1, 2, 11, and 3), while the correlation analysis shows a highly significant correlation between study plots 8 and study plot 4. The dry, exposed *D. octopetala*-heath at Kvitberget, 830 m a.s.l. (plot 4), is, however, according to both of the analyses, more

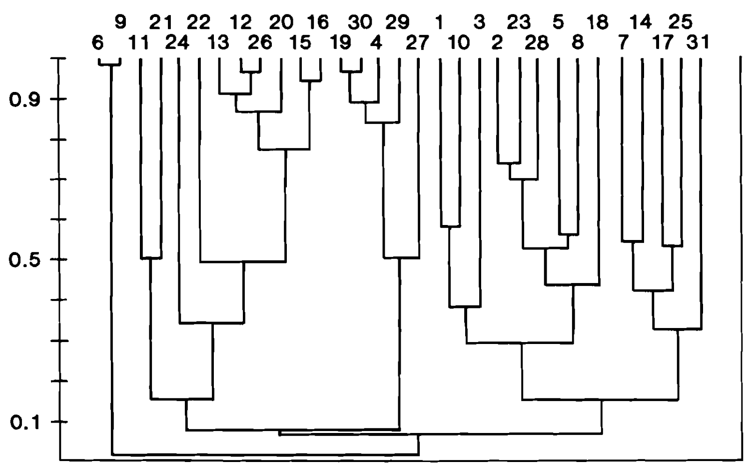


Fig. 2. Dendrogramme showing the degree of similarity in habitat preference for each of the 31 species. The numbers from 1 to 31 refer to the numbers of the various species given in Table 4.

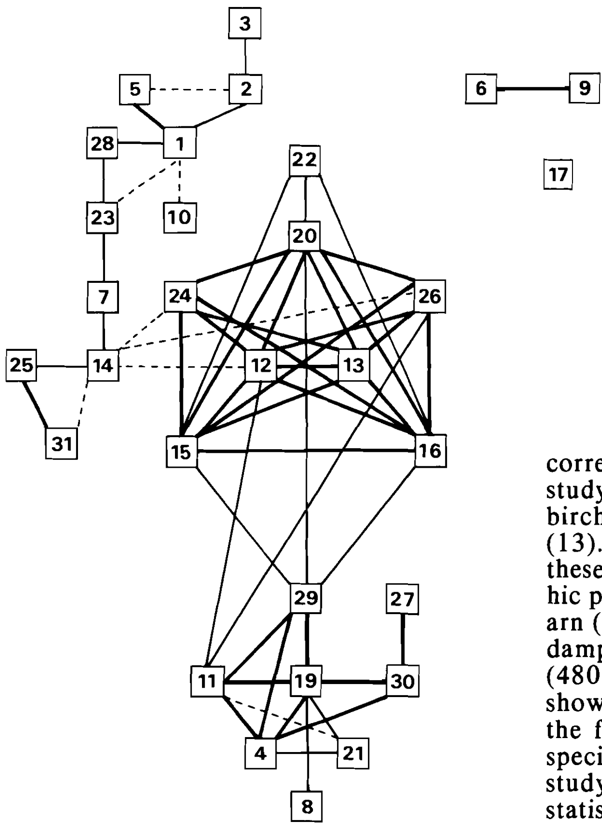


Fig. 3. The degree of similarity between the carabid species according to the significant values of the correlation coefficients. Thick line: $P \leq 0.001$ Thin line: $0.001 < p \leq 0.005$ Dotted line: $0.005 < p \leq 0.01$ The connection between the species 6 and 9 to the species 7 is less significant than the others ($p = 0.011$). (Small p-value = great similarity between the species in question).

firmly connected to the mixed *Empetrum*--heath and chinophilous *V. myrtillus*-heath, 630 m a.s.l. (plot 10), at the summit between Skjerstad and Beiarn, than to the plots 5 and 8 in the damp *Dryas* heath in the same area just further down the slope (at 660 m a.s.l.). The correlation analysis (Fig. 5) connects the two study plots at the Stormdalen, the tall herb birch forest (12) and the rich damp meadow (13). Fig. 4 shows less similarity between these two plots. Surprisingly, the oligotrophic pine forest (plot 14) at the moors in Beiarn (35 m a.s.l.) and plot 15, the mixed rich damp meadow and open extremely rich fen (480 m a.s.l.) in the Kvitbergvatnet area also show some connection (Fig. 4). This despite the fact that study plot 15 both has more species and greater individual number than study plot 14 (see Tab. 3). It seems that the statistical calculations have brought these two plots together, because of the great number of individuals from the *Carabus* genus they have in common. Based upon a biological consideration, this seems curious. The two plots have quite different moisture, vegetation, altitude, slope, and exposure. This is probably just a result of the earlier mentioned

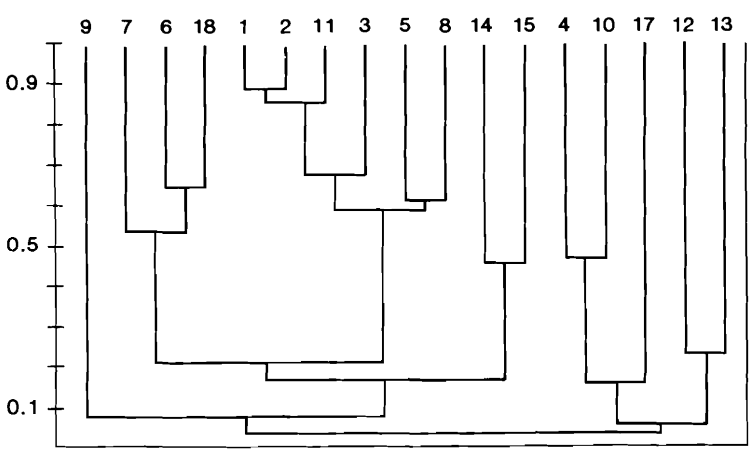
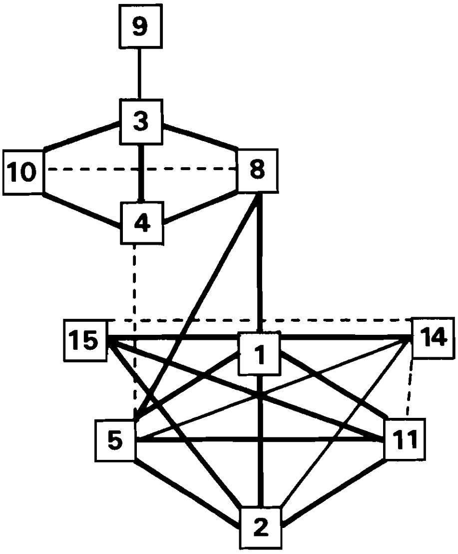


Fig. 4. Dendrogramme showing the degree of similarity between the study plots. The numbers 1 to 18 refer to the numbers of the used study plots.



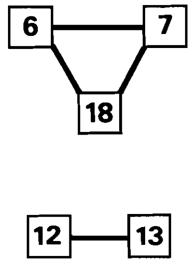


Fig. 5. The degree of similarity between the study plots according to the significant values of the correlation coefficients. For further explanation, see text to Fig. 3.

overrepresentation of this highly mobile *Carabus* group. Therefore, it is most natural to consider these plots to represent two different carabid beetle communities.

It is of importance to look at the climatic differences between the two years the material was collected, and see if those might have influenced the species constellations. According to Tab. 3, this may be the case for the pioneer-community on the sand beach (study plot 6 in 1976 and plot 18 the next year), where many of the hygrophile species were lacking in 1976. It was higher temperature and less precipitation this year, compared with 1975 (see Tab. 2). The biological explanation for the great variations in the species composition in this habitat is based upon the pioneer status of this plot, which indicates that the biological communities are controlled by physical factors (Margalef 1968). The birch forest, which was used as a study plot both years (2 in 1975 and 11 in 1976), did not show any difference in the species constellations, as this habitat represents a local climax community, which is controlled by biological factors and therefore is more stable (Margalef 1968). Another circumstance, that might reflect the influence of the climate and edaphic conditions, is almost no relationship between study plots 4 and 5, both calciphilous *D. octopetala*-heaths situated at the same slope of Kvitberget (plot 4, 830 m a.s.l. and plot 5, 660 m a.s.l.). Because of the higher altitude, plot 4 is more exposed and has later melting of snow. These circumstances classifies plot 4 together with the more oligotrophic alpine heath (plot 10).

According to these results, there is not always a correlation between the vegetation types and the carabid beetle communities. Very few of the species in question are just herbivorous, more commonly they are carnivorous, which in itself should not account for any close dependence. The local topographic, climatic and edaphic conditions give, however, a particular vegetation. The carabid species respond in different ways to the same abiotic environmental conditions, giving the different carabid communities. These communities will therefore, in some way, be correlated with the same abiotic factors as the vegetation.

Comments on some of the trapped species

Carabus glabratus Payk. The character species in the collected material from the heathery pine forest at the lowland of Beiarn.

Carabus violaceus L. Common on the rich damp meadow mixed with open extremely rich fen at the slope of Kvitberget (study plot 15). This species was most common in the parts of the study plot that were driest and most closely situated to the scattered birch trees in the plot (see Fig. 6).

Leistus rufescens Fbr. Only found in the Stormdalen area, in the southern parts of Saltfjellet.

Pelophila borealis Pay. All the trapped individuals were caught at an ombrotrophic hummock bog (plot 17).

Diachila arctica Gyll. Trapped in the same plot as *P. borealis,* in the Harodalen south of Kvitbergvatnet. None of these two species were trapped in the surrounding open, rich *Carex* fen, but on the somewhat drier hummock bog with *Cladia* spp., *Eriophorium vaginatum, Rubus chamaemonis* and *Betula nana.* Two individuals were found in the

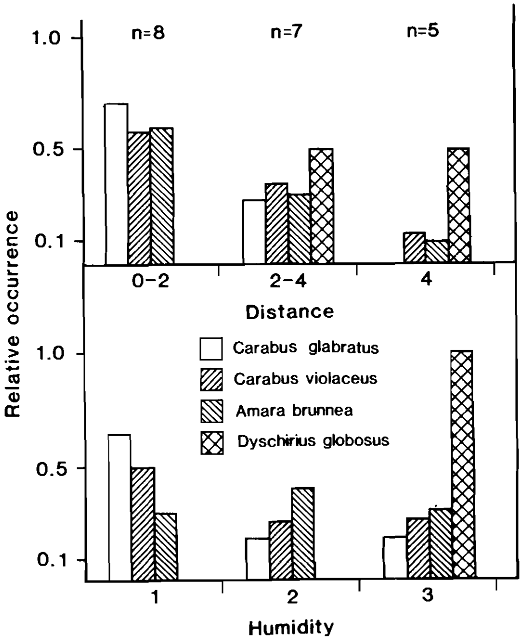


Fig. 6. The relative occurrence of four carabid species along two environmental gradients in the mixed rich damp meadow and open extremely rich fen (study plot 15). The top drawing shows how the species alternate in distance (three intervals given in meters) from the closest birch tree. The bottom drawing shows the occurrence of the species in three humidity intervals: 1) relatively dry micro-habitat. 2) intermediate humid micro-habitat, 3) humid micro-habitat.

traps 23 June, three 9 July and five 9 Aug. This is the first Norwegian record outside Finnmark (Lindroth 1985).

Elaphrus lapponicus Gyll. Trapped at damp *Dryas octopetala* heath at Kvitberget in 1975. One individual was also caught in the damp *V. myrtillus* birch forest at Kvitberget this year. The heath had a great assortment of herbs, such as *Saxifraga aizoides, S. oppositifolia, Pinguicula alpina* and *Thalictrum alpinum. E. lapponicus* was not trapped in any plot in 1976, when these habitats, because of less precipitation, was considerably drier. Most of the collected individuals were caught relatively late, as two were found in the traps 15 July, two 28 July and three 9 Aug. Both *D. arctica* and *E. lapponicus* therefore seemed to be more active later in the summer season at Saltfjellet than «normal» (Lindroth 1985).

Dyschirius septentrionum Munst. In 1975 this species was quite numerous in the *Dryas* heath at Kvitberget, but no individuals were trapped there the next summer (see also *E. lapponicus*).

Asaphidion pallipes Dft. Common in the pioneer vegetation on the calcareous sand beach at Kvitbergvatnet. Most of the individuals were caught during the period 21 July to 10 August.

Patrobus atrorufus Ström. Common in the tall herb birch forest at Stormdalen. Numerous in the traps both 30 June and 6 Aug.

Trichocellus cognatus Gyll. Only caught on the sand beach at Kvitbergvatnet.

Amara lunicollis Schiø. Numerous in the rich damp meadow with many herbs and *Salix* species at the bank of Stormdalsåga in Stormdalen. In the closely situated plot in the tall herb birch forest, no specimens of this rather euryocious species (Lindroth 1945) were caught.

Amara brunnea Gyll. Not trapped in Stormdalen and in the pine forest at Beiarn, elsewhere numerous. Its main active period in the Kvitberget area was the last part of July and the first days of August in 1975, and in the first part of July in 1976. This shift of activity period was clearly correlated with differences in some phenological phenomena, such as development and growth of the leaves of *B. pubescens* and *V. myrtillus* between the two years in question (Fig. 7).

Agonum fuliginosum Panz. Only trapped in the tall herb birch forest in Stormdalen, relatively close to a brook draining through the study plot.

The carabid fauna in different alpine and subalpine areas

Table 4 gives a survey of the collected material from six different alpine and subalpine areas; Torneträsk in Sweden (68°20'N), Petsamo (68°30'N) and Kilpisjärvi (69°N) in Finland, Hardangervidda (59°45'N), Jotunheimen (61°30'N) and Saltfjellet (67°oN) in Norway. Pitfall trapping was the only collecting method in the two last areas, while different collecting methods were used in the others. These differences in collecting methods will have a serious influence on the numbers of collected species. Still more important is, however, the diversity of the habitats the material was collected from.

The carabid material from Jotunheimen is collected from six study plots, while 15 different plots were used at Saltfjellet. This is

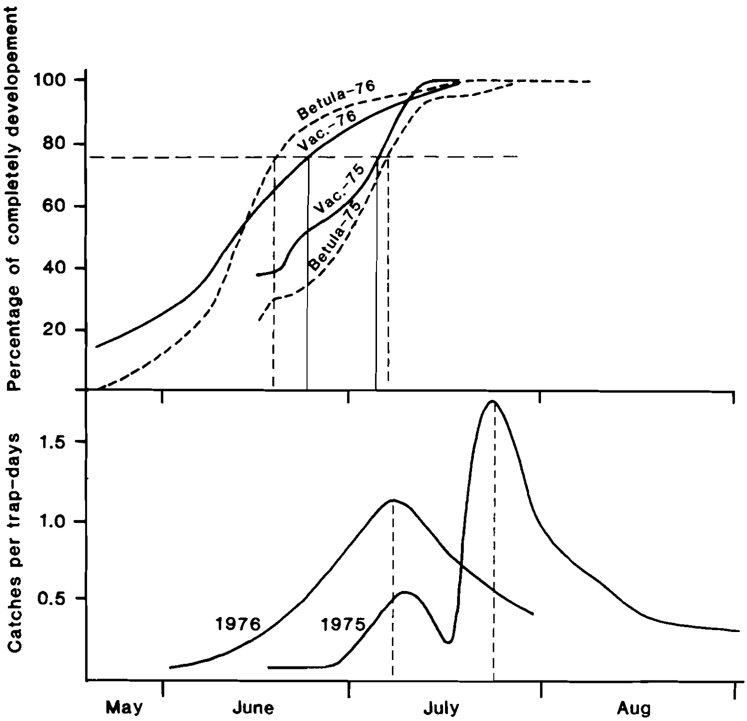


Fig. 7. On the top: The length growth of the leaves of *Betula pubescens* and *Vaccinium myrtillus* in the birch forest at Kvitbergvatnet in 1975 and 1976. The stippled horizontal line represents 75% of fully developed growth. The time lag between the two years is given by the vertical lines.
On the bottom: The acitivity patterns of *Amara brunnea* based on the mean catches per trap-day during the different catching periods (cf. Fig. 1) in the *Vaccinum myrtillus* birch forest at Kvitbergvatnet in 1975 and 1976. The stippled vertical lines show the time lag between the two years. The drop in activity medio July 1975 was caused by bad weather conditions during this period (for further details, see Thingstad (1980)).

Table 4. Survey of the collected species of carabid beetles in the sub-alpine habitats from Torneträsk (Brundin 1934), Petsamo (Platonoff 1942), Kilpisjärvi (Forsskåhl 1972), Hardangervidda (Fjellberg 1972), Jotunheimen (Refseth 1980) and Saltfjellet (this study). The genera and species are arranged alphabetically. The nomenclature is according to Lindroth (1945).

	Torne-träsk	Petsamo	Kilpis-järvi	Hardanger-vidda	Jotun-heimen	Salt-fjellet
Agonum consimile Gyll.	X		X	X	X	
A. dolens C.R. Sahlb.		X				
A. gracile Gyll.		X				
A. fulginosum' Panz				X		X
A. sexpunctatum L.					X	
Amara alpina Fbr.	X	X	X	X	X	X
A. apricaria Payk.	X	X	X			
A. brunnea Gyll.	X		X	X	X	X
A. communis Panz.		X		X		
A. erratica Dft.	X		X			
A. interstitialis Dej.	X					
A. litterea Thoms.	X					
A. lunicollis Schiø.						X
A. praetermissa C.R. Sahlb.	X		X	X		
A. Quenseli Schönh.	X	X	X	X		X
A. torrida Ill.	X		X			X
Asaphidion pallipes Dft.	X					X
Bembidion bipunctatum L.	X	X	X			X
B. dauricum Motsch.	X			X		
B. Doris Panz.		X				
B. difficile Motsch.	X	X	X			
B. Fellmanni Mannh.	X			X		
B. Grapei Gyll.	X					
B. guttula Fbr.			X			
B. Hasti C.R. Sahlb.	X		X	X		
B. hyperboraeorum Munst.	X		X			
B. nigrocornis Thoms.		X				

	Torne-träsk	Petsamo	Kilpis-järvi	Hardanger-vidda	Jotun-heimen	Salt-fjellet
B. nitidulum Mrsh.	X			X		
B. obliquum Sturm.		X				
B. prasinum Dft.		X				
B. quadrimaculatum L.		X				
B. rupestre L.	X	X	X			
B. saxatile Gyll.		X				
B. scandicum Lindr.	X					
B. velox L.		X				
B. virens Gyll.		X				
Bradycellus collaris Payk.	X		X	X		
Calathus erratus C.R. Sahlb.				X		
C. fuscipes Gze.				X		
C. melanocephalus L.	X		X	X	X	X
C. micropterus Dft.	X	X	X	X	X	X
Carabus glabratus Payk.	X		X	X	X	X
C. problematicus Hbst.				X		
C. violaecus L.	X			X	X	X
Cicindela maritima Dej.		X				
C. silvatica L.		X				
Clivina fossor L.		X		X		
Cychrus caraboides L.				X	X	X
Cymindis vaporariorum L.	X		X	X	X	X
Diachila arctica Gyll.			X			X
Dyschirius angustatus Ahr.		X				
D. globosus Hbst.	X	X				X
D. Helléni J. Müll.	X	X	X			
D. septentrionum Munst.	X	X				X
Elaphrus cupreus Dft.		X				
E. lapponicus Gyll.	X		X	X		X
E. riparius L.	X	X				X
Harpalus fuliginosus Dft.	X					
H. latus L.	X			X		
H. luteicornis Dft., Schaub.	X					
H. Winkleri Schaub.				X		
Leistus ferrugineus L.	X			X	X	X
L. rufescens Fbr.				X		X
Loricera pilicornis Fbr.	X	X	X	X		X
Miscodera arctica Payk.	X	X	X	X	X	X
Nebria Gyllenhali Schh.	X	X	X	X	X	
N. nivalis Payk.	X		X	X		
Notiophilus aquaticus L.	X	X	X	X	X	X
N. biguttatus Fbr.				X		
N. Germinyi Fauv.	X	X	X	X	X	
Patrobus assimilis Chaud.	X	X	X	X	X	X
P. atrorufus Ström.				X		X
P. septentrionis Dej.	X	X	X	X	X	X
Pelophila borealis Payk.	X		X	X		X
Pterostichus adstrictus Eschz.	X	X				X
P. diligens Sturm.	X	X	X	X		X
P. melanarius Ill.				X		
P. niger Schall.				X		
P. oblongopunctatus Fbr.			X	X		
P. strenuus Panz.				X		
Synuchus nivalis Panz.				X		
Tachyta nana Gyll.		X				
Trechus obtusus Er.				X		
T. secalis Payk.				X		
Trichocellus cognatus Gyll.	X	X	X			X
T. placidus Gyll.				X		

probably the main explanation for the registered greater species diversity at Saltfjellet. In the rest of the study areas, supplementary collecting methods surely have some of the responsibility for the larger number of species (48 at Torneträsk, 47 at Hardangervidda, 38 in Petsamo, 34 at Kilpisjärvi, against 31 at Saltfjellet and only 17 in Jotunheimen). According to Tab. 4, there are only two species of the tribe Bembidiini at Saltfjellet and noen in Jotunheimen, while there are collected 11 species of this tribe at Torneträsk, 12 in Petsamo, 6 at Kilpisjärvi and 4 at Hardangervidda. This result is due to the collecting method and insufficient investigations of the banks of the rivers and lakes in the two first areas. Andersen (1980), for example, has found both *Bembidion bruxellence* Wesm. *(B. rupestre* L.), *B. difficile Motsch., B. lunatum* Dft., *B. petrosum* Gebl. and *B. praginum* Dft. at some of the rivers in the Saltfjellet area. Many other species, earlier registered in the Saltfjellet area (e.g. Strand (1946) and Lindroth (1945—49)), were also lacking in this pitfall trap material. *Nebria rufescens* Strøm (*N. Gyllenhali* Schh.) is such an example. This cold-loving species, which is especially prominent in the lower alpine regions, often occurring along glacial streams (Lindroth 1985), most probably would have been collected if other habitats had been investigated.

Comparing the variety of the carabid fauna in the different areas on the basis of Tab. 4, therefore gives no sense. It only gives a survey of some of the most typical alpine and subalpine carabid beetles in Fennoscandia. The results from these different registrations indicate, however, that the alpine carabid fauna is equally abundant in north as it is in more southern altitudes.

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New records of Coleoptera in Norway, with notes on the significance of faunistic surveys

DAGFINN REFSETH

Refseth, D. 1987. New records of Coleoptera in Norway, with notes on the significance of faunistic surveys. *Fauna norv. Ser. B 34,* 117—119.

Forty-seven new records of 39 species of Coleoptera are given from parts of central and northwestern Norway, particularly the province of Møre og Romsdal. *Badister lacertosus* Sturm is recorded for the second time in Norway. The amount of new information on the distribution of Coleoptera which has emerged from recent faunistic surveys shows that the Norwegian insect fauna is still insufficiently known. Systematic sampling should be accomplished to obtain an adequate basis of faunistic knowledge for future research and management.

Dagfinn Refseth, Dept. of Zoology, Univ. of Trondheim, N-7055 Dragvoll, Norway.

INTRODUCTION

Due to quite extensive collecting activity the total number of species of Coleoptera recorded from various districts in Norway has increased considerably during the last 10—15 years. Nevertheless there are some districts, particularly in the central and western parts of the country, where the beetle fauna is still poorly known. Examination of samples of Coleoptera obtained mainly by pit-fall trapping, but also by occasional hand-collection, revealed several new records from parts of the provinces of Møre og Romsdal, Sør-Trøndelag and Nord-Trøndelag, which hereby are presented (cf. Lindroth 1960, Strand 1970b, 1977, Zachariassen 1977, Engdal & Zachariassen 1979, Refseth 1979, Andersen 1982, Hanssen & Olsvik 1982).

Part of the material was collected by Dag Dolmen during an investigation of deciduous forest habitats in 1971 (see also Refseth 1979). Some other finds date from a study on foraging in two wader species, accomplished by Arne Moksnes. The systematic arrangement of the species and the nomenclature follow Silfverberg (1979).

THE SPECIES

Carabus nemoralis Müller
NTi: Stjørdal (EIS:92) June 1984 (Leg. A. Moksnes).

Carabus nitens L.
NTi: Sonvatna (EIS:93) June 1979 (Leg. A. Moksnes).

Leistus terminatus (Hellwig)
MRy: Molde, Årø (EIS:84) July 1979.

Notiophilus germinyi Fauvel
MRy: Tingvoll, Vulvik (EIS:85) 12 July 1971 (Leg. D. Dolmen).

Elaphrus lapponicus Gyllenhal
NTi: Meråker, Klepptjørn (EIS:93) July 1984 (Leg. A. Moksnes). Identified from the stomach contents of a Ringed Plover *Charadrius hiaticula* L.

Trechus obtusus Erichson
MRi: Sunndal, Hoel (EIS:78) 30 May 1984.

Pterostichus adstrictus Eschscholtz
MRy: Fræna, Malmedal (EIS:84) 12 July 1984.

Pterostichus niger (Schaller)
NTy: Nærøy, Teplingan (EIS:110) 8 Aug. 1971 (Leg. D. Dolmen).

Pterostichus strenuus (Panzer)
MRy: Molde, Årø (EIS:84) 30 April 1984, Sjøholt (EIS:76) 31 May 1984.

Amara ingenua (Duftschmid)
MRy: Molde, Årø (EIS:84) 4 July 1978.

Amara lunicollis Schiödte
MRy: Fræna, Malmedal (EIS:84) 12 July 1984.

Amara nitida Sturm
MRy: Molde, Årø (EIS:84) 26 May 1979.

Amara plebeja (Gyllenhal)
MRy: Fræna, Malmedal (EIS:84) 12 July 1984.

Amara similata (Gyllenhal)
MRy: Molde, Årø (EIS:84) 4 July 1978.

Trichocellus placidus (Gyllenhal)
MRy: Molde, Årø (EIS:84) 26 May 1979, STy: Agdenes, Stovatnet (EIS:96) 20 June 1980.

Bradycellus caucasicus Chaudoir
MRy: Sjøholt (EIS:76) 10 Aug. 1984.

Badister lacertosus Sturm
MRi: Sunndal, Hoel (EIS:78) 30 May 1984. One specimen was trapped in a mixed deciduous forest habitat with a sparse ground vegetation cover. The species has previously been found only once in Norway, in SFi: Aurland (Løken 1965). In Sweden it is found in most districts in the southern area (Lindroth 1960).

Choleva septentrionis Jeannel
MRi: Stordal (EIS:76) 13 July 1984.

Catops nigricans (Spence)
MRy: Sjøholt (EIS:76) 13 July 1984.

Catops nigrita Erichson
MRy: Sjøholt (EIS:76) 31 May 1984.

Colon latum Kraatz
MRy: Molde, Årø (EIS:84) Aug. 1979.

Sphaerites glabratus (Fabricius)
MRy: Sjøholt (EIS:76) 13 July 1984.

Aphodius ater (Degeer)
MRi: Sunndal, Hoel (EIS:78) 30 May 1984.

Aphodius pusillus (Herbst)
MRy: Sjøholt (EIS:76) 31 May 1984, MRi: Sunndal, Hoel (EIS:78) 30 May 1984.

Aphodius sabulicola Thomson
MRi: Sunndal, Hoel (EIS:78) 30 May 1984.

Aphodius sphacelatus (Panzer)
MRy: Sjøholt (EIS:76) 31 May 1984.

Trichius fasciatus (L.)
STy: Stadsbygd (EIS:92) July 1971. NTy: Nærøy, Teplingan (EIS:110) 8 Aug. 1971 (Leg. D. Dolmen).

Rhagonycha lignosa (Müller)
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971, MRi: Eikesdal (EIS:78) 5 July 1971 (Leg. D. Dolmen).

Absidia (Podistra) rufotestacea (Letzner)
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971, MRi: Rindal, Dalsegg (EIS:86) 6 July 1971 (Leg. D. Dolmen).

Malthinus biguttatus (L.)
MRi: Eikesdal (EIS:78) 5 July 1971 (Leg. D. Dolmen).

Malthinus flaveolus (Herbst)
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971 (Leg. D. Dolmen).

Malthodes flavoguttatus Kiesenwetter
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971, MRi: Rindal, Dalsegg (EIS:86) 6 July 1971, STy: Snillfjord (EIS:91) 8 July 1971 (Leg. D. Dolmen).

Malthodes guttifer Kiesenwetter
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971, MRi: Eikesdal (EIS:78) 5 July 1971 (Leg. D. Dolmen).

Malthodes mysticus Kiesenwetter
MRy: Tingvoll, Eikrem (EIS:85) 12 July 1971 (Leg. D. Dolmen).

Reesa vespulae (Milliron)
STi: Trondheim (EIS:92) June 1978. Some specimens were found at the Department of Zoology, DKNVS, the Museum, and the species has later appeared in several zoological and botanical collections in Trondheim. The species was introduced to Europe from North America, and was found for the first time in Norway (AK) in 1963 (Strand 1970a). Later it has been reported from TRy (Strand 1977), and has obviously become established.

Niptus hololaucus (Faldermann)
MRy: Molde, Årø (EIS:84) 28 Dec. 1979.

Gonioctena (Phytodecta) viminalis (L.)
STi: Støren (EIS:87) 22 May 1984.

Batophila rubi (Paykull)
MRy: Molde, Årø (EIS:84) 26 May 1979.

Furcipus rectirostris (L.)
MRy: Molde, Årø (EIS:84) 26 May 1979.

DISCUSSION

The present list of species and those of other similar faunistic studies (e.g. Zachariassen 1977, Engdal & Zachariassen 1979, Refseth 1979, Hanssen & Olsvik 1982) appear to have two important aspects in common. First, most of the species occur in other parts of the country, some of them even being quite common and widespread. This observation implies that our knowledge about the real distribution of most species in Norway is still scanty. Furthermore, the lists include at least one rare species, in the present case represented by *Badister lacertosus,* which indicates that the frequency of rare species is rather high. This may particularly apply to the province of Møre og Romsdal, where local conditions regarding climate and vegetation seems to support several relict populations of Coleoptera (cf. Dragseth & Hanssen 1981, Dolmen & Hanssen 1982). However, some species may appear to be rare just because they inhabit areas which have been poorly investigated. Obviously much is left to be done before an adequate survey of the occurrence and the distribution of Coleoptera in Norway is attained.

The effect of collecting efforts becomes evident when considering the amount of new records of Carabidae which has appeared from surveys in the province of Møre og Romsdal during the last 25 years. According to Lindroth (1960) 68 species of Carabidae had been recorded from this province up to 1960, and only 25 of these had been found in the outer parts (MRy). Since then 25 and 35 additional species have been reported from the entire province and from MRy, respectively. Moreover, comparisons with the fauna of adjacent districts indicate that another 30—40 species probably occur in the area. And as the Carabidae is one of the best known insect families, even higher figures are to be expected for other groups. Even in the province of Sør-Trøndelag, where the Coleoptera have been fairly well explored, seven new species of Carabidae have been reported since 1960, the number of recorded species now being 136.

Faunistic data constitute the basic source of information for studies on immigration routes, patterns of dispersal, and courses of adaptation. They are also of great significance for the task of faunal management, for example regarding the conservation of endangered species. It is therefore inevitable that continuous faunistic surveys are accomplished, preferably by systematic sampling using various kinds of traps.

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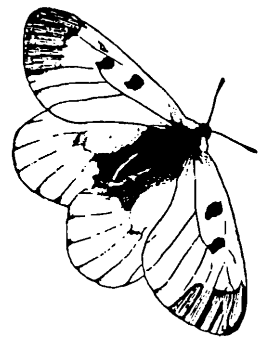

21. NORDISKE ENTOMOLOGMØTE

NORSK ENTOMOLOGISK FORENING innbyr herved til det 21. NORDISKE ENTOMOLOGMØTE i TRONDHEIM i tiden 3. til 7. juli 1988 med etterfølgende ekskursjoner. Vi ønsker foredrag innen alle entomologiske emner, og håper å få representert et bredt spekter av entomologien i Norden. Tema som vi kan tenke oss å gruppere foredrag til er tropisk insektøkologi, arktisk/alpine tilpasninger, naturvern av insekter, skogsentomologi og etologi. Dette bør imidlertid ikke hindre noen å anmelde foredrag som ikke kan rubriseres under de ovenfor nevnte tema.

MØTESTED

Møtet vil bli holdt ved Universitetet i Trondheim, og i den nybygde delen som er lokalisert til Dragvoll. Bespisning: På Dragvoll er det kantine hvor lunsj vil kunne inntas. Det vil også være mulig å spise middag her.

Innkvartering: Her er det 4 muligheter; 1) Scandic hotell hvor prisen for enkeltrom m/frokost vil være ca. 350,- kr og dobbeltrom m/frokost vil koste ca. 450,- kr. 2) Studenthybler til en pris av ca. 250,- kr pr. hybel u/frokost, men med anledning til å lage frokost selv. 3) Ungdomsherberget som tar ca. 170,- pr seng på dobbelt eller 4 manns rom (rimeligere seng kan også fås). 4) I kjøreavstand 20-30 minutter er det campingmuligheter. Studentbyen ligger ca. 30 minutter i gåavstand fra Dragvoll, og Scandic hotell ligger 20 minutter i gåavstand fra Dragvoll, men det er gode bussforbindelser mellom studentbyen/Scandic hotell og Universitetet på Dragvoll. Ungdomsherberget ligger ca. 10 minutters bilkjøring fra Universitetet på Dragvoll. Gode muligheter for bilparkering på alle steder.

EKSKURSJONER

Vi planlegger en ekskursjon til fjellområdet Dovre, som er et meget rikt område. Det vil være muligheter til å besøke lokaliteter fra kysten opp til ca. 15-1600 m over havet. Dette vil dekke nemorale til alpine områder. Innkvartering blir ved Kongsvoll biologiske stasjon og/eller Kongsvoll fjellstue.

Ytterligere informasjon fås gjennom Norsk entomologisk forening.

Taxonomy of Stonefly eggs of the genus *Isoperla* (Plecoptera, Perlodidae)

ALBERT LILLEHAMMER AND BJØRN ØKLAND

Lillehammer, A. & Økland, B. 1987. Taxonomy of Stonefly eggs of the genus *Isoperla* (Plecoptera, Perlodidae). *Fauna norv. Ser. B, 34,* 121—124.

Females of *Isoperla difformis, I. grammatica* and *I. obscura* can be separated on the microstructures of their eggs visible by S E M photos. The characters are seen in material from Museum collections that have been alcohol preserved and can therefore be included in a key to species.

Albert Lillehammer and Bjørn Økland, Zoological Museum, Univ. of Oslo, Sarsgt. 1, N-0562 Oslo 5, Norway.

INTRODUCTION

In Fennoscandia three species of *Isoperla* occure, *I. difformis* (Klapalek), *I. grammatica* (Poda), *I. obscura* (Zetterstedt). In some populations of the three species the form of the female subgenital plate may vary considerable and the identification may be difficult (Lillehammer 1974a). The present study is therefore an attempt to find valid characters in the microstructures (S E M) of eggs taken from alcohol preserved females of the three species.

Studies of egg structures have previously been made by authors such as Szczytko & Stewart (1978), Stark & Szczytko (1982) and Stark, Gonzales del Tango and Szczytko (1986).

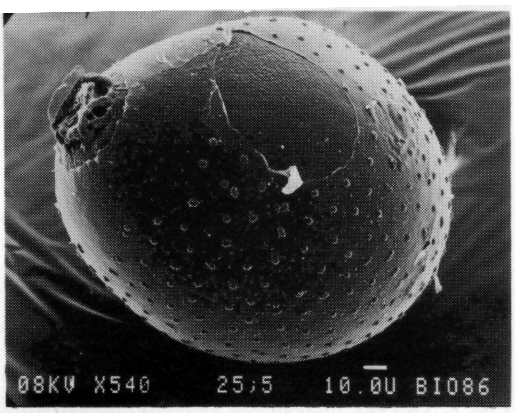

Fig. 1. S E M-photos of *Isoperla difformis* egg, showing the outer coat.

MATERIAL AND METHODS

Eggs from females of the three species preserved in 70% alcohol were dissected out and mounted for S E M studies. Since the eggs were preserved in alcohol, no aldehyde was used. Dehydration towards absolute alcohol was started directly from 70% alcohol. The orientation and shape of the microphyles and the form of the perforation of the chorium was used. In addition the length and with of the egg were mesured to the nearest 0.01 mm under a binocular microscope with a magnification of 50x. The volume were calculated for a representative number of each species, and the formula used were $v = \pi ab^2/6$, a = egg length (mm) and b = egg with (mm). In the search for the morphological structures on the egg chorium, the eggs dissected from the female had to be cleared for an outer coat (Fig. 1) that might occure in some eggs. The S E M photos have been taken by Fredrik Weidemann, Electron Microscopical Unit for Biological Sciences, Biological Institute, University of Oslo.

DIAGNOSTIC

Eggs of *Isoperla* species are all rounded and longer than wide. Collar stalked and margin unregular, neck of collar with several unregular ribs (Fig. 2). The anchor plate with perforation and the stalk with several ribs. Eggs of all three species have perforations of different types on chorium.

Isoperla difformis (Klapálek)
Eggs are dark pigmentated and the egg volume was $123 \times 10^{-5}\ \mu\ m^3$ in mean, sd (95%

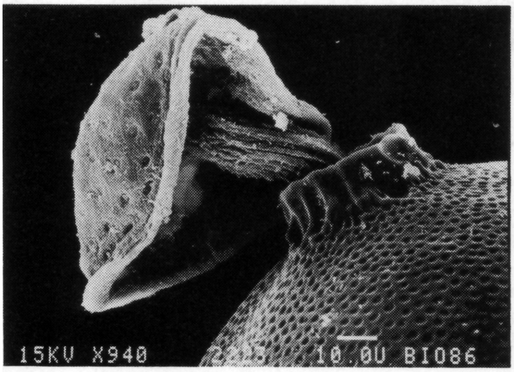

Fig. 2. S E M-photo of *Isoperla grammatica* egg showing the neck of collarand the anchor plate.

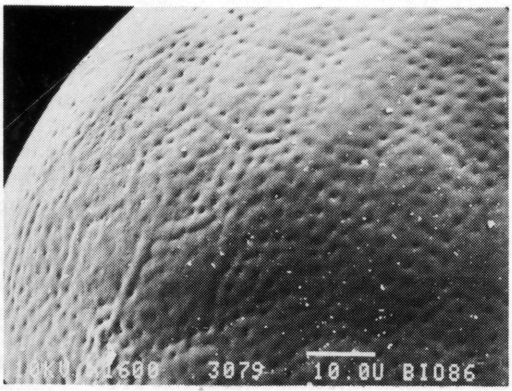

Fig. 3. The punctation structures on the egg chorium of *Isoperla difformis.*

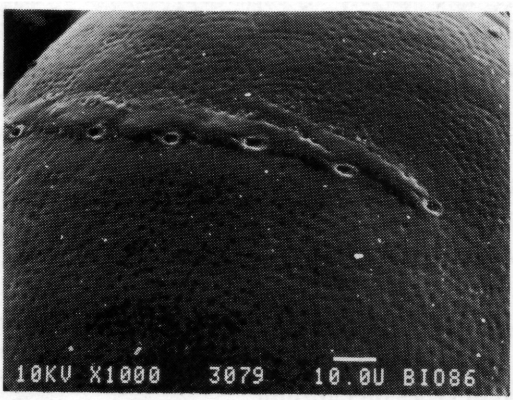

Fig. 4. The arrangement of microphyles on the egg of *Isoperla difformis.*

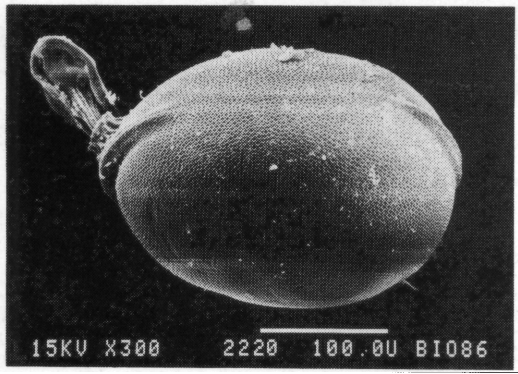

Fig. 5. The egg of *Isoperla obscura* showing the evenly scattered punctation on the egg chorium.

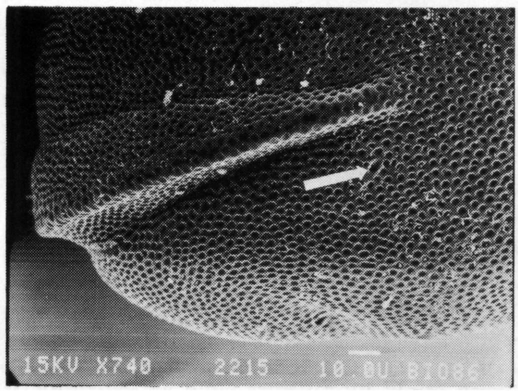

Fig. 6. The egg of *Isoperla obscura* with the microphyle (arrow).

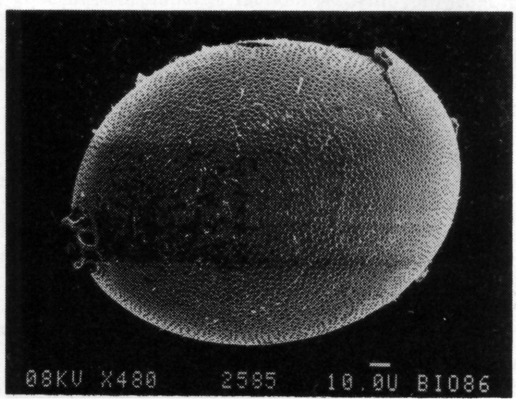

Fig. 7. The egg of *Isoperla grammatica* showing the hexagonal arranged punctation on the chorium.

Cl)—9.5 (N = 15). The eggs are oval without any ridges. The incomplete punctuation (Fig. 3) is arranged hexagonaly over the whole surface. Microphyle (arrow) are closely arranged distaly in a row of 6, with parralell keels (Fig. 4).

Isoperla grammatica (Poda)
Eggs are light brown or yellow in colour, and egg volume was 110.1 x 10^{-5} μm^3, in mean, sd (95% Cl) — 7.8 (N = 15). The eggs are oval without any ridges. The punctuation is deep and organized hexagonaly in arrangements of 10—20 together (Fig. 7). Microphyles occure in a row with widely separated openings without keels.

Isoperla obscura (Zetterstedt). (See Fig. 8, p. 124).
Eggs of *I. obscura* are weakly pigmentated and the egg volume was 99.6 x 10^{-5} μm^3, in mean, sd (95% Cl) — 7.8 (N = 15). The eggs may have distinct ridges in both ends (Figs. 5, 6). Other eggs may be without visible ridges. These ridges seem to form zones on the eggs, and they possibly become the exit for the nymph. The punctation is deep and evenly scattered over the egg chorium. Microphyles in a row without keels (2 microphyles visible on fig. 6).

The punctation, which is hexagonaly arranged in *I. grammatica* and *I. difformis* indicate a closer relationship between those two species than the *I. obscura*. The egg development of *I. obscura* is also different from the two other species (Saltveit & Lillehammer 1984). *I. obscura* has egg diapause, the other two have direct egg development. The distinct egg ridges of *I. obscura* is a third character that separate it from the other two species. However, there is a greater similarity between the *I. grammatica* and *I. obscura* in the arrangement of the microphyles than of *I. difformis.*

Key to species

1. Punctation of egg chorium deep, microphyles without keels 2
— Punctation narrow, microphyles with keels .... *I. difformis*
2. Punctation evenly distributed over the egg chorium (Fig.) .... *I. obscura*
— Punctation hexagonaly arranged in clumps of 10—12 over the egg chorium (Fig.) .... *I. grammatica*

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Received 16 Febr. 1987

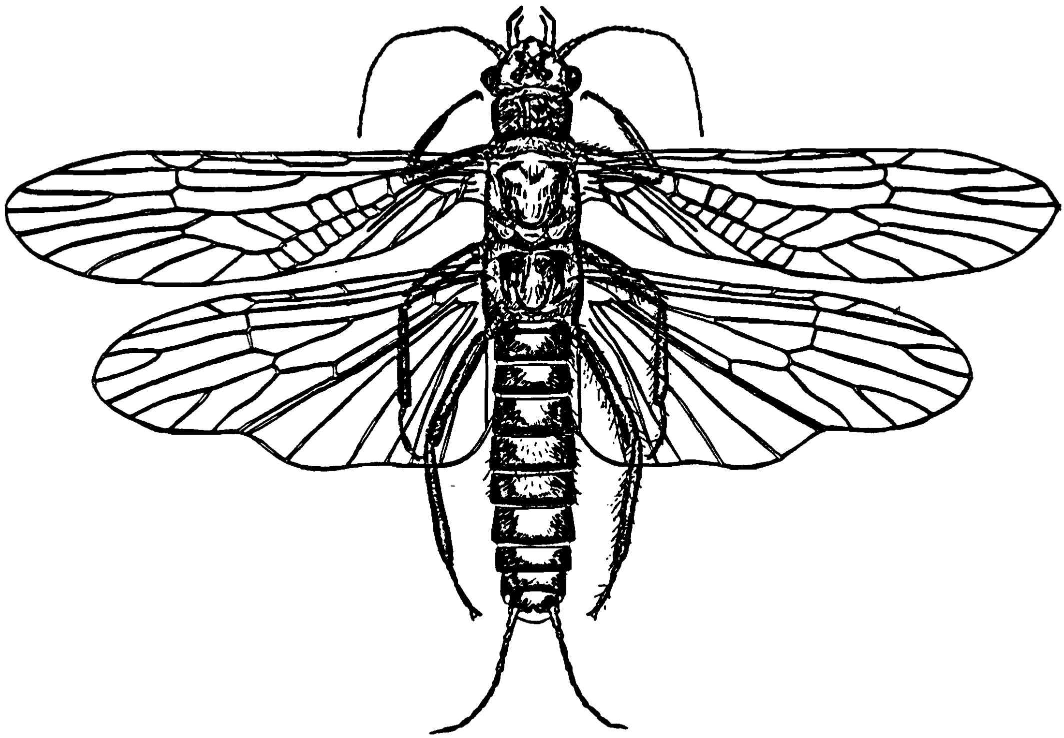

Fig. 8. *Isoperla obscura* (Zetterstedt) ♀. *Drawn by Mai Britt Ringdal.*

The Norwegian Xyelidae and Pamphiliidae (Hymenoptera)

FRED MIDTGAARD

Midtgaard, F. 1986. The Norwegian Xyelidae and Pamphiliidae (Hymenoptera). *Fauna norv. Ser. B. 34,* 125—130.

The Norwegian material of Xyelidae and Pamphiliidae is being revised, and 7 species appear to be new to the fauna: *Cephalcia intermedia* (Hellén), *C. pallidula* (Gussakovskij), *Neurotoma iridescens* (André), *Pamphilius histrio* Latreille, *P. gyllenhali* (Dahlbom), *P. fumipennis* (Curtis) and *Onycholyda sertata* (Konow).

Fred Midtgaard, Norwegian Forest Reseach Institute, P.O.Box 61, N-1432 Ås-NLH, Norway.

INTRODUCTION

Since Strand's (1898) check-list of the Norwegian Hymenoptera, very little new information has been published on the Norwegian Xyelidae and Pamphiliidae. Strand (1898) listed 15 species of Pamphiliidae from Norway, of which 14 are now regarded valid. Later Schøyen (1910, 1911) reported *Acantholyda hieroglyphica* (Christ) and *Cephalcia abietis* (Linnaeus) new to Norway. Recently Viitasaari (1982) reported *Pamphilius latifrons* (Fallén) and *P. stramineipes* (Hartig) new to Norway, the later species was also new to Fennoscandia.

Many of the scattered records on the distribution of Norwegian Pamphiliidae (Siebke 1880, Strand 1899, 1900, 1901, Kiær 1895, 1898, Schøyen 1880, 1910, 1911, Andersson 1962) are out of date or often based on misidentifications. A revision of all Norwegian specimens was therefore needed.

MATERIAL AND METHODS

The collections of the Zoological Museum of Oslo (ZMOS), the Zoological Museum of Bergen (ZMBE), the Zoological Museum of Trondheim, the Zoological Museum of Tromsø (ZMTR), Rana Museum (RM), the Forest Reseach Institute (NFRI), my own collection and a few specimens in private collections were examined.

The identifications follow a combination of the works of Benes (1974, 1976a, 1976b), Viitasaari (1982), Shinohara (1980, 1985b) and Achterberg & Aartsen (1986).

Plant names are according to Lid (1974). The faunal divisions used are the revised Strand system (Økland 1981).

RESULTS AND DISCUSSION

The distribution of all Norwegian Xyelidae and Pamphiliidae are listed in Tab. 1.

XYELIDAE

Xyela julii (Brebisson, 1818): Mentioned from Norway by Zetterstedt (1838) («Ad Giebostad Nordlandiae»). I have not included this report. Until recently the species was very rarely collected, but has probably been overlooked. The species is common on *Pinus* in southern Norway even up to 1100 m above sea level.

A key to the European species is given in Schedl (1978). The larva developes in male flowers of pine *(Pinus sylvestris)* (Benson 1954). Distributed throughout Europe, North Africa and the USSR (Schedl 1978).

PAMPHILIIDAE

Caenolyda reticulata (Linnaeus, 1758): Not common in Norway, and only occuring in the south.

Larva on *Pinus* (Lorenz & Kraus 1957). Distributed throughout northern and eastern Europe and the USSR (Viitasaari 1982).

Acantholyda erythrocephala (Linnaeus, 1758): Locally common in southern Norway.

Tab. 1. The distribution of the Norwegian Xyelidae and Pamphiliidae in the faunistic regions of the revised Strand system.

Species : / Faunal divisions :	Ø	AK	HES	HEN	OS	ON	BØ	BV	VE	TEY	TEI	AAY	AAI	VAY	VAI	RY	RI	HOY	HOI	SFY	SFI	MRY	MRI	STY	STI	NTY	NTI	NSY	NSI	NNØ	NNV	TRY	TRI	FV	FI	FN	FØ
XYELIDAE																																					
Xyela Dalman,1819																																					
julii (Brebisson,1818)	●	●				●	●		●	●	●	●	●	●				●	●				●		●												
PAMPHILIIDAE																																					
CEPHALCIINAE																																					
Caenolyda Konow, 1897																																					
reticulata (Linnaeus, 1758)		●										●																									
Acantholyda A.Costa, 1859																																					
erythrocephala (Linnaeus, 1758)	●	●			●	●	●					●				●		●																			
flaviceps (Retzius, 1783)		●																																			
hieroglyphica (Christ, 1791)			●																																		
posticalis Matsumura, 1912	●	●	●	●			●		●			●				●		●							●				●				●	●	●		●
Cephalcia Panzer, 1805																																					
abietis (Linnaeus, 1758)	●	●	●				●		●							●																					
arvensis Panzer, 1805		●	●				●		●			●																	●				●				
intermedia (Hellén, 1948)							●																														
pallidula (Gussakovskij, 1935)	●		●				●																														
fallenii (Dalman, 1823)		●	●				●	●	●			●													●				●								
PAMPHILIINAE																																					
Neurotoma Konow, 1897																																					
iridescens (Andre, 1882)									●																												
Pamphilius Latreille, 1802																																					
histrio Latreille, 1812		●																																			
gyllenhali (Dahlbom, 1835)		●					●														●												●				
inanitus (Villers, 1789)		●																																			
betulae (Linnaeus, 1758)		●						●	●						●																						
sylvaticus (Linnaeus, 1758)	●	●	●				●		●			●				●		●											●								
fumipennis (Curtis, 1831)		●	●				●														●																
latifrons (Fallen, 1808)																																	●				
pallipes (Zetterstedt, 1838)		●				●																								●			●		●		
vafer (Linnaeus, 1767)		●	●		●	●	●									●		●	●		●		●						●	●			●	●			
albopictus (Thomson, 1871)		●								●	●																										
varius (Lepeletier, 1823)	●	●	●						●		●					●		●							●				●			●					●
hortorum (Klug, 1808)		●																●	●			●			●				●					●			
balteatus (Fallen, 1808)		●					●	●				●						●							●												
stramineipes (Hartig, 1837)		●																																			
Onycholyda Takeuchi, 1938																																					
sertata (Konow, 1903)		●																																			

According to Zetterstedt (1838) the species should have been collected in northern Norway by H. Deutsch. This record is not included here.

Larva on *Pinus sylvestris* (Kontuniemi 1959) and *P. strobus* (Lorenz & Kraus 1957). Occasionally reported as a pest on ornamental trees *(Pinus cembra, P. mugo).*

Distributed throughout the Palaearctic region and North America (probably introduced) (Viitasaari 1982).

A. flaviceps (Retzius, 1783): This early flying species (April—May) is very rare in Norway, only found twice (AK, Oslo: Incognito, EIS 28, 22 April 1870, leg. Siebke, coll. ZMOS: ♂; Vestre Aker, 8 May 1880, leg. W.M.Schøyen, coll. ZMOS: ♀. In Finland specimens have been caught on sticky rings around stems of *Pinus contorta* (Viitasaari 1975). Maybe they do not fly much because of their early appearance.

Distributed throughout northern and Central Europe (Viitasaari 1982).

A. hieroglyphica (Christ, 1791): Reported for the first time by Schøyen (1910) under the name *Lyda campestris,* without author. This would most likely be *Cephalcia arvensis* Panzer, 1805 *(campestris* Fallen, 1808), but Schøyen calls it «the yellow pine web sawfly» and it would therefore have to be *A. hieroglyphica.* No specimen was preserved. I have only seen one male reared ex. larva from: HES, Elverum: Deseth, EIS 55, 1984, leg. Ø. Austarå, coll. NFRI. The larval web is frequently found and in 1986 an attack occurred on a 1.5 haa young plantation in VAY, Vennesla: Øvrebø, EIS 5. The species is a well known pest on small *Pinus sylvestris* in Fennoscandia.

Distributed throughout Europe and the USSR (Viitasaari 1982).

A. posticalis Matsumura, 1912: Common

all over the country. Larva on *Pinus sylvestris* (Kontuniemi 1959). No mass attacks have been reported.

Distributed throughout Europe, USSR, Japan and China (Viitasaari 1982).

Cephalcia abietis (Linnaeus, 1758): The species is common in the southern parts of the country. First reported from Norway by Schøyen (1911).

Larva on *Picea* spp. (Benes 1976a). Distributed throughout northern and Central Europe, Siberia, Sakhalin and China (Viitasaari 1982).

C. arvensis Panzer, 1805: Common in Norway north to TRI, Målselv: Dividal, Sletta, EIS 154, 14-29 Jun. 1986, leg. et coll. F. Midtgaard: 2♂♂. Some very dark specimens resemble *intermedia* Hellen, 1948. However, as there is a wide range of variation in the colouration of *C. arvensis,* see Shinohara (1986c), this character is of limited use. It is difficult to find morphologically distinct characters between dark specimens *(C. intermedia)* and pale specimens *(C. arvensis).* According to Vikberg (1982) the fully grown larva of *C. intermedia* has infuscated fovea on the anal tergite and differs thus from the larva of *C. arvensis,* which has no infuscation on the anal tergite. The situation in the *Cephalcia arvensis* complex is further complicated by the fact that larvae of some pale females also have infuscated fovea on the anal tergite. These pale females differ in colour from typical females of *C. arvensis* (Vikberg 1982).

Imagines are found from May to August, a longer period ,than any other Norwegian Pamphiliidae.

Larva on *Picea* spp. (Benes 1976a). Distributed in northern and Central Europe; eastwards to Ussuri and Sakhalin (USSR) (Viitasaari 1982).

C. intermedia (Hellén, 1948): New to Norway. Only one specimen from BØ, Hurum: Filtvet, EIS 28, 25 Jun. 1982, leg. F. Midtgaard: ♂. The identification is made on the basis of a single character only: the colouration of abdomen.

C. intermedia is a species living on Norway spruce *(Picea abies)* Vikberg 1982, Viitasaari 1982). If *C. intermedia* should fall into synonymy, it should be as a synonym of the spruce feeding *C. arvensis* and not as suggested by Achterberg & Aartsen (1986), of the larch *(Larix* spp.) feeding *C. lariciphila.*

Little is known about the distribution, but the species has been found in northern Europe and possibly also in Bulgaria and Romania (Shinohara 1985c).

C. pallidula (Gussakovskij, 1935): New to Norway. One male from HES, Sør-Odal: Maarud, EIS 37, 27 June 1970, leg. T. Sæther, det. F. Midtgaard, coll. NFRI; 1 male from BØ, Hurum: Tofte, EIS 28, 17 June—17 July 1985, leg. et coll. F. Midtgaard and 1 male from Ø. Borgevarde, EIS 20, 5. Jun. 1986, leg. T. J. Olsen, coll. F. Midtgaard. The larva is reported to feed on *Picea abies* ssp. *obovata,* and the biology has been studied by Verzhutskii (1973). *Picea abies* spp. *obovata* does not occur in southern Norway (Lid 1974) and the species most likely here feed on *Picea abies abies.* Distributed throughout northern Eurasia, from Fennoscandia across Siberia to Sakhalin (Benes 1976a).

C. fallenii (Dalman, 1823): Common within the natural distribution area of *Picea abies* in Norway. The species is very variable in colouration in Central Europe (Benes 1976a), but Norwegian specimens are all of the colour-form *annulata* (Hartig). Reported by Siebke (1880) as *falleni* (misspell.). Strand (1900) reported it as *Cephaleia alpina annulicornis* Hartig, a colour-form I have not seen from Norway.

Larva on *Picea abies* Benes 1976a). Distributed throughout northern and Central Europe, USSR (Achterberg & Aartsen 1986).

Neurotoma iridescens (André, 1882): New to Norway. Only one specimen: VE, Tjøme: Vestfjordveien, EIS 19, 22 June 1970, leg. T. Andersen, det. F. Midtgaard, coll. ZMBE: ♀. A key to the Palaearctic species of *Neurotoma* is given by Shinohara (1980). The Norwegian specimen has, like the Finnish specimens (Shinohara 1980), no yellow band on mesepisternum. The specimen has yellow spots on the upper inner orbit and a distinct spot on the paraantennal field. The fore and mid femora with a small black marking at base. The species lives on *Sorbus aucuparia* and *Prunus* spp. (Kontuniemi 1959). Reported from Finland, Germany, USSR, Korea and Japan (Shinohara 1980).

Pamphilius histrio Latreille, 1812: New to Norway. One specimen from AK, Oslo: Tøyen, EIS 28, 18 May 1983, leg. K. Sund, det. et coll. F. Midtgaard: ♀ and one from AK, Aurskog-Høland: Setskog, EIS 29, 16. Jun. 1986, leg. H. Pöyhönen, coll, F. Midtgaard: ♀. The specimen from Oslo was caught under a group of large *Populus nigra,* which is probably the food-plant. Known to feed on *Populus tremula* (Chambers 1952).

A key to the Palaearctic species related to *P. histrio* is given by Benes (1974). Distributed throughout Eurasia (Benes 1974).

P. gyllenhali (Dahlbom, 1835): New to Norway. Several specimens from different parts of the country: AK, Bærum: Ostøya, EIS 28, 30 May-10 June 1984, leg. et coll. F. Midtgaard: ♀; BØ, Hurum: Filtvet, EIS 28, 8 Aug. 1985, e.l. on *Salix aurita,* leg. et coll. F. Midtgaard: ♂, 3 ♀♀; SFI, Stryn: Videseter EIS 69, 14 Oct. 1957 (date?), leg. J. Meidell, det. R. B. Benson, coll. ZMBE: ♀: TRI, Målselv: Bjerkeng EIS 154, 15 June 1897, leg. Sp.Schneider, det. Saarinen, coll. ZMTR: ♀. The species lives on *Salix* spp., mainly *S. aurita* and *S. caprea* (Zirngiebl 1940).

Distributed throughout Europe (Benes 1974).

P. inanitus (Villers, 1789): Not uncommon in the Oslofjord area, but so far not found elsewhere in Norway. Larva on *Rosa cinnamomea* and *R. pimpinellifolia* (Kontuniemi 1959).

Distributed throughout Europe (Benes 1974).

P. betulae (Linnaeus, 1758): Scattered records from southern Norway: AK, Oslo: Oslo, EIS 28, (leg. Esmark, Siebke), coll, ZMOS, ZMTR: 3♀♀, ♂; BV, Rollag: Rollag st., EIS 35, 26 June 1981, leg. B. Sagvolden, coll. F. Midtgaard: ; AK, Sørum: Sørumsand, EIS 29, 1985, leg. S. O. Hansen, coll. F. Midtgaard: ♀; VE, Tjøme: Kjære, EIS 19, 14 June 1967, leg. A. Fjellberg, coll. ZMBE: ♀ and VAI, Audnedal: Sveindal, EIS 5, leg. S. Svendsen, coll. F. Midtgaard: ♀. Larva on *Populus tremula* (Chambers 1952).

Distributed throughout Eurasia (Benes 1974).

P. sylvaticus (Linnaeus, 1758): Common north to NSI, Rana: Svartisen, EIS 123.

Larva on *Sorbus aucuparia, Crataegus* spp., *Prunus padus, P. domestica* and *P. spinosus* (Lorenz & Kraus 1957). A key to the *sylvaticus*-group is given in Shinohara (1985b). Distributed throughout Europe and the European parts of the USSR (Shinohara 1985b).

P. fumipennis (Curtis, 1832): New to Norway. The species has been misidentified as *P. sylvaticus* in the collections. Rare, only six specimens found: BØ, Øvre Eiker; Fiskum, EIS 27, leg H. Kjær, coll. ZMOS: ♀; AK, Asker: Sem, EIS 28, Jun. 1985, leg. J. H. Simonsen, coll. F. Midtgaard: ♂ BØ, Hurum: Filtvet, EIS 28, Jun. 1985, leg. et coll. F. Midtgaard: ♀; HES, Odalen: ?lok., EIS 37, leg. Schøyen, coll. ZMOS: ♀; SFI, Leikanger: Gjerde, Hermansverk, EIS 50, leg. K. Hesjedal, coll. F. Midtgaard: ♀ and one male labelled: «Gudbrandsdal, Moe», ZMOS.

Larva on *Corylus avellana* and *Alnus incana* (Kontuniemi 1959). Distributed throughout Europe and the European parts of the USSR (Shinohara 1985b).

P. latifrons (Fallen, 1808): Reported from Norway by Viitasaari (1982): TRI, Storfjord: ?lok., EIS 155, 1899, leg. Sp. Schneider; det. M. Viitasaari, coll. Univ. of Helsinki: ♀. Larva on *Populus tremula* (Chambes 1952). Distributed throughout Eurasia (Benes 1976b).

P. pallipes (Zetterstedt, 1838): More common in the north and in the *Betula pubescens* region at high altitudes in Central Norway. There is considerable variation in the Norwegian material. Some of the specimens from northern Norway have much less dense microsculpture on the head, and a more rounded apical edge of clypeus, than specimens from other parts of Norway (Fig. 1). The type locality is Tromsø in northern Norway. Larva on *Betula* spp. (Malaise 1921). Reported to feed on *Alnus viridis* by Schedl (1975). *Alnus* spp. are also the food-plants in Japan

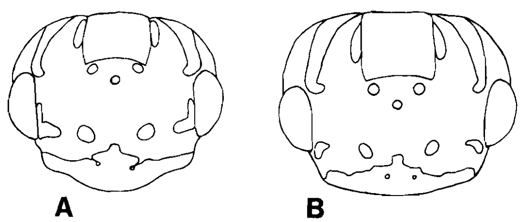

Fig. 1. Head dorsally of female *Pamphilius pallipes.* A: Specimen from Norway, TRI, Balsfjord: Mestervik (EIS 154), Jul. 1887, coll. ZMTR. B: Specimen from Norway, ON, Dovre: Fokstua (EIS 71), 11 Jul. 1877, leg. Schøyen, coll. ZMOS. The specimen from Troms in northern Norway (A) has only very little microsculpture between well-defined punctures on the postocellar area, while specimen B from the mountains of southern Norway has strong microsculpture between ill-defined punctures. Mallar space of specimen B is longer, 3 basal segments of flagellum relatively longer and head less narrowed behind the eyes. The type locality of *P. pallipes* is Tromsø in northern Norway (♀.). The male was described as *Lyda flaviceps* from Torne Träsk in Sweden by Zetterstedt (1838).

(Shinohara & Okutani 1983). Distributed throughout Central and northern Europe through USSR to Japan (Benson 1951).

P. vafer (Linnaeus, 1767): Common all over the country. For a long time *P. depressus* (Schrank, 1781) was regarded to be a synonym for *P. vafer* (Malaise & Benson 1934), and *P. depressus* is also listed as a synonym for *P. vafer* by Benes (1976b). In Finland it has been customary to distinguish *P. vafer* and *P. depressus* based on colouration, minor differences in the male genitalia and probably also in the choice of food-plant (Viitasaari 1982). The differentiation is rather easy in Finnish material, but in the approximately 70 specimens I have seen from Norway and Denmark a number of intermediates occur, and the characters intermingle in these materials. I therefore regard *P. depressus* to be synonymous with *P. vafer*. This is also the opinion of Achterberg & Aartsen (1986). Kiær (1898, 1902) mentioned *P. vafer* and *P. depressus* from Norway, but the *P. vafer* specimens I have seen, determinated by Kiær, are *P. albopictus*.

Larva on *Alnus* spp. *P. vafer* sensu Viitasaari, 1982 should live on *A. glutinosa*, and *P. depressus* sensu Viitasaari, 1982 on *A. incana*.

P. vafer is distributed throughout northern and Central Europe eastwards to Japan (Benes 1976b).

P. albopictus (Thomson, 1871): Only in the southeastern parts. Larva on *Prunus padus* (Kangas 1961, Kangas & Kangas 1963). Distributed throughout Eurasia (Benes 1976b).

P. varius (Lepeletier, 1823): Rather common all over the country. Larva on *Betula* spp. (Chambers 1952). Distributed throughout Eurasia (Benes 1976b).

P. hortorum (Klug, 1808): Found all over the country, but most records in coastal areas. Larva on *Rubus idaeus* (Kontuniemi 1959). The species was regarded as comprising two subspecies in northern Europe by Benson (1945). The Norwegian specimens belong to spp. *bicinctus* Benson, 1945, which is distributed throughout Scotland, Fennoscandia and Denmark; the nominal subspecies, *P. hortorum hortorum*, is known from Central Europe and England (Benson 1945). Specimens resembling *P. hortorum hortorum* occur occasionally in the Norwegian material.

P. balteatus (Fallen, 1808): Rather common in southern Norway north to STI, Trondheim: Fagerheim, EIS 92.

Larva on *Rosa cinnamomea* and *R. pimpinellifolia* (Kontuniemi 1959). Distributed in the Palaearctic region (Shinohara 1985a).

P. stramineipes (Hartig, 1837): In Fennoscandia only found in the inner Oslofjord. The species was found in 7 specimens in Oslo in the years 1845—1847. These localities do not exist today.

Recently a number of specimens have been found in AK, Bærum: Ostøya, EIS 28 in 1983, 1984 and 1985. The habitat is exposed, dry hills with scrub vegetation of *Rosa* spp. and *Prunus spinosa*.

Distributed throughout Europe (Benes 1976b).

Onycholyda sertata (Konow, 1903): New to Norway. Only found in AK, Bærum: Høvik, EIS 28, 18 June 1935, leg. Soot-Ryen, coll. ZMTR: ♀. Larva on *Filipendula ulmaria* (Kangas & Syrjänen 1962). Distributed throughout Fennoscandia and USSR (Viitasaari 1982).

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A key to the first-instar larvae of Fennoscandian *Agabus* Leach (Coleoptera: Dytiscidae)

ANDERS N. NILSSON

Nilsson, A.N. 1987. A key to the first-instar larvae of Fennoscandian *Agabus* Leach (Coleoptera: Dytiscidae). *Fauna norv. Ser. B, 34,* 131—137.

A key is presented for the generic identification of first-instar larvae of Fennoscandian Agabini, and of the genus *Agabus* the key enables identification of 26 species. The two northern species *A. adpressus* Aubé and *A. infuscatus* Aubé, and the southern species *A. neglectus* Er. are not included. The species-pair *A. opacus* Aubé and *A. wasastjernae* (C.R. Sahlb.) is not possible to separate in the first instar, and the species of the *congener*-group are treated collectively. A review is given of the leg chaetotaxy of first-instar *Agabus* larvae, and individual setae are coded in accordance with two different nomenclatural systems. A high number of detailed original illustrations are included.

Anders N. Nilsson, Dept. Animal Ecology, University of Umeå, S-901 87 Umeå, Sweden.

INTRODUCTION

Due to their small size and lack of secondary characters, the determination of first-instar larvae is often problematic. Published descriptions are often very brief, and of little value in separating species. After the list given by Nilsson (1982), the following papers have appeared that include descriptions of first-instar *Agabus* larvae: Galewski 1983a—e, 1984a; Nilsson 1983a & 1985a—b; Nilsson & Cuppen 1983.

The key to first-instar larvae of Central European *Agabus* recently given by Galewski (1984b) includes a review of diagnostic characters together with many illustrations. Still the key is difficult to use as it relies too heavily on relative and gradational characters. It then seems necessary to present a key that includes also the northern European species and makes use of better characters.

As noted earlier (Nilsson 1983b), the separation of larvae of the two genera *Agabus* and *Ilybius* is highly problematic, especially so in the first instar. To solve this problem I have in the beginning of this key included couplets that separate *Agabus* from *Ilybius* and *Platambus.* In this way the key covers the Fennoscandian Agabini. *Platambus* includes here only the single species *P. maculatus* (L.), and the first-instar larvae of *Ilybius* are identified with the keys found in Galewski (1966) and Nilsson (1981 & 1983b).

The first-instar larvae of the Agabini share the following characters that separate them from other dytiscid taxa: (1) head without frontal projection (nasale), anterior clypeal margin with lateral lobes and medially with 8 or more lamelliform setae, (2) legs without swimming hairs and tarsal claws without ventral spinulae, (3) antennomere 4 distinctly shorter than 3rd one, and (4) mandibles with deep grooves.

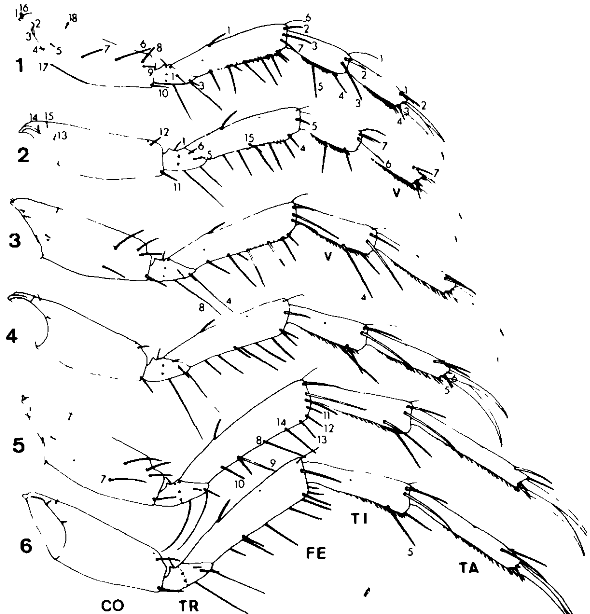
As a rule, the first instar is of a short duration, i.e. about a week. The seasonal occurrence of first-instar larvae varies with the type of life cycle (Nilsson 1986a). In most species the appearance of the first instar is restricted to a particular season, but in a few species it can be collected all-year round. In the species with overwintering eggs, the first instar appears in early spring, i.e. when snow starts to melt, in N Sweden in late April and early May. However, in most species only adults overwinter, and in this case the first instar is found from early to mid summer, in N Sweden from end of May to early July.

METHODS AND MATERIAL

Besides published descriptions, the key is based on reared or otherwise collected larvae from mainly northern Sweden. Larvae of *Agabus conspersus* and *A. nebulosus* were recieved from Italy, and those of *A. striolatus* and *A. undulatus* from the Netherlands. Larvae of *A. chalconatus* and *A. uliginosus* were collected in S Sweden, and those of *A. paludosus* were reared from eggs laid in captivity of adults collected in S Sweden.

Larvae were mounted in euparal on glass slides and studied in a Wild M11 transmission microscope provided with a drawing tube and a micrometer eyepiece. Measurements are used as in Nilsson (1982), though length of last abdominal segment is measured from posterior margin of subbasal elevation.

The following abbreviations are used: LAS = last abdominal segment, P1—P3 = proximal urogomphal setae 1—3, U1 = basal segment of urogomphus, U1/LAS length ratio between basal segment of urogomphus and last abdominal segment, HL = head length (including neck), HW = head width (across the ocelli). Leg sensilla are named in line with the system worked out by Wolfe & Roughley (1985) and modified by Nilsson (1986b, 1987).



Figs. 1—6. *Agabus arcticus* (Payk.), first-instar larva, legs. Setae are individually denoted (numbers corresponding to Bousquet & Goulet 1984): TA: 1 — DDiSt, 2 — ADDi, 3 & 4 —AVDi, 5 & 6 — PVDi, 7 — PDDi; TI: 1 — DDiSt, 2 & 3 —ADi, 4 - AV, 5 — PV, 6 & 7 — PDi; FE: 1 — D, 2, 3, 7 — ADi, 4 & 5 —PDi, 6 — DDiSt, 8—9, 11—14 — AV, 10 — AVPr, 15 — PV; TR: 1 — D, 2 & 3 — ADi, 4 — VSt1, 5 & 6 — PDi, 8 — VSt2; CO: 1—5 & 16—18 — APr, 6—9 — ASp4—1, 10 — AVDi, 11 — PVDi, 12 —DDi, 13—15 — PPr. —1—2. Fore leg. —3—4. Mid leg. —5—6. Hind leg. —1, 3, 5. Anterior aspect. —2, 4, 6. Posterior aspect.

Primary leg setation of *Agabus*

The use of leg sensilla in the key necessitates a review of the primary leg setation of *Agabus* larvae. In Figs. 1—6 the primary setation of *A. arcticus* is shown, and the individual sensilla are numbered in agreement with Bousquet & Goulet (1984).

Tarsus. ADDi 1, AVDi 2, DDiSt 1 (very short), PDDi 1, PVDi 2, V ≈ 20. Pretarsus with 2 spines.

Tibia. ADi 2, AV 1, DDiSt 1, PDi 2, PV 1, V ≈ 20. On fore tibia the AV spine has a more proximal and posterior position. In *A. confinis* there is an additional, short PV spine in proximal half.

Femur. ADi 3, AV 4—12, AVPr 1, D 1, DDiSt 1, PDi 2, PV 1—7. The position of the D spine varies from proximal to slightly distal to middle of femur. In spite of intraspecific variation, the number of AV and PV spines offer good specific characters.

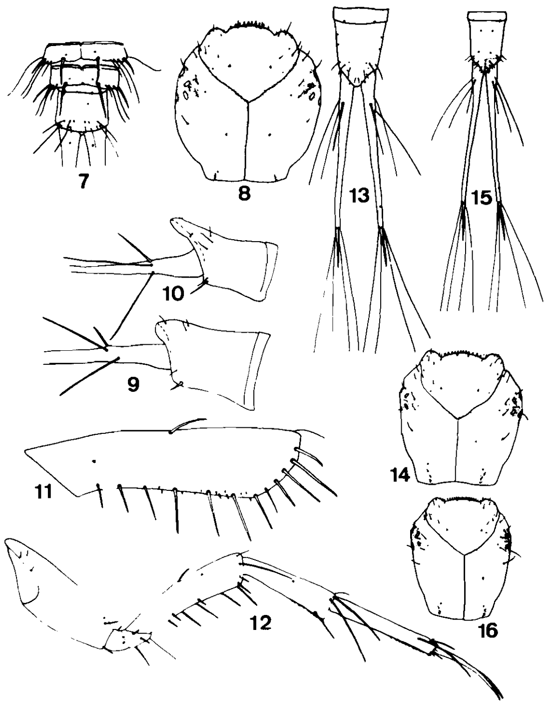
Trochanter. ADi 2, D 1, PDi 2, VSt1 & 2. The lower PDi spine is markedly larger than the upper one. VSt1 is often weaker than VSt2.

Coxa. APr 8, ASp1—4, AVDi 1, DDi 1, PPr 3, PVDi 1. The position of ASp3 is much more proximal on fore than on mid or hind leg.

KEY

A lack of material has made it impossible to include all Fennoscandian *Agabus* species in the key. Of the *congener*-group (sensu Nilsson 1984) I know only *A. congener* (Thunb.), *A. lapponicus* (Thoms.) and *A. levanderi* Hellén, and it is supposed that all species in this poorly differentiated group will key out to the same couplet. The two northern species *A. adpressus* Aubé and *A. infuscatus* Aubé both have their larvae undescribed. As I have not seen the larva of *A. neglectus* Er., it is not included in the key. In spite of the study of a large material, I have not found it possible to give characters for the separation of *A. opacus* Aubé and *A. wasastjernae* (Sahlb.).

1. LAS apically truncate (Fig. 7). Terga each with a pair of median spiniform setae (Fig. 7). Head with a transverse black band (Fig. 8) .... *Platambus.*



Figs. 7—16. First-instar larva. —7—8. *Platambus maculatus* (L.). —7. Abdominal segments 6—8, dorsal aspect. —8. Epicranium, dorsal aspect. —9—10. Last abdominal segment with base of urogomphus, lateral aspect. —9. *Agabus erichsoni* Gemm. & Har. — 10. *Ilybius vittiger* (Gyll.). —11. *I. vittiger,* fore femur, anterior aspect. —12—14. *Agabus serricornis* (Payk.). —12. Hind leg, posterior aspect. —13. Last abdominal segment with urogomphi, dorsal aspect. —14. Epicranium. —15—16. *A. labiatus* (Brahm). —15. Last abdominal segment with urogomphi, dorsal aspect. —16. Epicranium.

— LAS with at least a slight apical projection (Figs. 9—10). Terga without median spiniform setae. Head pattern varying 2

2. Proximal urogomphal setae either aggregated with dorsal setae of 1/2 length of other 2 setae and distinctly paler, or widely dispersed with P1 basal and P2—3 submedian. In the first case LAS has a long, tubular siphon (Fig. 10), and in the other case U1/LAS is 3.0 or more. Femur with 1—2 dorsal spines, if single it is attached distad to middle of femur (Fig. 11) .... *Ilybius.*

— Dorsal projection of LAS short (Fig. 9), not tubular. If urogomphus with P1 basal and P2—3 submedian U1/LAS is 2.0 or less. Femur with 1 dorsal spine that in most species is attached more proximally (Figs. 1—6). *Agabus* 3

3. Leg spines long (Fig. 12). Femoral AV spines subequal to or longer than width of femur. PDDi spine of hind tarsus almost as long as claws. Femoral D spine submedian. P1—3 aggregated basally on urogomphus. Head with distinct dorsal colour-pattern (Figs. 14, 16) 4

— Leg spines in most species shorter, with femoral AV spines shorter than width of femur, and PDDi spine of hind tarsus distinctly shorter than claws. If leg spines long the femoral D spine is more proximally attached (Figs. 1—6) or proximal urogomphal setae are widely dispersed. Head often without distinct pattern. (subgenus *Gaurodytes*) 6

4. Urogomphus relatively shorter, U1/LAS 2.4—2.6 (Fig. 13). Head broader, HW 0.8 mm, HL/HW 1.1 (Fig. 14). Hind femur with 3 PV spines (Fig. 12). (subgenus *Agabus* s.str.) .... *A. serricornis* (Payk.)

— Urogomphus relatively longer, U1/LAS 2.7—2.9 (Fig. 15). Head narrower, HW 0.7 mm, HL/HW 1.2 (Fig. 16). Hind femur with 1 PV spine. (subgenus *Eriglenus*) 5

5. Anterior clypeal margin with 12—13 lamelliform setae. Body with longitudinal, light band .... ***A. undulatus*** (Schrank)

— Anterior clypeal margin with 15—16 lamelliform setae. Body without longitudinal light band .... ***A. labiatus*** (Brahm)

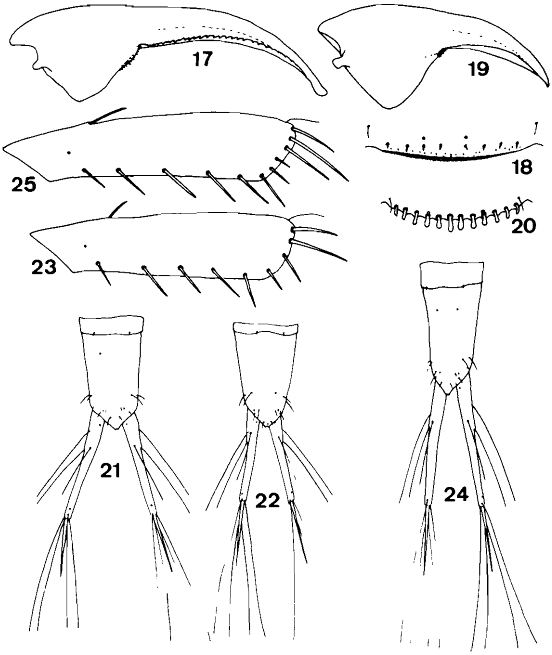
6. Mandibles slender with apex blunt, lower edge slightly serrated (Fig. 17). U1/LAS 1.0—1.4. Anterior clypeal margin broadened with row of 8—12 acute lamelliform setae slightly posterior to margin (Fig. 18) 7

— Mandibles broader with apex acute, without or with a very weak serration (Fig. 19). U1/LAS 1.8 or more. Anterior clypeal margin less broadened with row of lamelliform setae in most species blunt and at margin (Fig. 20) 9

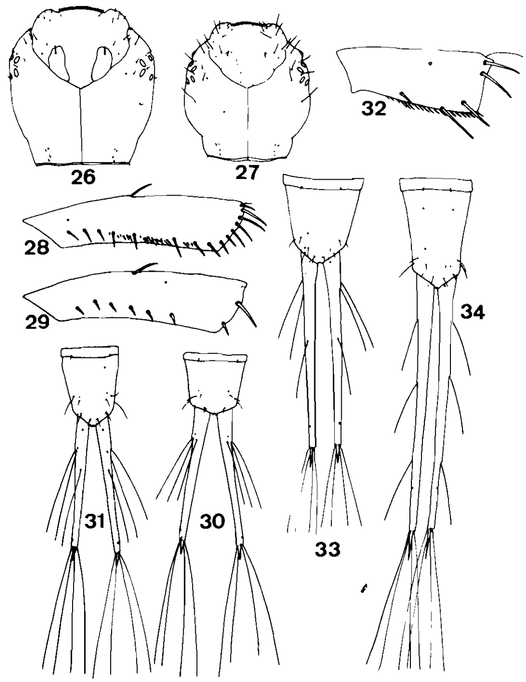
7. U1/LAS 1.3—1.4 (Fig. 21) .... *A. biguttulus* (Thoms.)

— U1/LAS 1.1—1.2 (Figs. 22, 24) 8

8. Length of LAS 0.43—0.47 mm (Fig. 22). Length of U1 0.47—0.55 mm. Anterior



Figs. 17—25. *Agabus,* first-instar larva. —17. *A. affinis* (Payk.), mandible, ventral aspect. —18. *A. unguicularis* (Thoms.), anterior clypeal margin, dorsal aspect. —19. *A. arcticus* (Payk.), mandible, ventral aspect. —20. *A. guttatus* (Payk.), anterior clypeal margin, dorsal aspect. —21—22. Last abdominal segment with urogomphi, dorsal aspect. —21. *A. biguttulus* (Thoms.). —22. *A. affinis.* —23. *A. affinis,* hind femur, anterior aspect. — 24—25. *A. unguicularis.* — 24. Last abdominal segment with urogomphi, dorsal aspect. —25. Hind femur, anterior aspect.



Figs. 26—34. *Agabus,* first-instar larva. —26—27. Epicranium. —26. *A. erichsoni* Gemm. & Har. —27. *A. melanocornis* Zimm. (redrawn from De Marzo 1974). —28—29. *A. erichsoni,* hind femur. —28. Anterior aspect. —29. Posterior aspect. — 30—31. Last abdominal segment with urogomphi, dorsal aspect. —30. *A. chalconatus* (Panz.). —31. *A. wasastjernae* (Sahlb.). —32—33. *A. confinis* (Gyll.). —32. Fore tibia, posterior aspect. —33—34. Last abdominal segment with urogomphi, dorsal aspect. —34. *A. fuscipennis* (Payk.).

clypeal margin with 10—11 lamelliform setae. Hind femur with 5 AV spines (Fig. 23) .... *A. affinis* (Payk.)

— Length of LAS 0.51—0.55 mm (Fig. 24). Length of U1 0.60—0.64 mm. Anterior clypeal margin with 8—9 lamelliform setae. Hind femur with 6—7 AV spines (Fig. 25) .... *A. unguicularis* (Thoms.)

9. Head more or less uniformly dark with a pair of large, subequal to 1/2 length of frontoclypeus, and very distinct pale frontal areas (Figs. 26—27). Frontal tubercles with longitudinal ridge. Femur with more than 8 AV and more than 5 PV spines, and D spine median or more distal (Figs. 28—29) 10

— Head colour varying, often with a contrastive pattern but without such large pale areas posteriorly on frons. Frontal tubercles in most species without longitudinal ridge. Femur in most species with fewer AV and PV spines, and D spine more proximally attached (Figs. 1—6) 13

10. Dorsally attached proximal urogomhal seta pale and of about 1/2 length of the other 2 black ones (Fig. 9). Anterior clypeal margin with 20—23 lamelliform setae. Larva large, HL more than 1.0 mm 11

— All 3 proximal urogomphal setae of about same length and colour (Figs. 30—31). Anterior clypeal margin with 20 or less lamelliform setae. Larva smaller, HL less than 1.0 mm 12

11. Larva blackish brown. Slightly smaller, HL 1.0—1.1 mm, length of pronotum

0.60—0.65 mm, length of U1 1.1—1.2 mm. Hind femur with 4—6 PV spines .... *A. subtilis* Er.

— Larva greyish brown. Slightly larger, HL 1.2 mm, length of pronotum 0.75—0.85 mm, length of U1 1.3—1.4 mm. Hind femur with 6—7 PV spines (Fig. 29)... *A. erichsoni* Gemm. & Har.

12. Proximal urogomphal setae closely attached (Fig. 30). Tergal setation long. U1/LAS about 2.5 (Fig. 30). Anterior clypeal margin with 15—16 lamelliform setae .... *A. chalconatus* (Panz.)

— Proximal urogomphal setae more widely dispersed (Fig. 31). Tergal setation short. U1/LAS about 2.0 (Fig. 31). Anterior clypeal margin with 18—20 lamelliform setae .... *A. opacus* Aubé & *A. wasastjernae* (Sahlb.)

13. Fore tibia with additional short PV spine in basal half (Fig. 32). Larva dark brown with urogomphus long and with proximal setae widely dispersed (Fig. 33). Head width about 1.0 mm......... *A. confinis* (Gyll.)

— Fore tibia with only 2 ventral spines (Figs. 1—2). Other characters varying 14

14. Proximal urogomphal setae widely and evenly dispersed along entire length of U1 (Fig. 34). Larva large, HW about 1.0 mm, of dark brown colour .... *A. fuscipennis* (Payk.)

— Proximal urogomphal setae less widely and not evenly dispersed along entire U1. Other characters varying.......... 15

15. Urogomphus very long, U1/LAS 3.1—3.5. Head narrow, HL/HW 1.2—1.4. Larva pale yellowish 16

— Urogomphus shorter, U1/LAS 2.8 or less. Head less narrow, HL/HW 1.1 or less. Colour varying 17

16. Femur with 3—4 PV spines (Fig. 35). Urogomphus slightly longer, U1/LAS 3.4—3.5 (Fig. 36). Head narrower, HL/HW 1.3—1.4 (Fig. 37) .... *A. nebulosus* (Forst.)

— Femur with single PV spine (Fig. 38). Urogomphus slightly shorter, U1/LAS 3.1—3.2 (Fig. 39). Head less narrow, HL/HW 1.2 (Fig. 40) .. *A. conspersus* (Marsh.)

17. Proximal urogomphal setae widely dispersed, distance between P1 and P3 subequal to or longer than distance from P1 to base of urogomphus 18

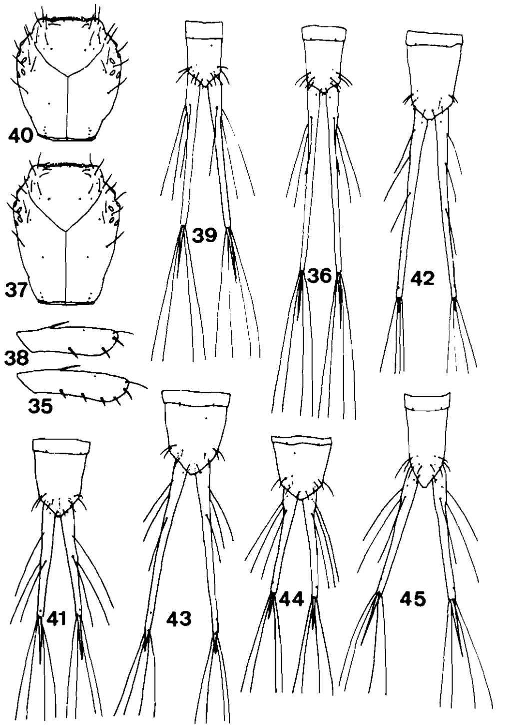
— Proximal urogomphal setae attached close together, distance between P1 and P3 shorter than that from P1 to base of urogomphus.................... 20

18. P2 attached near P3. Urogomphus short, U1/LAS 1.8—2.0 (Fig. 41) .... *A. uliginosus* (L.)

— P2 attached closer to P1 than to P3. Urogomphus long, U1/LAS exceeding 2.5 (Figs. 42—43) 19

19. Proximal urogomphal setae more widely dispersed, P3 attached near middle of U1 (Fig. 42) .... *A. zetterstedti* Thoms.

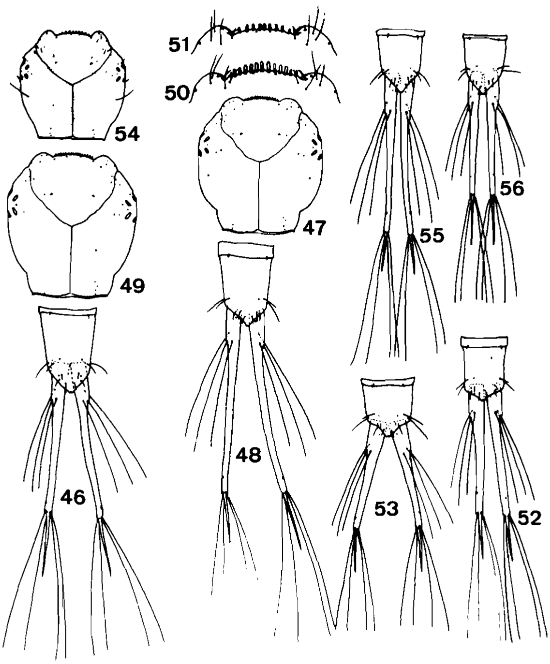
— Proximal urogomphal setae less widely dispersed, P3 attached distinctly basal to



Figs. 35—45. *Agabus,* first-instar larva. —35—37. *A. nebulosus* (Forst.). —35. Fore femur, posterior aspect. —36. Last abdominal segment with urogomphi, dorsal aspect. —37. Epicranium. —38—40. *A. conspersus* (Marsh.). —38. Fore femur, posterior aspect. —39. Last abdominal segment with urogomphi, dorsal aspect. —40. Epicranium. —41—45. Last abdominal segment with urogomphi, dorsal aspect. —41. *A. uliginosus (L.). -42. A. zetterstedti* Thoms. —43. *A. congener* (Thunb.). —44. *A. striolatus* (Gyll.). —45. *A. elongatus* (Gyll.). (Figs. 35—40 redrawn from De Marzo 1974).

middle of U1 (Fig. 43)... *A. congener* (Thunb.)-group

20. Anterior clypeal margin broad, inside lateral lobes 1.5 x as broad as half neck width. LAS narrow, 1.5 x as long as basal width (Fig. 44). Urogomphus short, U1/LAS 1.9—2.0 .... *A. striolatus* (Gyll.)
— Anterior clypeal margin narrow, inside lateral lobes subequal to half neck width. LAS less elongated and urogomphus often relatively longer 21
21. Tergal setae short, median mesonotal pair distinctly shorter than length of terga. Anterior clypeal margin with 14—16 lamelliform setae. Larva larger, HW 0.9 mm 22
— Tergal setae long, median mesonotal pair longer than length of terga. Anterior clypeal margin with 9—13 lamelliform setae. Larva smaller, HW 0.8 mm or less 23
22. Urogomphus short, U1/LAS about 2.0 (Fig. 46). Head laterally subparallel with temporal angles distinct (Fig. 47) .. *A. melanarius* Aubé
— Urogomphus long, U1/LAS about 2.8 (Fig. 48). Head laterally more rounded with temporal angles weak (Fig. 49)... *A. bipustulatus* (L.)
23. Anterior clypeal margin more protruding, medially projecting anteriorly of lateral lobes (Fig. 50). Anterior clypeal margin with 12—13 lamelliform setae 24
— Anterior clypeal margin less protruding, medially not projecting anteriorly of lateral lo*bes (Fig. 51). Anterior clypeal margin with 9–11 lamelliform setae* *25*
24. *Urogomphus longer, U1/LAS about 2.4 (Fig. 52)* .... *A. guttatus* (Payk.)
— Urogomphus shorter, U1/LAS about 2.1 (Fig. 53) .... *A. paludosus* (Fabr.)
25. Epicranium with distinct central dark patch (Fig. 54). Urogomphus longer, U1/LAS 2.1 or more (Figs. 55—56)... 26
— Epicranium without distinct colour-pattern. Urogomphus shorter, U1/LAS 2.0 (Fig. 45) .... *A. elongatus* (Gyll.)
26. Urogomphus longer, U1/LAS 2.6—2.8 (Fig. 55) .... *A. arcticus* (Payk.)
— Urogomphus shorter, U1/LAS 2.1—2.3 (Fig. 56) .... *A. sturmii* (Gyll.)



Figs. 46—56. *Agabus,* first-instar larva, dorsal aspect. —46—47. *A. melanarius* Aubé. —46. Last abdominal segment with urogomphi. —47. Epicranium. —48—49. *A. bipustulatus* (L.). —48. Last abdominal segment with urogomphi. —49. Epicranium. —50—51. Anterior clypeal margin. —50. *A. paludosus* (Fabr.). —51. *A. sturmii* (Gyll.). —52—53. Last abdominal segment with urogomphi. —52. *A. guttatus* (Payk.). —53. *A. paludosus.* —54—55. *A. arcticus* (Payk.). —54. Epicranium. —55. Last abdominal segment with urogomphi. —56. *A. sturmii,* last abdominal segment with urogomphi.

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Bokanmeldelser

LAURITZ SØMME, 1987. *Insektenes suksess.* **En vellykket dyregruppe og dens tilpasning til miljøet.** Universitetsforlaget. 134 sider. Pris kr. 145.

Dette er en delikat liten bok om insektenes bygning, liv og levnet. I forordet sier forfatteren at hensikten med boken er å presentere noen av de siste årtiers forskningsresultater i en popularisert form. Boken er skrevet for alle som er glad i naturen, og gjerne vil vite mere om denne fasinerende dyregruppen.

Boken er inndelt i 16 kapitler som omhandler bygning, utvikling, opprinnelse, sanser, atferd, forholdet planter—insekter, insektsamfunn, insekter i kalde strøk, skadeinsekter, insektbekjempelse og insekter i vårt daglige liv. Temaene er mange og varierte, og innenfor 134 sider blir det bare smakebiter av det mylder av tilpasninger som insektene har til sine omgivelser. Mange av kapitlene har så morsomme og interessante opplysninger fra en lite kjent verden at en skulle ønske at de var lengre. Boken er lettlest og grei og det er samlet opplysninger om insektenes liv som ellers kan være vanskelig å finne på norsk. Boken bør være av stor interesse for alle insektinteresserte, fagfolk som lekfolk. Dette bør være en fin gavebok til naturinteressert ungdom.

Det er ikke hverdagskost at det blir utgitt «spennende» insektbøker på norsk, så denne er hjertelig velkommen.

John O. Solem

Short communications

GRAMMOTAULIUS NITIDUS (MÜLLER, 1764) (TRICH., LIMNEPHILIDAE), A NEW CADDIS FLY FOR NORWAY.

TROND ANDERSEN AND GEIR E.E. SØLI

The caddis fly *Grammotaulius nitidus* (Müller, 1764) is recorded in Norway for the first time. Three males were captured in a light trap situated close to a lake near Lillesand, Southern Norway.

Trond Andersen, University Library, Dept. of Science, Realfagbygget, Allégt. 41, N-5007 Bergen, Norway.
Geir E.E. Søli, Zoological Museum, University of Bergen, Muséplass 3, N-5007 Bergen, Norway.

Three males of the limnephilid *Grammotaulius nitidus* (Müller, 1764) were taken in a light trap situated close to the lake Grimevannet (Grimenes, UTM: 32VMK618648, EIS: 6, AAY: Lillesand), 8 km north of Lillesand, between 13 and 18 Aug. 1985.

The light trap was situated about 50 m from the shore. At this site, a channel with a slow flowing water connects Grimevannet with lake Østre Grimevannet (water surface 47 and 46 m a.s.l., respectively). The channel is overgrown with *Phragmites* and various sedges. Grimevannet, in the trapping site area, is rather shallow with sparse vegetation. A marshy area with several smaller ponds and ditches is found some 150 m from the trapping site.

In the light trap catches at Grimevannet, *G. nitidus* was taken together with *G. nigropunctatus* (Retzius, 1783), the latter being by far the most common. Both are rather large limnephilids, easily recognized by a blackish line found along the fourth apical sector in the hind wings. They have long, narrow anterior wings with only moderately dilated apices; in *G. nitidus,* the anterior wings are greatly produced and the apical portion is very acute. The specimens of *G. nitidus* taken at Grimevannet have all very pale straw-coloured wings without any dark markings, while the anterior wings of *G. nigropunctatus* specimens had more or less brownish irroration. The two species are also easily distinguished by the male genitalia, i.e. the shape of the «superior appendage», in which *G. nitidus* has only a small, shallow excision.

G. nitidus is distributed throughout England, Central Europe, the European USSR, Caucasus, western Siberia, middle Asia and Iran (Schmid 1950). In northern Europe, it has been recorded in Denmark and Sweden, but not in Finland (Svensson & Tjeder 1975). The distribution in Sweden covers the southernmost provinces, north up to Bohuslän in the west (Forsslund & Tjeder 1942). Thus, a distribution area covering the south-eastern coastal parts of Norway was expected, but a thorough search for this species in Vestfold in the 1970's was inconclusive.

According to Mosely (1939), *G. nitidus* seems to be a rather local species in England, found in fens and marshy areas. Lepneva (1966) stated that its habitats are small, overgrown water bodies, especially swampy spring puddles, while Tobias and Tobias (1981) also mentioned the species inhabiting the potamon zone of rivers. In Central Europe the flight period of *G. nitidus* covers July to September (Tobias & Tobias 1981).

ACKNOWLEDGEMENTS

We are indebted to Mr. Arne Auen Grimnes for looking after the light trap. Mrs. Elin Pierce has corrected the language.

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ORMYRUS PUNCTIGER WESTWOOD, 1832 (HYMENOPTERA, ORMYRIDAE) NEW FAMILY AND SPECIES TO THE NORWEGIAN FAUNA

FRED MIDTGAARD

A specimen of *Ormyrus punctiger* Westwood, 1832 was collected with a Malaise trap on the island Håøya in the inner Oslofjord in the period 27 Jun.—22 Jul. 1984. No species of the family Ormyridae has formerly been reported from Norway.

Fred Midtgaard, Norwegian Forest Research Institute, P.O.Box 61, N-1432 Ås-NLH, Norway.

One female *Ormyrus punctiger* Westwood, 1832 was collected with a Malaise trap on Akershus, Frogn: Håøya (EIS 28), 27 Jun.—22 Jul. 1984 (trap B), leg., det. et coll. F. Midtgaard.

The family, which is closely related with the family Torymidae, numbers only approximately 13 European species. The approximately 30 world species are distributed on all continents except South America and Australia (Sellenschlo & Wall 1984).

Even though four species of Ormyridae are known to occur in Sweden (Hedqvist 1984), little has been published about the family in Fennoscandia. Sellenschlo & Wall (1984) list no species from Fennoscandia or Denmark.

The family Ormyridae may be distinguished from Torymidae on the short antennae, the konvex, shining mesosoma with scarse punctures, the feble developed notaulices, the konical metasoma with pointed apex, the very large punctures apically on the tergits, the short ovipositor and the teeth on the apical margins of the tergits (Sellenschlo & Wall 1984).

The species of this family have been reared mainly from Cynipidae (Hymenoptera), Cecidomyiidae and Tephritidae (Diptera) (Sellenschlo & Wall 1984).

The Europea species may all belong to one genus, *Ormyrus*, because it is possible that the two genera *Tribaeus* and *Monobaeus*, erected by Förster, are based on small individuals of *O. papaveris* Perris and *O. wachtli* Mayr, respectively (Mayr 1904). In her key to the Chalcidoidea of the European USSR, Nikolskaja (1952) recognizes only the genus *Ormyrus*. Later authors (Erdös 1955, Peck et al. 1964) key out the three genera as valid.

The species in this family are very variable in colour and size (Sellenschlo & Wall 1984). There is a key to the European Ormyridae in Sellenschlo & Wall (1984).

Ormyrus punctiger has been reared from galls of a number of species of Cynipidae on oak *(Quercus)*, but has also been reported from *Agromyza rubi* Bremi (Diptera, Agromyzidae) on *Rubus* (Sellenschlo & Wall 1984).

The known distribution includes Germany, Austria, Italy, France, Hungary, Yugoslavia and the southern parts of the European USSR (Sellenschlo & Wall 1984).

ACKNOWLEDGEMENT

I am greatly indebted to Dr. Udo Sellenschlo, Hamburg for verifying the identification.

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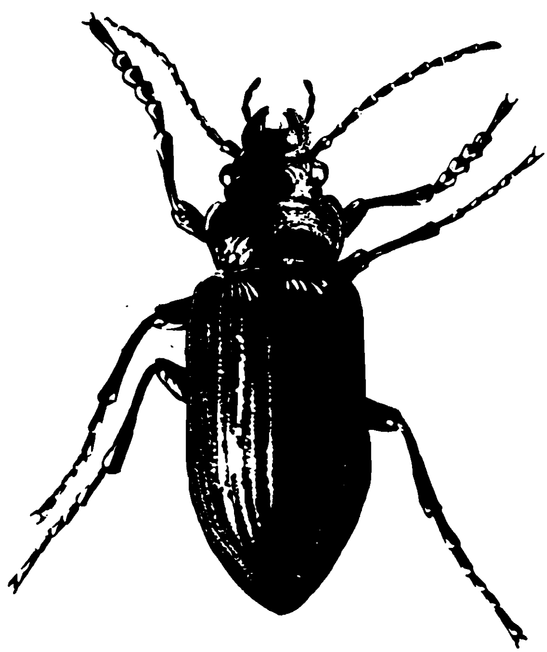

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