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# Professor Ole A. Sæther 50 years

Former editor of *Fauna norvegica*, Professor Ole A. Sæther, celebrated his 50th birthday recently. Since the event of his birthday coincides more or less with the 25 years anniversary of an extraordinarily active career, these days are an opportunity to see Sæther's contributions to science in retrospect. For most of this time Sæther has been devoted to the study of chironomid midges (Diptera: Chironomidae).

The family Chironomidae has a world wide distribution, comprizing about 6000 known species. As a group it demonstrates an unusually wide range of ecological adaptations and many species are found in environments which may be considered at the limits of life. The larvae are predominantly aquatic and of major ecological significance in many kinds of water bodies. For this reason, studies of Chironomidae came to play an important role in the early development of limnology.

Sæther was born at Kristiansand on 9th December 1936. He obtained his first academic degree in 1960. From 1961 he was employed as a scientific assistant at the University of Oslo and continued his studies in the Department of Limnology. In 1963 he obtained the degree *can.d.real.* with a voluminous dissertation treating the biology and environmental factors of the culturally eutrophied Lake Østensjøvann. Shortly afterwards he was promoted to University Lecturer, a position which he held until 1969. At that time, Sæther had already made his first research visit to North America. From 1967 he joined the Freshwater Institute of the Fisheries Research Board in Winnipeg, Canada, initially as a visiting scientist. In 1969 he was employed as a Research Scientist to do basic research on benthic communities, with particular reference to eutrophication problems. Here, in the Eutrophication Section of the Freshwater Institute, Sæther obviously benefited from a fertile scientific environment and became highly productive in writing publications. Several great monographs appeared from his hands during these years, most of them concerned with systematic revisions of ecologically important chironomid taxa. In 1977 Sæther was Professor by the University of Bergen. Since then he has been scientific

Head of the Department of Systematics of the Museum of Zoology.

Although he may find the environment here less nourishing, at least when financial backup is concerned, Sæther has maintained a high production of scientific papers and his publication list presently includes more than 100 publications amounting to a sum of about 2500 printed pages.

The bulk of Sæther's contributions to entomology are concerned with descriptive and analytical systematics. To date he has described and authored about 220 new taxa, predominantly chironomids, but also species of water mites (Hydracarina), phantom midges (Chaoboridae), shore flies (Ephydriidae), caddis flies (Trichoptera, and chalcids (Hymenoptera). Most of these descriptions are not isolated, but parts of full revisions of genera and generic groups. Consequently the number of species described by Sæther is much higher and his descriptions usually include immature stages and both sexes of adult midges.

Sæther's generation of chironomid students inherited a systematics which was virtually constituted by two poorly integrated taxonomic systems. One system stemmed from entomologists and was based on adult midges, the other from limnologists based on immature stages. The results of an intensive, but perhaps less coordinated research on chironomids was an inconsistent systematics which must have been extremely confusing and discouraging to deal with, especially for those who wanted to take up studies of chironomids for the first time. It is on this background that Sæther's merits must be evaluated. In the process of elaborating an integrated systematics on the Chironomidae he has submitted several major contributions, generally in series of large monographs.

Sæther early adopted the ideas developed by W. Hennig and phylogenetic systematics became his conceptual framework as well as his working methodology. The general scope of phylogenetic systematics is to elaborate classifications based on monophyletic groups which in turn give hypotheses on the actual course of cladistic evolution. This seemed to be the only way to deal with the problems

derived from more or less intuitive classifications, in which adult and immature stages of taxa may appear to show different phyletic affinities. The method requires a great number of characters to be studied. Consequently, Sæther's descriptions include a large array of character statements and his papers taken together are an extraordinary loaded series of data. The value of these data is further increased by their mostly homogenous and consistent presentation.

Cladistic analysis means searching for evolutionary trends and interpretation for each cladogenetic level which characters are primitive (plesiomorphic) or derived (apomorphic). In one major opus after another Sæther presented resolved cladograms from large and complicated data matrices. Of particular importance was his classification of chironomid subfamilies where, for the first time in chironomid systematics, the information displayed by female adult morphology was used in classification. Sæther had prepared the ground himself to make this possible. In a study of female genitalia, he described and figured more than 200 species of chironomids and other nematoceros Diptera and he outlined a terminology of female genital structures. When he presented this broad comparison of morphological differentiation of female genitalia, two major achievements were made. First, it revealed good prospects for the possibility of identifying the previously neglected chironomid females and nowadays, descriptions of females generally form an integral part of chironomid species descriptions. Secondly, new sets of characters were available to be used in cladistic analyses. The impact of this on chironomid systematics was significant, resulting among other things in a reevaluation of the relationship between chironomid subfamilies.

Another work of significant impact on chironomid systematics was Sæther's glossary to chironomid morphological terms. This compilation of terminology with recommended terms and their synonyms has certainly made life easier for the chironomid systematist and the paper was an important step towards standardization and homogenization of chironomid descriptions. This particular work together with the recently elaborated keys to the Holarctic genera of chironomids, to which Sæther has made significant contributions, will probably give a greater number of entomologists and freshwater biologists ac-

cess to and guidance through the labyrinths of chironomid systematics.

Although the study of systematics is an autonomous discipline and has become a full time commitment in itself for Sæther, he has not forgotten his basic training as a limnologist and his initial motivation for entering into systematics. The «Seetypen Lehre» developed by Thienemann and his followers culminated when Sæther in 1979 published his more refined means of characterizing trophic levels of lakes from the composition of their chironomid communities. To the extent that these methods have been used they have sometimes proved to be more informative than physio-chemical analyses in detecting ecological changes and sources of pollution.

Through his detailed studies of a great variety of chironomid groups, Sæther has reached a level of overview as well as detailed insight into manifestations of evolutionary differentiation that probably few systematists share with him. His experience derived from analyses of morphological variation in a highly complex taxon and his practical application of phylogenetic systematics has made him believe that the interpretation of apomorphies and plesiomorphies is less straightforward than originally anticipated in phylogenetic theory. Accordingly, in several of his more recent publications he has advocated the idea of «underlying synapomorphism», a concept introduced by L. Brundin as «inside parallelism». He has also defined what he considers a necessary distinction between «objective synapomorphies» and «subjective synapomorphies». Objective synapomorphies more or less correspond to the orthodox definition of synapomorphies. Underlying synapomorphies behave in an analogous manner to recessive genes and are regarded as a potential capacity to develop a certain character. These ideas are controversial among adherents of phylogenetic systematics and by raising them Sæther has provoked dispute and theoretical confrontation in international journals. Nevertheless, the issues focused here by Sæther are undoubtedly of great importance in clarifying the theoretical basis of any attempts to reconstruct coherent phylogenetic systems. Sæther claims that all kinds of character sets must be taken into account in the total evaluation of genealogical relationships between taxa. Although one may disagree with his conclusions, his way of pre-

sending and systemising these character sets, including conflicting evidence, is the strenght of his methodology.

Sæther has been an active participant in many international meetings on systematics, phylogenetics and freshwater ecology. He has contributed to the arrangement of symposia and congresses, recently as chairman of the organizing committee of IXth International Symposium of Chironomidae held at Bergen.

Endre Willassen

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# Contribution to the knowledge of the Norwegian Lepidoptera II

LEIF AARVIK

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*Teleiodes sequax* (Haworth, 1828) and *Pyrausta ostrinalis* (Hübner, 1796) are deleted from the Norwegian list. Further information on *Rhyacionia logaea* Durrant, 1911 and *Acerbia alpina* (Quensel, 1802) in Norway are given. The following species are reported new to Norway; *Tinea bothniella* Svensson, 1953, *Elachista triatomea* (Haworth, 1828), *Amphisbatis incongruella* (Stainton, 1849), *Agonopterix astrantiae* (Heinemann, 1870), *Pexicopia malvella* (Hübner, 1805) *Psoricoptera speciosella* Teich, 1892, *Leioptilus lienigianus* (Zeller, 1852), *Schoenobius gigantella* (Denis & Schiffermüller, 1775) and *Mesapamea secalella* Remm, 1983.

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## INTRODUCTION

Examination of Lepidoptera material in museums and private collections has shown that *Teleiodes sequax* (Hw.) and *Pyrausta ostrinalis* (Hb.) should be deleted from the Norwegian list. The distributions in Norway of three pairs of sibling species, viz. *Psoricoptera gibbosella* (Zell.), *P. speciosella* Teich and *Rhyacionia duplana* (Hb.), *R. logaea* Durr. and *Mesapamea secalis* (L.), *M. secalella* Remm are discussed. In addition seven species are reported new to Norway and details of the Norwegian record of *Acerbia alpina* (Quens.) are given. Latin names on plants are according to Lid (1974). The EIS-grid numbers are mentioned only after the first locality when there are records from more than one locality in a square.

## Species deleted from the Norwegian list

Gelechiidae: *Teleiodes sequax* (Haworth, 1828)

This species was recorded new to Norway by Grønlien (1937) from AAY, Risør; but no material exists among Grønlien's Lepidoptera at the Zoological Museums in Oslo and Bergen. Mehl (1973) recorded *sequax* from MRI, Kvanne, but Opheim (1979a) stated that this specimen was misidentified and belonged to *Teleiopsis diffinis* Haworth. *T. sequax* figures as Norwegian in the lists by Krogerus et al. (1971) and Opheim (1978). The

food-plant of *sequax* is *Helianthemum* which does not grow in Norway. As no material of *sequax* is present in Norwegian collections, and it is very unlikely to occur here, it should be deleted from the Norwegian list.

Pyalidae: *Pyrausta ostrinalis* (Hübner, 1796)

The name *ostrinalis* has been used in the Norwegian literature for a long time either as a form of *Pyrausta purpuralis* (Linnaeus, 1758) e.g. Schøyen (1893), Haanshus (1933) or as a distinct species (Krogerus et al. 1971, Opheim 1975).

Examination of specimens present under the *ostrinalis* label at the Zoological Museum in Oslo, showed that they all belonged to *purpuralis*. Similarly no *ostrinalis* specimens could be found at the Zoological Museum in Bergen (A. Fjeldså pers. comm.) or in any private collection. Consequently *ostrinalis* should be deleted from the Norwegian list.

## Species new to Norway

Under this heading eight species new to Norway and two species which have been recorded previously, but without precise data, are treated.

Tineidae: *Tinea bothniella* Svensson, 1953

Recently Mr. Reidar Mehl showed me the genitalia of a male *Tinea* species which in

1984 had attacked old woolen garment in a museum at HEN, Tynset: Tynset (EIS 80). The garment was kept in a house which was not heated. The genitalia belonged to *Tinea bothniella* Svensson which is new to Norway. *T. bothniella* is distributed in Sweden (Västertoppen, Norrbotten, Lule Lappmark) (Gustafsson 1980), Finland (from Turku in the south to Ostrobotnia borealis in the north), USSR eastward to S. Siberia and Mongolia (Kyrki 1978, Robinson 1979).

Previously raptor pellets is the only foodstuff reported for this species (Robinson 1979).

Wings and genitalia of *bothniella* and related species are figured by Robinson (1979).

Elachistidae: *Elachista triatomea* (Haworth, 1828)

AK, Bærum: Ostøya (EIS 28) ♂ 15 June 1985 L. Aarvik leg. The specimen was netted in the evening.

*E. triatomea* is distributed in N. and C. Europe. In Sweden it has been found northwards to Dalarne and Uppland, in Finland it is known from the Aland islands (Traugott-Olsen & Nielsen 1977).

Figures of wings and genitalia and information on the biology are given by Traugott-Olsen & Nielsen (1977).

Oecophoridae: *Amphisbatis incongruella* (Stainton, 1849)

Ø, Hvaler ♂ E. Strand leg. The specimen was discovered by Ole Karsholt in material of Elachistidae on loan from the Zoological Museum in Bergen. The specimen was only labelled «Hvaløerne, Strand». It must have been collected in spring 1900 or 1902 (Strand, 1901, 1904).

In Sweden *A. incongruella* has been collected north to Södermanland (Gustafsson 1980), in Denmark it is widely distributed in Jutland, and there is one locality in North East Zealand (Palm 1978). Otherwise in C. Europe including Britain, and Spain (Jacobs 1978).

The habitat is moors where the larva which lives in a case feeds on various herbs, especially heather (Jacobs 1978, Palm 1978). The species' wings are figured by Jacobs (1978) and Palm (1978). Palm (1978) also figures the genitalia.

*Agonopterix astrantiae* (Heinemann, 1870)

MRY, Molde: Sekken (EIS 77) ♂ Aug. 1980. T. Andersen leg., O. Karsholt det. The specimen was found by O. Karsholt in light trap material.

In Sweden this species has been collected from Skåne to Uppland (Gustafsson 1980), in Finland on the Aland islands only (Kyrki 1978). Otherwise in Denmark and C. Europe including England (Palm 1973, Jacobs 1978).

The food-plants of the larva are *Astrantia major* or *Sanicula europaea* (Palm 1973, Jacobs 1978). Judging from the distribution (Lid 1974), the latter is probably the food-plant in Norway.

Wings and genitalia are figured by Palm (1973).

Gelechiidae: *Pexicopia malvella* (Hübner, 1805)

AK, Ås: Ås (EIS 28) ♀ 18 July 1985 L. Aarvik leg. The specimen was captured in a light trap.

*P. malvella* is distributed from Skåne to Gästrikland and Dalarne in Sweden (Gustafsson 1980). It is widespread in S. Finland (Kyrki 1978). In Denmark it is now spreading and is known from four SE districts (O. Karsholt in litt.). Otherwise in S. and C. Europe including Britain (Sattler 1960).

The larva feeds on the seeds of various Malvaceae (Emmet 1979). The genitalia are figured by Sattler (1960).

*Psoricoptera speciosella* Teich, 1892

AK, Asker: Brønnøya (EIS 28) ♀ 26 May 1980 e.l. on *Salix* T. Edland leg.; Heggedal 2 ♂♂ 5 Aug. 1978, 4 Aug. 1979 K. Berggren leg.; AK, Bærum: Ostøya 3 ♂♂ 14 July—3 Sept. 1983 L. Aarvik leg.; AK, Nesodden: Fagerstrand ♀ 25. Sept. 1982 S. Kobro leg.; AK, Ås: Ås 3 ♂♂, 2 ♀♀ 12—17 Aug. 1982, 18 Aug. 1983, 13—29 Aug. 1984 L. Aarvik leg.; BØ, Drammen, Åssiden ♀ 11 Sept. 1983 L.O. Hansen leg.; AAY, Grimstad: Eide (EIS 6) ♂, ♀ 24 Aug. 1984; VAY, Kristiansand: Kuholmen (EIS 2) ♂ 3 Aug. 1975, Stangenes 5 ♂♂ 11 Aug. 1978, 17 Aug. 1979 K. Berggren leg. All specimens except the one from Brønnøya were captured at light. This species has a very restricted distribution. In Sweden it was recently recorded in Gästrikland (Svensson 1982). In Finland it has been found in five southern districts (Kyrki 1978). The only known locality outside Fennoscandia

dia is the type locality, Livonia, in the Baltic part of the USSR (Teich 1892).

*P. speciosella* differs from the related *P. gibbosella* (Zeller, 1839) by the absence of reddish colour in the forewing. The differences between the two species in the male genitalia pointed out by Svensson (1982) do not hold. There are too much variation in both species. O. Karsholt has informed me that he could not find any difference between *gibbosella* and *speciosella* in the female genitalia. Thus the taxonomic status of *speciosella* needs further study.

The record of *gibbosella* by Opheim (1978, 1979 b) represent *speciosella* (K. Berggren pers. comm.). Still *gibbosella* is also a member of the Norwegian fauna. I have seen the following Norwegian specimens: Ø, Rygge: Sildebauen (EIS 19) ♂ 23 July 1980 L. Aarvik leg.; AAY, Grimstad: Groos (EIS 6) ♂ 30 Aug. 1982 C.F. Lühr leg.; VAY, Kristiansand: Stangenes (EIS 2) ♂ 12 Aug. 1978 L. Aarvik leg.

Both species occur sympatrically in some localities in S. Norway.

The food-plant of *speciosella* is *Salix*. The food-plant of *gibbosella* is *Quercus*, exceptionally *Salix* (Benander 1928, O. Karsholt pers. comm.).

Tortricidae: *Rhyacionia logaea* Durrant, 1911

Ø, Fredrikstad: Fredrikstad (EIS 20) ♂ (no date) E. Strand leg.; AK, Bærum: Sandvika (EIS 28) ♂ April 1922 E. Barca leg.; AK, Ås: Nettet ♂ 10 May 1985 L. Aarvik leg.; HES, Elverum: Løking (EIS 55) 6 ♂♂ 9 May 1981 L. Aarvik leg.; BØ, Hurum: Rødtangen (EIS 28) 9 ♂♂ 16—17 April 1982 L.O. Hansen leg.; BØ, Kongsberg: Mildigheit (EIS 27) 3 ♂♂ 9 May 1979 S. Bakke leg.; VE, Nøtterøy: Herstad (EIS 19) ♂ 6 April 1984 A. Fjeldså leg.; AAY, Tromøy: Bjelland (EIS 6) 4 ♂♂ 15—17 April 1976 S. Bakke leg.; AAY, Tvedestrand: Laget (EIS 11) ♂ 20 April 1922 N. Knaben leg.; VAY, Kristiansand: Kuholmen (EIS 2) ♂ 30 April 1980 K. Berggren leg.; HOY, Os: Gåssandvann (EIS 31) ♂ 9 April 1967 A. Fjeldså leg. Owing to difficulties with identification, females are excluded from the list. According to Benander (1946) there is a specimen of *logaea* from Dovre present at the Zoological museum in Lund. The specimen was probably collected by Boheman who visited Dovre and the adjacent

Gudbrandsdalen. Until recently *R. logaea* has been treated as a form of *R. duplana* (Hübner, 1813) by most authors. Obraztsov (1964) found no difference between *duplana* and *logaea* in the genitalia and treated *logaea* as a subspecies of *duplana*. However, there is a constant difference in the male antennae: The cilia in *logaea* are twice as long as in *duplana*. There are also small differences in the forewing markings of the males. The females are very difficult to separate. The male antennae and forewings of the two species are figured by Buhl et al. (1983). Winter (1981) found differences in the larvae of the two species. In many areas in Scandinavia *duplana* and *logaea* occur sympatrically, and this also speaks for the distinctness of the two species.

In Sweden *R. logaea* is distributed north to Västerbotten and *duplana* to Lycksele Lapmark (Gustafsson 1980). Both species occur in Finland (Krogerus et al. 1971). In Denmark *duplana* occurs in most districts, whereas *logaea* has only been collected in a small area in N. Zealand (Buhl et al. 1983). Otherwise *logaea* occurs in France and Scotland (Obraztsov 1964).

In Norway *duplana* is less common than *logaea*, but the following specimens have been collected: AK, Oslo: Fjeldstuen (EIS 28) ♂ 10 April 1854 L.M. Esmark leg.; AK, Ås: Ås ♂ 19 April 1983 L. Aarvik leg.; HES, Elverum: Damtjern (EIS 55) ♂ 10 May 1981 L. Aarvik leg.; VAY, Kristiansand: Augland (EIS 2) ♂ May 1984 K. Berggren leg.; Stangenes ♂ 3 May 1980 S. Svendsen leg.; VAY, Mandal: Holum ♂ 15 May 1985 K.A. Johanson leg.; VAY, Marnardal: Bjelland (EIS 5) ♂ 18 May 1980 K. Berggren leg. The females are not included owing to difficulties with identification.

*R. duplana* is distributed from N. and C. Europe (excluding Britain) through the USSR to Japan (Bradley et al. 1979). The larva of both species feed in the buds and shoots of various *Pinus* species.

Pterophoridae: *Leioptilus lienigianus* (Zeller, 1852)

Ø, Rygge: Sildebauen (EIS 19) ♂ 23 July 1985 L. Aarvik leg. The specimen was captured in a light trap.

In Sweden this species has been collected in Skåne, Öland and Gotland only (Gustafsson 1980). Otherwise in S. Finland (Kyrki

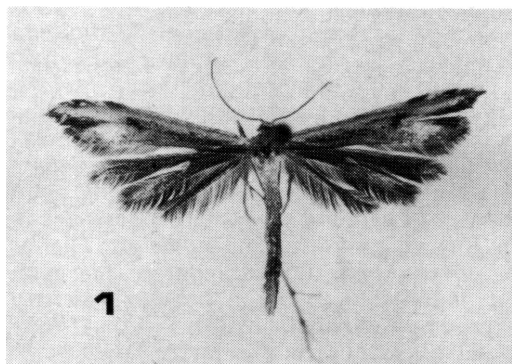


Fig. 1. *Leioptilus lienigianus* (Zell.). The specimen from Rygge.

1978), all over Europe and in parts of Asia and Africa (Hannemann 1977).

The larva feeds chiefly on *Artemisia vulgaris* (Hannemann 1977). The genitalia are figured by Hannemann (1977).

**Pyralidae: *Schoenobius gigantella* (Denis & Schiffermüller, 1775)**

AK, Ås: Nettet (EIS 28) ♂ 5—14 July 1984 L. Aarvik leg. The specimen was captured in a light trap.

In Sweden *S. gigantella* has been collected north to Västmanland (Gustafsson 1980), in Finland north to Ostrobothnia media (Kyrki 1978). Otherwise in Denmark (Krogerus et al. 1971), C. Europe and E. Asia (Hannemann 1964).

The larva feeds on *Phragmites* (Hannemann 1964). The Norwegian locality is close

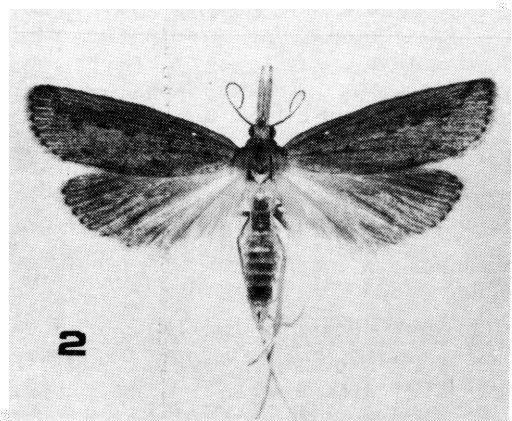


Fig. 2. *Schoenobius gigantella* (Den. & Schiff.). The specimen from Ås.

to a lake with rich growth of *Phragmites*. *S. gigantella* is figured by Hannemann (1964).

**Arctiidae: *Acerbia alpina* (Quensel, 1802)**

Aagaard (1979), Linnaluoto & Koponen (1980) and Sotavalta et al. (1980) mention that *Acerbia alpina* has been collected in N. Norway without giving details of the record. Prof. Olavi Sotavalta has kindly furnished more information. The Norwegian specimen was captured by N. Outakoski and published as a note in the Finnish newspaper Pohjolan Sanomat (Outakoski 1972). The locality is FN, Tana: near the outlet of Levajokka (EIS 175), *regio alpina*, and the date was last week of June 1972.

*A. alpina* is a great international rarity, occurring in the arctic parts of both the Old- and the New World. Outside Fennoscandia it has been collected in Siberia, N. Mongolia, Alaska and arctic Canada. The type specimen was captured in Enontekiö, Finland in 1799, and it was not rediscovered in Europe until 1962 on the mountain Saana in the same district. From 1962 onwards several imagines, larvae and pupae have been collected in Enontekiö (Sotavalta 1962, Sotavalta et al. 1980). In 1980 the species was recorded for the first time in Sweden: A cocoon was found on the mountain Nissuntjärro in Torne Lappmark (Hellberg 1981).

The biology of *A. alpina* is dealt with in detail by Sotavalta et al. (1980). They also show photos of the early stages. The biotope is the treeless tundra or above the timberline in mountains. The larva is polyphagous and usually hibernates once. The life cycle may take many years if several cold summers occur in succession.

The moth is figured by Sotavalta (1962), Sotavalta et al. (1980) and in colour by Gulander (1963).

**Noctuidae: *Mesapamea secalella* Remm, 1983**

Ø, Sarpsborg: Borregaard (EIS 20) 2 ♂♂ 28 July—14 Aug. 1983 T.J. Olsen leg.; AK, Oslo: Haugerud (EIS 28) 2 ♂♂ 16 Aug. 1984 K. Myhr leg.; AK, Ås: Nettet 4 ♂♂ 5 July—6 Aug. 1984 L. Aarvik leg.; AK, Ås: Ås ♀ 20 Aug. 1970 S. Bakke leg., ♀ 25 Aug. 1982, 5 ♂♂ 6—15 Aug. 1984 L. Aarvik leg.; OS, Gjøvik: Rambekk (EIS 45) ♂ 22 Sept. 1971 L. Aarvik leg.; BØ, Drammen: Åssiden (EIS 28) 2 ♂♂ 8—9 Aug. 1983 L.O. Hansen leg.;

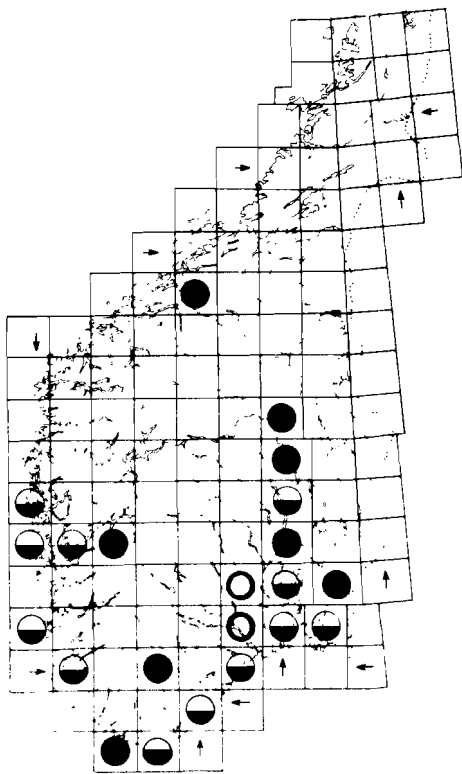


Fig. 3. The distribution of *Mesapamea secalis* (L.) and *M. secalella* Remm in Norway. Dots denote records of *secalis*, circles denote records of *secalella* and half-filled circles denote records of both species.

VE, Sem: Narverød (EIS 19) ♀ 4 Aug. 1970, ♂ 24 Aug. 1971, ♂ 8 Aug. 1974 C.F. Lühr leg.; VE, Tønsberg: Tønsberg ♀ 29 July 1966 K. Berggren leg.; TEY, Porsgrunn: Dammane (EIS 11) 2 ♂♂ 10 July—11 Aug. 1983 G. Ellefsen leg.; TEY, Porsgrunn: Åsstranda (EIS 18) 4 ♂♂ 10 July—16 Aug. 1983 G. Ellefsen leg.; TEI, Notodden: Notodden (EIS 27) ♂, ♀ 10 Aug. 1969 F. Smedstad leg.; AAY, Grimstad: Groos (EIS 6) ♂ 12 Aug. 1974 C.F. Lühr leg.; AAY, Tromøy: Bjelland ♂ 3 Aug. 1983 A. Bakke leg.; AAY, Øyestad: Øyestad ♂ 22 July 1968 S. Bakke leg.; VAY, Kristiansand: Augland (EIS 2) ♂, ♀ 31 July 1985 K. Berggren leg.; RY, Randaberg: Sande (EIS 7) ♂ 1 Aug. 1948 F. Jensen leg.; RY, Stavanger: Rosenli ♂ 22 Sept. 1926 F. Jensen leg.; RY, Karmøy: Vikingstad (EIS 13) ♂ 19 July 1980 M.-H. Velde leg.; HOY, Fjell: Eidesvåg (EIS 30) 2 ♂♂ 6—11 Aug. T. Andersen leg.; HOY, Os: Lii (EIS 31) ♂ 6—

12 Aug. 1976 T. Andersen leg.; HOY, Bergen: Ervik (EIS 39) ♂ 17 Aug. 1976 T. Andersen leg.

Remm (1983) demonstrated the existence of a previously unrecognized species which had been confused with the common *Mesapamea secalis* (Linnaeus, 1758). He named the new species *Mesapamea secalella*. Remm's material was from the USSR: Estonia.

Subsequent research by lepidopterists in various countries showed that *secalella* has a wide distribution in Europe. It has so far been reported from Sweden, Finland, Denmark, USSR, England, Scotland, Ireland, W. Germany, Netherlands, Belgium, France, Spain, Switzerland, Austria, Hungary, Czechoslovakia, Bulgaria and Romania (Fibiger et al. 1984, Gyulai 1984, Rezbanyai-Reser 1984, Skinner 1984). In Sweden there are verified records of *secalella* northwards to Uppland and Dalarna (Palmqvist 1984, 1985), in Finland *secalella* has been collected in one province on the south coast only (Fibiger et al. 1984) and in Denmark the moth has been found all over the country (Fibiger in litt.). Fig. 3 gives the distribution of *secalis* and *secalella* in Norway. Only verified records of both species are included. It has not been possible to examine all specimens present in Norwegian collections, so the map must be considered as preliminary.

The male genitalia of *secalis* and *secalella* are figured by Remm (1983), Fibiger et al. (1984) and Palmqvist (1984). Rezbanyai-Reser (1984) figures the genitalia of both sexes. So far no distinguishing external character has been found. *M. secalella* varies along the same lines as *secalis*. Norwegian specimens of *secalella* are on the average smaller than *secalis* and with less contrasting pattern on the forewing. Both species occur in the same habitats.

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# Occurrence and life cycle of *Dinocras cephalotes* (Curtis, 1827) (Plec. Perlidae) in North Norway

HELGE HURU

Huru, H. 1987. Occurrence and life cycle of *Dinocras cephalotes* (Curtis 1827) (Plec. Perlidae) in North Norway. *Fauna norv. Ser. B*, 34, 14—18.

*Dinocras cephalotes* (Curtis 1827) was registered very locally in tributaries of the rivers Reisa and Lakselv and in the River Alta in northern Norway. Suitable habitats for the nymphs seem to be very scarce in these rivers.

*D. cephalotes* has probably a 4 to 5 year life cycle in Alta River. Growth took place only during two to three months each year.

It is supposed that *D. cephalotes* had a wider distribution in postglacial times being connected to the southern Scandinavian populations and that the more recent colder climate has separated the northernmost populations from the southern ones.

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## INTRODUCTION

The carnivorous stonefly *Dinocras cephalotes* (Curtis, 1827) is widespread in central and western parts of Europe (Illies 1978, Zwick 1981). In central Europe it occurs mainly in mountain streams and rivers

(Schoenmund 1925, Kuhlreibe 1934, Aubert 1946). The species is common in continental parts of southern Norway and Sweden (Brinck 1949, Lillehammer 1974), but has only been registered in three rivers in western Norway (Lillehammer 1974, Hermansen 1979). In Scandinavia *D. cephalotes* is common north to 66° N (Brinck 1949, Ulfstrand 1968b, Lillehammer 1974, Koksvik 1976), and is registered very sporadic north of 66° N, Fig. 1 (Thomas 1969, Lillehammer 1974). It has not yet been found in Finland (Meinander 1980). High temperature requirements to initiate egg development (Lillehammer 1986) limit its occurrence in northern latitudes.

This paper deals with the distribution and life cycle of *D. cephalotes* in the northernmost part of Norway.

## MATERIAL AND METHODS

Bottom fauna were collected in twenty watercourses in northern Norway (Fig. 1, 2) between 1978—1984, using the standard travelling kicking method (STKM, Pollard 1981). Aquatic invertebrates were collected with a net which usually had mesh size 500  $\mu\text{m}$ . In Alta River, a net with mesh size of 250  $\mu\text{m}$  were used. In the localities, several abiotic and biotic parameters were measured. In Alta River, nymphs were sampled four to five times/year over three years. In the rivers Lakselv and Reisa, nymphs were sampled

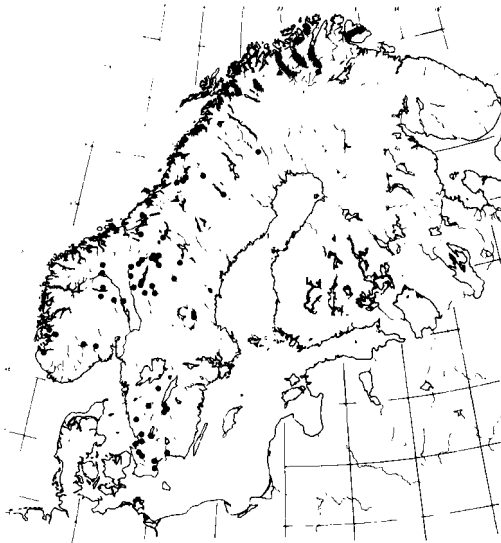


Fig. 1. The distribution of *Dinocras cephalotes* in Fennoscandia.

Circles: Distribution of *D. cephalotes* according to Brinck 1949, Thomas 1969, Lillehammer 1974 and Hermansen 1979.

Triangles: New records of *D. cephalotes*.

Investigated area shaded.



twice a year over a period of one or two years. The nymphs were preserved in 80% alcohol prior to analysis. The width of the pronotum was measured using a Wild M 5 stereo microscope and a M 5 drawing tubus. The pronotum was measured to the nearest 0,05 mm for small nymphs and 0,1 mm for larger nymphs. Low densities of *D. cephalotes* gave low number of collected individuals, and this makes the interpretation of the data for life cycle prediction difficult. Seventysix nymphs from Alta river were measured. In the rivers Reisa and Lakselv, thirtyone and twentytwo nymphs were collected, they were not used in the prediction of life cycle.

No adults were caught despite being looked for in the surrounding vegetation and ground.

## RESULTS

### Distribution

*D. cephalotes* was found only in the three rivers Lakselv, Alta and Reisa (Fig. 1, 2) of the 20 rivers sampled. Its distribution in the rivers was very restricted, and the species was found at only two localities in each river.

*D. cephalotes* was seldom the predominant Plecoptera in any of the samples. Carnivorous Plecoptera e.g. *Diura nanseni* (Kempny) and partly *Archynopteryx compacta* (Mc Lachlan) and *D. cephalotes* were usually numerous in most samples in addition to one or two Leuctrid or Capniid species. The domi-

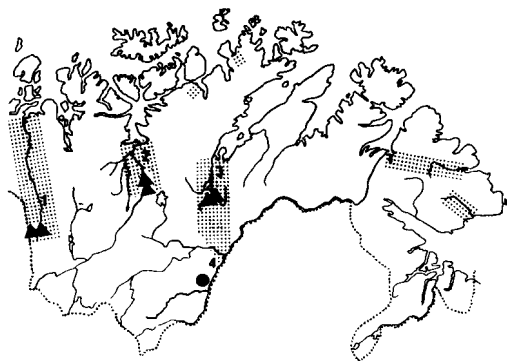


Fig. 2. Records of *D. cephalotes* in northernmost Norway.  
 Triangles: New records.  
 Circles: Earlier records.  
 Shaded area shows the investigated area.  
 1: Reisa river. 2: Alta river. 3: Lakselv river. 4: Tana river.

nating species of Ephemeroptera was *Baetis rhodani* (Pictet) sometimes accompanied by other *Baetis* species. The dominating taxa in the bottom fauna was Ephemeroptera and Chironomidae.

The localities where *D. cephalotes* occurred in the watershed of the rivers Lakselv and Reisa were small streams (becks), while *D. cephalotes* was an inhabitant of Alta River itself. All localities lies in narrow valleys with vegetation of birch and willow, in the middle boreal (Alta) or north boreal vegetation zone (Dahl et al. 1986), where maximum water temperature can exceed 16°C.

### The life cycle

Information on the life cycle was obtained through analysis of the nymphal stages from Alta River. Small nymphulae occurred in May—July, and they grew very little during the first summer. The nymphs had a very slow growth. Most of the growth took place in two to three months in the warm season during a year, Fig. 3. Different sizes of nymphs were registered during the whole ice-free season (Fig. 3). Three to five size groups were found at most of the sampling times. Fullgrown

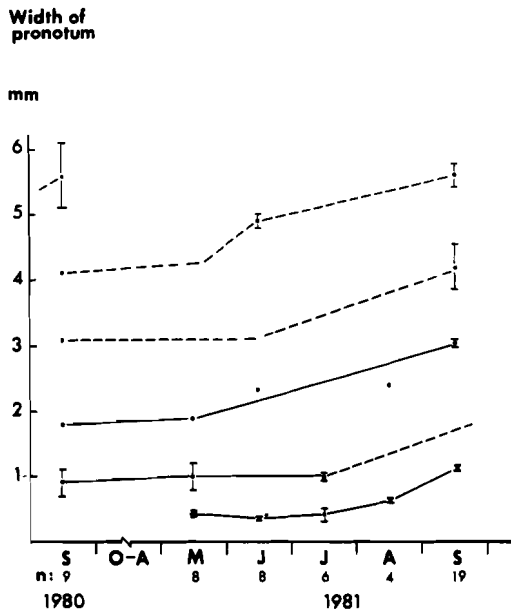
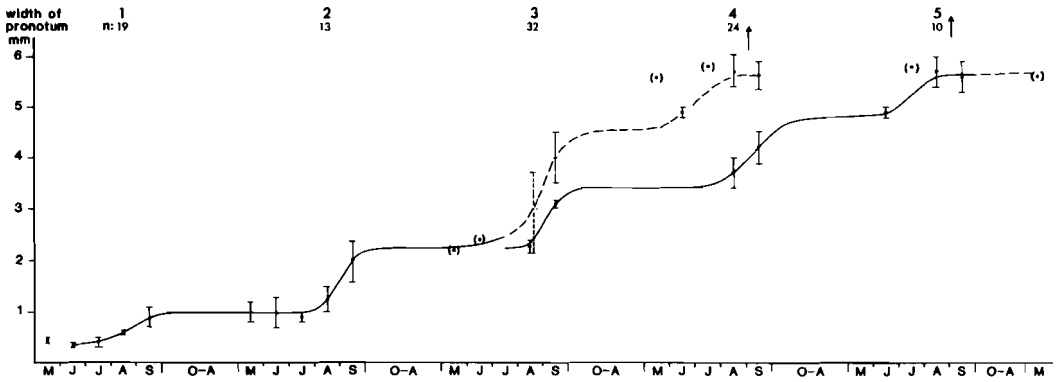


Fig. 3. Measurements of nymphs of *D. cephalotes* from Alta river in 1980 to 1981, with standard deviations.



Figs. 4. Growth of *D. cephalotes* based on measurements of nymphs from 1980 to 1983, with standard deviations.

1—5: age in years. Dotted line: alternative growth curve. Arrows indicate possible emergence times.

nymphs were found during the whole ice-free season. The sampling gave no information about emergence times. Brinck (1949) indicated July—August as flight periods in continental parts of Sweden. Ulfstrand (1968a) registered winged specimens mainly in July. The size groups of *D. cephalotes* in Fig. 3 indicate a life cycle of 4 to 5 years.

## DISCUSSION

Aquatic invertebrates have been sampled in a great number of rivers and streams in northern Norway during the last few years (Fig. 1,

2) (Lillehammer 1974, Huru 1980 a, b, 1981 a, b, c, d, 1982, Eie, Brittain & Huru 1982, Huru 1984), but the distribution of *D. cephalotes* was restricted to a few localities in the four rivers Tana, Lakselv, Alta and Reisa (fig. 1, 2). The gap between the northernmost populations and those in more southern areas indicates that the populations of *D. cephalotes* in the northernmost part of Norway are geographically separated from the main southern populations.

*D. cephalotes* has a southern distribution, preferring stony streams and becks, and streams in areas with continental climate (Hynes 1941, Ulfstrand 1968 a, Illies 1978). In Norway, it seldom occurs in coastal areas (Lillehammer 1974, Hermansen 1979). *D. cephalotes* has not been recorded in the alpine vegetation zone (Lillehammer 1986), which co-

Table 1. Measurements of the width of pronotum on different size groups of *Dinocras cephalotes* from Alta River, collected in 1980—1984.

Month	Size group	n	x	SD	Month	Size group	n	x	SD
May	I	2	0.45	-	June	I	5	0.35	0.04
	II	4	1.0	0.22		II	2	1.0	-
	III	1	2.2	-		III	1	2.4	-
	V	1	5.6	-		VI	3	4.9	0.16
July	I	5	0.42	0.10	August	I	2	0.60	-
	II	2	1.0	-		II	3	1.5	0.26
	V	1	5.8	-		III	5	2.3	0.15
				IV		4	3.7	0.54	
				V		5	5.7	0.33	
Sept.	I	6	0.90	0.20					
	II	2	2.0	-					
	III	12	4.0	0.5					
	V	10	5.6	0.30					

vers a large area in the northern part of Fennoscandia. The records in this paper was in the middle boreal (Alta) or north boreal vegetation zone. Hynes (1941) found *D. cephalotes* most common in places where the substratum was stable and moss-covered. Malmquist & Sjøstrøm (1984) found the microdistribution of *D. cephalotes*, among other parameters, positively correlated to high densities of prey (Chironomidae) and the presence of moss. All localities in this study were sparsely moss-covered. The density of Chironomidae was high in Alta. The localities in northern Norway where *D. cephalotes* was present had several similarities: Stony, stable bottom, sparse plant-cover, fast running water, continental climate, they all laid maximum 7 km below upstream lakes and in narrow valleys with forests, and air and water temperatures can be high, even in cold summers. Which one of these factors are most important is difficult to say.

Lillehammer (1986) supposed that the distribution of *D. cephalotes* is restricted by temperature. The upstream lakes may act as heat reservoirs and thereby ensure sufficient thermal sums during the summer. A continental climate gives higher sum of day-degrees in these valleys than do coastal or mountain areas in the same region. In Alta River, for instance, the sum of daydegrees in 1981 varied from 1360 in lower parts to only 460 day degrees in the uppermost becks (Traaen 1983).

In a population from southern Norway, eggs of *D. cephalotes* required near 12°C to initiate egg development and about 780 day degrees to hatch (70–80 days at 12°C) (Lillehammer 1986). The sum of degree days at the actual locality in Alta River in 1981 was 740 with temperature > 10°. Even if these northern populations have lower temperature requirements, the number of habitats where *D. cephalotes* can survive in northern Norway is very limited. *D. cephalotes* has not been registered in Finland and other factors than water temperature and thermal sums is also important for its occurrence, i.e. vegetation cover, prey items (Malmquist & Sjøstrøm 1984), water chemistry and oxygen regime (*D. cephalotes* has external gills).

The occurrence of *D. cephalotes* in the northernmost Norway seems to be a result of its ecological requirements and changes in climate in postglacial time. The species survives in very few localities in northern Nor-

way where its ecological requirements still exist. These populations are probably very sensitive to disturbance, maybe even to smaller changes in general climate.

The genus *Dinocras* is endemic in Europe. Pleistocene refuges are known to have existed in the Mediterranean area, and *D. cephalotes* (among other Plecoptera species) have reached other parts of Europe in postglacial time from these (Zwick 1981). Brinck (1949) supposed that *D. cephalotes* immigrated from Germany via Denmark in early postglacial time. Since the last deglaciation there have been a few warm periods in northern Norway, and for instance pine (*Pinus silvestris*) had maxima in occurrence during these periods (Vorren 1977, Vorren & Alm 1984). Pine was also more widespread in the valleys Tana, Alta and Reisa. The pine here was connected to the Finnish pine forests (Juul 1925, Hustich 1966). It is also reasonable to suppose that *D. cephalotes* was more widespread than today in these valleys. As the climate became colder and wetter, the areas in which *D. cephalotes* could survive decreased in size, and, in time, the northern populations became separated from the southern ones. It is also possible that *D. cephalotes* almost disappeared under these cold periods, and a new colonization has occurred during the last centuries.

*D. cephalotes* is one of the few plecopteran species with a life cycle longer than two years (Brinck 1949, Hynes 1941). Hynes (1941) found that, at 15°C, eggs needed ca. 100 days to hatch, while Lillehammer (1986) found incubation time from 70–80 days (12°) to 35 days (20°). In South Sweden nymphs emerge in June–July 3 years after eggs were laid (Brinck 1949). Also in more southern areas, *D. cephalotes* has a three-year life cycle (Schoenmund 1925, Hynes 1941, Brinck 1949, Hynes 1977). Ulfstrand (1968a) proposed a possible four-year life cycle for the populations in the mountains of Middle Sweden. It is thus not surprising that the life cycle in northernmost Norway may reach 4–5 years.

The long life cycle and preference for temperate water, indicates that the ecological niche of *D. cephalotes* is narrow. The very limited geographical distribution in northernmost Norway can be explained by a low number of suitable habitats, where low water temperatures is an important factor.

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# *Brachycaudus* spp. new to the Norwegian fauna (Homoptera: Aphididae)

CHRISTIAN STENSETH

Stenseth, C. 1986. *Brachycaudus* spp. new to the Norwegian fauna (Homoptera: Aphididae). *Fauna norw. Ser. B*; 34, 19—21.

The present paper gives biometric data and describe records of *Brachycaudus* (*Acaudus*) *populi* (de Guericco) and *B. (Thuleaphis) sedi* Jacob from Norway. The until now unknown fundatrix of *B. (A.) populi* is described.

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Nine species of the genera *Brachycaudus* van der Goot are reported from Norway (Ossianilsson, 1969, Tambs-Lyche, 1970). This paper gives informations about further two *Brachycaudus* species found.

*Brachycaudus (Acaudus) populi* (Del Guericco)

## Fundatrix

Body length 2.19—2.54 mm. Antennae 5- or 6-jointed. Antennal flagellum 0.964—1.162 mm, 0.44—0.52 X the body length. Antennal joint 3 (5-jointed) or 3 + 4 (6-jointed) 0.529—0.592 mm long, 2.1—2.6 X processus terminalis which is 0.232—0.255 mm long. Longest hair on 3. antennal joint 0.028—0.031 mm and 1.1—1.4 X basal articular diameter of that joint. Hairs on abdominal tergite 8, 0.052—0.094 mm. Other characters as in apterous viviparous female. Measurements of 4 specimens.

## Apterous viviparous female

Body length 1.66—2.71 mm. Antennae 6-jointed, brown like the head but 3. joint may be paler than rest of the antennae. Secondary rhinaria absent in normal apterae, but 1 to 11 may occur on 3. joint in alatiform specimens. Antennal flagellum 1.09—1.83 mm long, 0.63—0.76 X the body length. Antennal joint 3, 0.372—0.569 mm long, 0.74—1.08 X processus terminalis which is 0.418—0.592 mm. Longest hair on 3. antennal joint 0.026—0.44 mm and 0.8—1.8 X basal articular diameter of that joint. Hairs on abdo-

minal tergite 3 maximally 0.035—0.069 mm and those on 8. tergite 0.073—0.102 mm. Apical rostral segment with 7—9 hairs, 0.143—0.185 mm long and 0.84—1.05 X second joint of hind tarsus which is 0.140—0.194 mm long. Siphunculi 0.126—0.196 mm, 0.8—1.0 X the length of second joint of hind tarsus, tapering or conical, brown but darker than the dorsal sclerotisation, faintly imbricated with incision before the flange. Cauda rounded 0.094—0.112 mm long, but shorter than the basal width and with 8—12 hairs. Abdominal tergite 8 with 7—10 hairs and tergite 6 with 5—8 hairs, normally 6, between siphunculi. Abdominal tergites 1—7 with a brown sclerotic shield which is marginally partly reaching the stigmal plates. Thoracic segments and 8. abdominal tergite with cross bars. Abdominal marginal tubercles irregular present on tergites 2—5. Tibia pale with brown apics. Femora 3 and 2 darker brown than femora 1. Measurements of 19 specimens.

## Alate viviparous female

Body length 2.3—2.5 mm. Antennae 6-jointed, brown, with 20—25 secondary rhinaria along whole length of joint 3 but on one side. Antennal flagellum 1.89—2.13 mm long, 0.79—0.87 X the body length. Antennal joint 3, 0.604—0.677 mm long, 0.92—1.05 X processus terminalis which is 0.604—0.697 mm long. Antennal hairs and those on abdominal tergites 3—6 and 8 as those for apterae. Apical rostral segment 0.162—0.173 mm long and 0.83—0.95 X second joint of hind

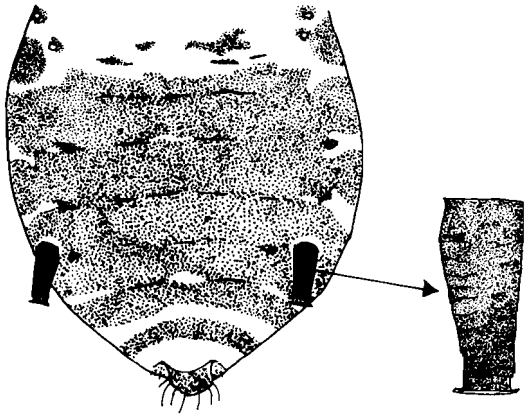


Fig. 1. *Brachycaudus (Acaudus) populi*, dorsale view of abdomen in alate viviparous female.

tarsus which is 0.181—0.194 mm. Siphunculi 0.175—0.209 mm long faintly imbricated with a cylindrical basal part and then tapering. Abdominal sclerotic pattern as shown in fig. 1. Measurements of 3 specimens.

Colour in life black.

The Norwegian apterous and alate viviparous females shows greater variation in maximum hairlength on third antennal joint and third abdominal tergite than described by Burger (1975). The abdominal spino-pleural blotch in alate viviparous female is also greater, extending from abdominal tergites 3—6. Fundatrix is not described earlier.

### Records

Collected from *Silene maritima* on leaves, stems, flower-stalk and subterranean stem (only fundatrix) at Grimstad, Aust-Agder (4 June 1979, fundatrix & 20 July 1974) and at Skjeberg, Østfold (23 June 1974). Collected from *Silene vulgaris* on leaves and stems in Sogn & Fjordane at Leikanger (24 June 1966 & 9 July 1968), Lærdal (3 July 1966) and Borgund (3 July 1966), at Stordal, Møre & Romsdal (12 June 1974, det.: Hille Ris Lambers), at Nord Fron, Oppland (31 July 1975) and at Alta, Finnmark (28 Aug. 1968, oviparae).

Burger (1975) mentions *B. (A.) populi* from South- and Central-Europe. The Norwegian records are from coastal districts with exception of the sample from Oppland which is from the inland, 850 m above sea level.

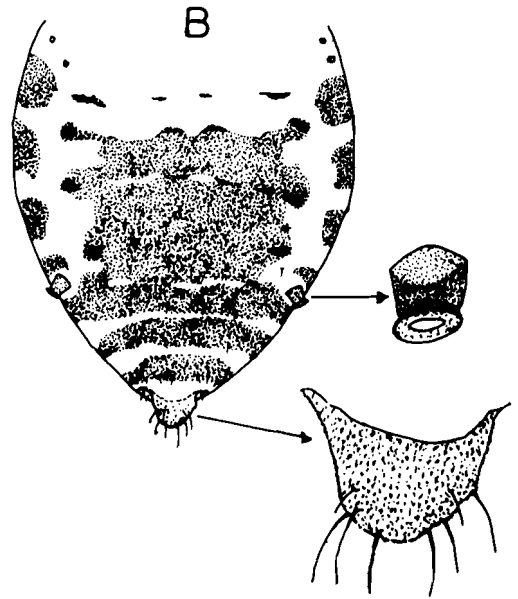
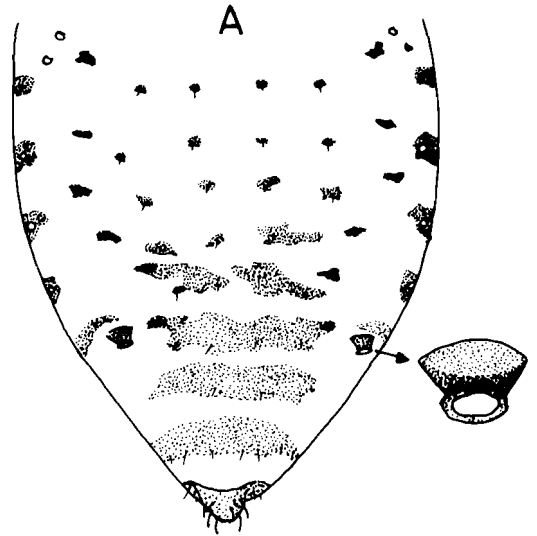


Fig. 2. *Brachycaudus (Thuleaphis) sedi*, dorsal view of abdomen. A = apterous viviparous female. B = alate viviparous female.

### *Brachycaudus (Thuleaphis) sedi* Jacob, 1964 Apterous viviparous female

Body length 1.93 mm. Antennae 6-jointed, antennal flagellum 0.581 mm, ratios of flagellar joints 173:57:69:104 + 151. Longest hair on 3. antennal joint 0.007 mm and 0.3 X basal articular diameter of that joint. Hairs

on 3. abdominal tergite maximally 0.014 mm and those on tergite 8, 0.060 mm and 11 in numbers. Apical rostral segment with 4 secondary hairs and 0.107 mm long. Second joint of hind tarsus 0.136 mm. Siphunculi (fig. 2) pale brown, smooth conical, not longer than basal width which is 0.027 mm. Cauda with 8 hairs. Antennae, femora and tibiae pale brown. Sclerotic pattern as shown in figure 2, pale brown.

Marginal tubercles on abdominal tergites 2—4 and spinal tubercles on tergite 8. One specimen examined. Colour in life reddish brown.

#### **Alate viviparous female**

Body length 1.72 mm. Antennae 6-jointed, antennal flagellum 1.01 mm, ratios of flagellar joints 312:151:128:116:116 + 232, secondary rhinaria on 3. joint 13 and on 4. joint 3. Longest hairs on 3. antennal joint 0.09 mm, on 3. abdominal tergite 0.017 mm and on 8 tergite 0.052 mm. Apical rostral segment with 8 secondary hairs and 105 mm long. Second joint of hind tarsus 0.152 mm. Siphunculi brown, tapering faintly longer than basal width of 0.049 mm (fig. 2). Cauda 0.099 mm long and basal width of 0.101 mm, with 8 hairs. Antennae brown with a pale

base on 3. joint. Femora and tibia brown. Abdominal sclerotic pattern as shown in fig. 2, brown. Marginal tubercles on abdominal tergites 2—3 and a spinal tubercle on tergite 8. One specimen examined.

#### **Record**

Collected in flowers of *Sedum roseum* at Nord-Fron, Oppland (8 Aug. 1975) 900 m above sea level.

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# Nymphal development and food consumption of *Atractotomus mali* (Meyer-Dür) (Hemiptera: Miridae), reared on *Aphis pomi* (DeGeer) and *Psylla mali* Schmidberger

NINA JONSSON

Jonsson, N. 1987. Nymphal development and food consumption of *Atractotomus mali* (Meyer-Dür) (Hemiptera: Miridae), reared on *Aphis pomi* (DeGeer) and *Psylla mali* Schmidberger. *Fauna norv. Ser. B*, 34, 22—28.

Food consumption and the duration of nymphal development of *Atractotomus mali* were tested by rearing *A. mali* on apple leaves, the aphide *Aphis pomi* and the psyllide *Psylla mali*. Few *A. mali* nymphs developed when fed on only apple leaves. 3.8% of them survived from 2 nymphal stage until adulthood. *A. mali* nymphs consumed more animal food at 20°C than at 15°C, and their consumption of *A. pomi* was higher than that of *P. mali* nymphs. At a temperature of 20°C, *A. mali* nymphs in stages 2—5 consumed 87 *A. pomi* or a dry-weight 3.7 mg, and 40 *P. mali* with a dry-weight of 2.1 mg. Corresponding figures at 15°C were 110 *A. pomi* or 5.0 mg, and 41 *P. mali* and 2.3 mg. The duration of *A. mali* development from nymphal stages 2 to 5 was 11.6 days at 20°C when fed on *P. mali*, and 13.0 days when fed on *A. pomi*. Figures at 15°C were 22.6 days and 28.8 days, respectively. Adult *A. mali* consumed more *P. mali* in nymphal stages 4—5 than they consumed adults. During a 15 day period at 20°C, 26.2 *P. mali* nymphs with a dry-weight of 4.60 mg and 11 *P. mali* adults with a dry-weight of 1.90 mg were consumed. At 15°C, 15.8 *P. mali* nymphs (dry-weight 2.80 mg) and 4.7 *P. mali* adults (dry-weight 0.83 mg) were consumed. A single adult *A. mali* was capable to controlling populations of 50 *A. pomi* individuals in an apple tree.

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## INTRODUCTION

*Atractotomus mali* is a common heteropteran in Norwegian apple orchards (Austreng & Sømme 1980, Skånland 1981a, Jonsson 1983a). Existing literature gives contradictory informations concerning the food of this species. Collyer (1953), Sandford (1964) and Lord (1971) maintained that *A. mali* nymphs can survive and develop to adults in the absence of animal food, whereas Leonard (1965), Strawinski (1964) and MacPhee (1976) claimed that *A. mali* is mainly zoophagous, or feeds on a combination of animal and plant foods. Thus far, few quantitative studies on food consumption by *A. mali* nymphs and adults, and the effects of diffe-

rent food items on nymphal development at various temperatures have been published.

Therefore I tested the duration of nymphal development in association with *A. mali* consumption at two different temperatures (15°C and 20°C), when fed on prey species *Aphis pomi* and *Psylla mali* placed on apple leaves, and when fed only on apple leaves. I compared the consumption of adult *A. mali* reared on *P. mali* nymphs, with that of *P. mali* adults. The potential size of *A. pomi* populations which may be controlled by *A. mali* placed in apple trees was also examined.

## METHODS

The laboratory experiments were conducted at two different temperatures (15±1°C and 20±1°C) between 6 May—5 August 1980. Relative humidity during the experiments was 60±5%, the illumination was 94 lux. The

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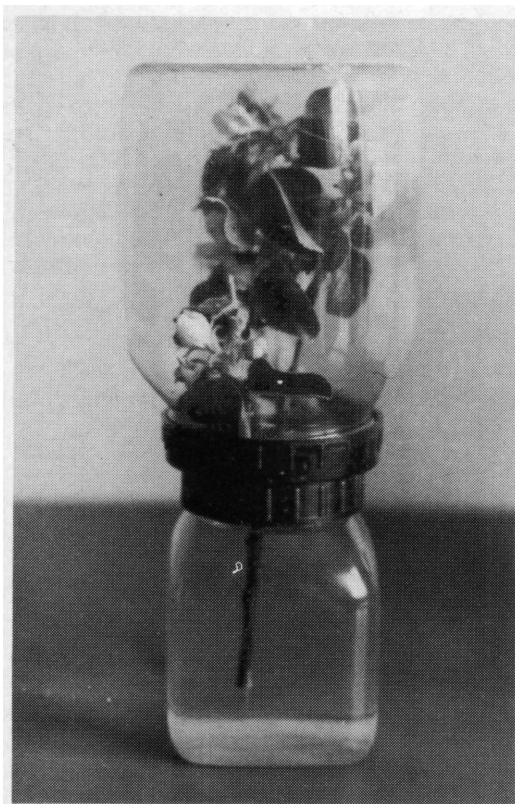


Fig. 1. A. Plastic bottles used in laboratory experiments with adults *Atractotomus mali*. B. Nylon bags which surround branches in the field experiments.

photoperiod consisted of 16 hours photophase and 8 hours scotophase. In the first laboratory experiment I investigated maximum consumption and length of the developmental stages of *A. mali* nymphs when reared on surplus of: (1) *P. mali* in corresponding developmental stages, (2) random selected *A.*

*pomi* with body lengths between 0.5—2.3 mm, and (3) only apple leaves. *A. mali* were kept individually in covered plastic containers (diameter 5 cm, height 1.5 cm). I covered the bottom of the containers with water saturated blotter paper, on which I placed an apple leaf serving as food for the prey. Daily, I registered the number of prey consumed by *A. mali*, and moulting products of the nymphs. In addition, I daily changed food supply, apple leaf and blotter paper.

In the second laboratory experiment I investigated the maximum food consumption of adult *A. mali*, reared on a surplus of *P. mali* (30 individuals) in: (1) 4—5 nymphal stages and (2) adults. Predators were kept individually on an apple branch, surrounded by plastic bottles (Fig. 1a). The branches used in the experiment, were devoid of other potential food items such as eggs, pupae, and larvae of arthropods. Every third day food consumption was recorded, and the food supply and branches changed. Experiments lasted for 15 days. As controls I estimated natural mortality of the prey at the two temperatures by using 10 containers and 10 bottles with prey only. Consumed dry-weight was estimated as the difference between dry-weight of undigested and digested prey at the same developmental stages. Prey items were dried in a vacuum for 24 hours at 60°C.

In the field experiment, carried out during 10 July—18 August 1980, I investigated the number of random selected *A. pomi*, one adult *A. mali* was able to stabilize. Experiments were performed at Blindern, Oslo, during a period without noteworthy precipitation. I used 3 year old apple trees. *A. mali* were kept individually on a branch, surrounded by a 45 cm long nylon bag, with mesh size 360  $\mu\text{m}$  bar mesh (Fig. 1b). Branches did not contain eggs, pupae or larvae of arthropods, and were not treated with any chemical pesticide. I made 6 parallel experiments using each of the following prey densities: 30, 40, 50, 60 and 70 *A. pomi*. Prey number were determined on basis of several pilot experiments. To estimate the growth of *A. pomi* in absence of predators, I concurrently kept 6 bags with prey only, each starting with 50 *A. pomi*. 2—3 times a week the number of *A. mali* in all bags were counted. Air temperature and relative humidity were the same inside and outside the bags. Light intensity inside the bags was, however, reduced by ca. 25% because of the nylon fabric.

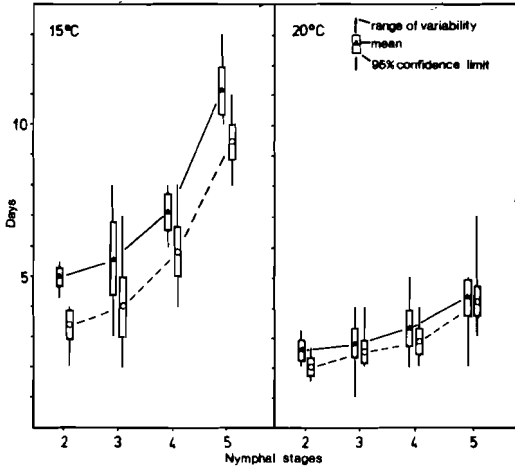


Fig. 2. Duration of 2—5 nymphal stages of *Atractotomus mali* reared on *Aphis pomi* (▲—▲) and *Psylla mali* (○---○) at 15°C and 20°C. The data are based on 11 and 13 parallel experiments when fed on *A. pomi* at 15°C and 20°C, respectively, and 24 parallel experiments when fed on *P. mali* at both temperatures.

## RESULTS

### Nymphs

Two (3.8%) *A. mali* nymphs survived from 2nd nymphal stage to adulthood when fed on apple leaves only. Both survivors were males. The mean time period over which nymphs were kept alive was significantly longer at 15°C than at 20°C ('t'-test,  $P < 0.05$ ), and mean life time at 15°C and 20°C ( $\pm 95\%$  confidence limits) was  $10.4 \pm 2.7$  days, and  $6.4 \pm 1.2$  days, respectively. Nymphs passed through more moulting stages at higher temperatures than at lower temperatures. At 15°C, 16 nymphs lived through one moulting, and 10 nymphs died without moulting. At 20°C, 2 nymphs reached the adult stage, 6 nymphs survived one and two moultings, and 19 nymphs died without moulting. I started with second instar nymphs only in this experiment.

*A. mali* nymphs developed faster at 20°C than at 15°C (simultaneous 't'-tests, all  $P < 0.001$ ), and when fed on *P. mali* rather than *A. pomi* ('t'-tests, all  $P < 0.01$ ) (Fig. 2). Duration of nymphal stages increased towards the adult stage. Development at 15°C, from second instar nymphs to adult *A. mali*, lasted for 28.8 days when reared on *A. pomi*, and 22.6 days when reared on *P. mali*. The

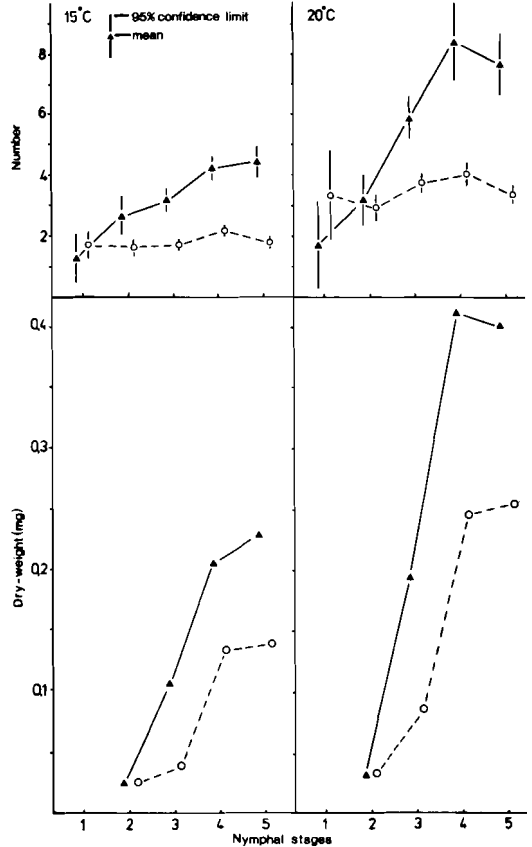


Fig. 3. Mean number and dry-weight consumed per *Atractotomus mali* nymph and day of *Aphis pomi* (▲—▲) and *Psylla mali* (○---○) at 15°C and 20°C. The data are based on 11 and 13 parallel experiments when fed on *A. pomi* at 15°C and 20°C, respectively, and 24 parallel experiments when fed on *P. mali* at both temperatures.

corresponding growth periods at 20°C, were 13.0 days and 11.6 days, respectively.

Food consumption by *A. mali* nymphs was higher at 20°C than at 15°C ('t'-tests, all  $P < 0.05$ ) (Fig. 3). The number of *P. mali* consumed within each instar stage was nearly constant at both temperatures. The number of *A. pomi* consumed, however, increased with age, except for the fifth instar nymphs at 20°C, which had very low food intake during the final two days before their moulting to adults. Dry-weights consumed increased with increasing nymphal stages. At 15°C mean number and dry-weight of *A. pomi* consumed from second instar stage to adult stage were 110 and 5.0 mg, and of *P. mali* 41 and 2.3 mg,

respectively. At 20°C, mean number and dry-weight of consumed *A. pomi* were 87 and 3.7 mg, and of *P. mali* 40 and 2.1 mg. When reared on *P. mali*, 2.5% of the *A. mali* nymphs died before reaching the adult stage, while 7.5% died when reared on *A. pomi*. 2.5% of the nymphs died at 15°C and 7.5% at 20°C. Consumption by predators which died during the course of the experiment was omitted from the results.

### Adults

The consumption-rate of adult *A. mali* was higher when they were fed on *P. mali* in 4 and 5 nymphal stage, than when fed on adults (*t*-tests, all  $P < 0.001$ ) (Fig. 4 and 5). Consumption of *P. mali* nymphs varied in range during the three day periods from 1–6 individuals at 15°C, to 2–9 individuals at 20°C. The corresponding range of variability in consumptions of *P. mali* adults was 0.4 individuals and 1.5 individuals, respectively. At 15°C, *A. mali* consumed 15.8 *P. mali* nymphs (2.8 mg), and 4.7 *P. mali* adults (0.83 mg). Corresponding consumptions at 20°C were 26.2 nymphs (4.6 mg) and 11 adults (1.9 mg). None of the *A. mali* which were fed on *P. mali* nymphs died during the experiment. However, two female *A. mali* died at each temperature when fed on *P. mali* adults. Food consumption of those *A. mali* which died was omitted from the results.

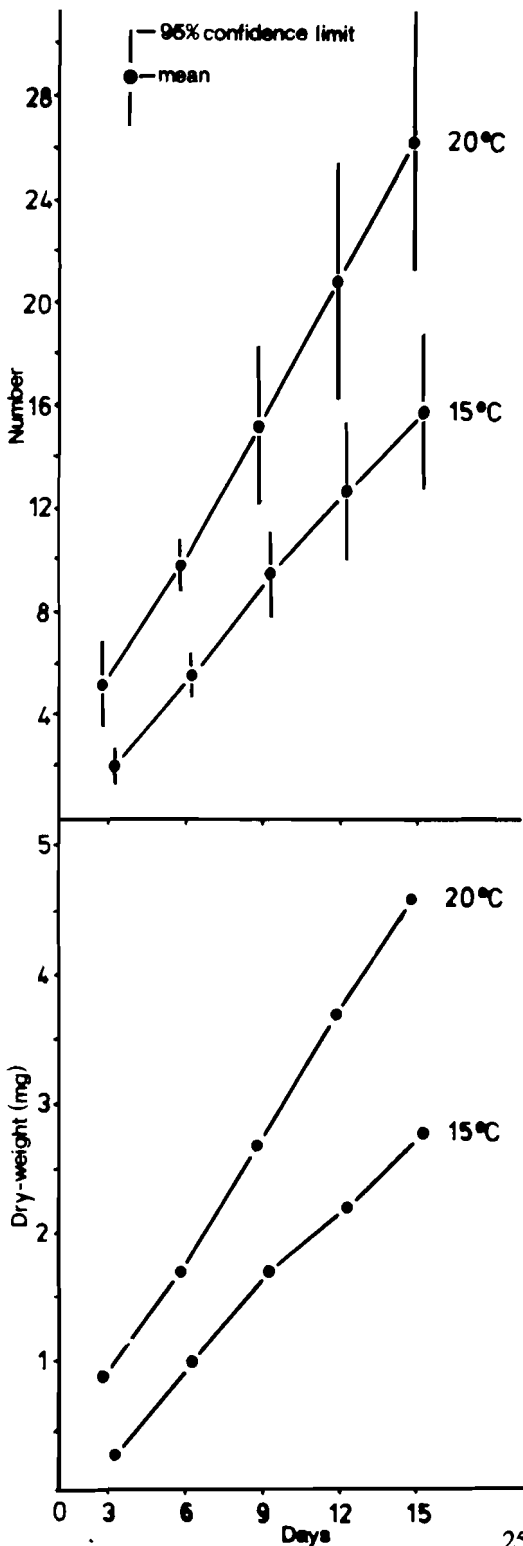
### Controls

Mortalities of *P. mali* nymphs and adults in plastic containers and bottles were negligible (ca. 1% per day). The mortality of *A. pomi*, however was high. Only digested prey were recorded in the results, while those which died for other reasons were excluded. Prey killed by *A. mali* were easily recognized by their shrunken body form.

### Field experiment

One *A. mali* adult stabilized populations of 50 *A. pomi* individuals (Fig. 6). An initial prey population of 40 *A. pomi* individuals or

Fig. 4. Mean cumulative consumption in number and dry-weight of adult *Atractotomus mali* at 15°C and 20°C during 15 days, when reared on 4 and 5 nymphal stage of *Psylla mali*. The data are based on 6 parallel experiments at each temperature.



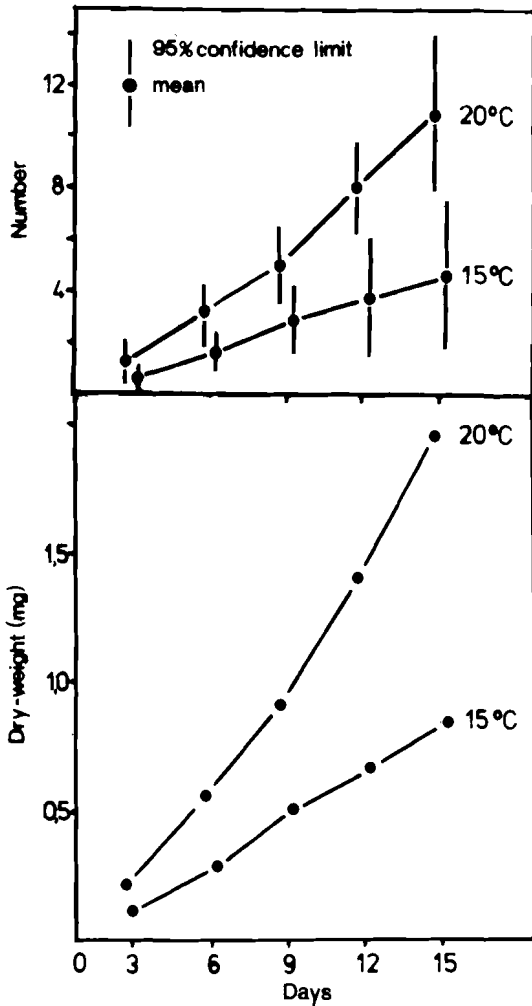


Fig. 5. Mean cumulative consumption in number and dry-weight of adult *Atractotomus mali* at 15°C and 20°C during 15 days, when reared on adult *Psylla mali*. The data are based on 6 parallel experiments at each temperature.

fewer decreased, while initial population sizes of 60 or more *A. pomi* individuals increased in presence of one *A. mali* predator. Control populations of *A. pomi* increased from 50 to 250 individuals within 16 days.

## DISCUSSION

The present results illustrate that only a very few *A. mali* nymphs survived and developed from nymphs to adults on apple leaves only.

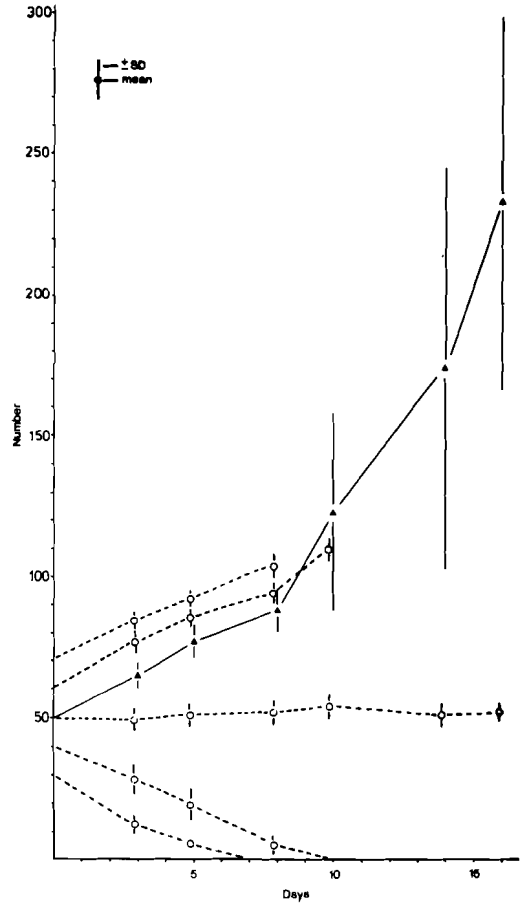


Fig. 6. Numerically changes in *Aphis pomi* (○---○) in presence of one adult *Atractotomus mali*. Data are based on 6 parallel experiments. Initial population sizes of *A. pomi* varied between 30 and 70 individuals. Mean growth of 6 *Aphis pomi* populations (▲—▲) in absence of predators.

Most individuals probably need some animal protein in order to survive. During the present experiments consumption by *A. mali* nymphs was low in comparison with food consumption by other predaceous heteroptera such as *Anthocoris nemorum*, *Blepharidopterus angulatus* or some Coccinellidae larvae (Skånland 1981b).

*A. mali* nymphs developed more slowly and mortality was higher when reared on *A. pomi* than *P. mali*, and at 15°C than at 20°C, even through more *A. pomi* were consumed

than *P. mali*. Upon examination of the growth rates of *A. mali*, the psyllid *P. mali* seemed to be the more suitable prey item. Anderson (1962) observed that Anthocoridae nymphs developed faster fed on aphids than on psyllids, and therefore classified the Anthocoridae species as aphidophagous. Correspondingly, *A. mali* may be classified as psyllophagous. The reason for *A. mali*'s quicker growth on *P. mali* than on *A. pomi*, may be that *P. mali* is more easy to locate and capture, and *A. mali* and *P. mali* may be co-adapted, because of the parallel development in the blossom clusters on apple trees (Jonsson 1983b, 1985). Nymphal development of *A. mali* and *P. mali* are synchronous, and each year *P. mali* occur in great numbers on apple trees. Nymphs are easily caught because of their slow movements. *P. mali* therefore seems to be a predictable food resource for *A. mali* nymphs, on which they may specialize their foraging activities. On the other hand, population densities of *A. pomi* vary considerably from year to year. No *A. pomi* were observed in apple trees at Gaustad, Oslo in 1979 and 1981, while *A. pomi* were numerous in 1980 (Jonsson 1981). Furthermore, the distribution of *A. pomi* in apple trees is scattered, and colonies are usually built on freshly sprouted leaves. *A. pomi* appears to be an unstable food resource and an unpredictable prey species for *A. mali* nymphs, possibly explaining why *A. mali* does not show any particular trophic specialization on the latter prey item.

Adult *A. mali* consumed 2—3 times more *P. mali* nymphs than *P. mali* adults. An explanation for this may be that adults are more difficult to catch than nymphs. During the laboratory experiments, adult *P. mali* were mostly observed on the leaf surfaces and petioles, and usually they jumped away in the near presence of *A. mali* or when touched by them with the proboscis. *P. mali* in 4—5 nymphal stages also lived on the leaf surfaces and petioles, but moved quite slowly. No adult *A. mali* died when fed on *P. mali* nymphs. However, two *A. mali* died when fed on *P. mali* adults. *P. mali* nymphs may be more easily caught than adults.

Field experiments illustrated that one adult *A. mali* is capable of stabilizing populations of 50 *A. pomi*. In corresponding experiments, *Anthocoris nemorum* and *Blepharidopterus angulatus* were able to stabilize populations of 70 *A. pomi* (Skånland 1978).

However, *A. mali* is abundant in many apple orchards (Austreng & Sømme 1980, Skånland 1981a, Jonsson 1983a) and may therefore be one of the important predators controlling natural populations of aphids. But, as *A. mali* is a less efficient predator than some other heteropterans, it may be less desirable as a biological pest control species.

## ACKNOWLEDGEMENTS

My sincere thanks go to Dr. Bror Jonsson, Directorate for Nature Management, for constructive criticism of the manuscript and to Professor Lauritz Sømme, University of Oslo, for various kinds of help during the study. This research was supported by the Department of Biology, University of Oslo, and Directorate for Nature Management.

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# The first record of *Thaumalea verralli* Edwards (Diptera: Thaumaleidae) from Scandinavia

ENDRE WILLASSEN

Willassen, E. 1987. The first record of *Thaumalea verralli* Edwards (Diptera: Thaumaleidae) from Scandinavia. *Fauna norv. Ser. B.* 34, 29—30.

A single male imago of *Thaumalea verralli* Edwards was caught when resting within the moss-bed in a hygropetric locality on Mt. Fløyen, Bergen, Norway. The wing and genitalia are figured.

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## INTRODUCTION

About sixty species of the family Thaumaleidae are known from Europe (Vaillant, 1981). Only three species are known from Scandinavia: *Thaumalea caudata* Bezzi, *Thaumalea testacea* Ruthe, and *Thaumalea truncata* Edwards (Edwards, 1929, Anderson, 1977). Two additional species, *Thaumalea obscura* (Zetterstedt) and *T. tricuspis* Tjeder (1949b) have been listed in the records, but these have been shown to be synonyms of *T. testacea* (Tjeder, 1949a, Anderson, 1977).

## OBSERVATIONS

On 21 Sept. 1983 I visited a hygropetric locality on the Mt. Fløyen, Bergen. The site is within a park area where the arboreal vegetation is partly dominated by planted, introduced species. The stream is predominantly shaded by beech (*Fagus*) canopy.

While examining partly submerged mosses on a vertical rock surface for hygropetric Diptera larvae, I discovered a flying midge landing on the mosses and watched it crawl into the moss-bed.

The specimen was mounted in Canadabalsam for identification and turned out to be a male of *Thaumalea verralli* Edwards (Fig. 1).

No larvae or pupae of Thaumaleidae were found neither among the mosses nor on the patches of the rock being devoid of macrovegetation.

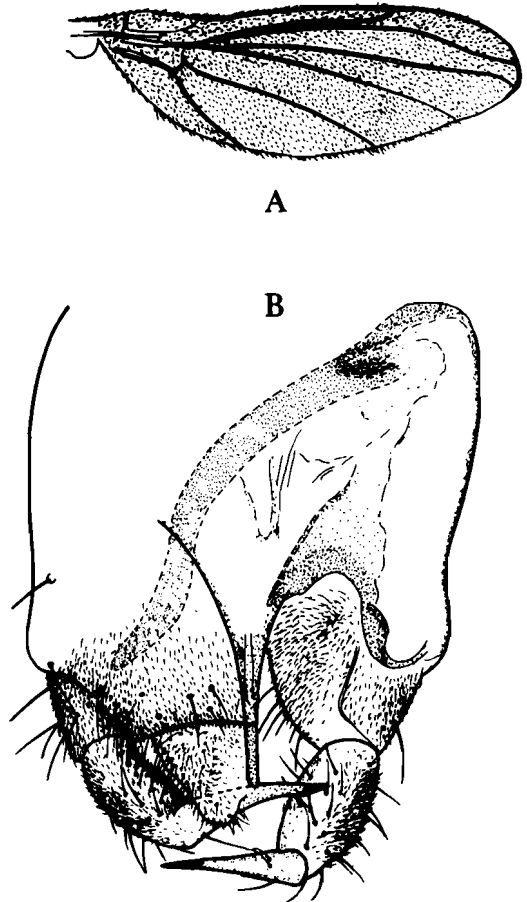


Fig. 1. *Thaumalea verralli* Edwards, male imago, A wing, B genitalia.

## DISCUSSION

The larvae of the Thaumaleidae inhabit the hygropetric zone of relatively cool springs and streams. Having amphipneustic respiratory system, with one pair of spiracles on the dorsal part of prothorax and one spiracle dorsally between the procerci (Saunders, 1923) they live partly submerged in the thin film of water flowing over rocks. The fauna of such habitats have not been examined in any extent in Norway. Although no immatures were found at the site where *T. verralli* was captured, there is reason to believe that the locality supports a population of thaumaleids. According to Vaillant (1978) the imagines are relatively sedentary and usually do not leave the surroundings of the larval habitat.

In contrast to the majority of Thaumaleidae species, *T. verralli* is widely distributed in Europe (Vaillant, 1969, 1978). The species has even been recorded from Iceland (Tjeder, 1949b, Nielsen & al., 1954) and the Faroes (Pedersen, 1971). Vaillant (1978) listed *T. verralli* in «Limnofauna Europaea» as probably occurring in region 17, which includes Denmark and S. Sweden. The finding of this species in region 20 adds weight to Vaillant's expectation and probably reflects that no intensive search for thaumaleids has been carried out in Scandinavia to date. Western Norway is relatively rich in hygropetric habitats and although Vaillant (1978) pointed out that there seem to be no exclusively boreal species of thaumaleids in Europe, there is reason to expect that the number of species in Scandinavia may be higher than shown as yet.

## ACKNOWLEDGEMENT

I thank Dr. F. Vaillant, Grenoble, for checking the manuscript.

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# *Bibio nigriventris* Haliday, 1833 (Dipt. Bibionidae) in Norway

LITA GREVE

Greve, L. 1987. *Bibio nigriventris* Haliday, 1833 (Dipt. Bibionidae) in Norway. *Fauna norv. Ser. B* 34, 31–34.

A total of 316 specimens of *B. nigriventris* Haliday, 1833, based on old revised and new collections, have been recorded from around 70 localities. The distribution of *B. nigriventris* in Norway is given. *B. nigriventris* is common in the lowland north to Troms province, and is probably one of the most common species of Bibionidae in Norway. The species has been collected up to 900 m a.s.l. which belong to the subalpine zone, but it seems to be rare here. Most records are from mixed coniferous and deciduous forests.

The flight period is late May to July in the lowlands, except in the two northernmost provinces where the flight period is June to early August. The few records from the subalpine zone dates to late June and July. The sex ratio in all the material is 1 : 1, but in Malaise traps the sex ratio changes towards 2 males per 1 female.

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## INTRODUCTION

Adult Bibionidae are common in many parts of Norway. Several species make swarms and are then easy to capture. Few researchers, however, have studied this fly family in Norway. The last survey dates back to Siebke (1877). Bibionidae larvae feed on different plant roots, and some are pests on agricultural crops.

Two species of *Dilophus* and thirteen species of *Bibio* (= Hirtea) was listed by Siebke. Older material of *Dilophus* should be revised on account of Haenni's (1982) revision. Greve, Solem & Olsen (1984) found *D. femoratus* Meigen to be fairly common in Norway. *B. clavipes* (Meigen), *B. fulvipes* Zett., *B. pomonae* (Fabr.) and *B. rufipes* Zett. were found to be common at Kongsvoll, Southern Trøndelag province (Greve, Solem & Olsen, 1984). Greve (1986) mentioned two more *Bibio* species from Norway, *B. hortulanus* (L. 1758), included in Siebke's survey, and *B. marci* (L. 1758) as new to Norway. *B. umbellatarum* Zett in list probably represents a synonym for *B. fulvipes* Zett.

Freeman & Lane (1985) listed a total of twenty species of the genus *Bibionidae* from the British Isles — sixteen belonging to the genus *Bibio*- and four to the genus *Dilophus*.

Hackman (1980) listed eleven *Bibio*, one *Dilophus* and one *Penthetria* from Finland, and Wahlgren (1919) listed thirteen *Bibio* and three *Dilophus* from Sweden. Compared to these lists the number of *Bibionidae* in Norway can be calculated to be roughly fifteen, but only the seven specifically mentioned above and *B. nigriventris* Haliday, 1833, treated here, are recorded with certainty from Norway. *B. nigriventris* is mentioned from southern parts of Sweden (Wahlgren, 1919), and it is listed by Hackman (1980). More information on the European distribution is given by Verbeke (1971).

## MATERIAL AND METHODS

A total of 316 specimens of *B. nigriventris*. 158 males and 158 females were collected from around seventy localities. All material hitherto determined and recorded as *B. nigriventris* in Norwegian museums is included in this survey. Material is for the main part deposited in Zoological Museum, University of Bergen. Material deposited in museums elsewhere is notified in the list of records.

There is little information on collecting methods, but one can assume that most of it has been collected by a sweep-net. Much ad-

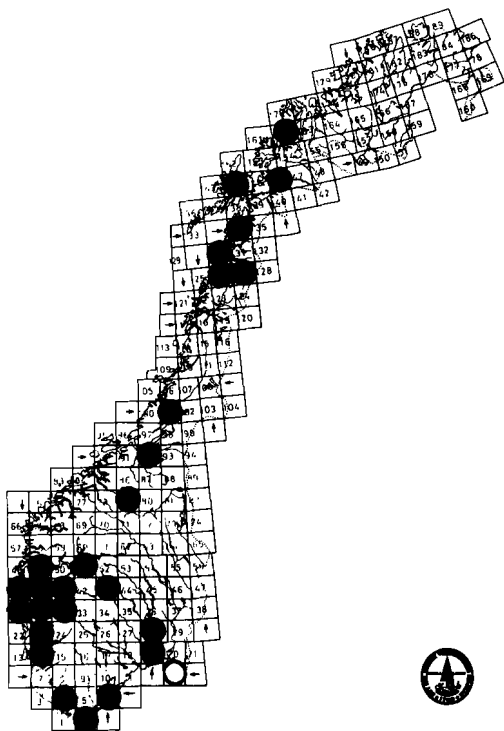


Fig. 1. The distribution of *Bibio nigriventris* Halden in Norway. Closed circles represent material seen by the author. Open circle represents published record, material not seen by the author.

ditional *Bibionidae* material has been collected in the last ten years by other methods like lighttraps, Malaisetraps, pitfalltraps and watertraps (yellow trays). Some of the traps have been collecting all through the summer season.

### Morphological characters

*B. nigriventris* has a body length 6–8 mm and is thus a middle sized *Bibio* species. The

number of segments of the antennal flagellum is only five (rarely six according to Freeman & Lane, 1985) compared to seven or more in most other *Bibio* species. This makes it fairly easy to distinguish *B. nigriventris* from other Norwegian *Bibio* species. The body is black in both sexes. The coxae of the male and the femora are black, at least the last pair of tibia are more brighter reddish-yellow. The front wing-ribs are dark in both sexes. The last part of the male wings including the ribs is milky white, all wingsribs in the last part of the female wing, however, is dark and contrasting. The stigma of the male wing is not very distinct, and only touching the margin of the wingfront in a smaller part. The stigma is distinct in the female wing. *B. nigriventris* larvae may damage roots of larch.

### Earlier records of *B. nigriventris*

Ø, Halden: Hvaler (Strand, E. 1913). This material is today not present in Norwegian collections. Siebke (1877) records *B. nigriventris*, 1 ♀, from AK, Oslo: Tøyen, the Botanical garden, 1845, June. This female is not present in Zoological Museum, University of Oslo (ZMO). VAI; Sirdal: Sireosen (Strand, E. 1913): As for Østfold (see above). HOY, Bergen: Kalfaret 1 ♀ 7 June 1876 (ZMO NO. 11291). There is also 1 ♀ labelled Bergen, 7 June 1874, coll. Schneider, which also might have been seen by Siebke (1877). (ZMO No. 11290).

### Revised records of *B. nigriventris*

AK, Oslo: Tøyen, the Botanical garden, 1 ♀, June 1845. This female was published as *B. varipes* Meigen by Siebke (1877), (ZMO 11295). Siebke wrote «in horto botanica. Juni», but he stated no year. AK, Oslo: Lysa-

Table 1. Flight periods of *Bibio nigriventris*. The months are divided into decades.

Area	May			June			July			Aug.		
	1	2	3	1	2	3	1	2	3	1	2	3
South Norway, 0-600 m a.s.l.			X	X	X	X	X	X				
South Norway, 600-900 m a.s.l.							X	X	X			
North Norway, Nordland & Troms					X	X	X	X	X	X		

ker 1 ♀ 27 June 1873 (ZMO 11293). Probably material published by Siebke (1877) as *B. johannis* (L.).

### New records of *B. nigriventris*

AK, Froggn: Håøya. Malaisetrapp A 5 ♀♀, Malaisetrapp B 1 ♂ 2 ♀♀. BØ, Hurum: Holmsbu 1 ♀, Tofte 52 ♂♂ 27 ♀♀. BV, Hol: Geilo 1 ♀. VE, Tjøme: Kjære 1 ♂, Mostrand 2 ♂♂ 4 ♀♀. AAY, Arendal: Hasselåsen 4 ♀♀. VAY, Flekkefjord: Hidra, Dragøy 1 ♀; Søgne: Søgne Folkehøgskole 1 ♂. RY, Kårstø: Storavann 1 ♀, Årvik 1 ♀. HOY, Bergen: Bergen 1 ♂ 1 ♀, Sandviken 1 ♂ 2 ♀♀, Helleneset 1 ♂ 1 ♀, (Åsane) Vollane 1 ♂ 2 ♀♀, (Åsane) Golfbanen 1 ♂ 4 ♀♀, (Fana) Stavollen 1 ♂, (Fana) Stend 2 ♂♂ 3 ♀♀, (Fana) Flesland 1 ♀; Samnanger: Ådland 1 ♀; Os: Røykenesvann 1 ♂ 2 ♀♀; Sund: Sæle 2 ♂♂ 2 ♀♀; Askøy: Hestetreet 3 ♂♂ 1 ♀; Osterøy: Herland 2 ♀♀, Skaftå 3 ♂♂ 2 ♀♀; Øygarden: Blomvåg 1 ♂ 1 ♀. HOI, Etne: Austrheim 10 ♀♀, Brenneland 1 ♀; Kvinnherad: Berget 1 ♂, Guddalsdal 2 ♀♀, Rosendal, Baroniet 2 ♂♂ 1 ♀, Rosendal, near church, 1 ♂, Skeie 1 ♀, Skeiehavn 1 ♂, Uskedal 1 ♀, Varaldsøy, Djuvslund, Knarrevikshei 1 ♀; Ullensvang: Djønno 1 ♂, Ringøy 1 ♀; Eidsfjord: Hjølmødalen 1 ♀, Øvre Eidfjord 1 ♂ 1 ♀; Ulvik: Granvin 1 ♂ 2 ♀♀, Granvin, Seim 3 ♂♂ 1 ♀; Voss: 4 km east of Mjølfjell 5 ♂♂ 15 ♀♀; Kvam: Bjerke 3 ♂♂ 1 ♀, Tørrviksbygd, Bergsliane 1 ♀. SFY, Gulen: Brekke 1 ♀, Indre Takle 1 ♀. SFI, Lærdal: Eggum 1 ♀, Kvamme 1 ♂. STI, Trondheim: Lade 1 ♀; Oppdal: Kongsvoll 1 ♂ 5 ♀♀, Kongsvoll, Raubekken 1 ♀ (The Museum, Univ. Trondheim); Klæbu: Målsjøen 1 ♀ (The Museum Univ. Trondheim); NTI, Steinkjer: Steinkjer 1 ♂. NSY, Bodø: Bodø 1 ♂ 1 ♀, Falkflaugvann 3 ♂♂ 1 ♀, Falkflaug, upper Falkflaug 8 ♂♂ 3 ♀♀ (two partly damaged *Bibio* males probably also belong here), Urskar, Kronli 3 ♂♂ 1 ♀, Urskar, Skuti 4 ♀♀, Valnes, Sjøgand 5 ♂♂ 6 ♀♀; Gildeskål: Oterstranda 9 ♂♂ 6 ♀♀. NSI, Hemnes: Skårelvdal 2 ♀♀ (Rana Museum 2350); Rana: Kvandalen VP 4357 2 ♂♂ (Rana Museum 2983), Kvandalen VP 4356 1 ♂ (Rana Museum 2980), Kvandalen VP 4257 2 ♂♂ (Rana Museum 2969, 2857), Straumbygd 1 ♀ (Rana Museum 2983); Beirarn: Kvål 1 ♂ 1 ♀, Solhøy 1 ♂; Saltdal: Rognan 4 ♂♂ 1 ♀. NNØ, Hamarøy: Fjelltun at Kråkmo 1 ♂. TRY, Tromsø: Tromsøya 1 ♂; Kvæfjord: Borkenes 1 ♂, Straumsbotn 2 ♂♂ 2 ♀♀. TRI, Bardu: Setermoen 2 ♂♂ 1 ♀.

### DISCUSSION

The distribution of *B. nigriventris* in Norway is shown in Fig. 1, and plotted in EIS squares. *B. nigriventris* is commonly distributed in the lowlands north to Troms province. Pecina (1965) reported *B. nigriventris* from alpine areas in Middle-Europe, but did not state how high up into the mountains the specimens were collected. In Norwegian mountains *B. nigriventris* is however, not recorded in the alpine zone (above the tree line), and it is not common in subalpine areas either. The locality having the highest elevation is Raubekken, Kongsvoll, South-Trøndelag province where one female was taken in a Malaise-trap at 900 m a.s.l. Solem (1985) described this site as sub-alpine zone with birch forest. The surroundings of Kongsvoll in the Dovrefjell mountains, South Norway, has through several years been surveyed throughout the month June to October, and a number of Malaise-traps were used in the middle-, low- and the subalpine zones, but only this one female was collected. The Bibionidae fauna of the Dovrefjell mountains were described by Greve et al. (1984). Neither was *B. nigriventris* represented in the IBP collections from the middle and low alpine zones at Hardangervidda.

Similar sites to the one in the subalpine zone where *B. nigriventris* was collected at Kongsvoll are one at Geilo at approximately 700 m a.s.l., and another at Mjølfjell at 670 m a.s.l. where *B. nigriventris* was collected in Malaise-traps during the summers 1985 and 1986. These data indicate that *B. nigriventris* occurs in the subalpine zone, but is scarce here. Other sites where *B. nigriventris* has been collected are mostly far below these levels.

Pecina (1965) described *B. nigriventris* as an eurytopical and forest species. This description fits well with the data from Norway, where most specimens have been collected in the vicinity of or in deciduous or mixed forests. Since sweep nets are not the best collecting method in forest habitats this may partly explain why a common species like *B. nigriventris* is scarce in older collections. The Norwegian material shows that outside forests, *B. nigriventris* may occur in herbage, gardens, and sometimes in meadows. Pecina (1965) also mentioned habitats similar to these, and remarks also that in contrast to other *Bibio* species which swarm in great numbers, *B. nigriventris* often occur in low

numbers at the sites. This is a trend in the Norwegian collections also, and especially when a sweep-net has been used for collecting.

The flight period of *B. nigriventris* is shown in Fig. 2, and here material from occasional catches and Malaise-traps have been considered. The flight period of *B. nigriventris* is found to be late May to first part of July in southern Norway, while the records from northern Norway indicate late July to early August. This delay is certainly caused by a later spring in northern Norway compared with southern Norway. The climatic variations that occur from the extreme coast to areas having more continental climate does not influence on the flight period of *B. nigriventris*. Specimens appeared in Malaise traps at the same time at these two areas.

The earliest record on an annual basis is represented by a specimen taken 5 May at Holmsbu, Hurum, Buskerud province, and the latest record is 4 August at Urskar, Bodø, Nordland. Freeman & Lane (1985) noted the flight period to be May—July at the British Isles, which is fairly similar to the flight period in southern Norway. Pecina (1965) reported the flight period to be May—June in the lowlands while specimens were collected in late July in the mountains of Czechoslovakia. The flight period of *B. nigriventris* in the mountains of Czechoslovakia corresponds with the few findings in the Norwegian mountains.

In the total material the sex ratio is 1:1. In Malaise-trap collections, however, the males outnumbered the females, e.g. at BØ, Hurum: Tofte, the sex ratio was 2 males per 1 female. This indicates that the males move around much more than the females.

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I am indebted to J.E. Raastad, Museum of Zoology, University of Oslo, John O. Solem, The Museum, University of Trondheim and Per Straumfors, Rana Museum for loan of material. My thanks are due to the following

persons who collected parts of the material: Tor & Sissel Fjellidal, Bergen; Fred Midtgaard, Ås; Tore R. Nielsen, Sandnes; and last, but not least my colleagues Torstein Solhøy and Arild Fjeldså.

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# *Megamerina dolium* (Fabricius, 1805) (Dipt. Megamerinidae) in Norway

LITA GREVE AND FRED MIDTGAARD

Greve, L. & Midtgaard, F. 1987. *Megamerina dolium* (Fabricius, 1805) (Dipt. Megamerinidae) in Norway. *Fauna norv. Ser. B*, 34, 35—36.

*Megamerina dolium* (Fabricius, 1805) (Dipt. Megamerinidae) is recorded from Frogn, Håøya in Akershus county. This is the second record from Norway, and the first in nearly 140 years. One male was sorted out from Malaise-trapped material caught between 3—16 June 1984.

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In connection with a study of the insect fauna of Håøya in the Oslofjord, light-traps, window-traps and Malaise-traps have been used in the years 1983 and 1984. In material collected in a Malaise-trap between 3—16 June 1984, one male *Megamerina dolium* was found. The trap was placed in an open deciduous forest with *Tilia*, *Ulmus* and *Quercus* near old oak trees with dead branches. The forest in this part of the island has been partly protected for decades, and a proportional high number of dead and decaying trees can be found in this area. The bottom vegetation was rich. The trap was operated from April to September 1984. The island Håøya (EIS 28) is in Frogn community and Akershus county. No more specimens were found in this trap (A), and no specimens at all in another trap (B) positioned on the island during 1984.

*Megamerina dolium* (Fabricius, 1805) is the only representative of the family Megamerinidae in Scandinavia. Megamerinidae is a very small fly family numbering between 15—20 species on a world basis. The family is usually placed in the superfamily Psiloidea (Rohdendorf 1974).

*M. dolium* is a fly of medium size, slender, 8—10 mm long. Most of the head, thorax and abdomen is black. In dry specimens the lower part around the eyes are with a silvery shine which looks black in alcohol fixated specimens. Hind femora with two rows of short, stout spines — see Fig. 1.

Until recently little information was to be found on the biology of *M. dolium*. A.A. Al-

len (pers. comm.) has informed us that *M. dolium* probably develops in rotten wood though it has not been proved. Specimens have in England been caught close to decayed

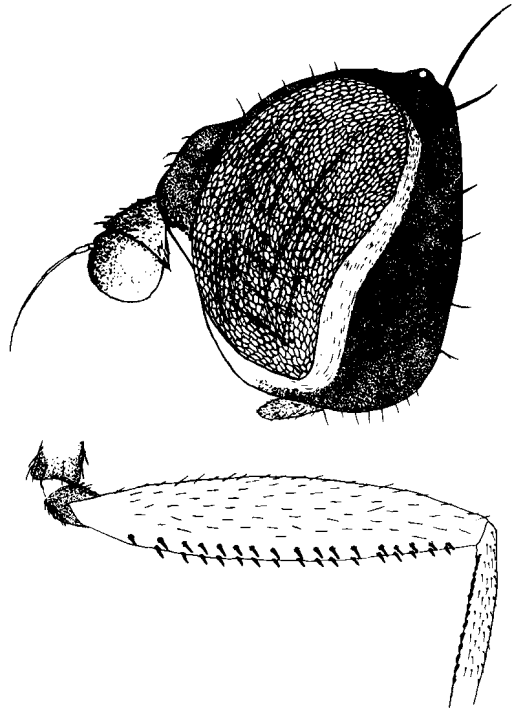


Fig. 1. Upper: Head of *Megamerina dolium* (Fabricius). Lower: Hind leg — femur; note the two rows of ventral spines.

treestumps and near fallen timber, and one specimen has been reared from a pupa found under oak (*Quercus*) bark in April (Chandler, 1975). Chandler (1975) and Allen (1983) both mention localities of older forest — mixed woodland and older park area.

*M. dolium* has been recorded once earlier from Norway as *Lissa loxocerina* Fallén by Siebke (1877). It was found in the botanical garden at Tøyen in Oslo August 1st. 1847. The specimen, a female, is present in Zoological Museum of Oslo. In the Zoological Museum of Oslo one additional specimen, a male collected by Esmark and labelled «Oslo» only, was found. This is the only material in Norwegian museums. The name *M. loxocerina* Fallén 1829 was synonymized by Hennig (1941) in his revision of the *Megamerinidae*.

Lyneborg (1962) reports *M. dolium* as distributed all over Denmark, but not common. In Sweden it is a southern species distributed north to the provinces Bohuslän, Västergötland, Öland and Gotland (Ringdahl 1960). Walter Hackman (pers. comm.) has informed us that *M. dolium* is distributed in SW-Finland, and that it is a rare species there.

*M. dolium* is probably a rare fly also in Norway. It is doubtful that the Botanical garden today can sustain populations of flies developing in rotten wood or fallen timber. It is noteworthy that in a survey of another island, Ostøya, in the inner Oslofjord with Malaise-traps, window-traps and netting during the years 1982 to 1984, no specimens

were found even though localities should be suitable for *M. dolium*. Parts of outer Vestfold have also been surveyed during the last years, but no specimens of this species have been found.

#### ACKNOWLEDGEMENTS

We are most grateful to the following people for information on the distribution of *M. dolium*: A.A. Allen, London (England), W. Hackman, Helsingfors (Finland) and U. Qvick, Eskilstuna (Sweden).

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# New Norwegian Empididae (s.str.) (Dipt.)

TERJE JONASSEN

Jonassen, T. 1987. New Norwegian Empididae (s.str.) (Dipt.). *Fauna norv. Ser. B* 34, 37—40.

Thirty species of Empididae (s.str.) are reported new to the Norwegian fauna.

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## INTRODUCTION

Below are given data for 30 species of Empididae (s.str.) that do not seem to be reported from Norway previously. Of these, at least five species are new to Scandinavia. This indicates that these flies have received relatively little attention from preceding Norwegian entomologists. This especially refers to the Hemerodromiinae where the total number of Norwegian species hereby is increased by 55 per cent, from 18 to a total number of 28. The Hemerodromiinae are also poorly known on a European basis, as indicated by the scattered records for some of the species (e.g. *Hemerodromia*, cf. Vaillant 1981). This is probably due to their inconspicuousness, both in general appearance and in their choice of habitats. They are most commonly found in damp situations. I have captured specimens in low herbage near water, on mud banks, on wet rocks and damp moss in and near streams. The *Hydrodromia* species have all been captured skating on minor accumulations of water, where they at some localities are dominant species in the very early days of spring.

The specimens from Håøya have all been collected by Fred Midtgaard. Elsewhere, when nothing else is mentioned, the specimens have been collected by the author and is deposited in the author's collection. A few of the specimens are deposited in the Museum of Zoology, Bergen (ZMB).

The identifications follow the works of Engel (1938—1954), Frey (1954—56), Collin (1961), Straka (1975), Vaillant (1981) and Barták (1982). Some of my *Rhamphomyia* species have been verified by Dr. Miroslav Barták, Pecky, Czechoslovakia, while some of the Hemerodromiinae have been checked by Dr. Rüdiger Wagner, Schlitz,

Germany (MB and RW, respectively, below).

The geographical division of the districts follows Økland (1981).

## SYSTEMATIC LIST

### Subfamily Empidinae

#### *Rhagas unica* Walker

AK, Frogn: Håøya, EIS 28, 5—19 May 1984, 1 ♂, 1 ♀ (Malaise trap A), 2 ♂♂, 1 ♀ (Malaise trap B); 3—16 June 1984, 1 ♀ (Malaise trap A); 19 May—3 June 1984, 1 ♂ (Malaise trap B); RI, Forsand: Songesand skule, EIS 7, 4 June 1983, 1 ♀.

#### *Rhamphomyia (Pararhamphomyia) albidiventris* Strobl

AK, Frogn: Håøya, EIS 28, 19 May—3 June 1984, 1 ♀; RI, Forsand: Songesand skule, EIS 7, 5 June 1984, 1 ♀ (MB). This species is easily distinguished in the female sex due to its white abdomen. There are still some slight uncertainty concerning the males of the species, which Frey originally described under the name of *woldstedti*. He subsequently synonymized these males with *albidiventris*, of which Strobl's type specimen is a female. There seem, however, not to be any records of males and females taken in copula.

*R. (Pararhamphomyia) albipennis* (Fallén)  
RY, Finnøy: Kyrkjøy, EIS 14, 20 May 1986, 1 ♂.

*R. (Pararhamphomyia) micropyga* Collin  
AK, Frogn: Håøya, EIS 28, 19 May—3 June 1984, 4 ♀♀ (Malaise trap A). A rather little known species with previous records from Great Britain and Czechoslovakia only (Barták 1982).

*R. (Pararhamphomyia) murina* Collin  
VAY, Flekkefjord: Djupvik, EIS 4, 29 May 1982, 3 ♂♂ (MB); RI, Forsand: Songesand skule, EIS 7, 4 June 1982, 1 ♂; 15 May 1984, 7 ♂♂ leg. Helene Moen; 24 May 1984, 2 ♂♂; 27 May 1984, 1 ♂; 13 May 1985, 1 ♂ leg. Tom E. Nøklung; 28 May 1985, 1 ♂; towards Sunnmork, EIS 14, 2 June 1985, 3 ♂♂, 3 ♀♀ (1 ♂, 1 ♀ in ZMB); Helmikstøl, EIS 8, 1 ♂. As with the above species, *murina* is previously known from Great Britain and Czechoslovakia only (Barták 1982, and in litt.). Taken most abundantly on and around *Salix*, *Betula* and similar vegetation in the subarctic zone.

*R. (Pararhamphomyia) nitidicollis* Frey  
AK, Froggn: Håøya, EIS 28, 19 May—3 June 1984, 2 ♂♂; 3—16 June 1984, 1 ♂ (all Malaise trap B); RI, Forsand: Songesand, EIS 7, 4 June 1983, 2 ♀♀; 20 May 1984, 1 ♂; 24 May 1984, 1 ♀; 27 May 1984, 12 ♂♂, 7 ♀♀ (2 ♂♂, 2 ♀♀ in ZMB); 28 May 1985, 5 ♂♂, 2 ♀♀; Skurvedalen/Songesandstølen, EIS 7, 31 May 1984, 2 ♂♂, 1 ♀; Helmikstøl towards Forestølen, EIS 8, 2 June 1985, 1 ♂; towards Sunnmork, EIS 14, 2 June 1985, 1 ♀. Very common at the localities in Forsand on the leaves of *Betula* ultimo May/primo June. No swarming was observed.

*R. (Pararhamphomyia) simplex* Zetterstedt  
RY, Hå: Brusand, EIS 3, 11—12 June 1985, 1 ♂. This typically coastal species was swept up from the vegetation surrounding a saline pool at the beach.

*R. (Pararhamphomyia) tibiella* Zetterstedt  
VAY, Kristiansand: Stangenes, EIS 2, 5 June 1983, 1 ♂ leg. S. Svendsen; RY, Sandnes: Høle, EIS 7, 4 June 1982, 2 ♂♂, 1 ♀; RI, Forsand: Songesand, EIS 7, 9 June 1983, 1 ♂; 29 May 1984, 1 ♂.

*R. (Pararhamphomyia) unguiculata* Frey  
VAY, Flekkefjord: Djupvik, EIS 4, 29 May 1982, 1 ♂, 1 ♀; RI, Forsand, Songesand, EIS 7, 1 June 1983, 1 ♂ (MB), 1 ♀; 17 June 1983, 1 ♂ (MB); 6 June 1984, 1 ♂ (ZMB).

*R. (s.str.) coracina* Zetterstedt  
STI, Oppdal: Kongsvoll (900—1000 m a.s.l.), EIS 79, 19 June 1967, 1 ♂ leg. A. Løken (MB) (ZMB). A mountain and northern species previously known from the

middle and northern parts of Sweden and Finland in addition to Northern Germany.

*Empis (s.str.) bicuspidata* Collin  
OS, Nord-Aurdal: Vasettdansen (770 m a.s.l.), EIS 44, 11 July 1982, 1 ♂ leg. K. Rognes.

*E. (Coptophlebia) hyalipennis* Fallén  
VAY, Flekkefjord: Hidra, Kråkedal, EIS 4, 25—30 July 1981 (Malaise trap), 1 ♀ leg. Alf J. Nilsen; RY, Finnøy: Eik, Sjernerøy, EIS 14, 13 August 1985, 1 ♀; Kyrkjøy, EIS 14, 14 August 1985, 1 ♂; RI, Forsand: Songesand skule, EIS 7, 2 August 1983, 1 ♂; Helmikstøl, EIS 8, 20 August 1984, 4 ♂♂, 3 ♀♀. No previous Norwegian records, but probably rather widespread. Also present in the collections in ZMB (Lita Greve Jensen in litt.).

*Hilara canescens* Zetterstedt  
RY, Sandnes: Høle, EIS 7, 22 July 1982, 5 ♂♂, 1 ♀; RI, Forsand: Songesand, EIS 7, 28 June 1984, 1 ♂; 18 July 1984, 1 ♂; 8 August 1984, 1 ♂; 23 July 1985, 1 ♀; Helmikstøl, EIS 8, 25 July 1985, 1 ♂; HOI, Etne: near Austreim, EIS 23, 26—30 June 1985 (Malaise trap), 1 ♀ leg. Lita Greve Jensen (ZMB). Although no previous records are available, the species is probably not uncommon in Norway and has in the past possible been confused with other species. There are also additional specimens present in ZMB (Lita Greve Jensen in litt.).

*H. cornicula* Loew  
AK, Froggn: Håøya, EIS 28, 19 May—3 June 1984, 1 ♂; 3—16 June 1984, 3 ♂♂, 8 ♀♀ (all Malaise trap A).

*H. flavipes* Meigen  
RI, Forsand: Songesand, EIS 7, 2 August 1983, 1 ♂; 19 July 1984, 3 ♂♂; 23 July 1985, 1 ♂ (ZMB), 1 ♀.

*H. implicata* Collin  
RY, Finnøy: Eik, Sjernerøy, EIS 14, 13 August 1985, 1 ♀. Distinguished from related species by the dull black head and the pair of bristles each side of the pronotum. All other diagnostic features agree closely with Collin's (1961) description. This species has previously been known from British specimens only. As with the specimen at hand, the British specimens have all been captured in August.



*H. obscura* Meigen

RY, Rennesøy: Førsvoll, EIS 14, 26 July 1982, 1 ♂; Sel, EIS 14, 10 July 1983, 1 ♂. The genitalia of the latter have been examined and they agree closely with the figures given by Collin (1961) and Straka (1975).

*H. pilosa* Zetterstedt

AK, Frogn, Håøya, EIS 28, 19 May—3 June 1984, 2 ♂♂, 6 ♀♀ (Malaise trap A), 1 ♂ (Malaise trap B). Although Siebke (1877, citing Zetterstedt) includes this species as Norwegian, Collin (1961) has subsequently identified the Norwegian specimens as belonging to *scrobiculata* Loew. Thus, the specimens from Håøya are the first Norwegian records of the true *pilosa*.

*H. platyura* Loew

AK, Frogn: Håøya, EIS 28, 16—27 June 1984, 1 ♂. The genitalia of this specimen have been examined, and they agree closely with the figures given by Collin (1961).

*H. submaura* Collin

HOI, Voss: 4 km east of Mjølfjell (670 m), 8 June—13 July 1985 (Malaise trap), 1 ♀ leg. L. Greve (ZMB). A species within the *Hilara maura*-complex, distinguishable in the females by the combination of slender hind femora and yellow knees.

Subfamily Hemerodromiinae

*Chelipoda vocatoria* (Fallén)

RY, Sandnes: Melshei, EIS 7, 3 August 1982, 1 ♂ (RW); Rennesøy: Vikevåg, EIS 14, 2 September 1981, 1 ♂. By older authors often confused with the similar *C. albiseta* Zetterstedt. Thus the *Chelipoda* specimens captured by Boheman in the Dovre mountains (Siebke 1877, under *albiseta*), could in fact well be *vocatoria*.

*Chelifera concinnicauda* Collin

RY, Sandnes: Melshei, EIS 7, 3 August 1982, 1 ♂, 1 ♀ (RW); RI, Forsand: Songesandstølen, EIS 7, 30—31 July 1984, 2 ♂♂, 1 ♀ (of which the female and one male are deposited in ZMB); Kvernvatn, EIS 15, 30 July 1984, 2 ♂♂. Until recently known from British specimens only. Vaillant (1981) has however found the species to be abundant in Swedish Lapland, from where there are several specimens deposited at the University of Lund. He has also shown *concinnicauda* to be conspe-

cific with *Ch. lapponica* Frey. The species has also been taken in France and Mongolia.

*Chelifera precabunda* Collin

RY, Rennesøy: Førsvoll, EIS 14, 26 August 1982, 1 ♀ (RW); RI, Forsand: Songesand, EIS 7, 18 July 1984, 1 ♂; 9 August 1984, 1 ♀; 2 September 1984, 1 ♂; Helmikstøl, EIS 8, 5 September 1982, 1 ♀, (RW); 10 August 1984, 1 ♂; 20 August 1984, 1 ♂; HOI, Voss: 4 km east of Mjølfjell (670 m), EIS 41, 13 July—3 August 1985, 1 ♀ and 3 August—21 September 1985, 2 ♂♂, 3 ♀♀ L. Greve leg. (Malaise trap) (ZMB). Previously known from Great Britain and continental Europe (Vaillant 1981). These are the first records from Scandinavia.

*Hemerodromia adulatoria* Collin

RY, Rennesøy: Førsvoll, EIS 14, 11 June 1982, 3 ♂♂, 1 ♀ (RW). This is the first record to be published from Scandinavia. It has, however, also been captured near Umeå in Sweden (R. Wagner in litt.). Previously recorded from Great Britain (Collin 1961) and France (Vaillant 1981) only.

*Hemerodromia raptoria* (Meigen)

RY, Klepp: Øksnevad, EIS 7, 15 June 1982, 1 ♂, 2 ♀♀ (RW); RI, Forsand: Helmikstøl, EIS 8, 4 June 1985, 1 ♂. A distinctive species, previously known from Great Britain, Germany and Sweden (Vaillant 1981).

*Trichopeza longicornis* (Meigen)

RY, Sandnes: Melshei, EIS 7, 6 July 1982, 2 ♂♂, 2 ♀♀; RI, Forsand: Songesand, EIS 7, 29 June 1983, 1 ♀; 13 August 1983, 1 ♀; 18 July 1984, 2 ♂♂; 2 July 1985, 1 ♂, 2 ♀♀ (of which the male and one female are deposited in ZMB).

*Clinocera (s.str.) nigra* Meigen

RI, Forsand: Helmikstøl, EIS 8, 20 August 1984, 1 ♀.

*C. (Hydrodromia) fontinalis* (Haliday)

RY, Rennesøy: Vikevåg, EIS 14, 26 August 1984, 1 ♂ (ZMB); RI, Forsand: Songesand, EIS 7, 13 March 1983, 2 ♂♂, 2 ♀♀ (RW); 22 April 1984, 1 ♀; 28 April 1984, 1 ♂.

*C. (Hydrodromia) stagnalis* (Haliday)

RY, Gjesdal: Idland, EIS 7, 4 October 1981, 1 ♂; Rennesøy: Vikevåg, EIS 14, 25 July 1982, 1 ♀.

*C. (Hydrodromia) wesmaelii* (Macquart)  
RI, Forsand: Songesand, EIS 7, 13 April 1982, 1 ♂; 2 October 1982, 1 ♀; 13 March 1983, 6 ♂♂, 2 ♀♀, 1 ♂♀ (in copula) (RW) (1 ♂, 1 ♀ in ZMB); 31 March 1983, 1 ♀; 1 April 1983, 1 ♀.

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# Influence of temperature on the egg-stage of *Capnopsis schilleri* (Plecoptera; Capniidae)<sup>1</sup>

ØYVIND HÅLAND

Håland, Ø. 1987. Influence of temperature on the egg-stage of *Capnopsis schilleri* (Plecoptera; Capniidae). *Fauna norv. Ser. B* 34, 41—44.

The egg incubation time, the hatching success and the duration of the hatching of eggs of *Capnopsis schilleri* were studied at seven different constant temperatures (2°—24°C) in the laboratory. The mean incubation time in the interval 4°—20°C could be described by the equation  $Y = 429 \cdot T^{-1.24}$  where Y is time in days and T is temperature. Eggs did not hatch at 2°C, and only a few at 24°C, where they needed more time than at 20°C. The eggs needed on average 264 day-degrees to hatch.

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## INTRODUCTION

In their study of the egg biology of the stonefly *Capnia atra* Morton, Brittain et al. (1984) found that different populations differed in egg size and size of 1st instar nymphs, but showed basically the same relationship between egg incubation time and temperature. The last mentioned fact made it possible also to predict the hatching time of eggs from other populations.

One aim of the present study was to investigate the relationship between egg incubation time and temperature in a population of *Capnopsis schilleri* (Rostock) in the vicinity of Oslo. *C. schilleri* is distributed throughout most of Europe, and has also been found in Tunisia in North Africa (Berthélemy 1973). It is thus subjected to very different environmental conditions, but still probably maintains a univoltine life cycle everywhere (Berthélemy 1973, Lillehammer 1975b). A paper under preparation will report on the study of the life cycle of *C. schilleri* in the stream Sæterbekken near Oslo, where the eggs for this study were collected.

Another aim of this study was to see if there is any tendency towards ovovivipary in *C. schilleri*. This phenomenon has been observed in other species of the Capniidae (see i.e. Harper & Hynes 1972).

The egg biology of *C. schilleri* has been studied to some degree before by Berthélemy (1973) under fluctuating temperatures, and by Lillehammer (1975b) under 4°C constant temperature. Lillehammer (1975b) found quite great differences in egg incubation time for two different egg batches of *C. schilleri*.

## MATERIAL AND METHODS

Adult of *C. schilleri* were captured by the stream Sæterbekken near Oslo, Norway, in May and June 1978 and 1979. The stream is described by Lillehammer (1975a), who also gives temperature data for the stream over a period of three years. The adults were brought to the laboratory in plastic boxes, 10—20 individuals in each box. In the boxes were also some moss, twigs, leaves, and a small petri dish with water from the stream. The flies copulated in the boxes and laid their eggs in the dish. By having many flies in the same box I got many eggs, but there might be several females who deposited their eggs in the dish at the same time, so I could not know the size of the individual egg batches. In the following the eggs found in a dish at one time is treated as one egg batch. When eggs were found in a dish, the dish was removed, the eggs were counted, and the dish was placed in an incubator, while a new dish was put in its place.

6521 eggs in 25 batches were deposited.

<sup>1</sup> Contribution No. 195, Zoological Museum, University of Oslo.

The incubators, with almost constant temperature ( $\pm 0,5^{\circ}\text{C}$ ) and constant darkness, were set at  $4^{\circ}\text{C}$  intervals: 4, 8, 12, 16, 20 and  $24^{\circ}\text{C}$ . A cold room at approximately  $2^{\circ}\text{C}$  ( $\pm 1^{\circ}\text{C}$ ) was also used. The eggs were inspected daily for hatching until all eggs had hatched or the remaining eggs were either discoloured or destroyed by fungi. The incubation time of the whole egg batch was considered to be the time from the egg laying until 50% of the eggs that eventually would hatch had hatched (Brittain 1977).

Table 1. Number of eggs laid (N) and hatched (N'), % hatching, mean incubation time and variation in incubation time for egg batches of *C. schilleri*.

Temp.	N	N'	Hatch. %	Mean. ink. time	Var. time
2	69	0	0		
4	113	54	47,8	77	68-93
	69	5	7,2	68	67-69
	682	668	97,9	73	61-87
	132	56	42,4	71	63-85
8	334	329	98,5	38	30-45
	832	811	97,5	39	30-55
	525	504	96,0	37	30-48
	70	14	20,0	38	38-42
12	182	180	98,9	20	19-27
	295	294	99,7	18	15-25
	45	39	86,7	16	15-17
	62	24	38,7	20	18-22
	360	320	88,9	23	18-26
	350	190	54,3	22	19-30
16	119	119	100,0	11	9-15
	899	894	99,4	15	11-25
	186	157	84,4	14	10-18
20	137	137	100,0	11	9-15
	266	264	99,3	11	9-13
	50	48	96,0	11	10-16
	62	62	100,0	9	7-12
24	19	11	57,9	10	9-14
	650	63	9,7	13	9-15
	13	4	30,8	12	11-21

N = 6521 N' = 5247

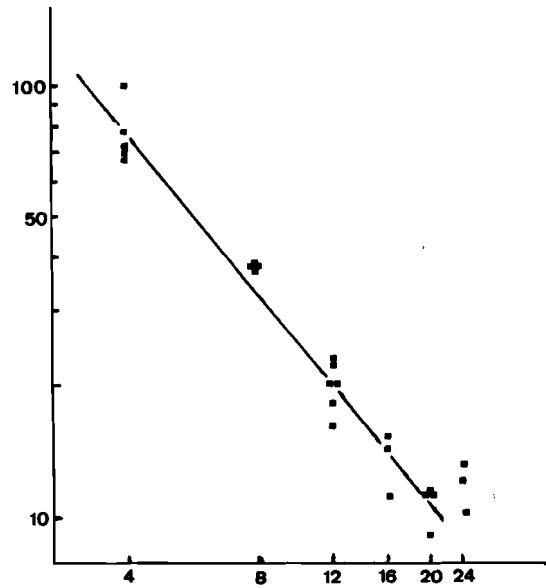


Fig. 1. The mean incubation time of egg batches of *C. schilleri* plotted on log. paper with regression line.

## RESULTS

The results of the egg incubation studies are given in Tab. 1, and pooled for each temperature in Fig. 1. The egg incubation time which was clearly dependent on temperature, decreased as the temperature increased. The eggs did not hatch at  $2^{\circ}\text{C}$  and only a few hatched at  $24^{\circ}\text{C}$ . At this high temperature it seems that the incubation time increased again, but this might be an artifact caused by the low number of eggs. If the data from  $24^{\circ}\text{C}$  are ignored, the rest fit very well the regression line  $Y = 429.T^{-1,24}$ , ( $r = 0,985$ ) where Y is time in days and T is temperature in  $^{\circ}\text{C}$ .

The eggs hatched with no sign of delayed hatching with the possible exception of  $24^{\circ}\text{C}$ .

The hatching success varied with temperature (see Tab. 1), and also for different egg batches. The highest hatching success was in the temperature interval of 8— $20^{\circ}\text{C}$ , but one egg batch at  $4^{\circ}\text{C}$  also had a very high hatching success.

The eggs needed on average 264 day-degrees above  $0^{\circ}\text{C}$  to hatch, but the variation was big; 120—500 day-degrees (Fig. 2). The lowest heatsum was needed between 12 and  $20^{\circ}\text{C}$ .

The method used does not allow an assessment of the number of eggs deposited in each

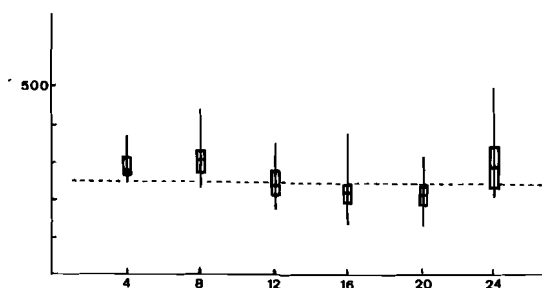


Fig. 2. Day-degrees needed for eggs at different temperatures. The stippled line is the mean for all temperatures. The mean value for each temperature is also indicated.

egg batch from each female, since several females could have laid eggs in the same dish at the same time.

Newly laid eggs did not show any visible sign of an embryo.

## DISCUSSION

The egg incubation time of *C. schilleri* is clearly temperature dependent. Other factors influencing the incubation time are individual variation within the egg batch and variation between egg batches from different females, as well as differences between the different egg batches from a single female. The same pattern is revealed in the study of Brittain (1977) on *Taeniopteryx nebulosa* (L.) (Taeniopterygidae) and the studies of Saltveit (1977), Brittain (1978) and Rekstad (1979) on different species of Nemouridae, though with different inclination of the regression line for the different species. Lillehammer (1975b) found different incubation time for different egg batches at the same temperature for several species of Capniidae, Nemouridae and Leuctridae. Late in this study I started wondering whether the size of the egg batch had any influence on the incubation time and especially on the hatching success, since some of the smallest batches differed a little from the others. This might be because these batches were the last of several batches from the same female, but with smaller resources. It would be interesting to follow this line of investigation further.

Probably there are also differences between different populations regarding the relationship between incubation time and temperature. Brittain (1978) and Rekstad (1979),

who investigated populations of *Nemurella pictetii* Klapalek from a high mountain site and a lowland site respectively, found some differences. But Brittain et al. (1984) found that population differences made no significant contribution to variation in egg incubation time in *Capnia atra*. Probably the results of this study are generally applicable to other populations of *C. schilleri*, but some variation is to be expected. The only study that has been made of another population is the study of Berthélemy (1973) from Tunisia, but he used fluctuating temperatures, so it is difficult to make a direct comparison.

The high hatching success at very diverse temperatures would indicate that *C. schilleri* could thrive under very different environmental conditions, no one temperature being clearly optimal for the egg stage. Since there was no sign of diapause or delayed hatching or ovovivipary, the regulation of the life cycle to suit the different conditions the species will meet must be in other stages of the life cycle, namely the nymphal stage. Berthélemy (1973) says that *C. schilleri* in Tunisia has a diapause in the larval stage during the hot summer.

The egg development of *C. schilleri* in Norway is quick; 6 eggs hatched after only 7 days in one egg batch at 20°C. Since the eggs were inspected only once every day there is a possibility that these eggs were laid nearly one day before the batch was registered and hatched just before the first nymphs were discovered. This could mean that the real development time is 8 days and not 7. This applies to all the eggs on all temperatures of course, but is a relatively greater source of error at the highest temperatures. To have exact development time one would have to inspect the eggs much more often, but this is not always possible.

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# Distribution and seasonal abundance of adult stoneflies (Plecoptera) in the Dovrefjell National Park, South Norway\*

JOHN O. SOLEM, JARLE STEINKJER AND SIMEN BRETTEEN

Solem, J.O., Steinkjer, J. & Bretten, S. 1987. Distribution and seasonal abundance of adult stoneflies (Plecoptera) in the Dovrefjell National Park, South Norway. *Fauna norv. Ser. B*, 34, 45—50.

Emergence traps and Malaise traps used at 12 sites in the Dovrefjell National Park caught 24 species of adult stoneflies. Their relative abundance and the number of sites each species were collected at, showed that 13 species, *Arcynopteryx compacta*, *Diura nanseni*, *Isoperla obscura*, *Brachyptera risi*, *Amphinemura standfussi*, *A. sulcicollis*, *Nemoura cinerea*, *Nemurella pictetii*, *Protonemura meyeri*, *Capnia atra*, *Leuctra fusca*, *L. hippopus* and *L. nigra* were widespread and common in the National Park. The remaining 11 species had a restricted distribution, but may be locally abundant. *Diura bicaudata*, *Dinocras cephalotes*, *Siphonoperla burmeisteri*, *Amphinemura borealis*, *Nemoura avicularis*, and *Capnia pygmaea* were collected at one site only.

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## INTRODUCTION

In a large scale the stonefly fauna of Norway is well known, and the greatest contribution to the occurrence and distribution is given by Lillehammer (1973, 1974). However, the stonefly fauna, or for that matter, the insect fauna of our national parks is almost unknown. From general knowledge of the distribution of insect species, we can predict that a given species will be present in e.g. the Dovrefjell National Park, but nothing is known about the actual number of species, which species are common and widespread, which are locally distributed, which are rare, species abundances and composition of insect communities. This holds for all the national parks in Norway. Our national parks are protected against major disturbances and they should be excellent reference areas for life sciences. Today our national parks are reference areas of spectacular topography, a few for vegetation, birds and mammals, but none for insects. Scientific documentation is a necessary requisite before an area can be

considered a reference area, and the present paper give data on the distribution, abundance and flight periods of the stonefly fauna in the Dovrefjell National Park.

## STUDY AREA AND METHODS

The study area was the surroundings of Kongsvoll Biological Station (62°17'N, 09°59'E) between the elevations 870 m and 1452 m in the Dovrefjell National Park, South Norway (Fig. 1). The River Driva is the main water course into which all the smaller streams empty. In general, the streams are fastflowing, except for Jerosbekken. Sampling was made at eight streams and the River Driva. Two-sided Malaise traps (Fig. 2) and emergence traps of the tent type (Fig. 3) were used, and the sampling covered the period late May to October. Solem (1985) gives a table of the number of Malaise traps at the streams and the years they were used. At Vestbekken and Kvernbekken only emergence traps were used, 16 and 4 traps, respectively. Following the definitions of the biotic zones in Sjörs (1967) and Rønning (1972), the sampling covered the sub-alpine, low and

\* Printing grant given by Kongsvoll biological station.

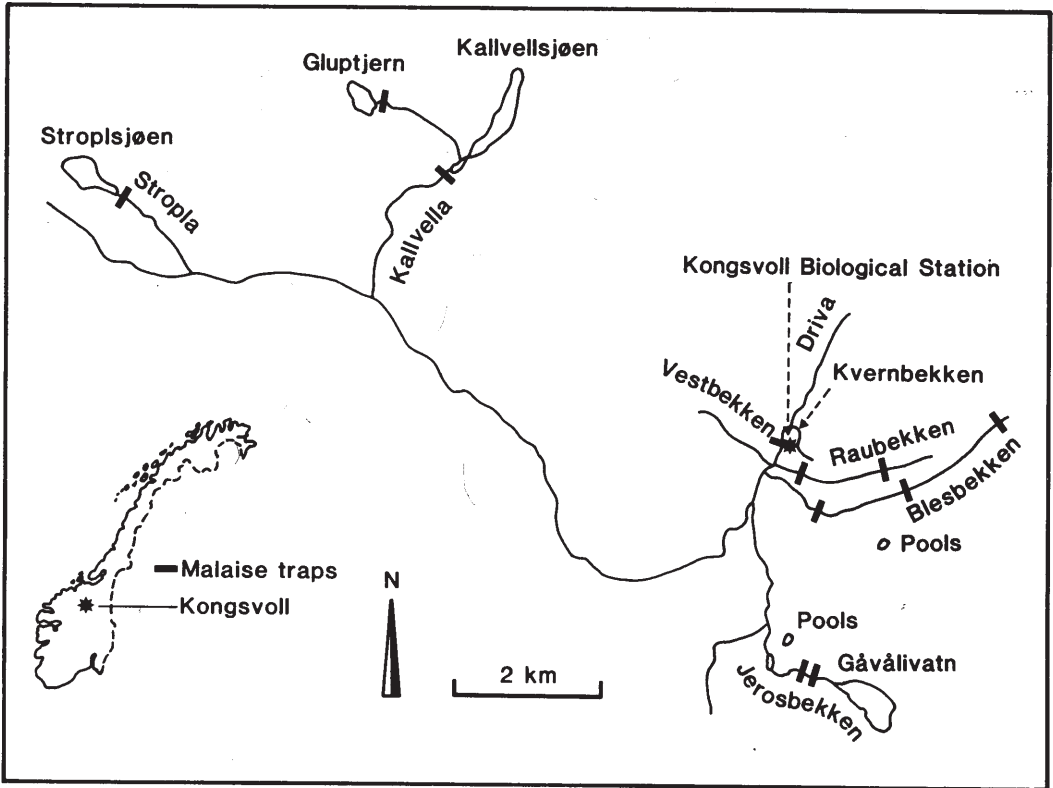


Fig. 1. Map of the sampling area in the surroundings of Kongsvoll in Dovrefjell National Park. Sites of the Malaise-traps are shown. The location of Kongsvoll in Norway is indicated.

the middle alpine zones, with six, five and one sampling site for traps, respectively. Additionally, sweep-net catching and handpicking were done at the 1500 to 1600 m a.s.l.

Two large geological regions in the southern Scandinavian Calidonides meet in the field area, and the border roughly follows the River Driva. On the eastern side is the

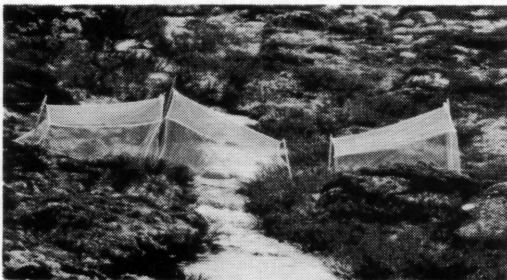


Fig. 2. Two-sided Malaise-traps used in the sampling.

Trondheim region, which contains mainly medium-grade mica schists and green-stones of cambro-silurian age. The western side is mainly a basal gneiss region built up of high-grade gneisses and schists of precambrian age.

The climate of the area is mainly continental, with a yearly precipitation of 473 mm at Kongsvoll. The yearly mean temperature at Hjerkin (959 m a.s.l. and 10 km south of



Fig. 3. Emergence traps used in the sampling.



Table 1. Percentage composition of Plecoptera in Malaise traps at different streams in the alpine zones.

	Middle alpine zone		Upper part low alpine zone		Lower part low alpine zone	
	Gluptjern 1452 m	Stropla 1289 m	Blesbekken 1350 m	Blesbekken 1200 m	Kallvella 1220 m	Raubekken 1100 m
<i>Arcynopteryx compacta</i>	-	-	0.2	0.4	0.01	0.05
<i>Brachyptera risi</i>	2.8	-	1.2	1.6	0.03	0.3
<i>Diura nanseni</i>	-	0.9	0.3	0.3	0.4	0.3
<i>Isoperla obscura</i>	-	0.3	0.3	15.2	3.4	1.2
<i>Amphinemura sulcicollis</i>	5.6	0.3	-	-	0.4	0.05
<i>A. standfussi</i>	-	42.7	-	2.6	0.04	6.0
<i>Nemoura cinerea</i>	-	35.4	0.7	3.9	0.07	50.4
<i>Nemurella pictetii</i>	69.4	-	1.3	18.1	0.4	35.0
<i>Protonemura meyeri</i>	16.7	19.5	0.9	0.9	95.0	-
<i>Capnia atra</i>	2.8	0.7	95.0	35.7	0.07	4.2
<i>Capnopsis schilleri</i>	-	-	-	-	-	2.0
<i>Leuctra fusca</i>	-	-	-	12.3	0.03	0.2
<i>L. hippopus</i>	2.8	-	-	1.6	-	0.2
<i>L. nigra</i>	-	-	0.1	7.5	0.04	0.2
Total number	36	573	1009	692	7480	1912

Kongsvoll) is  $-0.1^{\circ}\text{C}$ , and only 19 days a year have daily mean temperatures above  $10^{\circ}\text{C}$  (Nordhagen 1943).

## RESULTS

### Middle alpine zone

Only a small collection is present from this zone, and *Brachyptera risi* (Morton), *Amphinemura sulcicollis* Stephens, *Nemurella pictetii* Klapálek, *Protonemura meyeri* Pictet, *Capnia atra* Morton, and *Leuctra hippopus* Kempney were captured as adults in Malaise traps at Gluptjern (Tab. 1). At Stridåtjønnin (about 1500 m a.s.l.) *Arcynopteryx compacta* McLachlan was collected.

### Low alpine zone

In the upper part of the low alpine zone (Tab. 1) and in addition to the species captured in the middle alpine zone, *A. compacta*, *Diura nanseni* (Kempney), *Isoperla obscura* (Zetterstedt), *Leuctra nigra* (Oliver), *Amphinemura standfussi* Ris and *Nemoura cinerea*

(Retzius) were caught. Dominant species at the various streams were *A. standfussi*, *N. cinerea*, *P. meyeri*, and *C. atra*. *C. atra* outnumbered other species at Blesbekken.

In the lower part of the low alpine zone *Capnopsis schilleri* (Rostock) and *Leuctra fusca* Linnaeus can be added to the list of species from higher elevation. *P. meyeri* outnumbered other species in the catches at Kallvella. *N. cinerea* and *N. pictetii* were dominant species at Raubekken, and *I. obscura*, *N. pictetii*, *C. atra* and *L. fusca* at Blesbekken.

### Sub-alpine zone

Twenty-three species were recorded (Tabs. 2 and 3), and additional to those mentioned earlier are *Diura bicaudata* (Linnaeus), *Isoperla difformis* (Klapálek), *Isoperla grammatica* (Poda), *Dinocras cephalotes* (Pictet), *Siphonoperla burmeisteri* (Pictet), *Taeniopteryx nebulosa* (Linnaeus), *Amphinemura borealis* Morton, *Nemoura avicularis* Morton, *Capnia bifrons* (Newman), and *Capnia pygmaea* (Zetterstedt).

**Table 2. Percentage composition of Plecoptera in Malaise traps at different streams in the sub-alpine zone.**

	Hlesbekken 1000 m	Raubekken 920 m	Jerosbekken 920 m	Driva 870 m
<u>Arcynopteryx compacta</u>	0.09	-	-	-
<u>Diura bicaudata</u>	-	-	0.007	-
<u>D. nanseni</u>	0.4	0.4	-	9.1
<u>Isoperla difformis</u>	-	-	0.02	-
<u>I. grammatica</u>	-	-	2.4	11.1
<u>I. obscura</u>	2.4	0.9	0.05	-
<u>Dinocras cephalotes</u>	-	-	0.02	-
<u>Siphonoperla burmeisteri</u>	-	-	0.002	-
<u>Taeniopteryx nebulosa</u>	-	-	0.004	1.3
<u>Brachyptera risi</u>	2.1	1.8	0.002	2.9
<u>Amphinemura borealis</u>	-	-	0.01	-
<u>A. standfussi</u>	19.7	9.4	0.03	5.5
<u>A. sulcicollis</u>	0.04	0.05	37.8	6.2
<u>Nemoura avicularis</u>	-	-	2.9	-
<u>N. cinerea</u>	17.1	11.9	1.0	5.5
<u>Nemurella pictetii</u>	23.9	69.5	0.3	14.3
<u>Protonemura meyeri</u>	1.2	0.08	0.05	3.9
<u>Capnia atra</u>	1.5	0.4	0.09	6.8
<u>C. bifrons</u>	0.1	-	0.002	-
<u>C. pygmaea</u>	-	-	0.004	-
<u>Leuctra fusca</u>	12.7	0.2	24.7	12.7
<u>L. hippopus</u>	1.0	0.2	30.7	18.6
<u>L. nigra</u>	18.2	5.2	-	2.0
Total number	2328	3699	43946	307

**Table 3. Percentage composition of Plecoptera in emergence traps in 1978.**

Species	Vestbekken	Kvernbekken
<u>Amphinemura standfussi</u>	53.3	15.0
<u>Nemoura cinerea</u>	20.2	23.1
<u>Nemurella pictetii</u>	11.4	39.3
<u>Brachyptera risi</u>	5.3	6.0
<u>Leuctra nigra</u>	3.3	16.5
<u>L. hippopus</u>	1.9	-
<u>L. fusca</u>	1.4	-
<u>Isoperla difformis</u>	0.9	-
<u>Protonemura meyeri</u>	0.9	-
<u>I. obscura</u>	0.7	-
<u>Arcynopteryx compacta</u>	0.2	-
<u>Diura nanseni</u>	0.2	0.2
<u>Capnia bifrons</u>	0.2	-
<u>Capnopsis schilleri</u>	-	0.2
Total number	430	642

**Table 4. Flight periods of Plecoptera in the Dovrefjell mountains 1980 to 1983 given as number of specimens collected at weekly intervals.**

Species	May		June					July				Aug				Sept				Oct		
	N	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13
<u>Arcynopteryx compacta</u>	9					1	2	2	2	1	1											
<u>Diura bicaudata</u>	3						3															
<u>D. nanseni</u>	101		3	6	6	8	7	24	24	16	6	1										
<u>Isoperla difformis</u>	6								1	3	2											
<u>I. grammatica</u>	1081						21	37	481	293	139	69	17	2	12	4	3	3				
<u>I. obscura</u>	499								8	79	67	109	101	114	29	17	20	1	3	1		
<u>Dinocras cephalotes</u>	7								1	6												
<u>Siphonoperla burmeisteri</u>	1										1											
<u>Taeniopteryx nebulosa</u>	6	3	3																			
<u>Brachyptera risi</u>	157						1	5	11	33	36	19	36	7	7		2					
<u>Amphinemura borealis</u>	5										5											
<u>A. standfussi</u>	1206										4	98	116	127	143	120	189	274	48	41	45	1
<u>A. sulcicollis</u>	16643				5	1142	4144	726	8684	1670	226	28	12	4	1	1						
<u>Nemoura avicularis</u>	1274		251	499	67	189	202	27	37	2												
<u>N. cinerea</u>	2525			3	15	72	219	184	642	402	422	268	180	75	17	13	8	5				
<u>Nemurella pictetii</u>	4216			16	172	367	534	725	629	854	430	252	130	55	25	6	7	9	1	3	1	
<u>Protonemura meyeri</u>	7306			1	57	64	675	3555	1602	975	344	30	2	1								
<u>Capnia atra</u>	1402	9	106	66	9	12	89	938	92	54	19	6	2									
<u>C. bifrons</u>	4		3	1																		
<u>C. pygmaea</u>	2		1				1															
<u>Leuctra fusca</u>	11265											66	224	553	300	869	1074	2717	745	2741	1976	
<u>L. hippopus</u>	13600		3636	2245	335	1747	3219	605	1647	155	9	2										
<u>L. nigra</u>	726			7	137	130	163	64	87	56	41	20	16	3	2							

Table 5. Dates when 50% of annual catch of selected species of Plecoptera were obtained in Malaise trap sampling during 1980 to 1983.

<u>Arcynopteryx compacta</u>	7 July
<u>Diura nanseni</u>	7 July
<u>Isoperla difformis</u>	21 July
<u>I. grammatica</u>	21 July
<u>I. obscura</u>	18 Aug.
<u>Brachyptera risi</u>	28 July
<u>Amphinemura sulcicollis</u>	14 July
<u>A. standfussi</u>	1 Sept.
<u>Nemoura avicularis</u>	9 June
<u>N. cinerea</u>	14 July
<u>Nemurella pictetii</u>	14 July
<u>Protonemura meyeri</u>	7 July
<u>Leuctra hippopus</u>	23 June
<u>L. nigra</u>	30 June
<u>L. fusca</u>	22 Sept.

Only in the Raubekken and the Vestbekken did one species, *N. pictetii* and *A. standfussi*, respectively, outnumber all other species.

### Flight periods

Flight periods from late May to mid October is shown in Tab. 4. The data on the typical late winter species *T. nebulosa*, *C. atra*, *C. bifrons*, and *C. pygmaea* are only partly correct, because the captures only show the last part of their flight period. The dates when 50% of annual catch of 15 selected species is given in Tab. 5. Thirteen species have the median date in June and July. Only *I. obscura* had the median date in August, and two species, *A. standfussi* and *L. fusca* in September.

### DISCUSSION

The Malaise trap captures in the Dovrefjell mountains covered summer and autumn. However, *Capnia* spp. and *T. nebulosa* ap-

peared on the snow in April at the river Driva, and only the last part of their flight period was covered, except the site Blesbekken 1350 m where the Malaise trap was left out at a time when only a few meters of the stream was open. Up- and downstream to this open area the stream was completely covered with snow for a distance of several hundreds of meters. The relative abundance of stonefly species based on Malaise trap captures may be biased by shortwinged individuals, which may occur in *C. atra*, *A. standfussi* and *A. compacta* (Lillehammer 1974). *L. hippopus* may also have shortwinged specimens, but not in the mountains (A. Lillehammer pers. comm.). Populations with shortwinged specimens and reduced flight is likely to be caught in a lower percentage in Malaise traps than populations having longwinged specimens and normal flight ability. If and how much the shortwingedness has affected the data presented is unknown.

Thirteen species, *A. compacta*, *D. nanseni*, *I. obscura*, *B. risi*, *A. standfussi*, *A. sulcicollis*, *N. cinerea*, *N. pictetii*, *P. meyeri*, *C. atra*, *L. fusca*, *L. hippopus*, and *L. nigra* were captured at six or more sites, and must be regarded as widespread and common. The remaining eleven species have a restricted distribution, but may be locally abundant. *D. bicaudata*, *D. cephalotes*, *S. burmeisteri*, *A. borealis*, *N. avicularis*, and *C. pygmaea* were collected at one site only.

The various sites where collections were made vary in many ways, e.g. topography which may cause differences in the species composition. However, *P. meyeri* was very abundant at the Kallvella and fairly abundant at the Gluptjern and Stropla. These sites are all in the western mountains. *P. meyeri* was present at the stream Blesbekken on the eastern side also, but represented low percentages of the number of individuals captured. Lillehammer (1974) reported *P. meyeri* to be most numerous in small streams, and present up to 1300 m a.s.l.. In the Dovrefjell mountains *P. meyeri* was recorded up to 1452 m a.s.l. The difference in the distribution and abundance of *P. meyeri* between the eastern and the western side coincides with the differences in geology between the sides, but if the geology is the real reason for the difference is not known. None of the remaining species had a similar pattern of distribution as *P. meyeri*.

Most of the species recorded in the Dovrefjell National Park are expected to be found,

but from a zoogeographical point of view, a few should be commented on. *I. difformis* was captured at two sites, Jerosbekken and Kvernbecken, and are the westernmost records in the mountains of South Norway. *N. avicularis* was recorded only at Jerosbekken. Nøst (1981) also reports *N. avicularis* from one site only, the lake Lindalsvatn. These two mentioned records are, according to Lillehammer (1974), the westernmost records in the mountains of South Norway.

Lillehammer (1974) recorded 27 stonefly species in the eastern part and 22 species in the western part of the mountain range of South Norway. The present study, which is inbetween the areas reported by Lillehammer (1974), revealed 24 species to inhabit the watercourses of the Dovrefjell National Park. Compared with the eastern area (Lillehammer 1974), we have not recorded *Leuctra digitata*, but *L. digitata* is reported from the stream Grøvu west of the Dovrefjell mountains (Nøst 1981); nor did we find *Nemoura flexuosa* Aubert and *Isoperla nubecula* Newman. The two last mentioned species were neither reported by Nøst (1981) from the western part of the mountains of South Norway.

Lillehammer (1974, 1978) reported four species, *C. atra*, *A. standfussi*, *I. obscura* and *A. compacta* to occur in streams in the middle alpine zone in the Øvre Heimdalen area, Jotunheimen, and only *C. atra* and *A. compacta* are in common with the collections from the Dovrefjell mountains. *B. risi*, *A. sulcicollis* and *L. hippopus* were taken with one or two individuals only in the trap in the middle alpine zone, and are most likely blown in from lower areas.

From the Øvre Heimdalen area in Jotunheimen, Lillehammer (1978) reported 11 and 20 species from the low alpine and sub-alpine zones, respectively, and respectively 16 and 25 for the whole southern Norway (Lille-

hammer 1985). In the Dovrefjell mountains the corresponding numbers are 14 and 23 species. From a botanical point of view the Dovrefjell area is very rich in species, and a similar pattern may be true also for stoneflies when compared with other mountains areas at similar elevations.

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# Distribution and seasonal abundance of adult Tipulidae (Diptera) in the Dovrefjell National Park, South Norway\*

TROND HOFVANG, JOHN O. SOLEM AND SIMEN BRETTEEN

Hofsvang, T., Solem, J.O. & Bretten, S. 1987. Distribution and seasonal abundance of adult Tipulidae (Diptera) in the Dovrefjell National Park, South Norway. *Fauna norv. Ser. B*, 34, 51–56.

In Malaise traps from 11 sites 15 species of adult Tipulidae were collected in the Dovrefjell National Park, South Norway; 4 in the middle alpine zone, 11 in the low alpine zone and 10 in the subalpine zone. The only record of *Tipula (Pterelachisus) middendorffi* Lackschewitz in Fennoscandia is reported here. In Norway *Tipula (Savitschenkia) pagana* Meigen was earlier only known from the Oslo area and *Nephrotoma lundbecki* (Nielsen) only from North Norway.

Common species were *T. (A.) salicetorum*, *T. (V.) excisa*, *T. (S.) gimmerthali*, *T. (S.) invenusta* and *T. (S.) subnodicornis*. Rare species were *T. (V.) laccata*, *T. (V.) nubeculosa*, *T. (S.) pagana*, *T. (S.) grisescens*, *N. lundbecki* and *P. subserricornis*. The River Driva divide the area sampled into an eastern and a western area and great differences in the species composition between the two areas were found. Data on habitat preferences are given.

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## INTRODUCTION

The insect fauna of National Park in Norway is very poorly known. This paper is in a series with aim to increase the knowledge of the insect fauna of the Dovrefjell National Park. Our National Parks are areas with a high degree of protection, and scientific documentation of the fauna will increase the value of the parks as reference areas. Such reference areas are especially important in long term studies of insect communities. Such long term studies may include natural changes in communities and changes caused by external factors which artificially may stress communities, e.g. acid rain.

Tipulidae is worldwide the largest family in the order Diptera, may be divided into three subfamilies, Tipulinae, Cylindrotominae and Limoniinae (Byers 1984). Some investigators erase these subfamilies to families

(van Leeuwen 1978, Mendl 1978), and we have adopted this view, and our fam. Tipulidae is comparable to subfam. Tipulinae.

Apart from a few studies (Hogsvang 1972, 1974), only small and irregular sampling of tipulids have been made in Norway. The main objective of the present investigation was to study aquatic insects such as caddisflies (Trichoptera) and stoneflies (Plecoptera). The larvae of most of tipulids are also aquatic or semiaquatic, and adults are usually found along streams and around pools and ponds (Byers 1984). Larval tipulid abundance and distribution in woodland floodplains in North America appear to be influenced by high soil moisture and organic content (Merritt and Lawson 1981). The sampling sites chosen gave a good representative of the tipulid fauna as well, and this is the first comprehensive study of distribution and abundance of tipulids in a defined area in Norway.

\* Printing grant given by Kongsvoll biological station.

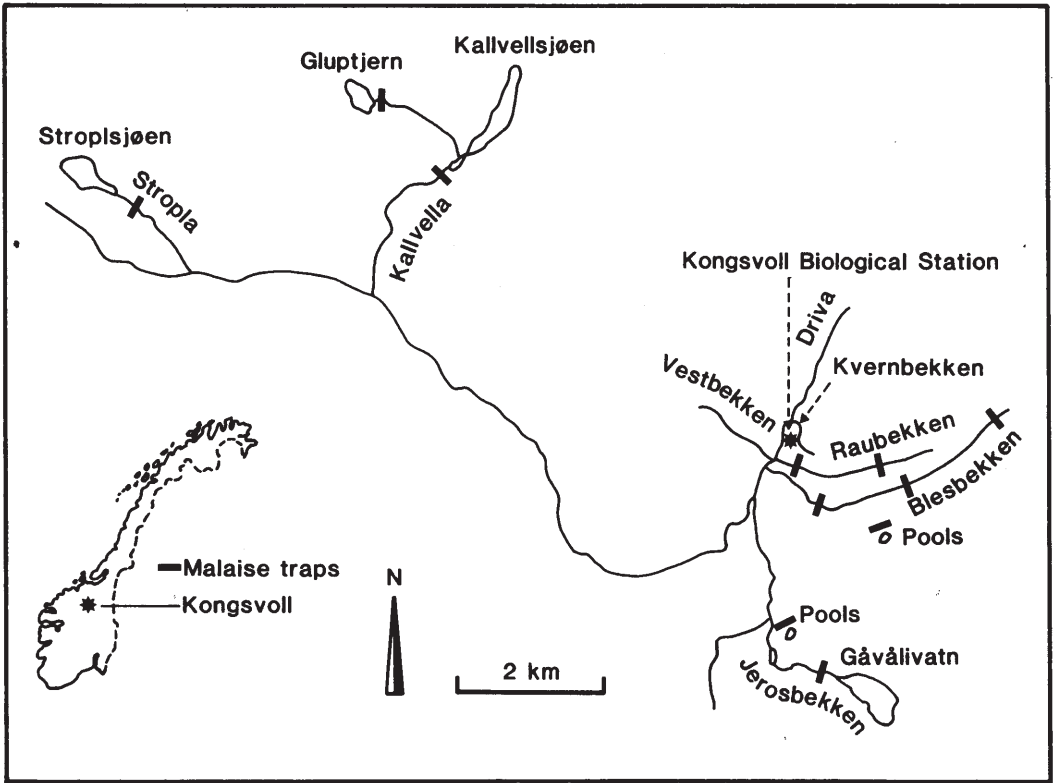


Fig. 1. Map of the surroundings of Kongsvoll Biological Station, showing also the sites of Malaise traps from which Tipulidae collections have been examined. The location of Kongsvoll is also indicated.

## STUDY AREA AND METHODS

The study area was the surroundings of Kongsvoll Biological Station ( $62^{\circ}17'N$ ,  $09^{\circ}59'E$ ) between the elevations 900 and 1452 m (Fig. 1). Two large geological regions in the southern Scandinavian Caledonian meet in the sampling area, and the border roughly follows the River Driva. On the eastern side is the Trondheim region, which contains mainly medium-grade mica schists and greenstones of the cambro-silurian age. The western side is mainly a basal gneiss region build up of high-grade gneisses and schists of pre-cambrian age. The differences in the geology between the eastern and the western side of the valley are most conspicuous when plant species are considered. The eastern side has a much higher diversity of plant species than the western one. The sampling sites Stropla,

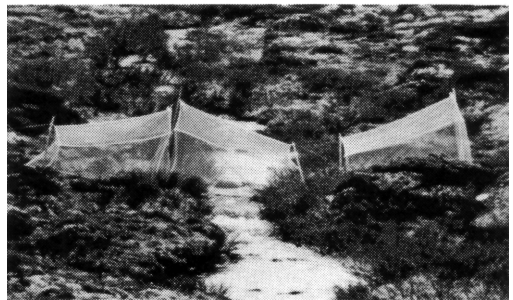


Fig. 2. Malaise traps used in the present study.

Kallvella and Gluptjern (Tab. 2) are on the western side and the remaining sites on the eastern side. The streams and lakes in the Stroplsjø area have pH in the range 6.0 to 6.5, and the lake Kallvellsjøen is about pH 6.8. The River Driva and lakes and streams on the eastern side have pH in the range 7.3 to 7.9 (Bretten unpubl. data).

The climate of the area is mainly continental, with a yearly precipitation of 473 mm at Kongsvoll. The yearly mean temperature at Hjerkin (955 m a.s.l. and 10 km south of

Table 1. Tipulidae species recorded in Dovrefjell National Park.

*Tipula (Arctotipula) salicetorum* Siebke, 1870  
*Tipula (Vestiplex) excisa* Schummel, 1833  
*T. (V.) montana*, spp. *verbernae* Mannheims & Theowald, 1959  
*T. (V.) laccata* Lundström & Frey, 1916  
*T. (V.) nubeculosa* Meigen, 1804  
*Tipula (Savtshenkia) gimmerthali* Lackschewitz, 1925  
*T. (S.) invenusta* Riedel, 1919  
*T. (S.) limbata* Zetterstedt, 1838  
*T. (S.) subnodicornis* Zetterstedt, 1837  
*T. (S.) pagana* Meigen, 1818  
*T. (S.) griseascens* Zetterstedt, 1851  
*Tipula (Platytipula) melanoceros* Schummel, 1833  
*Tipula (Pterelachisus) middendorffi* Lachsche-witz, 1936  
*Nephrotoma lundbecki* (Nielsen, 1907)  
*Prinocera subserricornis* (Zetterstedt, 1851)

Kongsvoll) is  $-0.1^{\circ}\text{C}$ , and only 19 days a year have daily mean temperature above  $10^{\circ}\text{C}$  (Nordhagen 1943).

Malaise trap samples (Fig. 2) from 11 sites along streams and at pools and lakes, have been used for this presentation. According to the definition of biotic zones in mountainous areas (Sjørs 1967, Rønning 1972), one of the sampling sites was in the middle alpine zone, six in the low alpine zone, and four in the subalpine zone. The middle alpine has patches of plant cover while a continuous plant cover is present in the low alpine zone. The subalpine is in this area characterized by a birch belt. Sampling was carried out during the years 1980—1983 and covered the months June to October.

Because of difficulties in identifying females of some of the species, our data include males only.

Table 2. Percentage composition of males at different habitats in subalpine -, low alpine -, and middle alpine zones in Dovrefjell National Park. Number of males collected at the different habitats shown at the bottom line of the table

	Subalpine zone				Low alpine zone						Middle alpine zone
	Blesbk 1000 m	Raubk 900 m	Gáváli 950 m	Dam Eo 930 m	Blesbk 1200 m	Blesbk 1350 m	Raubk 1200 m	Dam 1100 m	Kaldv 1220 m	Stropla 1280 m	Gluptj 1450 m
<i>Tipula (Arctotipula) salicetorum</i>									2.0	53.1	
<i>Tipula (Vestiplex) excisa</i>	3.1	19.0	5.4	16.7	46.8	85.7	34.6	12.5	63.5	30.6	42.9
<i>T. (V.) montana</i>						2.9			7.0	4.1	7.1
<i>T. (V.) laccata</i>						2.9					
<i>T. (V.) nubeculosa</i>			0.7								
<i>Tipula (Savtshenkia) gimmerthali</i>	72.3	53.3	60.8	8.3	8.5		55.1	12.5	0.5		
<i>T. (S.) invenusta</i>	6.1	4.2	28.4	25.0	27.7	8.6	6.4	31.3	24.0	10.2	
<i>T. (S.) subnodicornis</i>	9.2	18.7	1.4				3.8	12.5			14.3
<i>T. (S.) limbata</i>	4.6	0.5	0.7	8.3					6.3		
<i>T. (S.) pagana</i>	1.5										
<i>T. (S.) griseascens</i>			0.9								
<i>Tipula (Platytipula) melanoceros</i>	3.1	2.8	2.7	41.3	14.9			25.0	0.5		
<i>Nephrotoma lundbecki</i>					2.1						
<i>Prinocera subserricornis</i>										2.0	
<i>Tipula (Pterelachisus) middendorffi</i>									2.5		35.7
Number of males	65	214	148	12	47	35	78	16	200	49	14

## RESULTS

A total of 15 species were recorded in the area sampled (Tab. 1), but only 4 species, *Tipula (Vestiplex) excisa*, *T. (V.) montana*, *T. (Savtshenkia) subnodicornis* and *T. (Pterelachisus) middendorffi* were collected in the middle alpine zone (Tab. 2) which is above 1400 m a.s.l. Low numbers of specimens were collected in this zone, but *T. (V.) excisa* and *T. (P.) middendorffi* are certainly true inhabitants of this zone. Eleven species were found in the low alpine zone (which is between about 1100 and 1400 m a.s.l.), and all species caught in the middle alpine zone appeared here. Additionally, the following species occurred: *T. (S.) invenusta*, *T. (S.) gimmerthali*, *T. (Platytipula) melanoceros*, *T. (Arctotipula) salicetorum*, *Nephrotoma lundbecki*, *T. (V.) laccata*, and *Prinocera subsericornis*. Dominant species in the collections were *T. (V.) excisa*, *T. (S.) gimmerthali*, *T. (S.) invenusta* and *T. (A.) salicetorum*.

In the subalpine zone ten species were collected. Five species, *T. (V.) montana*, *T. (P.) middendorffi*, *T. (A.) salicetorum*, *T. (V.) laccata* and *P. subsericornis*, recorded in the alpine zone were not recorded in the sub-

alpine zone. Species only recorded in the subalpine zone were *T. (S.) pagana*, *T. (S.) grisescens* and *T. (V.) nubeculosa*. Abundant species in the subalpine collections were *T. (S.) gimmerthali*, *T. (S.) invenusta* and *T. (P.) melanoceros*. The tipulids were flying from early June to October (Tab. 3). In the Dovrefjell area June belong to spring/early summer, July—August is summer and September—October is autumn. Spring species are *T. (V.) nubeculosa*, *T. (S.) subnodicornis*, *T. (S.) pagana*, and *T. (S.) grisescens*. Summer species are *T. (A.) salicetorum*, *T. (V.) excisa*, *T. (V.) montana*, *T. (V.) laccata*, *N. lundbecki*, *T. (P.) middendorffi* and *P. subsericornis*. Autumn species are *T. (S.) gimmerthali*, *T. (S.) invenusta* and *T. (S.) limbata*. *T. (P.) melanoceros* seems intermediate between summer and autumn species.

## DISCUSSION

The flight periods of the species of Tipulidae in the Dovrefjell mountains are in accordance with those reported from two localities in Northern Sweden, the Messaure area, Lule Lappmark (Tjeder 1974), and the Abisko

Table 3. Flight periods of Tipulidae (Diptera) in the Dovrefjell mountains 1980 to 1983 shown as number of males collected in weekly intervals in Malaise traps

	June				July				Aug				Sept				Oct			
	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13	
<i>Tipula (Arctotipula) salicetorum</i>					2	23	1	1	2	1										
<i>Tipula (Vestiplex) excisa</i>			3	12	92	109	23	25	14		1									
<i>T. (V.) montana</i>					8	9		2												
<i>T. (V.) laccata</i>								1												
<i>T. (V.) nubeculosa</i>				1																
<i>Tipula (Savtshenkia) gimmerthali</i>													2	16	48	102	42	5	58	24
<i>T. (S.) invenusta</i>													1	12	33	57	36	5	2	
<i>T. (S.) limbata</i>													2	1	2			1	1	
<i>T. (S.) subnodicornis</i>		5	27	10	8	5	2													
<i>T. (S.) pagana</i>				1																
<i>T. (S.) grisescens</i>		1			1															
<i>Tipula (Platytipula) melanoceros</i>									3	14	5									
<i>Tipula (Pterelachisus) middendorffi</i>					1	5	3													
<i>Nephrotoma lundbecki</i>																			1	
<i>Prinocera subsericornis</i>																			1	



area, Torne Lappmark (Tjeder 1978). Except *T. (S.) pagana* and *T. (P.) middendorffi* the species found at Dovrefjell were included also in the Swedish investigations mentioned above. *T. (V.) excisa*, *T. (S.) invenusta*, *T. (S.) subnodicornis* and *T. (S.) grisescens* had nearly similar flight periods at Dovrefjell mountains and the low/middle alpine zone at Finse in the northern part of Hardangervidda, South Norway (Hofsvang 1974). Therefore, in the Scandinavian mountains from Hardangervidda, South Norway to Abisko, Torne Lappmark, the flight periods of the tipulid species do not deviate much.

The species of Tipulidae reported in the present study are found within the previously known distribution area in Norway except *T. (S.) pagana*, *T. (P.) middendorffi* and *N. lundbecki*. *T. pagana* was earlier only known from the Oslo area in Norway, but is recorded north to Ångermanland in Sweden (Tjeder 1955). *T. (P.) middendorffi* a boreal species and previously known from USSR east of Arkhangelsk (Theowald 1980), is reported new to Fennoscandia. *N. lundbecki* was earlier reported from North Norway (Mannheims 1951).

Of the 15 species collected from the Dovrefjell mountains, six species, *T. (V.) excisa*, *T. (V.) montana*, *T. (S.) gimmerthali*, *T. (S.) limbata*, *T. (S.) subnodicornis* and *T. (S.) grisescens*, show a boreoalpine disjunct distribution (Theowald & Oosterbroek 1985), which means that they are recorded in the continental European Alps and in the Scandinavian mountains. Five species have a boreal distribution, *T. (A.) salicetorum*, *T. (V.) laccata*, *T. (S.) invenusta*, *T. (P.) middendorffi* and *N. lundbecki*. With the exception of *T. (S.) invenusta*, these boreal species belong to a group of species with a mainly eastern Palaearctic distribution (Theowald & Oosterbroek 1985). *T. (V.) nubeculosa*, *T. (S.) pagana*, *T. (P.) melanoceros* and *P. subserricornis* are distributed in Northern Europe, but they are also a part of the tipulid fauna of the deciduous forests of the western and middle part of the European lowland (Theowald & Oosterbroek 1983).

Considering the number of specimens caught during 1980 to 1983 5 species, *T. (A.) salicetorum*, *T. (V.) excisa*, *T. (S.) gimmerthali*, *T. (S.) invenusta* and *T. (S.) subnodicornis* may be regarded as common or fairly common in the Dovrefjell National Park. All of these common species, except *T. (A.) sali-*

*cetorum*, were found in more than half of the number of localities sampled. *T. (A.) salicetorum* occurred in two traps only, at Kallvella and Stropla, and may set strong requirements to the habitat, but be locally abundant.

Six species, *T. (V.) laccata*, *T. (V.) nubeculosa*, *T. (S.) pagana*, *T. (S.) grisescens*, *N. lundbecki* and *P. subserricornis* must be regarded as rare in Dovrefjell National Park because they were only recorded at one locality and with one individual only. *T. (A.) salicetorum* and *T. (P.) middendorffi* were collected at two sites and on the western side only. The collections indicate that they have a restricted distribution in the area. *T. (V.) montana* was caught at the 4 highest collecting sites only. *T. (S.) gimmerthali*, *T. (S.) limbata* and *T. (P.) melanoceros* were recorded up to about 1200 m a.s.l. From tab. 2 it may look like that they are distributed only on the eastern side of the valley. This may be an artefact because of the collecting sites chosen. However, it is known from caddis-flies (Trichoptera) that great differences in species composition occur between the eastern and western side of River Driva (Solem 1985). The caddisfly *Apatania muliebris* McLachlan was dominant in the streams Blesbekken and Raubekken on the eastern side, but only scattered individuals were found on the western side. The differences found in geology, plant species and pH values between the eastern (range 7.3 to 7.9) and the western side (range 6.0 to 6.8) of the valley, may be reflected also in the species composition of the tipulids, but the present study does not give conclusive answers to this.

*T. (V.) excisa* on the other hand, was common at all sites and all high levels in the alpine zone on the eastern and the western side of the valley, and live in habitats rich in organic matter and in the present study have pH values between 6.0 to 7.9. *T. (S.) invenusta* showed a similar range in habitat preferences as *T. (V.) excisa*. Most tipulid larvae are detrital feeders (Byers 1984) and their ecological importance must be substantial in alpine areas. However, since tipulid larvae and adults are relatively large insects their ecological importance as food for other invertebrates, birds and mammals is probably even greater.

## ACKNOWLEDGEMENTS

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# Distribution, abundance and phenology of adult Neuropteroidea (Orders Planipennia, Raphidioptera and Megaloptera) and Mecoptera in the Dovrefjell mountains, South Norway\*

LITA GREVE, JOHN O. SOLEM AND SIMEN BRETTEEN

Greve, L., Solem, J.O. & Bretten, S. 1987. Distribution, abundance and phenology of adult Neuropteroidea (Orders Planipennia, Raphidioptera and Megaloptera) and Mecoptera in the Dovrefjell mountains, South Norway. *Fauna norv. Ser. B.* 34, 57–62.

Twelve species of Neuropteroidea and Mecoptera were collected in the Dovrefjell mountains. None were found in the middle alpine zone, but six and all twelve species were collected in the low and subalpine zones, respectively. Two species were common, *Hemerobius pini* Stephens, 1836 and *Wesmaelius nervosus* (Fabricius, 1793), while *Chrysoperla carnea* (Stephens, 1836), *Helicoconis lutea* (Wallengren, 1871), *Microgaster paganus* (L., 1767), *Hemerobius nitidulus* Fabricius, 1777, *H. perelegans* Stephens, 1836, *Wesmaelius malladai* (Navas, 1925), *W. mortoni* (McLachlan, 1899), *Sialis lutaria* (L., 1758), and *Boreus* sp. were rare. Because *W. mortoni* always occur with only a few specimens in collections, it is suggested that this species is rare in its whole area of distribution. *H. stigma* was collected as late as in October and is probably an autumn species. Adults of the remaining species were present in July and August and must be regarded as summer species.

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## INTRODUCTION

The insect fauna of National Parks in Norway is poorly known. This paper is in a series which aim to increase the knowledge of the insect fauna of the Dovrefjell National Park. Norwegian National Parks are areas with a high degree of protection, and scientific documentation of the fauna will increase the value of the parks as reference areas. Such reference areas are especially important in long term studies of insect communities and changes caused by external factors.

The superorder Neuropteroidea (Neuroptera s.l.) is divided in three orders: Planipennia (Neuroptera s. str.), Raphidioptera and Megaloptera. Planipennia is the largest of the three and is represented in Norway with five families: Hemerobiidae, Chrysopidae, Coniopterygidae, Sisyridae and Myrmeleontidae. The first three is represented in the material. The two last orders are small, and each

represented with only one family in Norway. This paper also deals with the small order Mecoptera represented in Norway with two families, of which only one, the Boreidae, have been found in the Dovrefjell National Park. The nomenclature for the Neuropteroidea follows Aspöck & Hölzel (1980). For the genus *Boreus*, see Svensson (1972).

A survey of the Norwegian Neuropteroidea and Mecoptera was made by Tjeder (1945), and since then several authors have added knowledge to the distribution and biology in Norway of single species or genera, but no larger survey has been made. Most of the published articles are enclosed in Aspöck et al. (1980). For additional information on Norwegian Mecoptera, see Greve (1965, 1975).

The main objective of the present investigation was to study aquatic insects. However, only the order Megaloptera have aquatic larvae of the group treated here, though a few larvae of Planipennia in families not found in this survey are also aquatic. The sites of Ma-

\* Printing grant given by Kongsvoll biological station.

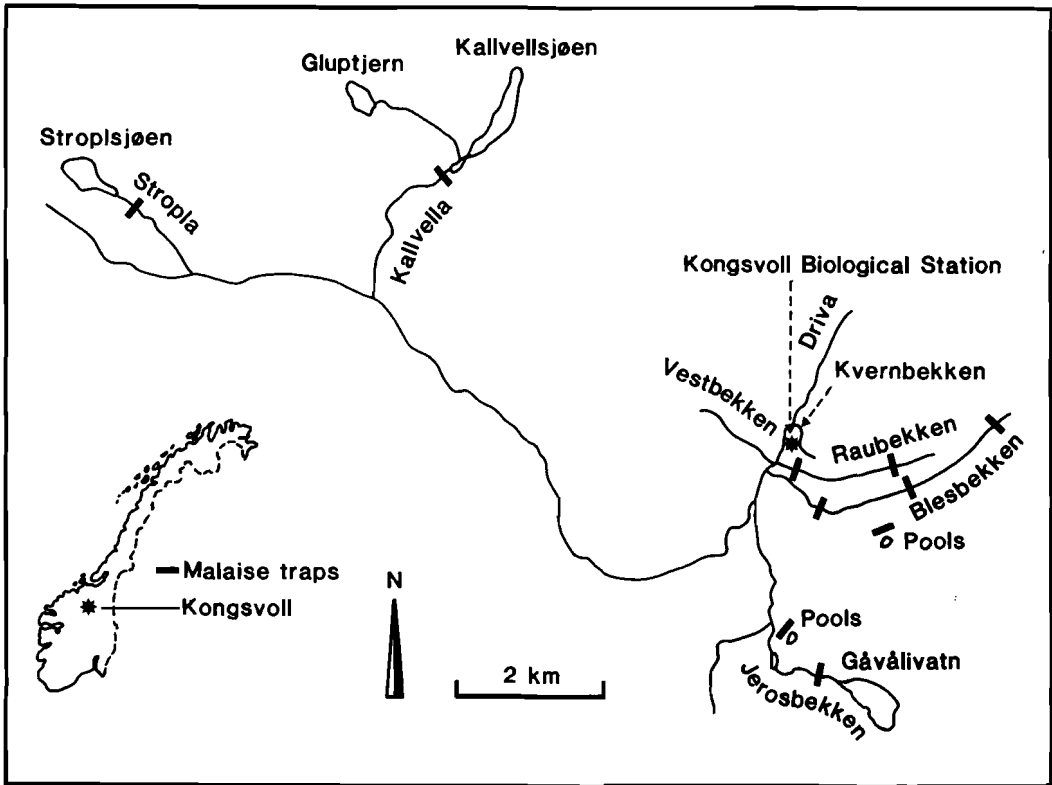


Fig. 1. Location of Kongsvoll in Norway, and a map of the area sampled. The sites of the Malaise traps are also indicated.

Malaise traps along streams and pools and lakes are thus not the best possible for collecting Neuropteridea. In spite of that, the material give interesting data from montane areas. On the other hand, Malaise traps give good information during periods of bad weather when nets are difficult to use efficiently.

## STUDY AREA AND METHODS

The study area was the surroundings of Kongsvoll Biological Station ( $62^{\circ}17'N$ ,  $09^{\circ}59'E$ ) between the elevations 900 and 1452 m (Fig. 1). The two large geological regions in the southern Scandinavian Caledonian meet in the sampling area, and the border roughly follows the River Driva. On the eastern side is the Trondheim region, which contains mainly medium-grade mica schists and greenstones of the cambro-silurian age. The western side is mainly a basal gneiss region build

up of high-grade gneisses and schists of pre-cambrian age. The differences in the geology between the eastern and the western side of the valley are most conspicuous when plant species are considered. The eastern side has a much higher diversity of plant species than the western one. The sampling sites Stropla, Kallvella and Gluptjern (Tab. 2) are on the western side and the remaining sites on the eastern side. The streams and lakes in the Stropelsjø area have pH in the range 6.0–6.5, and the lake Kallvellsjøen is about pH 6.8. The River Driva and the lakes and the streams on the eastern side have pH in the range 7.3–7.9 (Bretten unpubl. data).

The climate of the area is mainly continental, with a yearly precipitation of 473 mm at Kongsvoll. The yearly mean temperature at Hjerkin (955 m a.s.l.) 10 km south of Kongsvoll, is  $-0.1^{\circ}C$ , and only 19 days a year have daily mean temperature above  $10^{\circ}C$  (Nordhagen 1943).

Malaise trap samples from 11 sites along streams and at pools and lakes have been used for this presentation. According to the definition of biotic zones in mountainous areas

Table 1. Number of specimens (males/females) at different habitats in subalpine and low alpine zones in Dovrefjell National Park. Numbers of specimens collected at the different habitats shown at the bottom line of the table.

	Subalpine zone					Low alpine zone					
	Blesbk	Raubk	Gåvåli	Dam E6	Kongsvoll	Blesbk	Blesbk	Raubk	Dam E6	Kaldv	Stropla
	1000 m	900 m	930 m	930 m	Biol. St.	1200 m	1350 m	1200 m	1100 m	1220 m	1280 m
<u>Sialis lutaria</u> (L., 1758)	-	-	4/-	-	-	-	-	-	-	-	-
<u>Helicoconis lutea</u> (Wallengren, 1871)	-	-	1/-	-	-	-/1	-	-	-	-	-
<u>Hemerobius pini</u> Stephens, 1836	-	-	39/21	1/1	-	-/1	-	-/1	-	-	-
<u>Hemerobius nitidulus</u> Fabr., 1777	-	-	1/-	-	-	-	-	-	-	-	-
<u>Hemerobius perelegans</u> Stephens, 1836	-	-	-	-	-	1/1	-	-	-	-	-
<u>Hemerobius stigma</u> Stephens, 1836	-	2/1	-	-/1	1/2	1/-	-	-/3	-	-	-
<u>Micromus paganus</u> (L., 1767)	-	-	-/1	-	2/-	1/-	-	-	-	-	-
<u>Wesmaelius malladai</u> (Navas, 1925)	-	1/-	1/4	-	1/-	1/1	-	-	-	-	-
<u>Wesmaelius mortoni</u> (McLachlan, 1899)	-/1	-/1	-	-	-	-	-	-	-	-	-
<u>Wesmaelius nervosus</u> (Fabr., 1793)	-	-/4	9/14	-/2	-/2	19/11	-	12/4	-	-	-
<u>Chrysoperla carnea</u> (Stephens, 1836)	-	-	-	-	1/-	-	-	-	-	-	-
<u>Boreus westwoodi</u> Hagen, 1866	-	-	-	-	-/2	-	-	-	-	-	-
Number of specimens	1	9	95	5	11	38	-	20	-	-	-

Table 2. Flight periods of Neuropteroidea (Megaloptera and Planipennia) in the Dovrefjell mountains 1980—1985, shown as numbers of males/females collected in weekly intervals in Malaise traps.

	June			July			Aug			Sept			Oct						
	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13
<i>Hemerobius pini</i>	-	-	2/-	9/1	15/5	14/8	1/4	1/5	-	-	-	-	-	-	-	-	-	-	-
<i>Hemerobius stigma</i>	-	-	-	-	-	-	-	-	-/1	2/-	-	-	-	1/1	1/2	-	-/1	-	1/-
<i>Wesmaelius malladai</i>	-	1/-	-	-	1/-	1/2	-/1	1/-	-	-	-	-	-	-	-	-	-	-	-
<i>Wesmaelius nervosus</i>	-	-	-	1/1	5/4	9/10	9/7	2/11	2/2	1/1	-	1/-	-/1	-	-	-	-	-	-
<i>Sialis lutaria</i>	-	-	1/-	1/-	2/-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(Sjørs 1967, Rønning 1972), one of the sampling sites was in the middle alpine zone, six in the low alpine zone, and four in the subalpine zone. The middle alpine has patches of plant cover while a continuous plant cover is present in the low alpine zone. The subalpine is in this area characterized by a birch belt. Sampling was carried out during the years 1980—1983 and covered the months June to October.

## RESULTS

A total of 12 species were recorded in this study. No species were collected in the middle alpine zone (see Tab. 1), viz. above 1400 m a.s.l. Six species were found in the low alpine zone, between 1100 and 1400 m a.s.l. These are *Helicoconis lutea*, *Hemerobius perelegans*, *H. stigma*, *Micromus paganus*, *Wesmaelius malladai* and *W. nervosus*. *H. perelegans* was recorded only in the low alpine zone.

Two species were dominant in the samples, *H. pini* and *W. nervosus*. The remaining species were represented by single or few specimens only. One should, however, keep in mind that the number of specimens of these groups usually are rather low also in more favourable localities in Norway, and that mass occurrence is rarely seen.

In the subalpine zone 10 species were collected. Species recorded only in the subalpine zone are *Sialis lutaria*, *Chrysoperla carnea*, *H. nitidulus*, *W. mortoni*, and *Boreus* sp. The genus *Boreus* was represented by females only, and because these are difficult to identify, we have not listed species. However, only two species of *Boreus*, *B. hyemalis* (L., 1767) and *B. westsoodi* Hagen, 1866, have been recorded from Norway. Dominant species in the subalpine zone are the same as in the low alpine zone, viz. *H. pini* and *W. nervosus*.

The Planipennia were flying from June to October, but only a few species were sampled in such »high« numbers that they gave any reliable data on flight periods. These few species are listed in Tab. 2.

In the Dovrefjell area, June belongs to spring/early summer, July—August is summer, and September—October is autumn. There was no definite spring species. Summer species are *S. lutaria*, *H. pini*, *M. paganus* and *W. malladai*. *W. nervosus* seems intermediate

between summer and autumn. *H. stigma* is probably an autumn species.

Of the species represented with few specimens only, five were from July: *C. carnea*, *H. lutea* (early July), *H. nitidulus*, *H. perelegans* and *W. mortoni*. The single specimen of *W. concinnus* (see below) was caught in August. The *Boreus* specimens were found in late autumn.

## DISCUSSION

In addition to the 12 species recorded in this study, two more species have been recorded from areas bordering the National Park: *Raphidia ophiopsis* L., 1758 was recorded by Tjeder (1937) from Dovre, Fokstua, Oppland province, and *Wesmaelius concinnus* Stephens, 1836 at STI Oppdal, Driva (see Tab. 1). Two other species on the list, *Chrysoperla carnea* and *Boreus* sp. were only found in the vicinity of the Kongsvoll Biological Station.

The species of Neuropteroidea and Mecoptera reported here are within their previously known distribution areas in Norway. The groups are all rather poorly represented in the Scandinavian high mountains and none are confined to mountainous areas. All species have a wide distribution outside Norway.

Two species, *H. lutea* and *H. stigma*, have an Holarctic distribution. *H. nitidulus*, *M. paganus*, *W. malladai*, *W. mortoni* and *W. nervosus* have a distribution which cover most parts of Europe (excluded the Mediterranean areas) and parts of Asia. *W. nervosus* is also the only species of Planipennia found on Iceland and Greenland. *S. lutaria*, *H. pini* and *H. perelegans* are all widely distributed in Europe, but have not yet been reported from Asia. According to Vshivkova (1985), earlier reports which state *S. lutaria* to have a wide Palearctic distribution must be considered doubtful. *C. carnea* is today found nearly all over the world, brought by man to many places (Aspöck et al. 1980). Both *Boreus* species found in Norway have a wide European distribution. One species, *W. mortoni*, must be considered rare, both in this area and elsewhere (Greve 1984). Contrary to this, *W. nervosus* ranks among the most common Planipennia in North-Western Europe.

The biology of the adults of the species listed here is well known, while knowledge of the larval stages might be restricted. Many Planipennia, which all are predators, are found associated with certain plant groups,

this is probably because their prey live on these plants. Some species are always found near coniferous trees, *H. pini* and *H. stigma*, while others, like *M. paganus*, are mostly found on deciduous trees and herbage. *W. nervosus* has been recorded from many different plants.

Meinander (1972) found several species of Planipennia believed to live exclusively on coniferous trees far outside the areas of coniferous trees in northern Finland, and *Juniper communis*, growing like a low bush, may be a suitable habitat for species elsewhere found only on coniferous trees. While wind-drift may account for some specimens in mountainous areas (Greve 1969), the many specimens of *H. pini* cannot be explained by wind-drift, but only as specimens from a local population probably living on *Juniperus communis*.

Only two species, *H. pini* and *W. nervosus*, are common in the material. Most species must indeed be considered rare at Dovrefjell, because single specimens in one or at most two localities were found (see Tab. 1). The genus *Boreus* is underrepresented, because adults are winter active insects living in moss mostly under the snow cover during the winter, and they were thus not present during the collecting period June-October. The few specimens caught in the area were caught by hand in late October.

The flight periods for four species which were collected more than once or twice during the survey are shown in Tab. 2. *W. nervosus* have in Norwegian lowlands (Andersen & Greve 1975) been caught between June and November. The species is believed to be bivoltine on the northern British Isles (Killington 1936). At the Dovrefjell National Park *W. nervosus* seems to have a flight period restricted to July and first part of August, and is probably univoltine in this area. Based on information collected from museum material, *H. pini* in the Norwegian lowlands fly from early May until early October, though very few specimens have been caught after the middle of August. At Dovrefjell the bulk of the material were collected in July. *W. malladai* is represented with specimens caught as early as middle of June and until first week of August. *W. malladai* in western Norway fly as late as October with a start in June. *H. stigma* is the only species with a autumn flight period at Dovrefjell. In the Norwegian lowlands, the first specimens fly

in middle of April and adults are also found in late autumn, and hibernates as imago. *H. stigma* may be bivoltine in the lowlands and univoltine at Dovrefjell. Similar conditions for other species are found in middle Europe (Gepp 1975). The specimens of the only megalopteran caught, *S. lutaria*, was from 25 June to 9 July. *S. lutaria* is the only species of *Sialis* common in southern and central Norway. *S. lutaria* was also caught in similar biotops at Hardangervidda (Greve 1976), between 4 July and 1 August. The highest locality at Hardangervidda was at Normannslågen at 1243 m a.s.l. and thus in the lower alpine zone. The flight period is delayed in mountainous areas compared with lowland populations (Andersen & Greve 1975, Kaiser 1950), a phenomenon well known from other insect groups.

The populations of all species seem to be smaller than in the lowlands, though for some like *W. mortoni*, this conclusion cannot be drawn. The flight period of some species is definitely more restricted in the mountains than in the lowlands. As predators, they certainly take their toll among Aphididae and mites, well known food animals for the larvae, but since their size is rather small, they probably are not important as food for other invertebrates, fish (*Sialis lutaria* larvae only), birds or mammals.

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# Distribution and seasonal abundance of adult Limoniidae (Insecta, Diptera, Nematocera) in the Dovrefjell National Park, South Norway\*

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Mendl, H., Solem, J.O. & Bretten, S. 1987. Distribution and seasonal abundance of adult Limoniidae (Insecta, Diptera, Nematocera) in the Dovrefjell National Park, South Norway. *Fauna norv. Ser. B*, 34, 63—72.

In the mountains of Dovrefjell National Park, South Norway, we collected 45 spp. of fam. Limoniidae in Malaise traps in the years 1980 to 1983. *Dicranomyia incisurata* Lackschewitz is reported new to the Scandinavian fauna, and *Dicranota (Paradicranota) robusta* Lundström, *Ula mollissima* Haliday and *Symplecta scotica* Edwards new to the Norwegian fauna. The collecting covered the subalpine, low and middle alpine zones. The dominant species *Phyllolabis macroura* Siebke, made up 51.4% of the individuals in the subalpine zone, and 72.6% in the low alpine zone (1080—1400 m a.s.l.).

From zoogeographic aspects, the species list from Dovrefjell is compared with species lists from four other Scandinavian areas. Of the 45 species collected at Dovrefjell, 29 were in common with species from Varanger, North Norway, 24 with Ångerån, Sweden, 33 with Messaure, Sweden, and 37 with Torneträsk, Sweden. The montane areas Torneträsk and Dovrefjell, showed greatest similarity in species composition.

Data on phenology and notes on 10 species are given.

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## INTRODUCTION

During the years 1978 to 1984 the insect fauna of the Dovrefjell National Park was intensively studied. This paper deals with the species distribution, abundance, flight periods and zoogeographic views of the Limoniidae. The limoniids are poorly known in Norway. Mendl & Solem (1972) mentioned only very few papers dealing with the Limoniidae in Norway. The same conclusion can be drawn today too. Since 1972, only one additional paper has reported on Norwegian Limoniidae (Mendl 1984).

## STUDY AREA AND METHODS

This study was conducted in the Dovrefjell National Park, South Norway, where the Kongsvoll Biological Station is located (62° 17'N, 09°59'E, see Fig. 1). The River Driva is

the main water course into which all the smaller streams empty.

Two large geological regions in the southern Scandinavian Caledonian meet in the sampling area, and the border roughly follows the River Driva. On the eastern side is the Trondheim region, which contains mainly medium-grade mica schists and greenstones of the cambro-silurian age. The western side is mainly basal gneiss region build up of high-grade gneisses and schists of precambrian age. The differences in the geology are most conspicuous when plants are considered. The eastern side has a much higher diversity of plant species than the western one. The sampling sites Stropla, Kallvella and Gluptjern (Tab. 1) are on the western side, and the remaining on the eastern. The streams and lakes in the Stropla area have pH in the range 6.0 to 6.5, and the lake Kallvellsjøen is about pH 6.8. The River Driva and the streams and lakes on the eastern side have pH in the range 7.3 to 7.9 (Bretten unpubl. data).

\* Printing grant given by Kongsvoll biological station.

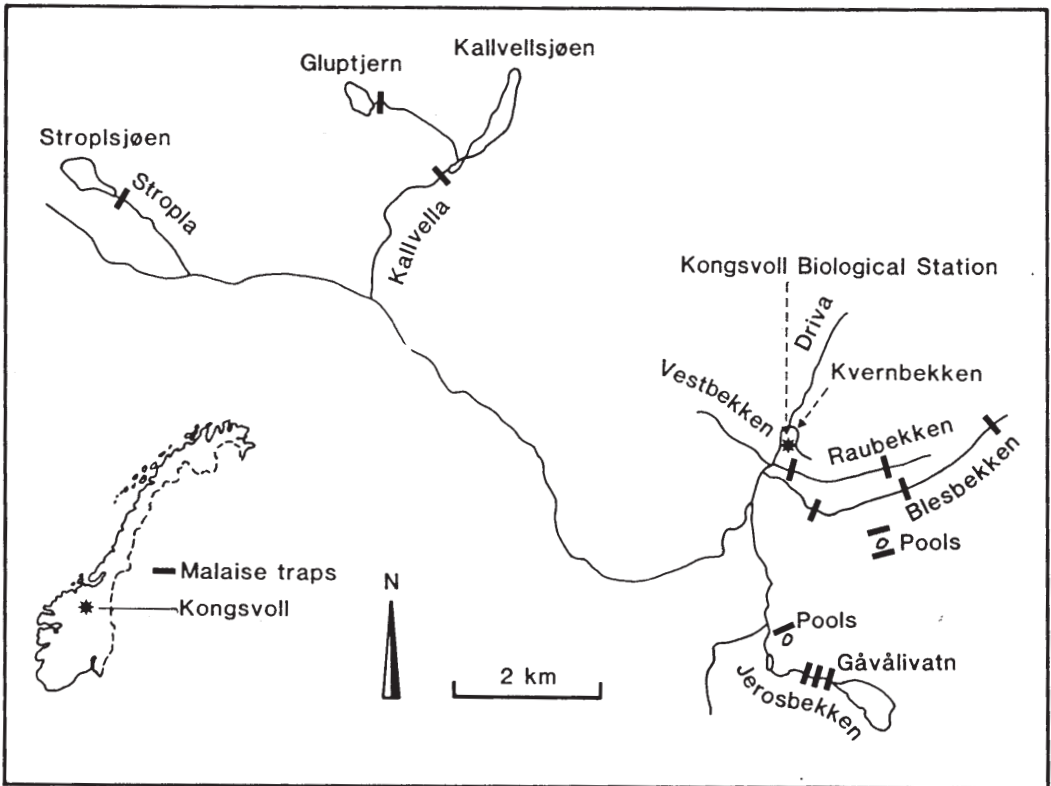


Fig. 1. Map of the area sampled in the Dovrefjell National Park, showing also the sites of the Malaise traps.

The climate of the area is mainly continental, with a yearly precipitation of 473 mm at Kongsvoll. The yearly mean temperature at Hjerkin (955 m a.s.l., and 10 km south of Kongsvoll) is  $-0.1^{\circ}\text{C}$ , and only 19 days a year have daily mean temperatures above  $10^{\circ}\text{C}$  (Nordhagen 1943).

Following the definitions of the biotic zo-



Fig. 2. Malaise traps used in the study.

nes after Sjörs (1967) and Rönning (1972), the sampling sites were located in three zones; the subalpine below ca. 1080 m a.s.l., the low alpine between 1080 and 1400 m a.s.l., and the middle alpine above 1400 m a.s.l. Only one site was sampled in the middle alpine zone, while 7 and 6 sites were sampled in the low and the subalpine zones, respectively. The main objective of the study was to obtain information about the aquatic insect fauna, and therefore, all sampling were done over or close to water courses. Malaise traps (Fig. 2) were set across streams, on the banks of streams, and at small and large standing water bodies. The traps were emptied once a week, and the first preservation liquid was 2–4% formalin, the definitive one 70% Ethanol. The collections are deposited at the University of Trondheim, The Museum.

#### SPECIES LIST

Forty-five species of Limoniidae, which refers to the following subfamilies: Pediciinae 10 spp., Hexatominæ 7 spp., Eriopterinae 14 spp. and Limoniinae 14 spp., were recorded:

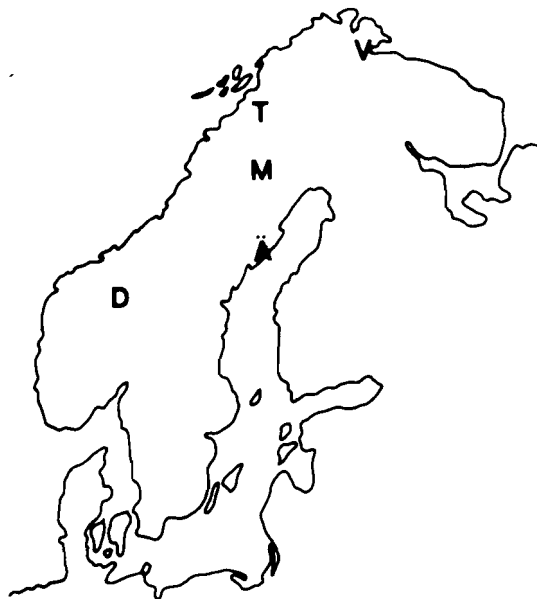


Fig. 3. Map of North-Western Europe. The letters show geographical areas in Norway and Sweden, where species lists have been used in comparison. D — Dovrefjell, Å — Ångerån, M — Messaure, T — Torneträsk and V — Varanger.

## PEDICIINAE

### Tribus Ulini

- Ula mollissima* Haliday, 1833  
*Ula sylvatica* (Meigen, 1818)

### Tribus Pediciini

- Tricyphona immaculata* (Meigen, 1804)  
*Tricyphona schummeli* Edwards, 1921  
*Dicranota* (s. str.) *bimaculata* (Schummel, 1829)  
*Dicranota* (s. str.) *guerini* Zetterstedt, 1838  
*Dicranota* (*Paradicranota*) *gracilipes* Wahlgren, 1905  
*Dicranota* (*Paradicranota*) *pavida* (Haliday, 1833)  
*Dicranota* (*Paradicranota*) *robusta* Lundström, 1912  
*Dicranota* (*Rhaphidolabis*) *exclusa* Walker, 1848

## HEXATOMINAE

### Tribus Limnophilini

- Eloephila trimaculata* (Zetterstedt, 1838)  
*Idioptera* (s. str.) *fasciata* (Linnaeus, 1767)

*Idioptera* (s. str.) *macropteryx* Tjeder, 1955

*Idioptera* (*Phylidorea*) *squalens* (Zetterstedt, 1838)

*Euphylidorea phaeostigma* (Schummel, 1829)

*Neolimnomyia* (*Brachylimnophila*) *nemorialis* (Meigen, 1818)

### Tribus Elephantomyini

*Phyllolabis macroura* Siebke, 1863

## ERIOPTERINAE

### Tribus Cladurini

*Crypteria limnophiloides* Bergroth, 1913  
*Chionea araneoides* Dalman, 1816

### Tribus Eriopterini

*Symplecta* (s. str.) *hybrida* (Meigen, 1804)  
*Symplecta* (s. str.) *scotica* Edwards, 1938

### Tribus Molophilini

- Erioconopa diuturna* (Walker, 1848)  
*Erioconopa trivialis* (Meigen, 1818)  
*Cheilotrichia* (*Empeda*) *cinerascens* (Meigen, 1804)  
*Ormosia* (s. str.) *fascipennis* (Zetterstedt, 1838)  
*Ormosia* (s. str.) *pseudosimilis* Lundström, 1912  
*Ormosia* (s. str.) *ruficauda* (Zetterstedt, 1838)  
*Ormosia* (s. str.) *staegeriana* Alexander, 1953  
*Rhypholophus haemorrhoidalis* (Zetterstedt, 1838)  
*Molophilus flavus* Goetghebuer, 1920

### Tribus Gonomyini

*Rhabdomastix* (*Sacandaga*) *parva* (Siebke, 1873)

## LIMONIINAE

### Tribus Antochini

*Orimarga attenuata* (Walker, 1848)

### Tribus Limoniini

- Rhipidia duplicata* (Doane, 1900)  
*Dicranomyia* (s. str.) *didyma* (Meigen, 1804)  
*Dicranomyia* (s. str.) *hyalinata* (Zetterstedt, 1850)  
*Dicranomyia* (s. str.) *incisurata* Lackshewitz, 1928

Table 1. Number of individuals of various species of Limoniinae collected in Malaise traps in the years 1980, -81, -82, and -83 at streams in the Dovrefjell National Park. Raubekken and Blesbekken were sampled during 1980 and -81, and the 1981 data are given in brackets.

	Gluptj. 1452	Blesbk. 1350 1200	Raubk. 1200	Dam B 1150	Dam C 1150	Kallvellsj. 1220	Stropla 1289	Blesbk. 1000	Raubk. 900	Dam E6	Gåvålibk. 3N 1 2		
<i>Dicranomyia incisurata</i>	1	8			3	1	1		11				1
<i>Dicranota guerini</i>	10	5		1		8	3	5					1
<i>Phyllolabis macroura</i>	1	12 146	139 (66)	263	99	50	42 342	(13)	113 (13)	81	2	3	2
<i>Limonia macrostigma</i>		1	(1)			1	1		(1)				
<i>Eloephila trimaculata</i>		2	1										
<i>Tricyphona immaculata</i>		4	1 (11)	1	7	3	10	6 (9)	1 (10)	1	1		
<i>Eriocnopa trivialis</i>		2					19						
<i>Melanolimonia caledonica</i>		1	1 (2)					(3)	2 (1)				2
<i>Rhaphidolabis exclusa</i>		2	11					23	(1)				
<i>Dicranomyia modesta</i>		1							1 (1)				
<i>Ormisia fascipennis</i>		1					7	5					
<i>Symplectia scotica</i>		3	(2)						1 (6)				
<i>Idiopiera macropteryx</i>		1	1 (3)	16	9	2	9	3	2 (2)	11	4		3
<i>Rhyppolophus haemorrhoidalis</i>		7						5 (2)	(1)				
<i>Ormosia staegeriana</i>		2	(10)		1			1 (1)	1 (1)				
<i>Orimarga attenuata</i>		1							1			1	
<i>Limonia sylvicola</i>		6	1 (3)				1	1 (2)	19 (11)			1	
<i>Dicranomyia hyalinata</i>		4	2 (2)	4	2		1	1	7 (1)	66			2
<i>Dicranomyia didyma</i>		1	1				1	15 (2)	1	1			
<i>Symplectia hybrida</i>		1		1				1	2 (2)				
<i>Dicranomyia autumnalis</i>		1						2 (1)	(1)				
<i>Ula mollissima</i>			1										
<i>Brachylimnophila nemoralis</i>			4 (1)	1	3			3	22 (6)	2		3	
<i>Molophilus flavus</i>			5 (12)						14 (11)			2	1
<i>Sphaeropyga stigmatica</i>			13 (8)		7			9 (3)	14 (14)	2	11	9	8
<i>Phylidorea squalens</i>			(1)						1				
<i>Tricyphona schummeli</i>			(1)						1				
<i>Sacandaga parva</i>			(1)		2				1				
<i>Eriocnopa diuturna</i>			(4)						1 (7)	2	2		2
<i>Melanolimonia rufiventris</i>					2				2				
<i>Ormosia pseudosimilis</i>						5	5						
<i>Dicranota bimaculata</i>						1							
<i>Euphyllidorea phaeostigma</i>							5						
<i>Empeda cinerascens</i>							2						
<i>Paradicranota gracilipes</i>							2						
<i>Ula sylvatica</i>								4					
<i>Rhipidia duplicata</i>								1 (1)					
<i>Idiopiera fasciata</i>								(1)					
<i>Crypteria limnophiloides</i>									1				
<i>Metalimnobia zetterstedti</i>									1				
<i>Ormosia ruficauda</i>									1				
<i>Dicranomyia terraenovae</i>									(1)				
<i>Chionea araneoides</i>									(4)				
<i>Paradicranota robusta</i>											1		
<i>Paradicranota pavidia</i>													1

Table 2. Distribution of Limoniidae species at different altitudes.

	Middle alpine >1400 m	Low alpine 1400- 1080 m	Sub- alpine <1080 m
<i>Dicranomyia incisurata</i>	X?	X	X
<i>Dicranota guerini</i>	X	X	X
<i>Phyllolabis macroura</i>	X?	X	X
<i>Limonia macrostigma</i>		X	X
<i>Eloephila trimaculata</i>		X	
<i>Tricyphona immaculata</i>		X	X
<i>Erioconopa trivialis</i>		X	
<i>Melanolimonia caledonica</i>		X	X
<i>Rhaphidolabis exclusa</i>		X	X
<i>Dicranomyia modesta</i>		X	X
<i>Ormosia fascipennis</i>		X	X
<i>Symplecta scotica</i>		X	X
<i>Idioptera macropteryx</i>		X	X
<i>Thypholophus haemorrhoidalis</i>		X	X
<i>Ormosia staegeriana</i>		X	X
<i>Orimarga attenuata</i>		X	X
<i>Limonia sylvicola</i>		X	X
<i>Dicranomyia hyalinata</i>		X	X
<i>Dicranomyia didyma</i>		X	X
<i>Symplecta hybrida</i>		X	X
<i>Dicranomyia autumnalis</i>		X	X
<i>Ula mollissima</i>		X	
<i>Brachylimnophila nemoralis</i>		X	X
<i>Molophilus flavus</i>		X	X
<i>Sphaeropyga stigmatica</i>		X	X
<i>Phyllidorea squalens</i>		X	X
<i>Tricyphona schummeli</i>		X	X
<i>Sacandaga parva</i>		X	X
<i>Erioconopa diuturna</i>		X	X
<i>Melanolimonia rufiventris</i>		X	X
<i>Ormosia pseudosimilis</i>		X	
<i>Dicranota bimaculata</i>		X	
<i>Euphyllidorea phaeostigma</i>		X	
<i>Empeda cinerascens</i>		X	
<i>Paradicranota gracilipes</i>		X	
<i>Ula sylvatica</i>			X
<i>Rhipidia duplicata</i>			X
<i>Idioptera fasciata</i>			X
<i>Crypteria limnophiloides</i>			X
<i>Metalimnobia zetterstedti</i>			X
<i>Ormosia ruficauda</i>			X
<i>Dicranomyia terraenovae</i>			X
<i>Chionea araneoides</i>			X
<i>Paradicranota robusta</i>			X
<i>Paradicranota pavida</i>			X

*Dicranomyia* (s. str.) *modesta* (Meigen, 1818)

*Dicranomyia* (s. str.) *terraenovae* (Alexander, 1920)

*Dicranomyia* (*Melanolimonia*) *caledonica* Edwards, 1926

*Dicranomyia* (*Melanolimonia*) *rufiventris* (Strobl, 1900)

*Dicranomyia* (*Sphaeropyga*) *autumnalis* (Staeger, 1840)

*Dicranomyia* (*Sphaeropyga*) *stigmatica* (Meigen, 1830)

*Metalimnobia zetterstedti* Tjeder, 1968

*Limonia macrostigma* (Schummel, 1829)

*Limonia sylvicola* (Schummel, 1829)

## HABITATS

Of the 45 species recorded, only 9 seem to be of terrestrial origin. The remaining species live in aquatic or semiaquatic habitats. Species of terrestrial origin are: *Phyllolabis macroura*, *Limonia macrostigma*, *Dicranomyia modesta* (?), *Limonia sylvicola*, *Ula mollissima*, *U. sylvicola*, *Rhipidia duplicata*, *Metalimnobia zetterstedti*, and *Chionea araneoides*. The dominant species in the low and subalpine zones is a terrestrial species.

## DISTRIBUTION AND ABUNDANCE OF SPECIES IN THE STUDY AREA

Tab. 1 shows the number of species collected at different sites during 1980 to 1983. Tab. 2 gives species collected at different altitudes, and Tab. 3 relative abundance in the low and subalpine zones.

In the middle alpine zone, three species, *Dicranota querini*, *Dicranomyia incisurata* and *Phyllolabis macroura* were collected. *D. querini* is certainly a true inhabitant of this biotic zone, but because only one specimen of each of *D. incisurata* and *P. macroura* was recorded, these species may have flown or blown in from lower altitudes.

In the low alpine zone, 36 species were collected. The very dominating species was *Phyllolabis macroura*, which occurred at all sites and outnumbered other species at most sites. Of 1125 specimens examined from the low alpine zone, *P. macroura* made up 72.6%, and the remaining species had each a lower percentage than 3.6, which was estimated for *Idioptera macropteryx*.

Thirty-seven species were caught in the subalpine zone, and again *Phyllolabis macroura* was the dominant species, counting 51.4% of 1006 individuals collected here. *P. macroura* was present at all sites investigated in this zone. The second dominant species was *Dicranomyia hyalinata*, which represen-

Table 3. Relative abundance of the most common species of Limoniidae in Malaise trap collections in low and subalpine zones in Dovrefjell National Park.

N = 1125 Low alpine		N = 1006 Subalpine	
<i>Phyllolabis macroua</i>	72.6%	<i>Phyllolabis macroua</i>	51.5%
<i>Idioptera macropteryx</i>	3.6%	<i>Dicranomyia hyalinata</i>	7.7%
<i>Tricyphona immaculata</i>	3.3%	<i>Sphaeropyga stigmatica</i>	7.0%
<i>Eriocnopa trivialis</i>	1.9%	<i>Limonia sylvicola</i>	3.6%
<i>Sphaeropyga stigmatica</i>	1.9%	<i>Brachylimnophila nemoralis</i>	3.6%
<i>Molophilus flavus</i>	1.5%	<i>Tricyphona immaculata</i>	2.8%
<i>Dicranomyia hyalinata</i>	1.4%	<i>Molophilus flavus</i>	2.8%
<i>Ormosia staeegerina</i>	1.2%	<i>Idioptera macropteryx</i>	2.5%
.....		<i>Rhaphidolabis exclusa</i>	2.4%
.....		<i>Dicranomyia didyma</i>	1.9%
.....		<i>Eriocnopa diuturna</i>	1.4%
		<i>Dicranomyia incisurata</i>	1.2%
		.....	
		.....	
		.....	

ted 7.7% of numbers, and third was *Sphaeropyga stigmatica*, counting for 7.0%. These two latter species occurred at 11 sites. The remaining species in the subalpine zone made up less than 4% each of the number of specimens. Of the species with low abundance, *Tricyphona immaculata* and *Limonia sylvicola* were found at 11 and 10 sites, respectively. All species recorded at 10 or more sites must be regarded as widely distributed in the area sampled. Forty species were collected at half or fewer number of sites sampled, and of these, 15 species were found at one site and 6 at two sites only (Tab. 4), and are very locally distributed or rare in the Dovrefjell National Park. Five species were recorded on the western side only, and 10 species on the eastern side only (Tab. 1).

summer and autumn species are *Dicranomyia didyma*, *D. autumnalis*, *D. modesta*, *D. terraenovae*, *Sphaeropyga stigmatica*, *Chionea araneoides*, and *Eriocnopa diuturna*. The longest flight period had *Dicranomyia hyalinata*, extending from July to October, and only three more species, *Sphaeropyga stigmatica*, *Limonia sylvicola*, and *Phyllolabis macroua*, and flight periods longer than two months.

Table 4. Species collected at 1 or 2 sites only, and which are rare or locally abundant in the Dovrefjell National Park.

1 site	2 sites
<i>Ula mollissima</i>	<i>Eloephila trimaculata</i>
<i>Dicranota bimaculata</i>	<i>Eriocnopa trivialis</i>
<i>Euphyllidorea phaeostigma</i>	<i>Dicranomyia modesta</i>
<i>Empeda cinerascens</i>	<i>Tricyphona schummeli</i>
<i>Paradicranota gracilipes</i>	<i>Melanolimonia rufiventris</i>
<i>Ula sylvatica</i>	<i>Ormosia pseudosimilis</i>
<i>Rhipidia duplicata</i>	
<i>Idioptera fasciata</i>	
<i>Crypteria limnophiloides</i>	
<i>Metalimnobia zetterstedti</i>	
<i>Ormosia ruficauda</i>	
<i>Dicranomyia terraenovae</i>	
<i>Chionea araneoides</i>	
<i>Paradicranota robusta</i>	
<i>Paradicranota pavidata</i>	

## PHENOLOGY

The flight period of the Limoniidae in the Dovrefjell mountains was June to October. Six species occurred as adults in June, 37 in July, 20 in August, 14 in September, and 10 in October (see Tab. 5). The first species to appear were *Idioptera macropteryx* and *Symplecta hybrida*. The latest species in autumn were *Dicranomyia hyalinata*, *Sphaeropyga stigmatica*, and *Chionea araneoides*, ten species, *Melanolimonia caledonica*, *Idioptera macropteryx*, *Ula mollissima*, *Paradicranota robusta*, *P. pavidata*, *Ula sylvatica*, *Symplecta hybrida*, *S. scotica*, *Sacandaga parva*, and *Rhipidia duplicata*, fly in early summer. Late

Table 5. Flight periods of Limoniidae in Dovrefjell National Park during 1980-83. The months are divided in four equal parts.

	June			July				Aug				Sept				Oct	
	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
<i>Idioptera macropteryx</i>	X	X	X	X	X	X	X	X									
<i>Symplecta hybrida</i>		X	X	X				X						X	X	X	
<i>Symplecta scotica</i>			X	X	X	X	X										
<i>Dicranota guerini</i>			X	X	X	X	X	X		X							
<i>Ula sylvatica</i>			X	X	X								X				
<i>Paradicranota robusta</i>			X														
<i>Idioptera fasciata</i>				X													
<i>Paradicranota pavida</i>				X													
<i>Melanolimonia caledonica</i>				X		X											
<i>Eloephila trimaculata</i>				X		X											
<i>Ormosia fascipennis</i>				X	X	X	X	X									
<i>Ula molissima</i>				X													
<i>Sacandaga parva</i>				X	X		X										
<i>Molophilus flavus</i>				X	X	X	X		X								
<i>Rhaphidolabis exclusa</i>				X		X	X	X	X								
<i>Brachylimnophila nemoralis</i>					X	X	X	X	X	X	X						
<i>Tricyphona immaculata</i>				X	X	X	X	X	X		X						
<i>Dicranomyia hyalinata</i>				X	X			X	X	X	X	X	X	X	X	X	X
<i>Dicranomyia incisurata</i>				X	X	X	X	X	X								
<i>Phylidorea squalens</i>					X												
<i>Tricyphona schummeli</i>					X	X											
<i>Rhipidia duplicata</i>					X										X		
<i>Crypteria limnophiloides</i>					X												
<i>Limonia macrostigma</i>					X	X	X										
<i>Metalimnobia zetterstedti</i>					X												
<i>Ormosia staegeriana</i>						X	X	X	X	X				X			
<i>Ormosia ruficauda</i>						X											
<i>Rhypholophus haemorrhoidalis</i>					X	X										X	
<i>Erioconopa trivialis</i>						X	X	X	X								
<i>Phyllolabis macroura</i>						X	X	X	X	X	X	X	X	X	X	X	X
<i>Orimarga attenuata</i>						X											
<i>Euphyllidorea phaeostigma</i>						X	X										
<i>Paradicranota gracilipes</i>							X										
<i>Dicranota bimaculata</i>							X										
<i>Melanolimonia rufiventris</i>							X	X		X							
<i>Ormosia pseudosimilis</i>							X	X									
<i>Limonia sylvicola</i>							X	X	X	X	X	X	X	X	X		
<i>Empeda sineracens</i>							X										
<i>Dicranomyia didyma</i>										X		X	X	X	X	X	
<i>Dicranomyia modesta</i>										X		X					
<i>Sphaeropyga stigmatica</i>										X	X	X	X	X	X	X	X
<i>Sphaeropyga autumnalis</i>												X	X	X			X
<i>Dicranomyia terraenovae</i>													X				
<i>Ericonopa diuturna</i>													X	X		X	
<i>Chionea araneoides</i>														X		X	X

### NUMBER OF SPECIES COLLECTED PER MONTH

A comparison of the number of species collected per month between Dovrefjell N. P. and three Swedish areas (Torneträsk, a mo-

untain area, 68°21'N, 18°49'E; Messaurø, a woodland area, 66°42'N, 20°25'E; and Ängerån, a coastland area, 63°55'N, 19°50'E) show some interesting features (Tab. 6, Fig. 4). In general there are great similarities between the Swedish localities, while the Dov-

Table 6. Number of species collected each month, and their percentage each month of the total number of species. Data given for Dovrefjell, Norway, and Torneträsk, Messaure and Ångerån, Sweden. (Data from Varanger, North Norway, could not be used because the sampling was not continuous over the warm season).

	May	June	July	Aug	Sept	Oct	Nov
Dovrefjell/mountain area 62°17'N, 09°59'E; n = 45	-	6 13.4%	37 82.2%	20 44.5%	14 31.1%	10 22.2%	-
Torneträsk/mountain area 68°21'N, 18°49'E; n = 73	-	9 12.3%	52 71.2%	56 76.7%	19 26.0%	3 4.1%	-
Messaure/woodland area 66°42'N, 20°25'E; n = 93	2 2.2%	35 37.6%	56 60.2%	60 64.5%	39 41.9%	12 12.9%	2 2.2%
Ångerån/coastal area 63°35'N, 19°50'E; n = 62	- 24.1%	15 62.9%	39 66.1%	41 43.5%	27 8.0%	5 1.6%	1

refjell mountains differ in several features. Firstly, the peak in number of species is much more pronounced at Dovrefjell, and secondly, a higher percentage of species are present in autumn at Dovrefjell than at the Swedish localities. The Dovrefjell and Torneträsk collections both have a low number of species in June, which certainly is caused by the late snowmelting in the mountains. While a definite peak in the number of species appeared in July at Dovrefjell, nearly equal numbers were found in July and August, with the very peak in August, at the Swedish localities. The low number of species found at Torneträsk in October compared to what was the case at Dovrefjell, may be related to the difference in daylength at that time between Torneträsk and Dovrefjell (look at the difference in latitude). The percentages given in Tab. 6 show a surprising similarity between Messaure and Ångerån localities. The differences between these two and Torneträsk and Dovrefjell, may be related to differences in altitudes between the localities. Dovrefjell and Torneträsk are mountain areas, while Messaure and Ångerån are lowland areas.

## ZOOGEOGRAPHY

Dovrefjell N. P. has a very interesting Limoniidae fauna. We have listed 45 species from the area. Among these, *Dicranomyia* (s. str.) *incisurata* is new for Scandinavia and North Europe. Three species, *Dicranota* (*Paradicranota*) *robusta*, *Ula mollissima* and *Symplecta scotica* are new to the Norwegian

fauna. When comparing the list of species from Dovrefjell with other Scandinavian areas, we have 29 spp. in common with Varanger, North Norway (where 51 spp. were found); 37 spp. with the Torneträsk mountains (73 spp); 33 spp. with the forest area in Messaure (93 spp); and 24 spp. with the coastal area at Ångerån (62 spp.). *Phyllolabris macroura* and *Dicranomyia incisurata* are typical for montane or northern latitude areas. *Idioptera macropteryx*, *Symplecta scotica*, *Sacandaga parva*, *Dicranomyia hyalinata* and *D. terraenovae*, have a northern distribution. The remaining species are more or less widely distributed in the western part of Palaearctic. Sixteen of the species are distributed to the eastern part of Asia, and three, *Ormosia fascipennis*, *Rhipidia duplicata* and *Dicranomyia terraenovae* also belong to the North American fauna (Tab. 7).

## NOTES ON SPECIES

Of the species collected at Dovrefjell, the following must be commented on specifically.

*Dicranota* (*Paradicranota*) *robusta* Lundström, 1912

Distribution: North and Middle Europe, Little Asia. Described from Finnish material, and later reported two times from Sweden (Småland and Messaure). Reported also from Denmark; Great Britain; Allgäu, Germany; Austria and Jugoslavia. This is the first report from Norway.



Table 7. Distribution of the Dovrefjell Limoniidae species in the Palearctic area. x = present, - = not present,<sup>1</sup> = also in North America.

Species collected at Dovrefjell	Varanger (51)	Abisko (73)	Messaure (93)	Ängersån (62)	Northern species	East Asia
<i>Ula molissima</i>	-	-	x	-		
<i>Ula sylvatica</i>	x	x	x	x		x
<i>Tricyphona immaculata</i>	x	x	x	x		
<i>Tricyphona schummeli</i>	x	x	-	-		
<i>Dicranota bimaculata</i>	x	x	x	x		
<i>Dicranota guerini</i>	x	x	x	x		x
<i>Paradicranota gracilipes</i>	x	x	x	x		
<i>Paradicranota pavida</i>	-	-	x	-		
<i>Paradicranota robusta</i>	-	-	x	-		
<i>Rhaphidolabis exclusa</i>	x	x	x	-		x
<i>Eloeophila trimaculata</i>	x	x	x	-		
<i>Idioptera fasciata</i>	x	x	x	-		
<i>Idioptera macropteryx</i>	x	x	-	x	x	x
<i>Phylidorea squalens</i>	x	x	-	-		x
<i>Euphylidorea phaeostigma</i>	-	x	x	x		
<i>Brachylimnophila nemoralis</i>	x	x	x	x		x
<i>Phyllolabis macroura</i>	-	x	-	-		
<i>Crypteria limnophiloides</i>	-	-	-	x		
<i>Chionea araneoides</i>	x	x	x	x		
<i>Symplecta hybrida</i>	-	x	-	x		x
<i>Symplecta scotica</i>	-	x	x	-	x	
<i>Erioconopa diuturna</i>	x	x	-	-		
<i>Erioconopa trivialis</i>	x	x	x	-		
<i>Empeda sineracens</i>	-	-	x	x		
<i>Ormosia fascipennis</i>	x	x	x	x		x <sup>1</sup>
<i>Ormosia pseudosimilis</i>	x	-	-	-		
<i>Ormosia ruficauda</i>	x	x	x	-		
<i>Ormosia staegeriana</i>	x	x	-	-		
<i>Rhypholophus haemorrhoidalis</i>	-	x	-	x		
<i>Molophilus flavus</i>	x	x	x	-		
<i>Sacandaga parva</i>	-	x	x	-	x	
<i>Orimarga attenuata</i>	-	x	x	-		
<i>Rhipidia duplicata</i>	-	x	x	x		x <sup>1</sup>
<i>Dicranomyia didyma</i>	x	x	x	x		
<i>Dicranomyia hyalinata</i>	x	x	x	x	x	x
<i>Dicranomyia incisurata</i>	-	-	-	-		x
<i>Dicranomyia modesta</i>	x	x	x	x		x
<i>Dicranomyia terraenovae</i>	x	x	x	x	x	x <sup>1</sup>
<i>Melanolimonia caledonica</i>	-	x	-	-		
<i>Melanolimonia rufiventris</i>	x	x	x	x		x
<i>Sphaeropyga autumnalis</i>	x	x	x	x		
<i>Sphaeropyga stigmatica</i>	x	x	x	x		
<i>Metalimnobia zetterstedti</i>	-	-	x	x		x
<i>Limonia macrostigma</i>	x	x	x	x		x
<i>Limonia sylvicola</i>	x	x	x	x		

*Ula mollissima* Haliday, 1833 (= *Ula crassicauda* Agrell, 1945, syn.)

Distribution: Great Britain, Sweden, CSSR, Germany, Austria, Switzerland. New to Norway.

*Idioptera macropteryx* Tjeder, 1955

Distribution: North and Mid-Scandinavia, East Asia. Fairly common in the Varanger area, but there is no report on this species from Finland, but surely it must occur also

there. This is a northern species, and the Dovrefjell area is the most southern site reported in Scandinavia. In Norway earlier only reported from the area at Skibotn and Varanger.

*Phyllolabis macroua* Siebke, 1863

Distribution: Scandinavia and the Alps. A boreo-alpine species, and its great abundance at Dovrefjell is somewhat surprising.

*Symplecta scotica* Edwards, 1938

Distribution: Great Britain, North Sweden (Messaurer and Abisko), North Finland (Sitonen leg.). *S. scotica* is very close to *S. hybrida*, but they are distinguished by the wing venation characters given by Edwards. *S. scotica* is new to Norway.

*Rhabdomastix (Scandage) parva* Siebke, 1873

Distribution: This species was described from material collected at Dovrefjell: Dovre (Fokstuen and Drivdalen / type specimens!), North Sweden (Abisko and Messaurer), Iceland. We have two more records from Norway; TRI, site at the road in northern Persko-gen, 1 female, 10 July 1984; HEN, at a swampy area near the road about 15 km north-west of Tynset, 31 females, 2 July 1985, Mendl leg. It is interesting to notice that only females of this species have been collected. A reliable question is; are we here dealing with a parthenogenetic species?

*Dicranomyia* (s. str.) *hyalinata* Zetterstedt, 1850

Distribution: North Europe, North Asia to East Asia.

*Dicranomyia* (s. str.) *incisurata* Lackschewitz, 1928

Distribution: The Alps, Hohe Tatra, Mongolia. Described from Mongolia as *D. sjöstedti* by Alexander, 1934, leg. Sven Hedin. *D. incisurata* occur at higher altitudes. New to Scandinavia and North Europe.

*Dicranomyia* (s. str.) *terraenovae* Alexander, 1920

Distribution: North-Eurasia. North America. This species was earlier reported as scarce in Scandinavia, as here at Dovrefjell also. However, *D. terraenovae* obviously find optimal habitats in forests, and is strongly attracted to light. In the collections from Messaurer, Swe-

den, *D. terraenovae* appeared in great abundances in light trap collections, and also in traps that were located quite a distance from wet areas.

*Dicranomyia (Sphaeropyga) stigmatica* Meigen, 1830

Distribution: Europe. *D. stigmatica* is very close to *D. nigristigma* Nielsen, 1919, and was described from Denmark. However, we are sure that our species is *D. stigmatica*, because one of us (H. Mendl) has seen nearly all material from Scandinavia.

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# Collembola from the Dovrefjell National Park, South Norway\*

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A list of 71 species, mainly from the Kongsvold area, is presented. A further 25—30 species are expected by future studies. An early species list from Kongsvold, published by Linnaniemi (1911), is commented. His record of *Tetracathella pilosa* Schött is considered dubious. The higher mountains in the park have a distinct element of rare, northern species.

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## INTRODUCTION

The information on alpine Collembola in south Norway is found in Linnaniemi (1911) and Fjellberg (1975, 1976, 1980). The present paper is based on Linnaniemi (op. cit.), Fjellberg (1976) and additional material collected by the author around Kongsvold in 1979. A few records from outside the formal borders of the national park are included (location in parenthesis following the species name). Species which were recorded by Linnaniemi but not recollected by the present author, are marked with an asterisk in the species list.

## SPECIES LIST

\**Hypogastrura purpureescens* (Lubbock), *H. viatica* (Tullberg) (on shore of Avsjøen), *H. lapponica* (Axelson), *Ceratophysella scotica* (Carp. & Evans), *C. denticulata* (Bagnall), *Willemia denisi* Mills (= *aspinata* Stach), *W. anophthalma* (Börner), *W. intermedia* Mills, *Friesea mirabilis* (Tullberg), *F. clavisea* Axelson, *Pseudachorutes subcrassus* Tullberg, *Micranurida pygmaea* Börner, *M. forsslundi* Gisin, *Anurida alpina* Agrell, *Paranura sexpunctata* Axelson, \**Neanura muscorum* (Templeton), *Onychiurus absoloni* (Börner), *O. arcticus* (Tullberg), *O. pseudovanderdrifti* Gisin, *Tullbergia arctica* Wahlgren, *T. italica* Rusek, *T. sylvatica* Rusek, *T. tenuisensillata* (Rusek), *Tetracanthella britannica*

*Cassagnau*, *T. wahlgreni* Linnaniemi, *Pseudanurophorus binocolatus* Kseneman, *P. inocolatus* Bödvarsson, *Folsomia agrelli* Gisin, *F. diplophthalma* (Axelson), *F. dovrensis* Fjellberg, \**F. fimataria* (L.), *F. nana* Gisin, *F. quadrioculata* (Tullberg), *F. sensibilis* Kseneman, *Isotomiella minor* (Schäffer), *Proisotoma borealis* (Axelson) (lake at Hjerkin), *P. subarctica* Gisin, *Agrenia bidenticulata* (Tullberg), *Vertagopus arcticus* Martynova, *V. cinereus* (Nicolet), *V. sarekensis* (Wahlgren), *V. westerlundii* Reuter, *Isotoma anglicana* Lubbock, *I. ekmani* Fjellberg, \**I. fenica* Reuter, *I. hiemalis* Schött, *I. neglecta* Schäffer, *I. notabilis* Schäffer, *I. olivacea* Tullberg, *I. violacea* Tullberg, *I. viridis* Bourlet, *Entomobrya nivalis* (L.), \**E. marginata* (Tullberg), \**Orchesella flavescens* (Bourlet), *Willowisia buski* (Lubbock), *Lepidocyrtus lignorum* (Fabricius), \**L. cyaneus* Tullberg, \**Tomocerus minutus* (Tullberg), *Sminthurides malmgreni* (Tullberg), *S. parvulus* (Krausbauer), *S. schoetti* (Axelson), *Arrhopalites principalis* Stach, *Sminthurinus aureus* (Lubbock), *S. concolor* (Meinert), \**S. niger* (Lubbock), \**Bourletiella pruinosa* (Tullberg), *Deuteriosminthurus rependus* (Ågren), *Heterosminthurus claviger* Gisin, *H. insignis* (Reuter), \**Sminthurus viridis* (L.), \**Dicyrtoma fusca* (Lucas).

## COMMENTS

Some of the taxa mentioned by Linnaniemi (1911) are collective names: *Hypogastrura armata* (Nicolet) is probably *Ceratophysella*

\* Printing grant given by Kongsvoll biological station.

*denticulata*, *Onychiurus armatus* (Tullberg) is probably *O. pseudovanderdrifti*, *Tullbergia krausbaueri* (Börner) could be a number of species, but hardly *krausbaueri* s. Rusek, *Tetracanthella pilosa* Schött is probably *T. britannica*. The true *pilosa* is only found twice in Norway (Troms, Fjellberg unpubl.). In addition Linnaniemi's record of *Bourletiella pruinosa* should be verified. The species might have been confused with both *pistillum* Gisin and *hortensis* (Fitch) which probably both occur in the area, although they were not present in the material at hand.

The above list counts 71 species. Further collections in the area will probably uncover some 25—30 additional species which are likely to be present in the area (Fjellberg 1980).

Most of the species on record are common and have a wide distribution in Norway. The more rare species are found in the alpine habitats: *Willemia intermedia*, *Anurida alpina*, *Tullbergia arctica*, *Pseudanurophorus inoculatus*, *Proisotoma subarctica*, *Vertagopus sa-*

*rekensis*, *V. arcticus*, *Sminthurinus concolor*. All these alpine species are present in north Norway as well, and appear to be more abundant there. *Vertagopus arcticus* is frequent in the high mountains in Troms and Finnmark, descending nearly to sea level in the Varanger peninsula. In south Norway it is so far only seen in a single sample from the summit of Mt. Snøhetta.

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# Bibionidae, Xylophagidae, Rhagionidae, Psilidae, Micropezidae, Clusiidae and Piophilidae (Diptera) from the Dovrefjell National Park, South Norway\*

LITA GREVE, JOHN O. SOLEM AND SIMEN BRETTEEN

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

Diptera belonging to the families Bibionidae, Xylophagidae, Rhagionidae, Micropezidae, and Clusiidae, together with some selected genera of Piophilidae and Psilidae, from the middle, low and sub-alpine zones ranging 1452 m to 900 m a.s.l., were investigated. Species of Bibionidae, Xylophagidae, Clusiidae and Piophilidae are only referred to, because they have been treated in previous papers.

Three species of Rhagionidae were collected in Dovrefjell National Park: *Rhagio scolopacea* (L.), *Symphoromyia crassicornis* (Panzer) and *Chrysopilus luteolus* (Fallén). *R. scolopacea* and *S. crassicornis* are both common in the area, while *C. luteolus* occur rarely in the sub-alpine zone. Flight periods for the common species are figured. The flight period for *S. crassicornis* is about the same in the Dovrefjell mountains and the lowland of Norway. *R. scolopacea* flies later in the season in the mountains than in the lowlands of Norway.

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Simen Bretten, Kongsvoll Biological Station, N-7340 Oppdal, Norway.

## INTRODUCTION

The present paper deals with Diptera belonging to several different families collected in the surroundings of Kongsvoll in the Dovrefjell mountains. The two families Psilidae and Piophilidae are represented with selected genera only. For the remaining five families, all material sorted out have been treated.

The area sampled is entirely within the Dovrefjell National Park and the adjacent protected area. Our national parks are areas with a high degree of protection, and the insect fauna is of great interest because scientific documentation of the fauna will increase the value of the parks as reference areas.

The methods used for collecting were chosen to give a good survey of the aquatic insects, and the traps were therefore placed near running or still water. For those Diptera whose larvae live in other habitats than water, wet or marshy areas, collecting at other

sites would probably give more comprehensive data on flies in the Dovrefjell National Park.

## STUDY AREA AND METHODS

The study area was the surroundings of Kongsvoll Biological Station (62°17'N, 09°59'E) between the elevations 900 and 1452 m (Fig. 1). Two large geological regions in the southern Scandinavian Caledonian meet in the sampling area, and the border roughly follows the River Driva. On the eastern side is the Trondheim region, which contains mainly medium-grade schists and greenstones of the cambro-silurian age. The western side is mainly a basal gneiss region built up of high-grade gneisses and schists of precambrian age. The differences in the geology between the eastern and the western side of the valley are most conspicuous when plant species are considered. The eastern side has a much higher diversity of plant species than the western one. The sampling sites Stropla,

\* Printing grant given by Kongsvoll biological station.

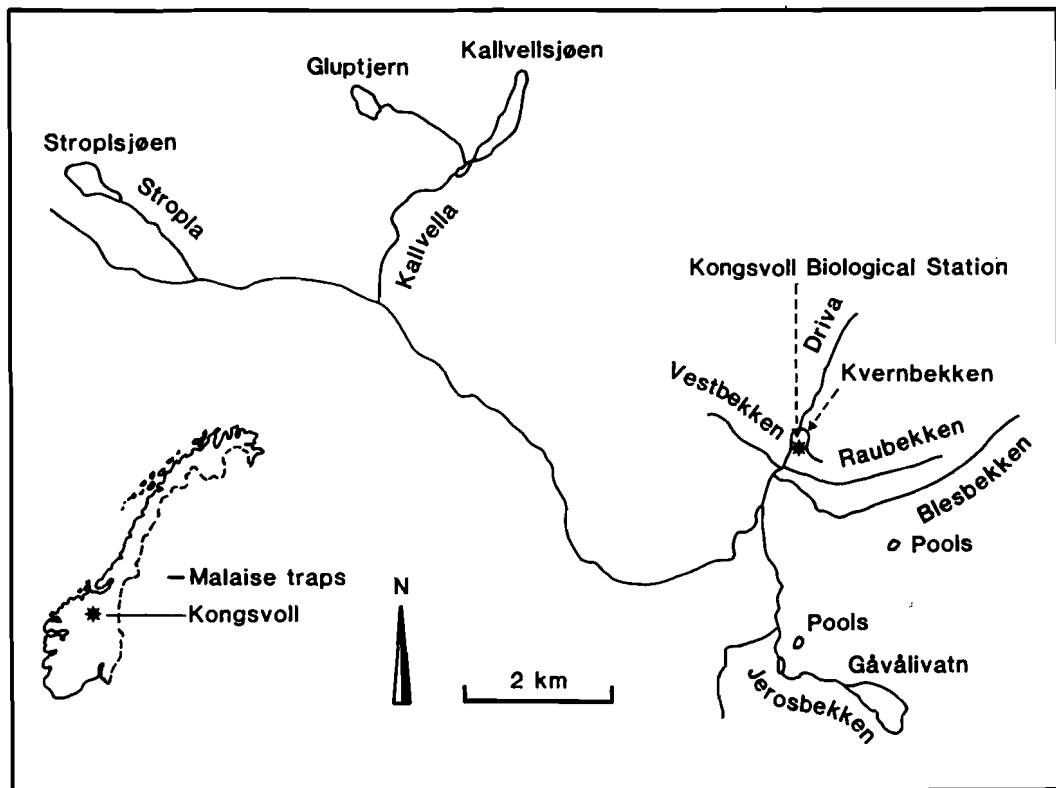


Fig. 1. Map of the area sampled.

Kallvella and Gluptjern are on the western side, and the remaining ones on the eastern side. The streams and lakes in the Stropisjø area have a pH in the range 6.0—6.5, and the lake Kallvellsjøen is about pH 6.8. The River Driva, the lakes and the streams on the eastern side have pH in the range 7.3—7.9 (Bretten unpubl. data).

The climate of the area is mainly continental, with a yearly precipitation of 473 mm at Kongsvoll. The yearly mean temperature at Hjerkin (955 m a.s.l.) 10 km south of Kongsvoll, is  $-0.1^{\circ}\text{C}$ , and only 19 days a year have daily mean temperatures above  $10^{\circ}\text{C}$  (Nordhagen 1943).

Malaise traps samples from 11 sites along streams, at pools and lakes, have been used for this presentation. According to the definition of biotic zones in mountainous areas (Sjörs 1967, Rønning 1972), one of the sampling sites was in the middle alpine zone, six in the low alpine zone, and four in the sub-alpine zone. The middle alpine has patches of

plant cover, while a continuous plant cover is present in the low alpine zone. The sub-alpine is characterized by a birch belt. Sampling was carried out during the years 1980—1983, and covered the months June to October.

## RESULTS

### Fam. Bibionidae

The following species were listed from the Dovrefjell mountains in Greve et al. (1984a): *Bibio clavipes* Meigen, 1818, *B. fulvipes* Zetterstedt, 1838, *B. rufipes* Zetterstedt, 1850, *B. pomonae* (Fabricius, 1885) and *Dilophus femoratus* Meigen, 1804. A sixth species can be added to the list: *Bibio nigriventris* Haliday, 1833. One female was collected at Raubekken on 17 July 1980. This was one of the unidentified specimens listed in Greve et al. (1984a). Additional material of *B. nigriventris*, 1 ♂ 5 ♀, were collected near Kongsvoll Biological Station 30 June 1981 (Zool. Mus.,

Univ. Bergen). *B. nigriventris* is widely distributed in Norwegian lowlands (Greve 1987), and the site at Raubekken represents the highest elevation of any sampling of *B. nigriventris* in Norway.

According to Malaise trap samples, *B. fulvipes*, *B. rufipes*, *B. pomonae* and *D. femoratus* seem fairly evenly distributed in the sub-alpine zone. In the alpine zone, *B. fulvipes* may be locally abundant and outnumber the remaining Bibionidae species. Readers who want to know more details, are referred to Greve et al. (1984a).

### Fam. Xylophagidae

One species, *Xylophagus compeditus* Wiedemann, 1851, was found in the area (Greve et al. 1984b). In addition to localities listed in Greve et al. (1984b), *X. compeditus* has also been found in TRI Kvænangen, Kvænangen (Ent. coll., Univ. Lund, Sweden), and in FØ Porsanger, Kistrand (Zool. Mus., Univ. Oslo), and is thus recorded from all over Norway. *X. compeditus* does not seem to be an abundant species in the Dovrefjell National Park. For more details, see Greve et al. (1984b).

### Fam. Rhagionidae

Three species were found: *Chrysopilus luteolus* (Fallén, 1814) (6 inds), *Rhagio scolopacea* (L., 1758) (12 inds) and *Symphoromyia crassicornis* (Panzer, 1809) (20 inds). Numbers in brackets represent total number of specimens.

1. *Chrysopilus luteolus* was not collected in the survey done by Solem (1985), but 2 ♂♂ 3 ♀♀ were netted by Tore R. Nielsen on 8 July 1966, at 800 m a.s.l. near the Biological Station at Kongsvoll, and 1 ♀ at Gåvålia on 20 July at 1960 m a.s.l. Both localities are in the sub-alpine zone.

*C. luteolus* has been found scattered in Norway north to northern part of Nordland province (Greve 1984), but was not collected in the survey of the International Biological Program at Hardangervidda (Greve 1980). The locality at Gåvålia at 960 m a.s.l. represents the highest elevation known in Norway.

2. *Rhagio scolopacea* was collected from two localities at Dovrefjell, Gåvålia and Raubekken, both in the sub-alpine zone. There are material collected near the Biological Station at Kongsvoll in both Zool. Mus., Univ. Oslo and Zool. Mus., Univ. Tromsø.

*R. scolopacea* is distributed all over Norway, and must be considered as very common. *R. scolopacea* was collected up to between 1100 and 1200 m a.s.l., viz. the lower alpine zone on Hardangervidda (Greve 1980). In the lowlands of Norway, the flight period commence in late May, and terminates in late July (Greve 1984). The flight period at Kongsvoll was found to be late June and July (Fig. 1).

3. *Symphoromyia crassicornis* was collected at Blesbekken 1980 and 1981 at 1000 m a.s.l., Raubekken at 900 m a.s.l., Gåvålia and Gåvålibekken at 930 m a.s.l. In addition, there are specimens in Zool. Mus., Univ. Bergen, collected near the Kongsvoll Biological Station and Grønnbakken at 940 m a.s.l. *S. crassicornis* is a common fly in mountain areas in Norway, but rather rare in the lowlands (Greve 1984). *S. crassicornis* was collected up to 1250 m a.s.l. at Hardangervidda (Greve 1980). The flight period in the lowland commence in middle of July, most records are from July and a few from the first part of August. The flight period in the Kongsvoll area is late June to early August (Tab. 1).

Table 1. Flight period of *Rhagio scolopacea* (L.) and *Symphoromyia crassicornis* (Panzer) in the Kongsvoll area. Numbers give monthly decades.

Species	June			July			August		
	1	2	3	1	2	3	1	2	3
<i>Rhagio scolopacea</i>			X	X	X	X			
<i>Symphoromyia crassicornis</i>			X	X	X	X	X		

### Fam. Psilidae

Material of Psilidae was not sorted out of the Malaise trap samples. However, a recent check of this family in the collections of Zool. Mus., Univ. Bergen, revealed one species probably new to the fauna of Norway. This record was from the Dovrefjell National Park: STI Oppdal, Kongsvoll, 1 ♀, 890 m a.s.l., 8 July 1966, *Psila (Psila) merdaria* Collin, 1944. Some of the specimens in Bergen had been determined as the closely related *P. fimetaria* (L., 1761). *P. fimetaria* was outnumbered by *P. merdaria* in the collection checked (2:12), and this could indicate that *P. merdaria* is the more common species. Lynneborg (1963) reports this trend in the Danish material. The distribution of *P. merdaria* (based on material in Bergen only) is: VE, HOY, HOI, SFI and TRY, viz. all over the country.

### Fam. Micropezidae

One species, *Calobata petronella* (L., 1758), was collected from Blesbekken, 1000 m a.s.l., and Raubekken, 900 m a.s.l. One female only from each locality. Material of *C. petronella* in Norwegian collections has been checked and only one locality at Haugastøl, Buskerud province, represents a sub-alpine habitat at 990 m a.s.l. *C. petronella* is a common fly species in the lowlands all over Norway.

### Fam. Clusiidae

One species, *Clusiodes apicalis* (Zetterstedt, 1841), was recorded from Blesbekken (8 inds). The family Clusiidae was treated by Greve & Midtgaard (1986), and the material from Blesbekken included. *C. apicalis* is found widely scattered in Norway.

### Fam. Piophilidae

One species, *Piophila (Amphipogon) flava* (Zetterstedt, 1838), was sorted out from the material where it occurred in surprising numbers at some localities, see also Greve & Solem (1983). *P. flava* has been found scattered in Norway. For more details, see Greve & Solem (1983).

### DISCUSSION

The present investigation and earlier surveys in mountainous areas in Norway (Greve 1980), show that the Rhagionidae, represented with three species, is well established in alpine habitats. Sweep-netting is a good method for collecting these flies, and a higher number of specimens were collected in the IBP survey at Hardangervidda, where such nets were much used. *C. luteolus* was not collected in Malaise traps, but solely by sweep-netting. Judged from material in Norwegian collections, *C. luteolus* will probably not be found above the sub-alpine zone.

*R. scolopacea* and *S. crassicornis* seem to have stable populations in alpine habitats. *S. crassicornis* is common in the Kongsvoll area, as it was at Hardangervidda also (Greve 1980). The species is fairly rare in the lowlands. This trend was first noted in Scandinavian material by Ringdahl (1951). The flight period of *R. scolopacea* commence and terminates later in the season in the Kongsvoll area than in the lowlands. Such differences between mountain and lowland populations are commonly found in insects. This is not found for *S. crassicornis*, where the flight period in the lowlands is approximately the same as in the Kongsvoll area.

The rhagionid genus *Ptiolina* was not found in the material. Some *Ptiolina* species confined to alpine habitats are rare, but have been recorded from a few areas in Norway. One record is from northern Oppland province, Dovre community, Svanå, at about 1200 m a.s.l., viz. an area bordering to the Dovrefjell National Park. It is reason to believe that *Ptiolina* is also present in the Dovrefjell National Park, but that this genus prefer other habitats than sampled in this survey. The genus is at present under revision, and it is still uncertain which species are represented in the Norwegian fauna outside the lowland species *P. obscura* (Fallén, 1814).

The Micropezidae and Psilidae are both represented with a small material, which give no basis for discussion. The families Bibionidae, Xylophagidae, Clusiidae and Piophilidae have been treated extensively in earlier publications referred to above.



## ACKNOWLEDGEMENTS

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# The thrips fauna near Kongsvoll in the Dovrefjell mountains (Sør-Trøndelag County, South Norway); distribution and habitat/host plant. (Thys., Insecta)\*

ANDERS OLSEN

Olsen, A. 1987. The thrips fauna near Kongsvoll in the Dovrefjell mountains (Sør-Trøndelag County, South Norway); distribution and habitat/host plant. (Thys., Insecta). *Fauna norv. Ser. B*, 34, 80—91.

A total of 27 thrips species were recorded near Kongsvoll in the Dovrefjell mountains (840—1684 m a.s.l.). Ten species were recorded above the tree border (abt 1100 m a.s.l.). Only *Apterothrips secticornis* (Trybom), *Aptinothrips stylifer* Trybom and *Thrips vulgatissimus* Haliday were found in the middle alpine (>1430 m a.s.l.). Several species had low population densities in the area, probably due to climatic conditions or to lack of food plants near their elevation limit. Other species were present in high numbers. The most abundant thrips species was *T. vulgatissimus*, whose larval development is largely dependent on the extensive *Salix* vegetation in the area.

*Scolothrips uzeli* Scille is reported from Norway for the first time.

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## INTRODUCTION

Kjellsen (1975) studied life history and population dynamics of *Aptinothrips stylifer* Trybom and *Apterothrips secticornis* (Trybom) on Hardangervidda (Hordaland County, West Norway). More recently Olsen & Solem (1982) listed some thrips records from Norwegian highlands, and Olsen (1984) reported sex ratios of three species of thrips living near Kongsvoll in the Dovrefjell mountains (Sør-Trøndelag County, Central Norway). Informations on the Norwegian alpine thrips fauna from other sources are fragmentary.

The main objective of the present study was an inventory of the thrips fauna at Dovrefjell. Collecting started in 1976, but the main field work was done during the summers 1977, 1978, and 1984.

Nomenclature and systematic arrangement of thrips species follow Jacot-Guillarmod (1970—78), apart from *T. atratus* Haliday, *T. pini* Uzel, and *T. vulgatissimus* Haliday which in accordance with Mound et al. (1976) are transferred from *Taeniothrips* Amyot & Serville to *Thrips* L. In addition,

\* Printing grant given by Kongsvoll biological station.

the catalogue of Jacot-Guillarmod does at present not comprise subfam. Phlaeothripinae (fam. Phlaeothripidae, suborder Tubulifera), and nomenclature and systematic arrangement here follow Priesner (1964). For identifications the keys in Ahlberg (1926), Maltbæk (1932), Priesner (1964), Mound et al. (1976), and Schliephake & Klint (1979) were used. Plant nomenclature is in agreement with Lid (1974).

## SAMPLING LOCALITIES

Sampling was carried out near Kongsvoll in the Dovrefjell mountains. The sampling area includes the upper part of the Drivdalen valley, Høgsnyta, Kongsvoll, Grønbakken, the Gåvålia areas, and the western parts of the Knutshø mountains. For detailed accounts on geology, climate and vegetation in the area, see e.g. Gjærevoll (1975), Nordhagen (1943), Strand (1975).

Because of conspicuous differences in vegetation and of course altitude, an individual species list is presented from each of the following parts of the area sampled:

1) The mixed vegetation along the Driva river (840 to 940 m a.s.l.). Near Kongsvoll biological station small fields alternate

with heather moor, willow thickets, birch shrubs, and former fields and/or meadows in different regrowing stages. Agricultural impact on vegetation decreases to the north and the south. In the north the birch forest stretches down to the valley bottom before shrub or heather moor take over. To the south the river mainly flow through shrub or heather vegetation.

2) The terrain against Gåvålia (abt 940 to 1000 m a.s.l.). In the south and south-eastern parts of the sampling area, against Gåvålia, there is a rather large poorly-wooded terrain, in which bogs and tarns alternate with heathers and ridges. The drier parts are largely covered by shrubs dominated by *Salix glauca* L., *Salix lapponum* L., and *Betula nana* L., and, more scattered, *Juniperus communis* L.

3) The subalpine birch forest (840 to 1100 m a.s.l.). Both blueberry and meadow birch forests are present. In some localities, especially on the western side of the Drivdalen valley, a luxuriant understory vegetation is present, often dominated by *Aconitum septentrionale* Koelle and *Geranium sylvaticum* L.

4) The lowalpine region (abt 1100 to 1300—1450 m a.s.l.). Due to different properties of the rocky ground, a more diverse alpine flora is present in the Knutshös area compared to alpine areas on the western side of the Drivdalen valley. However, on both sides of the Drivdalen valley, there is a zone characterized by willow species just above the tree border. In particular, this kind of vegetation is well developed in the slopes up to Midtre Knutshö mountain, and the dominating willow species are *Salix phylicifolia* L., *S. glauca*, *S. lapponum*, *Salix lanata* L., and *Salix myrsinites* L.

5) The middle-alpine region (1300—1450 to 1684 m a.s.l.), is characterized by grasses and *Cyperaceae* species. No part of the sampling area reach up to the high-alpine.

## MATERIAL AND METHODS

Collecting methods included net-sweeping and beating vegetation over a plastic tray. Specimens were removed from the tray or the net by a moistend tiny martenshair brush, or an aspirator. Also, specimens were washed off infested vegetation in soap-containing water in a special apparatus (e.g. Tayler & Smith 1955, Ota 1968). For separating thrips specimens from vegetation and litter a bat-

tery of ten Berlese-Tullgren funnels, modified according to Macfadyens (1955) small funnel extractor with air conditioning was employed. Flying specimens were caught in three suction traps of the «exposed cone type» (Johnson 1950, Taylor 1951, 1962) without any segregation mechanism. In addition water traps of different colours were used.

The material was collected into AGA (Mound et Pitkin 1972, Mound et al. 1976), and afterwards transferred to 60% alcohol. A Leitz binocular, ordinary with 10X oculars, and a standard plankton counting chamber (a plate of plexiglas, 129 x 68 x 8 mm, with four grooves, each 120 x 5 x 5 mm, the bredth measured at the bottom) were used for counting specimens. For identification and structural investigations a number of specimens were mounted on microscope slides in Canada Balsam or Hoyers mountat. The microscope used was a Standard WL Zeiss research microscope, with 12.5X oculars, 2.4X, 10X, 25X, 40X, and 60X objectives, phase contrast, ocular and optovar (0.8X—1.6X).

All the material is deposited in the collections of The University of Trondheim, The Museum, Zoological department.

## DISTRIBUTION AND HABITAT/HOST PLANT OF THE THRIPS SPECIES WITHIN THE SAMPLING AREA IN THE DOVREFJELL MOUNTAINS

In Tab. 1 the available data on guest/host relationships and habitat preference of the thrips species at Dovrefjell are summarized. However, we should bear in mind that thrips are small insects easily spread by wind, and some of the records may refer to animals accidently settled on unrelated vegetation.

It is very difficult to judge how far the observed distribution (Tab. 2) agrees with the real species distribution in the area, because the collection effort varied from place to place. In addition, several of the recorded species apparently have extremely low population densities at Dovrefjell and may therefore, by chance, have been missing in some of the collections. Nevertheless, it seems reasonable that the observed distribution pattern reflects differences in the climate and vegetational cover between the localities. Thus, the relatively high number of thrips species recorded in the mixed vegetation along the Driva

Table 1. Habitat/host plants for thrips species within the sampling area in the Dovrefjell mountains. ad: adult, L1: first instar larvae, L2: second instar larvae, PP: pre-pupae, P1: first instar pupae, P2: second instar pupae. 1) = only a single record.

Thrips species	Habitat/host plant	Altitude (abt m)	Stage ad.p	ad.o	L1	L2	PP	P1	P2
<u>Aeolothrips ericae</u>	<u>Arctostaphylos alpina</u> on a dry ridge	1000	X						
<u>Aeolothrips faciatus</u>	<u>Taraxacum</u> sp. on meadow	900		X					
<u>Sericothrips abnormis</u>	<u>Astragalus alpinus</u> along the E6 road	900	X						
	Vegetation of grasses, <u>A. alpinus</u> etc. near the birch forest (beating)	950	X						
<u>Sericothrips gracilicornis</u>	<u>Trifolium pratense</u> along the E6 road	900							
	<u>Astragalus frigidus</u> in birch forest and elsewhere	<1000	X	X					
	<u>Astragalus alpinus</u> along the E6 road	<950	X	X					
	<u>Astragalus norvegicus</u> along the E6 road	<950	X						
	Vegetation of <u>Arctostaphylos alpina</u> etc. on a dry ridge near the E6 road (beating)	880	X						
	Meadow vegetation of <u>Astragalus</u> spp. <u>Geranium sylvaticum</u> , grasses etc. (beating)	900	X						
<u>Chirothrips hamatus</u>	<u>Arrhenatherum pubescens</u> on meadow	900	X		X	X			
	Meadow (suction trap/sweeping)	900	X						
<u>Chirothrips manicatus</u>	Meadow (suction trap/sweeping)	900	X						
<u>Apterothrips secticornis</u>	<u>Urtica dioica</u> near the E6 road	<900	X						
	<u>Pedicularis oederi</u> on marchv ground, also in the low alpine	<1200	X		X	X			
	Meadow vegetation; grasses, <u>Astragalus</u> spp., <u>Geranium sylvaticum</u> etc. (beating)	<950	X						
	Understory vegetation in birch forest, most grasses (beating/sweeping)	<1100	X						
	Low and middle alpine herbs; grasses, <u>Hieracium</u> spp., <u>Geranium sylvaticum</u> etc. Also mire soaks (beating)	<1440	X						
<u>Aptinothrips stylifer</u>	<u>Urtica dioica</u> near the E6 road	900	X						
	<u>Melandrium rubrum</u> on meadow	900	X						
	<u>Astragalus frigidus</u> on bog	950	X						
	<u>Astragalus alpinus</u> , also along the E6 road	<950	X						
	<u>Pedicularis oederi</u> in mire soaks in birch forest	950	X						
	Herbs including grasses and several other plant species on meadows, in birch forest, and in the alpine regions. Often damp places (beating/sweeping)	<1440	X		X	X	Y	X	
<u>Belothrips acuminatus</u>	<u>Galium boreale</u> on meadow and along an old road in a dry grass heath	<1000	X	X	X	X			
<u>Oxythrips ajugae</u>	Meadow (suction trap)	900	Y						
	Vegetation in a mire soak in the birch forest (beating)	950	X						
<u>Oxythrips bicolor</u>	<u>Trifolium pratense</u> near the E6 road	900	X						
	Meadow vegetation; grasses, <u>Astragalus</u> spp. etc. (beating)	950	X						
<u>Ceratothrips ericae</u>	<u>Calluna vulgaris</u>	<1000	X	X	X	X			
	<u>Bartsia alpina</u>	1000	X						
	Heather vegetation, most <u>Arctostaphylos alpina</u> . Moist and dry places (beating)	<1120	X						
<u>Frankliniella tenuicornis</u>	Meadow (suction trap)	900	X						
<u>Mycterothrips latus</u>	<u>Retula pubescens</u> , also on individual trees outside the birch forest	<1150	X	X	X	X	X	X	X
	<u>Juniperus communis</u> in birch forest	950	X						
	<u>Urtica dioica</u> near birch forest	900	X						
	<u>Caltha palustris</u> in a moist place in birch forest	950	X						
	<u>Aconitum septentrionale</u> in birch forest	<1100	X			X			

Table 1, continues

Thrips species	Habitat/host plant	Altitude (abt m)	Stage						
			ad. ♀	ad. o	L1	L2	PP	P1	P2
	<u>Astragalus frigidus</u> in birch forest	<1100	X	X					
	<u>Geranium sylvaticum</u> in birch forest	<1100	X	X	X	X			
	Vegetation of grasses and other herbs in and near birch forest (sweeping/beating)	1150	X	X					
<u>Scolothrips uzeli</u>	<u>Juniperus communis</u> in dwarf shrub heath	1250	X						
<u>Taeniothrips picipes</u>	<u>Gymnadenia conopsea</u> in birch forest	950	X						
	<u>Hirtica dioica</u> near the E6 road	900	X						
	<u>Melandrium rubrum</u> on meadow	900	X						
	<u>Caltha palustris</u> on moist ground on meadow and in the birch forest	<950	X						
	<u>Aconitum septentrionale</u> in birch forest and other kinds of vegetation, also in the low alpine	<1150	X	X	X	X			
	<u>Astragalus frigidus</u> in birch forest and the low alpine	<1150	X		X	X			
	<u>Geranium sylvaticum</u> in birch forest and other kinds of vegetation, also in the low alpine	<1150	X	X	X	X			
	<u>Bartsia alpina</u> along the E6 road and in the low alpine	<1150	X		X	X			
	<u>Pedicularis oederi</u>	<1100	X	X	X	X			
	<u>Taraxacum</u> sp. on meadow and along the E6 road	900	X						
	Herbs (grasses etc.) on meadow, in the birch forest, and in the low alpine (sweeping/beating)	<1100	X						
<u>Thrips atratus</u>	<u>Melandrium rubrum</u> on meadow	900	X						
	Birch forest (emergence traps)	1000	X						
<u>Thrips dilatatus</u>	<u>Pedicularis oederi</u> , also in the low alpine	<1100	X						
	<u>Bartsia alpina</u> , on bog and near the E6 road	<950	X	X					
	Wetland vegetation, also in the low alpine (beating)	<1100	X						
	Understory vegetation in the birch forest (grasses, <u>Geranium sylvaticum</u> etc.) (beating)	<950	X						
<u>Thrips hukkineni</u>	<u>Trifolium pratense</u> along the E6 road	900	X						
	<u>Taraxacum</u> spp. along the E6 road and on meadow	900	X	X					
	<u>Hieracium</u> spp. along the E6 road	900	X						
	<u>Calathia palustris</u> on moist meadow	900	X						
	Meadow vegetation (grasses etc.) near the E6 road (beating/sweeping)	900	X						
<u>Thrips juniperinus</u>	<u>Pinus sylvestris</u> , transition zone between meadow and birch forest	900	X						
	<u>Juniperus communis</u> in different habitats, also in birch forest and low alpine dwarf shrub heath	<1150	X		X	X	X	X	X
<u>Thrips major</u>	<u>Dryas octopetala</u> in low alpine avens heath	1150	X						
	<u>Astragalus alpinus</u> in birch forest	1000	X						
	<u>Astragalus frigidus</u> in birch forest and in the low alpine	<1150	X	X					
	<u>Salix glauca</u> in a dry grass heath	930	X						
	<u>Salix myrsinites</u> in the low alpine	1150	X						
	<u>Betula nana</u> in birch forest and in the low alpine	<1250	X	X	X	X	X	X	X
	<u>Pedicularis lapponica</u> in the low alpine	1200	X						
	<u>Pedicularis oederi</u> on marshy ground in birch forest	1000	X						
	Herbs in dry places and on marshy ground, including species of grasses, <u>Astragalus</u> spp., <u>Achillea millefolium</u> etc. (beating/sweeping)	<1250	X	X					
<u>Thrips menyanthidis</u>	<u>Caltha palustris</u> in a mire soak in birch forest	950	X						
<u>Thrips validus</u>	<u>Caltha palustris</u> on moist meadow	900	X						
	<u>Taraxacum</u> sp. on meadow and along the E6 road	<900	X						

Table 1, continues

Thrips species	Habitat/host plant	Altitude (abt m)	Stage ad.q	ad.o	L1	L2	PP	P1	P2
<u>Thrips vulgatissimus</u>	<u>Juniperus communis</u> in birch forest and in the low alpine	<1250	X						
	<u>Betula nana</u> in birch forest and low alpine dwarf shrub heath	<1250	X						
	<u>Urtica dioica</u> on meadow and along the E6 road	<900	X						
	<u>Viscaria alpina</u> in the low alpine	1130	X						
	<u>Melandrium rubrum</u> on meadow	900	X						
	<u>Silene vulgaris</u> on meadow and along the E6 road	<900	X						
	<u>Caltha palustris</u> on moist ground on meadow	900	X						
	<u>Aconitum septentrionale</u> in birch forest, low alpine and elsewhere	<1200	X						
	<u>Saxifraga aizoides</u> near a brooklet in the low alpine	1130	X						
	<u>Prunus padus</u> in birch forest	1000	X						
	<u>Sorbus aucuparia</u> in birch forest	1000	X			X			
	<u>Comarum palustre</u> in the low alpine	1150	X						
	<u>Dryas octopetala</u> in mountain avens heath	1150-1470	X						
	<u>Trifolium pratense</u> on meadow and along the E6 road	<900	X						
	<u>Lotus corniculatus</u> along the E6 road	<1000	X						
	<u>Astragalus alpinus</u> along the E6 road and in birch forest	<1000	X						
	<u>Astragalus frigidus</u> in several localities, also in birch forest and the low alpine	<1200	X				X <sup>1)</sup>		
	<u>Geranium sylvaticum</u> in birch forest, low alpine and elsewhere	<1200	X						
	<u>Salix glauca</u> in the low alpine willow zone and several other localities	<1200	X		X	X			
	<u>Salix herbacea</u> in the low alpine	<1300	X		X	X			
	<u>Salix lanata</u> in the low alpine willow zone and several other localities	<1200	X		X	X	X		
	<u>Salix lapponum</u> in the low alpine willow zone and several other localities	<1200	X		X	X			
	<u>Salix myrsinites</u> in low alpine dwarf shrub heath	<1200	X		X	X	X	X	
	<u>Salix phylicifolia</u> in the low alpine willow zone and several other localities	<1200	X		X	X			
	<u>Calluna vulgaris</u> in different localities, also on bog	<1000	X						
	<u>Pedicularis lapponica</u> in the low alpine	1150	X						
	<u>Pedicularis oederi</u> in moist places within almost all parts of the sampling area	<1150	X				X <sup>1)</sup>		
	<u>Bartsia alpina</u> near the E6 road and in the low alpine	<1150	X						
	<u>Galium boreale</u> on meadow	900	X						
	<u>Solidago virgaurea</u> along the E6 road	<950	X						
	<u>Achillea millefolium</u> on meadow and along the E6 road	<900	X						
	<u>Chrysanthemum leucanthemum</u> on meadow	900	X						
	<u>Lactuca alpina</u> in low alpine tall forb meadow	1130	X						
	<u>Taraxacum</u> spp. along the E6 road, in birch forest and in the alpine regions	<1600	X						
	<u>Hieracium</u> spp. along the E6 road, in birch forest and in the low alpine	<1350	X						
	Herbs and heather vegetation. Peaten or swept from a large array of vegetation kinds; meadow vegetation including grasses and species of <u>Geranium sylvaticum</u> , <u>Aconitum septentrionale</u> and <u>Achillea millefolium</u> ; understory vegetation in birch forest; wetland vegetation (also in the low. and middle alpine); <u>Acetostaphylo alpina</u> -dominated vegetation on dry ridges	<1600	X						
	<u>Megathrips lativentris</u>	Litter under <u>Betula pubescens</u> in birch forest	<1100	X		X	X		
	<u>Haplothrips niger</u>	<u>Trifolium pratense</u> on meadow and along the E6 road	<900	X		X	X		
		Herbaceous vegetation along the E6 road (beating)	880	X					
	<u>Haplothrips propinquus</u>	<u>Achillea millefolium</u> on meadow and along the E6 road	<900	X	X	X	X		

Table 2. The thrips species recorded within each of the sampling localities in the Dovrefjell mountains

	The subalpine birch belt (<850-1100 m a.s.l.)			The alpine regions (>1100 m a.s.l.)	
	The mixed vegetation along the Driva river (23 species)	The terrain against Gåvålia (11 species)	The sub- alpine birch forest (14 species)	The low- alpine region (10 species)	The middle- alpine region (3 species)
<i>Aeolothrips ericae</i>		X			
<i>Aeolothrips faciatius</i>	X				
<i>Sericothrips abnormis</i>	X				
<i>Sericothrips gracilicornis</i>	X	X	X		
<i>Chirothrips hamatus</i>	X				
<i>Chirothrips manicatus</i>	X				
<i>Apterothrips secticornis</i>	X		X	X	X
<i>Aptinothrips stylifer</i>	X	X	X	X	X
<i>Belothrips acuminatus</i>	X	X			
<i>Oxythrips ajugae</i>	X		X		
<i>Oxythrips bicolor</i>	X				
<i>Ceratohrips ericae</i>	X	X	X	X	
<i>Frankliniella tenuicornis</i>	X				
<i>Mycterothrips latus</i>	X	X	X	X	
<i>Scolothrips uzeli</i>				X	
<i>Taeniothrips picipes</i>	X	X	X	X	
<i>Thrips atratus</i>	X		X		
<i>Thrips dilatatus</i>	X	X	X	X	
<i>Thrips hukkineni</i>	X				
<i>Thrips juniperinus</i>	X	X	X	X	
<i>Thrips major</i>	X	X	X	X	
<i>Thrips menyanthidis</i>			X		
<i>Thrips validus</i>	X				
<i>Thrips vulgatissimus</i>	X	X	X	X	X
<i>Megathrips lativentris</i>			X		
<i>Haplothrips niger</i>	X				
<i>Haplothrips propinquus</i>	X				

may be related to the diverse flora and low altitude of this part of the sampling area. Correspondingly, the much lower number of species recorded in the other parts of the sampling area may be ascribed to a more homogenous vegetation, and/or the more harsh climate at higher altitudes.

The numbers of collected specimens should not without caution be taken as an indication of relative species density. For some species the numbers also refer to large numbers of specimens collected for phenological studies, and the collection methods do not offer the same efficiency for all species. On the other hand, several samples contain immatures, which, at present, have not been determined, and hence are not included here.

#### *Aeolothrips ericae* Bagnall, 1920

The only record from Dovrefjell refers to a single female specimen (*f. mulleri*) beaten from heather of *Arctostaphylos alpina* (L.) Spreng. in the terrain against Gåvålia (abt

1100 m a.s.l.) (Host plant reported by Olsen & Solem (1982) as *Erica* sp., was a writing error of Ericaceae species.) In the vicinity of Trondheim the preferred hosts of the species seem to be *Trifolium pratense* L. and *Lotus corniculatus* L. (Olsen & Solem 1982). Records reported in the literature are predominantly from plants belonging to Fabaceae and Ericaceae, but in addition the species has been collected from plants from a variety of families (Priesner 1926—28, Mound et al. 1976, Schliephake & Klint 1979). According to Bagnall, the larvae is carnivorous (Priesner 1926—28).

#### *Aeolothrips faciatius* (Linné, 1758)

A single specimen, a male, was beaten from *Taraxacum* sp. in the mixed vegetation along Driva (abt 950 m a.s.l.). According to Jacot-Guillarmod (1970) and Schliephake & Klint (1979) the species is predator on thrips and mites, without any plant preference.

*Sericothrips abnormis* (Karny, 1909)

Two micropterous females were collected in the mixed vegetation along Driva. One was beaten from *Astragalus alpinus* L., the other swept from meadow, where also *A. alpinus* was present. Elsewhere in Norway, the species has been collected from *L. corniculatus* (Olsen & Solem 1982). Mound et al. (1976) claim *L. corniculatus* to be the host species, while e.g. Priesner (1964) and Schliephake & Klint (1979) list additional Fabaceae genera.

*Sericothrips gracilicornis* Williams, 1916

A common species in flowers of *Astragalus frigidus* L. and *A. alpinus* at the Dovrefjell mountains (coll. ad. + larvae, N >> 100). Obviously more numerous in the birch forest than in the other sampling localities. On Tjømø (Vestfold county) and Rombakken (Nordland county) numerous specimens have been collected from *V. cracca* (Olsen & Solem 1982), and according to Mound et al. (1976) and Schliephake & Klint (1979) *Vicia cracca* L. is the preferred host of the species. However, records have also been reported from other species of Leguminosae, and from unrelated plant genera as *Galium*, *Salix*, *Melanpyrum*, *Teucrium*, *Secale*, and *Avena* (Jacot-Guillarmod 1971).

*Chirothrips hamatus* Trybom, 1895

Females and larvae were swept from *Arrhenatherum pubescens* in the mixed vegetation along the Driva river (coll. ad. + larvae, N > 10). The species was not found on the common *Alopecurus geniculatus* L., even though the close relative *Alopecurus pratensis* L., in addition to *Phleum* spp., belong to its main host plants elsewhere (Priesner 1964, Jacot-Guillarmod 1971, Schliephake & Klint 1979, Olsen & Solem 1982).

*Chirothrips manicatus* Haliday, 1836

Females were taken in the mixed vegetation along the Driva river by suction traps, and by net-sweeping on different meadow grass species (coll. N > 5). At the other localities the species was not found, although potential host vegetation for this rather polyphagous grass-thrips species occurred there. It may therefore be possible that the species reach its elevation limit abt 900 m a.s.l. in the area. Elsewhere in Norway specimens of *C. manicatus* have been collected from different gras-

ses, but also from several other plants, e.g. *Calluna vulgaris* (L.) Hull, *Spergula arvensis* L., *V. cracca*, *Rosa* sp., *Hieracium* sp., and *Taraxacum* sp. (Olsen & Solem 1982). Schliephake & Klint (1979) state *Poa alpina* L. to be its preferred host, but records from other grass species, and also from plants belonging to other plant groups, have been repeatedly reported (e.g. Priesner 1926—28, 1964, Jacot-Guillarmod 1971, Mound et al. 1976, Schliephake & Klint 1979).

*Apterothrips secticornis* (Trybom, 1896)

Not uncommon on moist ground in the mixed vegetation along the Driva River, in the birch forest, and in the alpine regions (coll. ad. + larvae, N > 80). Females and larvae of the species were swept and beaten from different grasses, but also from *Pedicularis oederi* Wahl. Mond et al. (1976) and Schliephake & Klint (1979) claim grasses to be prime hosts of the species, although records from different other plants have been reported (Priesner 1926—28, Jacot-Guillarmod 1974).

*Aptinothrips styliifer* Trybom, 1894

Recorded from all parts of the sampling area, up to 1430 m a.s.l. (coll. ad. + larvae, N >> 250). Most specimens were beaten or swept from different grasses, but a few individuals were found on other plant species. Recorded also on rich bogs. Accordingly, Priesner (1926—28) reported the species to extend its distribution up into the high mountains, predominantly on moist ground. The species has been reported from a wide array of grass species, although *Dechampsia* and *Dactylus* seem to be preferred hosts (Priesner 1926—28, 1964, Palmer 1975, Mound et al. 1976, Schliephake & Klint 1979). Also in Norway the species seem to be associated with Graminae species. However, specimens are commonly found on other plant species (Olsen & Solem 1982).

*Belothrips acuminatus* (Haliday, 1836)

Adults and larvae were collected from *Galium boreale* L. on meadow in the mixed vegetation along the Driva river and in the terrain against Gávålia (coll. ad. + larvae, N > 50). No records of the species from the birch forest and the alpine regions were made, although *G. boreale* is present up to above the tree border (personal observation). *G. boreale* seems to be its preferred host also near



Trondheim (Olsen & Solem 1982), although Jacot-Guillarmod (1974) and Mound et al. (1976) report *Galium vernum* L. to be its main host plant. Indeed, both *G. vernum* and its relative *Galium palustre* L. are commonly found near Trondheim, but the species has not been found on these plants. In addition to the *Galium* species, *B. acuminatus* has been recorded from other plants of the Rubiaceae family, in addition to plants belonging to several other families, viz. Poaceae, Scrophulariaceae, Lamiaceae, Rosaceae, Fabaceae, Caryophyllaceae, and Compositae (Jacot-Guillarmod 1974).

#### *Oxythrips ajugae* Uzel, 1895

Only *f. bicolor* was recorded on Dovrefjell; two females on meadow in the mixed vegetation along the Driva river and one female at abt 950 m a.s.l. in the birch forest. The species is commonly found on conifers, especially *Pinus* spp. (Oettingen 1954, Priesner 1964), and it is possible that *O. ajugae* is bound to the coniferous forest, which is very sparsely represented in the area. However, the species has been reported from a number of shrubs and trees, e.g. *Betula*, *Fraxinus*, *Fagus*, *Quercus*, and *Sorbus*, and from herbaceous plants as *Ajuga reptans* L., *Trollius europaeus* L., *Gentiana lutea* L., *Ulex europaeus* L., *Gerista* sp., *Vaccinium myrtillus* L., and *Medicago sativa* L., together with grasses and grain species (Jacot-Guillarmod 1974, Schliephake & Klint 1979). However, it is not stated whether or not collected specimens belong to *f. bicolor*. *f. bicolor* has been collected from flowering *Salix* sp. near Trondheim, and from *Pinus sylvestris* L. near Trondheim and in Röra in Nord-Trøndelag County (Olsen & Solem 1982).

#### *Oxythrips bicolor* (Reuter, 1879)

A rare species in the sampling area at Dovrefjell. Two females were found in the mixed vegetation along Driva river, a third in the transition zone between this area and the birch forest (abt 950 m a.s.l.). The species has been reported by several authors as common in buds and flowers of pine trees (Priesner 1964, Jacot-Guillarmod 1974, Mound et al. 1976, Schliephake & Klint 1979), and this is supported by my own collections (Olsen & Solem 1982). As is supposed for *O. ajuge*, *O. bicolor* may be associated with the few coniferous trees in the Kongsvoll area. However,

the species is by several authors reported from a variety of different plants (Priesner 1926—28, Jacot-Guillarmod 1974, Olsen & Solem 1982).

#### *Ceratothrips ericae* (Haliday, 1836)

The species probably is firmly associated with the heather *C. vulgaris* in the Dovrefjell mountains, and records of *C. ericae* were made in all parts of the collecting area, up to above the tree border (coll. ad. + larvae, N > 30). Accordingly records from additional localities in Norway have predominantly been made from this heather species (Olsen & Solem 1982). *C. vulgaris*, in addition to *Erica* and *Vaccinium* species, is claimed by several authors to be the main host plant of the species (Priesner 1926—28, 1964, Oettingen 1954, zur Strassen 1973, Jacot-Guillarmod 1974, Schliephake & Klint 1979).

#### *Frankliniella tenuicornis* (Uzel, 1825)

A single female was caught in a suction trap in the mixed vegetation along the Driva river. The seemingly very low density of this polyphagous grass thrips species can not be related to lack of food, as excess of potential host plant species is at hand. Elsewhere in Norway large numbers of the species have been collected from *Secale cereale* L., in addition to records from plant species including *Berteroa incana* (L.) DC., *Agrostis* sp., *C. vulgaris*, *V. cracca*, *T. pratense*, and *Achillea millefolium* L. (Olsen & Solem 1982). In previous literature reported from Graminae; grain and grasses, but also from several flower plants (Priesner 1926—28, 1964, Oettingen 1954, Jacot-Guillarmod 1974, Mound et al. 1976, Schliephake & Klint 1979).

#### *Mycterothrips latus* (Bagnall, 1912)

Within the sampling localities in the Dovrefjell mountains *M. latus* follows its host plant, the common birch (*B. pubescens*) up to the tree border (coll. ad. + larvae, N > 1300). Outside the birch forest the species was also recorded from single birch trees, and will possibly always follow its host plant. Apart from the records from birch trees, a few individuals were collected from other plants. This always happened, however, in or in close proximity to the birch forest, and in my opinion these records refer to specimens accidentally settled on unrelated vegetation (Olsen unpubl.). Elsewhere the species has been

collected from birch in Oslo, in Trondheim, and in Lavangen (Troms County). The host specificity of the species was first stated by Morison (1929), and has later been confirmed by several workers (e.g. Titschak 1967, Quick 1977).

#### *Scolothrips uzeli* Schille, 1910

Three females, two of which had not completed ecdysis, were collected from *J. communis* in the low alpine region in the eastern part of the sampling areas on Dovrefjell. This is the first and, at present, the only record of this species from Norway (EIS 79: Kongsvoll near Blesbekken, 14 July 1984, 3 ♀♀ on *J. communis*, 1250 m a.s.l.). Also previous records are from *Juniperus* (Priesner 1964, Schliephake & Klint 1979), where the species, according to Jacot-Guillarmod (1971) is feeding on mites.

#### *Taeniothrips picipes* (Zetterstedt, 1828)

A very common species in the sampling areas in the Dovrefjell mountains, up to about 1200 m a.s.l. Adults and larvae were frequently collected from the large perennials *A. septentrionale* and *G. sylvaticum*, but also other species, viz. *Pedicularis oederi* and *Bartsia alpina* L., seemed to be true hosts of the species (coll. ad. + larvae, N > 4600). Schliephake & Klint (1979) state the species to be confined to Ranunculaceae in deciduous forest, but Priesner (1926—28) and Maltbæk (1932) report records from additional plant species, notably typically spring plants of genera as *Primula*, *Anemone*, *Helleborus*, and *Dentaria*. Similarly, near Trondheim numerous adults have been found on the early spring flowers *Anemone nemorosa* L. and *Hepatica nobilis* Mill., but always in the vicinity of deciduous forests (Olsen & Solem 1982). Larvae have never been recorded on these plants, and probably the visitors come there for feeding only. Besides, the flowering period of the plant species in concern may be to ephemeral for complete development of *T. picipes* larvae.

#### *Thrips atratus* Haliday, 1836

Only two specimens, both females, have been recorded from Dovrefjell. One was caught in an emergence trap in the birch belt, about 1000 m a.s.l. The other one was beaten from flowering *Melandrium rubrum* (Weig.) Garcke near Kongsvoll biological station

(900 m a.s.l.). Priesner (1926—28) reports records of this species from localities up to 2600 m a.s.l. in the Austrian Alps, presumably from flowers of *Cerastium uniflorum* Clairv. and *Papaver alpinum* L. Beyond that, the species has been reported from a very large number of plant species, although plant species belonging to Caryophyllaceae, Lamiaceae, and Compositae seem to be preferred (Priesner 1926—28, 1964, Jacot-Guillarmod 1975, Mound et al. 1976, Schliephake & Klint 1979). Near Trondheim the species has been collected from *C. vulgaris*, *A. nemorosa*, *Campanula latifolia* L., *Campanula rotundifolia* L., *T. pratense*, and *Taraxacum* sp. (Olsen & Solem 1982).

#### *Thrips dilatatus* Uzel, 1895

Records of this species from the sampling localities on Dovrefjell have predominantly been made from vegetation on humid ground, notably from *B. alpina* and *P. oederi*. Recorded from all the sampling localities, up to 1150 m a.s.l. (coll. ad., N = 54). Accordingly, records reported in the literature are predominantly from Scropulariaceae species, viz. *Euphrasia*, *Pedicularis*, and *Rhinanthus* (Priesner 1926—28, 1964, Jacot-Guillarmod 1975, Mound et al. 1976, Schliephake & Klint 1979), generally in humid places (Schliephake & Klint 1979). However, near Trondheim numerous specimens have been collected by net-sweeping and beating meadow herbage in rather dry localities (Olsen & Solem 1982). Except for one macropterous and one hemimacropterous female, all specimens recorded from Dovrefjell were micropterous.

#### *Thrips hukkineni* Priesner, 1937

In the Dovrefjell mountains collected mainly from *T. pratense*, *Hieracium* sp. and *Caltha palustris* L. in the mixed vegetation along Driva (coll. ad. N > 130). Elsewhere in Norway recorded from different *Taraxacum* and *Hieracium* species, but also from other plant species, e.g. *Solidago virgaurea* L., *C. rotundifolia*, *Matricaria inodora* L., *Chrysanthemum leucanthemum* L., *S. cereale*, *V. cracca*, and *A. millefolium* (Olsen & Solem 1982). Accordingly, previous records are predominantly from Compositae species, but also from several other plants (Priesner 1964, Jacot-Guillarmod 1975).

*Thrips juniperinus* Linné, 1758

In the sampling areas at Dovrefjell, the species seems to follow *J. communis* firmly, also above the tree border. In addition to the records from *J. communis*, a single specimen was beaten from *P. sylvestris* (coll. ad. + larvae, N > 200). Elsewhere in Norway only recorded from *J. communis* (Olsen & Solem 1982), and in former literature *Juniperinus* is reported to be the main host plant of the species (Priesner 1926—28, 1964, Jacot-Guillarmod 1975, Mound et al. 1976, Schliephake & Klint 1979).

*Thrips major* Uzel, 1895

In the Dovrefjell mountains recorded from all the sampling localities (coll. ad. + larvae, N >> 400). Although adult specimens were collected from several herbaceous plants (Table 1), *B. nana* obviously is the main host of the larvae in the area. This may be worth noting, as *T. major* in former literature is only regarded as a polyphagous flower thrips species (Priesner 1964, Jacot-Guillarmod 1975, Schliephake & Klint 1979). The adjustment to breeding on *B. nana* may be caused by the short summer season in the high mountains, which bring about a short flowering period of potential herbaceous host plants. Moreover, *B. nana* offer a long and stable food supply, in addition to protective microhabitats for larvae and pupae. Comprisingly, *M. latus* was not found on *B. nana* in the area, even where nearby infested *B. pubescens* was present.

*Thrips menyanthidis* Bagnall, 1923

Five adult female specimens were collected from *C. palustris* in a moist place in the birch forest (abt 950 m a.s.l.) on Dovrefjell. Near Trondheim adults and larvae have been collected from *Menyanthes trifoliata* L. (Olsen & Solem 1982). Also previous records are predominantly from this plant species, although additional records have been made from e.g. *Passiflora* spp. and *Pedicularis palustris* L. (Priesner 1964, Jacot-Guillarmod 1975, Schliephake & Klint 1979).

*Thrips validus* Uzel, 1895

Within the sampling area on Dovrefjell, records were made only from the mixed vegetation along the Driva river. Most specimens were recorded from *Taraxacum* sp., but specimens were also found on flowering *C. palu-*

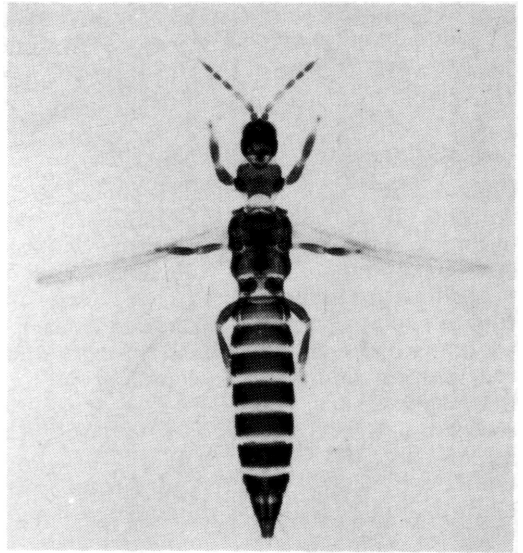


Fig. 1. Female *Thrips vulgatissimus* Hal., the most widespread and abundant thrips species at Dovrefjell. Mounted specimen.

*stris*. Previous reports give Compositae flowers as preferred hosts (Jacot-Guillarmod 1975, Mound et al. 1976, Schliephake & Klint 1979). Similarly, near Trondheim several records have been made from *Taraxacum* spp., in addition to records from other plants (Olsen & Solem 1982).

*Thrips vulgatissimus* Haliday, 1836 (Fig. 1)

This is the most abundant thrips species in the Dovrefjell mountains, recorded in all the sampling localities up to about 1600 m a.s.l. (coll. ad. + larvae, N > 18000). The very large population in the area is associated with the ability of the species to exploit the extensive *Salix* vegetation for its larval development, and almost every herbaceous plant as a food resource for newly hatched adults (see Table 1). Moreover, the species is active at very low temperatures, and initiates its reproductive cycle in the spring as soon as the *Salix* buds. In addition, the population at Dovrefjell is purely parthenogenetic (Olsen 1984), which allows a very fast population increase. Also near Trondheim, as well as in other localities in Norway, the species is very common, and records have been made from numerous plant species (Olsen & Solem 1982). Accordingly, in previous literature the species is stated to be extremely polypha-

gous (e.g. Jacot-Guillarmod 1975, Mound et al. 1976, Schliephake & Klint 1979), and Morison (1929) reports records from 102 native plants species in Great Britain.

#### *Megathrips lativentris* (Heeger, 1852)

At Dovrefjell recorded from litter in the birch forest (coll. ad. + larvae, N > 10). Also near Trondheim the species has been recorded in a similar habitat (Olsen & Solem 1982), and according to Mound et al. (1976) it feeds on fungus spores. Previously recorded from litter under *Salix*, *Corylus*, *Betula*, *Fagus*, and *Quercus*, in addition to records from the plant species *Acer campestre* L., *U. europaeus*, grass, and *Erica arborea* L. (Priesner 1926—28, 1964, Mound et al. 1976, Jacot-Guillarmod 1978). Also recorded from nests of birds and rodents (Schliephake & Klint 1979).

#### *Haplothrips niger* (Osborn, 1883)

Only recorded from the mixed vegetation along the Driva river in the Dovrefjell mountains, in which locality numerous specimens were collected from *T. pratense* along the roadside (coll. ad. + larvae, N > 130). Above 900 m a.s.l. no records of the species were made, although *T. pratense* is commonly found up to about the tree border. Also near Trondheim *T. pratense* apparently is the main host of the species, although single individuals have been found on other plants (Olsen & Solem 1982). Accordantly, Priesner (1964) states *T. pratense* as the main host of the species, although he reports records from other *Trifolium* species, in addition to records from other plants, viz. *Anthyllis*, *Astragalus*, *Coronilla*, *Cytisus*, *Robinia*, *Lotus* and *Medicago*.

#### *Haplothrips propinguus* Bagnall, 1933

Within the sampling areas in the Dovrefjell mountains, numerous specimens were collected from *A. millefolium* in the mixed vegetation along Driva (coll. ad. + larvae, N > 1400). However, as was the situation for *H. niger*, the species was not recorded above about 900 m a.s.l. *A. millefolium* is reported to be the main host of the species by both Mound et al. (1976) and Schliephake & Klint (1979), and also near Trondheim this is apparently the situation. However, single specimens are, in addition, recorded from other

plants, viz. *M. inodora* and *C. latifolia* (Olsen & Solem 1982).

#### ACKNOWLEDGEMENTS

I am greatly indebted to Dr. J.O. Solem (Trondheim, Norway), for valuable practical help and professional guiding during the present study. I also wish to thank Dr. L. A. Mound (England) and Dr. R. zur Strassen (BRD), who have checked my determinations on thrips species and corrected some of them. Simen Bretten and his wife Eli offered me practical help and suitable working and living conditions during the field work in the Dovrefjell mountains, and this is highly appreciated. Finally I will thank I. Harder, who has made the typing.

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## Short communications

### FOUR SPECIES OF TIPULIDAE (DIPTERA) NEW TO NORWAY

TROND HOFVANG

*Tipula (Lunatipula) alpina* Loew, 1873, *Tipula (Savtshenkia) staegeri* Nielsen, 1922, *Tipula (Savtshenkia) benesignata* Mannheims, 1954 and *Tipula (Pterelachisus) middendorffi* Lackschewitz, 1936 are reported from Norway for the first time.

Trond Hofsvang, Norwegian Plant Protection Institute, Department of Entomology, P.O. Box 70, N-1432 Ås-NLH, Norway.

One male of *Tipula (Lunatipula) alpina* Loew, 1873 was collected in oak woods 4 July 1978 in AAY Grimstad: Hesnes (EIS 6). According to Tjeder (1955) the species is reported from Skåne and Bohuslän in Sweden.

In Zoological Museum, University of Bergen, are two males and one female of *Tipula (Savtshenkia) staegeri* Nielsen, 1922 from HOY Bergen; Fana (EIS 30), 26 September 1965 (leg. A. Løken, det. B. Tjeder). This material have not previously been published, and the species is new to the Norwegian fauna. In Sweden this species is collected in Skåne and Västergötland (Tjeder 1955).

One male of *Tipula (Savtshenkia) benesignata* Mannheims, 1954 was caught in a suburb garden in AK Oslo: Munkerud (EIS 28) 1 September 1985. *T. (S.) benesignata* is known from Dalarne, Lycksele Lappmark, Lule Lappmark and Torne Lappmark in Sweden (Tjeder 1974).

In the surroundings of Kongsvoll in the Dovrefjell mountains (STI Oppdal: Kongsvoll, EIS 79) an extensive investigation of the insect fauna have been carried out. Several males of *Tipula (Pterelachisus) middendorffi* Lackschewitz, 1936 were caught in Malaise traps (leg. J.O. Solem). More information on distribution, phenology etc. will be published elsewhere (Hofsvang et al. 1987). *T. (P.) middendorffi* is reported new to Fennoscandia (Theowald 1980).

### ACKNOWLEDGEMENTS

I wish to thank Dr. Bo Tjeder, Lund and Lita Greve Jensen, Zoological Museum, Bergen, for permission to include unpublished data on *T. (S.) staegeri*.

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### ANOMALOUS MALE OF *APATANIA* *STIGMATELLA* (ZETTERSTEDT) (TRICHOPTERA, LIMNEPHILIDAE)

JOHN O. SOLEM

A male of *Apatania stigmatella* (Zetterstedt), which had not developed claspers on the genitalia, is figured and commented on.

John O. Solem, University of Trondheim, the Museum, Erling Skakkesgt. 47, 7000 Trondheim.

In a light trap collection of caddisflies, sampled at Engan, Oppdal county, S.-Trøndelag province, 11

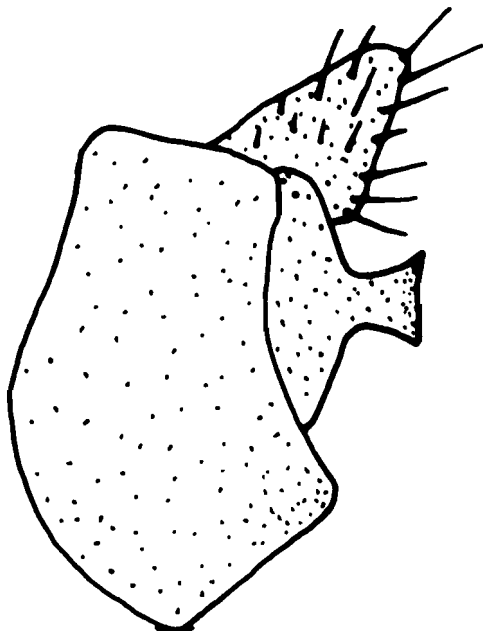


Fig. 1. Lateral view of the *Apatania stigmatella* male, which had not developed claspers.

Aug. 1977, a male *Apatania stigmatella*, which differed from the normal *A. stigmatella* males, was found. This odd specimen was also normal looking, except for the genitalia. Here, the claspers were missing (Fig. 1). The claspers are quite conspicuous in *A. stigmatella* males, but in this specimen, they had never developed. At the first sight the specimen looked as a new species, but more thorough examination revealed that the remaining parts of the genitalia agreed with those of a normal *A. stigmatella* male. I have seen several hundreds of males from this area, and this was the only anomalous *A. stigmatella* found. Normal looking males of *A. stigmatella* are figured in e.g. Malicky (1983) and Tobias & Tobias (1981).

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#### *AGRIOTYPUS ARMATUS* CURTIS, 1832 (HYMENOPTERA, ICHNEUMONIDAE, AGRIOTYPINAE) IN NORWAY

FRED MIDTGAARD

#### ABSTRACT

*Agriotypus armatus* Curtis, 1832 (Hymenoptera, Ichneumonidae, Agriotypinae) is reported new to the Norwegian fauna. Two specimens were found at Agdenes in Central Norway.

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

In alcohol preserved material from STY, Agdenes: Storvatnet, EIS 96, 23 Jun. 1973, leg. Solem, coll. Zoological Museum of Trondheim, two females of the striking species *Agriotypus armatus* Curtis, 1832 were found.

I have not seen any record of this species from Norway, but it has been found in e.g. Sweden and England (Schmiedeknecht 1930) and could be expected here also.

Only this species is known from Europe within the subfamily Agriotypinae, which by Schmiedeknecht (1930) was regarded as a separate family. The larva parasites larvae of Trichoptera living in mountain rivers (Schmiedeknecht 1930).

#### ACKNOWLEDGEMENTS

I am indebted to J.O. Solem for loan of alcohol preserved material from the Zoological Museum of Trondheim.

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#### *TRICHONCUS VASCONICUS* DENIS (ARANEAE, LINYPHIIDAE) NEW TO NORWAY

ERLING HAUGE

#### ABSTRACT

The species (1 ♂ + 1 ♀) was registered for the first time in Norway, in an open coastal habitat in the south-eastern part of the country.

Hauge, E., Zoological Museum, University of Bergen, Muséplass 3, N-5000 Bergen, Norway.

One ♂ and 1 ♀ were found at Grimestad (VE: Tjøme) (south-eastern Norway) July 11, 1985 (A. Fjeldså coll.) in a very dry locality dominated by open bedrock (dark eruptives) and grasses. Present were also some *Viscaria vulgaris*, *Rumex acetocella* and *Silene maritima*.

The systematic status of this species is uncertain (see Locket et al. 1974, Brignoli 1983) and it is difficult to distinguish from *T. saxicola* (O.P.-Cambridge) and *T. affinis* Kulczynski. The present specimens have been identified according to descriptions given by Wiehle (1960) and Locket et al. (1974). Especially the dark coloured tibiae I + II have been a decisive character. The species is new to Norway, and is probably the only species of the genus occurring in the nordic countries, where it seems to be restricted to coastal areas.

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**ADDITIONS TO THE KNOWLEDGE OF  
THE NORWEGIAN SPIDER FAUNA  
(ARANEAE).**

ERLING HAUGE

**ABSTRACT**

Hauge, E. 1987. Additions to the knowledge of the Norwegian spider fauna (Araneae). *Fauna norv. Ser. B* 34, 94—95.

*Neoscona adianta* (Walckenaer), *Araniella opistographa* (Kulczynski), *Dipoena tristis* (Hahn), *Dictyna latens* (Fabricius) and *Clubiona diversa* O. P. Cambridge are reported for the first time in Norway, *Salticus zebraneus* (C. L. Koch) is reported for the second time. Brief comments on the species' pattern of distribution are given.

Erling Hauge, Zoological Museum, Muséplass 3, University of Bergen, N-5000 Bergen, Norway.

The examination of a small collection of spiders from south-eastern Norway has resulted in one species previously reported only once in Norway and 5 species new to the country.

The sampling method has been with sweep net. The collector is Mr. Arild Fjeldså, to whom I am very thankful.

**The species are:**

*Neoscona adianta* (Walckenaer)

At VE: Tjøme, Mostrand, 3 males and 3 females were collected 2 July 1983 in a dry meadow. The species is new to Norway.

This is a palaeartic species (Roewer 1942) which is distributed far into the east (Proszynski & Starega 1971). A southern species in Britain (see Locket & al. 1974). According to Braun & Rabeler (1969) and Maurer (1978) the species is absent from Northern Europe. However, it has been reported from Denmark (Bøggild 1961, 1962), from Southern Sweden (Kronstedt 1983) and in the USSR (Estonia) (Vilbaste 1972, 1980, 1981). It is absent from the check list of Finland (Palmgren 1977). Thus the species probably is close to its northern limit of distribution in this Vestfold locality.

*Araniella opistographa* (Kulczynski).

One male was found together with the *N. adianta* specimens 20 Juli 1983, and is identified with reference to Locket & Millidge (1953, Text-fig. 98B). Much more uncertain are 2 females caught 14 July 1986 in a thicket of *Populus tremula* in the same area as the males. The epigynes are, however, provided with a relatively long scaphus (see Locket & al. 1974)

The species is distributed in England and Middle Europe from Switzerland and Balkan north to the USSR (Estonia) (Braun & Rabeler 1969, Braun 1969). In the Nordic countries it is restric-

ted to Southern Sweden (Holm 1977) and to south-eastern Finland (Palmgren 1974a). It has previously not been reported from Norway, but may earlier have been confused with the very similar *A. cucurbitina* (Clerck).

*Dipoena tristis* (Hahn).

One female was found at AK: Oslo, Sandemåsen (close to the border of Ski community) 6 July 1983 on a turf moor.

This is a species of Middle-Eastern and South-eastern Europe, according to Roewer (1942). In England and Ireland it seems to be uncommon and restricted to the southern parts (see Locket & al. 1974). It has been reported once in Denmark (Larsen & Bøggild 1970), and also in the southern parts of Sweden (Kronstedt 1983). In Finland, on the contrary, it seems to be quite common and is distributed far north (Palmgren 1974b). The species is new to Norway.

*Dictyna latens* (Fabricius).

Two males were found at VE: Tjøme, Mostrand, 20 July 1983 (together with *N. adianta*). The first record in Norway.

According to Roewer (1954) the species is widespread in Europe. It is, however, in the Nordic countries restricted to southern and south-eastern parts of Sweden (Kronstedt 1983) and to the south-western corner of Finland (Palmgren 1977). Also in the British Isles the species has a southern distribution. The northernmost record is in the most southern part of Scotland (see Locket & al. 1974).

*Clubiona diversa* O. P. Cambridge.

One male was found at VE: Tjøme, Mostrand, 8 July 1983 in a *Phragmites*-vegetation. The species is new to Norway.

A European species, previously known north to Northern Scotland (Locket & al. 1974), Denmark (Bøggild 1961, Larsen & Bøggild 1970), Southern and South-western Sweden (Kronstedt 1983) and close to the southern coast of Finland (Huhta 1971, Palmgren 1977).

*Salticus zebraneus* (C. L. Koch).

One male was found at VE: Tjøme Moutmarka, 28 June 1985, in a meadow with tall herbs.

A south European species, according to Braun (1969). In England known only from the south-eastern areas (Locket & al. 1974). It is reported once in Denmark (Zealand) (Larsen & Bøggild 1970). In Sweden it is known (but obviously sparse) in the southern areas north to Södermannland (Tullgren 1944), which probably represented the northern limit of distribution, together with a previous report from SE Norway (Akershus) (Waalder 1967) and that from SE Finland (Karelen) (Palmgren 1977).

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## TRON SOOT-RYEN; MUSEUMSMANN OG ENTOMOLOG

ARNE FJELLBERG

### ABSTRACT

Fjellberg, A. 1987. Tron Soot-Ryen. *Museologist and entomologist*. Fauna norv. Ser. B,

At the age of 90, Tron Soot-Ryen passed away on 10 May 1986. He was one of the pioneers in developing Tromsø Museum where he served as leader and curator of zoology during the period 1921—1959. Although he did not publish more than 10 papers on entomological subjects — mainly on Diptera — he was a very efficient collector who contributed substantially to the museum's collection of insects. A short bibliography (entomology) is given.

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Den 10. mai 1986 døde Tron Soot-Ryen i en alder av 90 år. Dermed var det slutt på et langt liv i virksomhet for norsk zoologi. De siste 30 årene tilbrakte han i Sør-Norge, men han vil i første rekke bli husket for sin store innsats for Tromsø Museum der han virket som konservator fra 1921 til 1959.

Da Soot-Ryen kom til Tromsø i 1921, overtok han og førte videre det grunnleggende arbeid som var utført av museets første konservator, H. J. Sparre Schneider (1877—1918). Før Soot-Ryen tiltrådte, hadde C. F. L. Dons bestyrt museet et par år. Både Sparre Schneider og Soot-Ryen gikk løs på sine livsoppgaver som unge menn i 20-årene og forble på post i flere tiår. Mens Sparre Schneider var en entusiastisk entomolog like til sin død, så delte Soot-Ryen sine krefter på flere fag, og ble etter hvert mer orientert mot marin zoologi. Da han sluttet som konservator i Tromsø, ble han engasjert av NAVF som redaktør av serien «Marine invertebrates of Scandinavia». Hans entomologiske produksjoner er relativt begrenset. Jeg har klart å oppspore ti publikasjoner, de fleste om Diptera-faunistikk. Hans kronologiske gjennomgang av litteraturen om norske Diptera inntil 1940 har vært et nyttig kildeskrift for senere dipterologer.

Selv om Soot-Ryen ikke publiserte særlig mye entomologi, så var han en iherdig samler. Spesielt mye samlet han i krigsårene i indre Troms. Messteparten av museets samlinger var da evakuert fra byen og lå nedpakket i en låve i Malangen. Soot-Ryen hadde tilsyn med samlingene, og oppholdt seg mye av tiden på innlandet. Dette er et av våre mest interessante insektområder, og Soot-Ryen høvet inn mange godbiter. Blant annet gjorde han det første norske funn av den myrmecophile phoriden *Enigmatias Tubbocki* (Verrall) som har vingeløse hunner.

Soot-Ryen innså at han ikke kunne rå med alt materialet selv, og han sørget for at tidens fremste spesialister fikk gå gjennom museets samlinger og

publisere resultatene. I museets årshefter fra årene 1925 til 1944 er det adskillige oversikter over nordnorske insektgrupper ført i pennen av Lengersdorf, Ringdahl, Forsslund, Lackschewitz, Roman, Holdersen, Tjeder, Ossiannilsson og Strand. Men fortsatt står det tusenvis av ubestemte nordnorske insekter fra Soot-Ryens tid.

Soot-Ryen var gjerne knapp i sin etikettering av materialet. Nålen har ofte en etikett med kun et lokalnavn — av og til forkortet — og en dato. Heldigvis var han omhyggelig med datering, og ved å sortere lokalitetslistene på dato, var det klart at «Skj. 22/6-42» stammer fra Skjåvikør i Balsfjord. Ved museene i Bergen og Tromsø har vi lister over nærmere 700 lokalitetsnavn (med tilhørende kommune) fra Soot-Ryens materiale. Disse er til stor hjelp for entomologer som ikke er lokal kjente under bearbeiding av materialet.

Tromsø Museums konservatorer har alltid hatt en nær kontakt med sitt omland, og følgende historie er typisk: En gang på 50 tallet fikk Soot-Ryen tilbud om å kjøpe en «smådjævel» — nedlagt på Helgeland — til den nette sum av kr. 500.000,—. Etter en del forhandlinger gikk Soot-Ryen med på å betale en halv million dersom det var en *virkelig* smådjævel. Men det var opp til museet å artsbestemme skapningen. Pakken med liket ankom, og det viste seg å være en pingvin som stammet fra en utsetting av en gruppe fugl på Røst i 1936 foretatt av Naturfredningsforeningen. Pingviner ble likevel aldri dagligdags kost på Helgeland, og det høyt verdsatte «utyske» møtte sin skjebne da det kom tassende inn gjennom en åpen kjøkkendør.

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1946. *Scaeva arcuata* Fallén 1817. *Ent. Tidsskr. 67*, 195—197.

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*Book:*

Mayr, E. 1913. *Animal species and evolution*. Harvard University Press. Cambridge, Mass.

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

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# Content

Fauna norv. Ser. B. Vol. 34, No. 1

Williassen, E.: Professor Ole A. Sæther 50 years .....	1
Aarvik, L.: Contribution to the knowledge of the Norwegian Lepidoptera II .....	7
Huru, H.: Occurrence and life cycle of <i>Dinocras cephalotes</i> (Curtis, 1827) (Plec. Perlidae) in North Norway .....	14
Stenseth, Ch.: <i>Brachycaudus</i> spp. new to the Norwegian fauna (Homoptera: Aphididae) ....	19
Jonsson, N.: Nymphal development and food consumption of <i>Atractotomus mali</i> (Meyer-Dür) (Hemiptera: Miridae), reared on <i>Aphis pomi</i> (DeGeer) and <i>Psylla mali</i> Schmidberger .....	22
Willassen, E.: The first record of <i>Thaumalea verralli</i> Edwards (Diptera: Thaumaleidae) from Scandinavia .....	29
Greve, L.: <i>Bibio nigriventris</i> Haliday, 1833 (Dipt. Bibionidae) in Norway .....	31
Greve, L. & Midtgaard, F.: <i>Megamerina dolium</i> (Fabricius, 1805) (Dipt. Megamerinidae) in Norway .....	35
Jonassen, T.: New Norwegian Empididae (s.str.) (Dipt.) .....	37
Håland, Ø.: Influence of temperature on the egg-stage of <i>Capnopsis schilleri</i> (Plecoptera; Capniidae) .....	41
Solem, J.O., Steinkjer, J. & Bretten, S.: Distribution and seasonal abundance of adult stoneflies (Plecoptera) in Dovrefjell National Park, South Norway .....	45
Hofsvang, T., Solem, J.O. & Bretten, S.: Distribution and seasonal abundance of adult Tipulidae (Diptera) in Dovrefjell National Park, South Norway .....	51
Greve, L., Solem, J.O. & Bretten, S.: Distribution, abundance and phenology of adult Neuropteroidea (Orders Planipennia, Raphidioptera and Megaloptera) and Mecoptera in Dovrefjell mountains, South Norway .....	57
Mendl, H., Solem, J.O. & Bretten, S.: Distribution and seasonal abundance of adult Limoniidae (Insecta, Diptera, Nematocera) in Dovrefjell National Park, South Norway ....	63
Fjellberg, A.: Collembola from the Dovrefjell National Park, South Norway .....	73
Greve, L., Solem, J.O. & Bretten, S.: Bibionidae, Xylophagidae, Rhagionidae, Psilidae, Micropezidae, Clusiidae and Piophilidae (Diptera) from the Dovrefjell National Park, South Norway .....	75
Olsen, A.: Thrips fauna near Kongsvoll in the Dovrefjell mountains (Sør-Trøndelag County, South Norway); distribution and habitat/host plant (Thys., Insecta) .....	80

## Short communications

Hofsvang, T.: Four species of Tipulidae (Diptera) new to Norway .....	92
Solem, J.O.: Anomalous male of <i>Apatania stigmatella</i> (Zetterstedt) (Trichoptera, Limnephilidae) .....	92
Midtgaard, F.: <i>Agriotypus armatus</i> Curtis, 1832 (Hymenoptera, Ichneumonidae, Agriotypinae) in Norway .....	93
Hauge, E.: <i>Trichoncus vasconicus</i> Denis (Araneae, Linyphiidae) new to Norway .....	93
Hauge, E.: Additions to the knowledge of the Norwegian spider fauna (Araneae) .....	94
Fjellberg, A.: Tron Soot-Ryen; Museumsmann og entomolog .....	96