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Front cover: *Hemaris fuciformis* (L., 1758) (Sphingidae). Artist: Hallvard Elven.

Notes on tephritid flies (Diptera, Tephritidae) from Norway

Lita Greve

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Chaetostomella cylindrica (Robineau-Desvoidy, 1830), *Campiglossa difficilis* (Hendel, 1927), *C. plantaginis* (Haliday, 1833) and *Oxyna nebulosa* (Wiedemann, 1817) are recorded new to Norway. Notes are presented on the distribution of *Platyparea discoidea* (Fabricius, 1787), *Dithryca guttularis* (Meigen, 1826), *Campiglossa grandinata* (Rondani, 1870), *C. guttella* (Rondani, 1870), *C. solidaginis* (White, 1986), *Oxyna flavipennis* (Loew, 1844), *Tephritis angustipennis* (Loew, 1844) and *Trupanea stellata* (Fuessly, 1775) in Norway.

Key words: Tephritidae, Diptera, Norway.

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INTRODUCTION

The family Tephritidae is still insufficiently known from Norway, and only 53 species are with certainty recorded from the country. The only survey of this family in Norway is the one made by Siebke (1877). Short articles by Greve, 1986 a, b, 1987, 1988, 1996), Bjureke & Greve (1996) and Greve & Nilsen (1985) have added information on the fauna. Some species like *Ceratitis capitata* (Wiedemann, 1824), a species reared from imported citrus fruits (Mehl 1980), is not included in the Norwegian list.

Earlier tephritid specialists relied on some characters later proven not to be trustworthy, and because of this some genera like *Campiglossa* Rondani, 1870 needs revision.

Hedström (1995) presented a list of 73 species from Sweden, a geographical area comparable to Norway. Three species not included in Hedström's list have been recorded from Norway. More than 60 species have been recorded from Finland (Hackman 1980), and White (1988) presented a check-list of approximately 80 species from the British Isles.

Merz's (1994) revision of the Swiss tephritid fauna includes recent collected material from Norway, see *Campiglossa guttella* (Rondani, 1870) and synonyms are listed where Merz differs from Foote (1984)

MATERIAL

The material presented here is deposited either in Norwegian university museums or in a few private Norwegian collections. All material with exception of the male *Oxyna flavipennis* (Loew, 1844) in Zetterstedt's collection, Lund, Sweden has been examined by the author. Where nothing is stated, the material is deposited in Zoological Museum, University of Bergen. Abbreviations used: ZMO=Zoological Museum, University of Oslo; ZMB=Zoological Museum, University of Bergen; RM=Rana Museum; TrM=Tromsø Museum, TJO=Thor Jan Olsen, Sarpsborg, private collection. TRN=Tore Randulff Nielsen, Sandnes, private collection, MT=Malaise trap, LT=Light trap, BT=Barbertrap. The nomenclature follows Merz (1994). Species new to Norway are marked with an asterisk *.

LIST OF SPECIES

Subfamily Trypetinae

Tribus Trypetini

Platyparea discoidea (Fabricius, 1787)

Tephritis discoidea: Siebke 1877, p. 147

AK Asker: Heggedal (EIS 28) 2 June 1986 3 ♂♂ 1 ♀ leg. T.R. Nielsen; Bærum: Haslum (EIS 28) 18 May 1990 1 ♀ leg. O.-J. Lønnve. **BØ** Hurum: Filtvedt (EIS 28) 3 June 1985 2 ♀♀ leg. F. Midtgaard, Tofte (EIS 28) MT 18 May – 2 June 1985 1 ♂ 7 ♀♀ leg. F. Midtgaard; Røyken: Hyggen, Kinartangen (EIS 28) 7 May 1989 1 ♂ leg. L.O. Hansen. **VE** Våle: Langøya (EIS 19) 29 May 1989 1 ♀ leg. L.O. Hansen.

Siebke (1877) recorded *Platyparea discoidea* (Fabr.) as *Tephritis discoidea* Fabr.: «Feminam Christianiam & Østre Skøien deprehendi Juni-Juli». There is, however, no material in ZMO of this species today. The host plant is believed to be *Campanula latifolia* (Merz 1994), a plant fairly common in Norway north to Nordland province (Lid & Lid 1994).

Platyparea discoidea is reported from a restricted area in SE Norway. The wing pattern of this species is quite striking and in contrast to most Tephritidae this species can be determined in the field. Still it is very rare in Norwegian insect collections. All specimens have been caught in spring/early summer, which fits well with Merz (1994) reporting the flight period in Switzerland to be April – May. A very early flight-period could also explain the apparent scarcity in collections. *P. discoidea* is according to White (1988) rare on the British Isles.

Subfamily Terellinae

Tribus Terelliini

* *Chaetostomella cylindrica* (Robineau-Desvoidy, 1830)

Trypeta onotrophes Loew, 1846

Chaetostomella onotrophes: Persson 1958, p. 119

Sitarea scorzonerae: Foote 1984, p. 124

Ø Sarpsborg: Skjeberg, Blåkollen (EIS 20) 31 May 1992 2 ♂♂ leg. T.J. Olsen, 27 June 1992 1 ♀ leg.

T.J. Olsen, Tune, Holleby (EIS 20) 12 June 1993 1 ♀ (TJO pers. coll.). **AA** Risør: Stamsøykilen, Kiiljordet (EIS 6) 25 July 1992 1 ♂ leg. L. Greve; Tvedestrand: Sagesund (EIS 6) 22 July 1983 1 ♀ leg. B.A. Sagvolden. **NS** Bodø: Sjøgand, Valnes (EIS 130) 6 July 1981 1 ♀ leg. A. Fjeldså; Kronli, Urskar MT (EIS 130) 15 July – 20 Aug. 1986 1 ♀ leg. A. Fjeldså.

C. cylindrica superficially looks like a species of the genus *Chaetorellia*, but lacks presutural dorso-central setae. Both genera have a black apical spot and a pair of black basal spots on the scutellum. The genus *Terellia* looks somewhat similar. Only members of the genus *Chaetostomella* have numerous well developed black genal setae, see figures in Merz (1994).

The wing-pattern in the three genera is fairly similar. Persson (1958) records *C. cylindrica* from some localities in southern Sweden. Hackman (1980) lists it as *Chaetostomella onotrophes* (Loew, 1848) from Finland. Hedström (1995) records several new localities from Sweden.

Freidberg (1989) and Merz (1994) present a long list of host plants for this species. Host plants in Norway, among others, could be fairly common species like the *Centaurea nigra*-group and *Cirsium* spp.

C. cylindrica is here recorded new to Norway, a widespread, but fairly rare species.

Subfamily Tephritinae

Tribus Dithrycini

Dithryca guttularis (Meigen, 1826)

HES Åsnes: «Kjølen» (near Kjøle), north of Hoff (EIS 47) 1 ♂ leg. Siebke (ZMO); Elverum: West of Økset saga (EIS 55) (32V PN 345.634) 29 June 1998 2 ♂♂ 1 ♀ leg. L. Greve; Åmot: Rena (south) (EIS 55) 17 July 1987 1 ♂ leg. A. Fjeldså. **ON** Dovre: Lårgård (Laurgård) (EIS 71) 22 July 1853 1 ♀ leg. Siebke (ZMO)

D. guttularis is widely distributed in the northern, middle and eastern Europe, rare in southern Europe Merz (1994). Hedström (1995) records this species

from several provinces in Sweden north to LyLpm (= Lycksele lappmark) which is approximately as far north as Nordland province in Norway.

The larvae of *D. guttularis* live in galls in *Achillea millefolium*, a very common plant all over Norway (Lid & Lid 1994).

D. guttularis was reported twice by Siebke (1877) more than 104 years ago. It must be a rare species, since there is only two new records since the time of Siebke. Judged from the records it might have an eastern distribution in Norway. *D. guttularis* has a distinct wing pattern and should not easily be overlooked in the field. *D. guttularis* has according to Hedström (1995) a much wider distribution in Sweden.

Subfamily Tephritinae

Tribus Tephritini

* *Campiglossa difficilis* (Hendel, 1927)

Paroxyna difficilis: Foote 1984, p.114)

ON Dovre: Rudiløkken (EIS 71) (UTM 32V NP 166.667) 21 July 1979 1 ♂ leg. L. Greve, Sel, Rosti (EIS 62) 6 July 1966 1 ♂ 2 ♀♀ leg. T.R. Nielsen. **BV** Hol: Geilo (EIS 43) 9 Oct. 1965 1 ♂ leg. L. Greve, Rollag: Rollag (EIS 35) 7 July 1983 1 ♂ leg. B.A. Sagvolden. **VE** Larvik: Larvik (EIS 19) 23 July 1983 1 ♀ leg. B.A. Sagvolden. **TEI** Kviteseid: Haugland (EIS 17) 4 July 1970 1 ♂ leg. L. Greve, Morgedal (EIS 17) 27 June 1975 1 ♀ leg. L. Greve, Morgedal, Brekke (EIS 17) 29 June 1975 1 ♂ leg. L. Greve; Tinn: Njaatveit (EIS 26) 4 July 1983 1 ♂ leg. F. Midtgaard. **HOI** Voss: Hjelle (EIS 41) 3 Aug. 1947 1 ♀ leg. Hans Tambs-Lyche. **SFY** Gloppen: Sandane (EIS 68) 2 July 1965 1 ♂ leg. L. Greve. **SFI** Luster: Gaupne (EIS 60) 8 July 1938 2 ♂♂ 1 ♀, 9 July 1938 1 ♂, 10 July 1938 2 ♂♂ 1 ♀ leg. N. Knaben, Aurland: Aurland (EIS 51) 5 May 1966 1 ♀, 21 July 1981 1 ♂ leg. L. Greve. **STI** Midtre Gauldal: Budal, Haugen (EIS 87) 21 June 1967 1 ♀ leg. A. Løken. **TRY** Harstad: Kanebogen (EIS 145) 17 Aug. 1983 1 ♂ leg. L. Greve. **FI** Kautokeino: Kautokeino (EIS 157) 24 June 1984 1 ♀ leg. T.R. Nielsen. **FØ** Sør-Varanger: Emanuelsbekken (EIS 160) 29 June 1977 1 ♀ leg. T.R. Nielsen.

C. difficilis has not earlier been recorded explicitly from Norway, however, Merz (1994) records it from Scandinavia. Nearly all of the 26 specimens listed above from 17 localities have been determined by him. *C. difficilis* is spread all over Norway and is not rare, though there are no alpine records.

Hedström (1995) records a wide distribution of this species from Sweden. The host plant is the genus *Taraxacum*.

Campiglossa grandinata (Rondani, 1870)

BØ Drammen: Konnerud (EIS 28) 25 May 1985 1 ♂ leg. B. Borgersen; Røyken: Hyggen, Kinnartangen (EIS 28) MT 4 Aug. – 8 Sept. 1991 1 ♂ leg. L.O. Hansen. **BV** Rollag: Øya (EIS 35) 30 Aug. 1987 1 ♀ leg. B.A. Sagvolden, Hol: Øvre Hein (EIS 42) 1160 m asl (G.VIII a) 17 Aug. 1969 1 ♂ leg. IBP Project. **VE** Tjøme: Mo (EIS 19) 2 April 1965 1 ♂ leg. A. Fjellberg. **TEI** Notodden: Lisleherad (EIS 27) 22 June – 6 Aug. 1993 1 ♀ leg. A. Bakke. **VAY** Flekkefjord: Hidra, Dragøy (EIS 4) MT 26 March – 6 May 1982 2 ♂♂ leg. A.-J. Nilssen. **HOI** Voss: Mjølfjell, Solbakken (EIS 41) 670 m asl MT 31 Aug. – 29 Sept. 1991 1 ♂ leg. L. Greve; Kvam: Near Svevatn (EIS 31) Square 37 MT 13 – 28 May 1997 1 ♀ leg. J. Skartveit/L. Greve, Square 102 BT 4 May – 23 June 1998 leg. J. Skartveit. **SFI** Luster: Hodnads seter (EIS 60) 6 Aug. 1945 1 ♂ leg. N. Knaben. **NSI** Rana, Hjartåsen (EIS 123) 19 Aug. 1980 1 ♂ (Rana Museum). **TRY** Tromsø: Ramfjord (EIS 162) 30 Aug. 1925 1 ♀ leg. T. Soot-Ryen (TrM.). **FV** Alta: Mattisdalen (S) (EIS 165) MT 4 Aug. – 26 Sept. 1996 2 ♂♂ leg. L.O. Hansen/H. Rinden.

C. grandinata is distinguished from other species of *Campiglossa* by the two small, white droplets in the stigma, where other species have only one or none at all. *C. grandinata* has been recorded once from Norway, the locality at Mjølfjell, Solbakken by Greve (1996). Hedström (1995) records this species north to Lycksele- and Lule-Lappmark. Merz (1994) reports this species to be distributed in the whole of the Palaearctic region, including Mongolia. In Switzerland it has been recorded from 1600 to 2500 m asl.

The male from Tjøme was caught flying across juniper and heather as early as on 2 April; the other specimens were caught in late August or early September. A couple of specimens have been caught in Malaise traps. The specimen caught at Mjølfjell is the only specimen from several Malaise traps used in this area throughout several years.

The host plant for *C. grandinata* is *Solidago virgaurea*, the larvae form stem galls. The plant is widely distributed in Norway.

C. grandinata is obviously a fairly rare species in Norway as only eleven specimens are known from the country. On the other hand this species has a very wide distribution from southern Norway to Tromsø. *C. grandinata* has been caught in the lowlands as well as in alpine areas - the locality at Øvre Hein at 1160 m asl is well above the tree borderline. The locality at Mjølfjell is birch forest at nearly 700 m asl.

Campiglossa guttella (Rondani, 1870)

Paroxyna achyrophori: Foote 1984, p. 113

Ø Sarpsborg: Tune, Råkil (EIS 20) 7 July 1993 1 ♀ leg. T.J. Olsen. **AK** Oslo: Bygdøy, Hengsengen (EIS 28) 1 June 1994 4 ♂♂ 1 ♀ leg. L. Greve; Bærum: Ostøya (EIS 28) 31 May 1994 5 ♂♂ 3 ♀♀ leg. L. Greve, 2 June 1984 1 ♂ 1 ♀ leg. F. Midtgaard. **BØ** Lier: Tranby, Bua (EIS 28) 8 May 1988 1 ♂ leg. B. Borgersen. **BV** Rollag: Rollag (EIS 35) 4 April 1984 1 ♀, 11 Sept. 1984 1 ♂ leg. B.A. Sagvolden. **VE** Sande: Kommersøya (EIS 19) 17 May 1990 4 ♂♂ 2 ♀♀ leg. L.O. Hansen; Larvik: Tjølling, Heggedal (EIS 19) 4 July 1987 1 ♂ leg. B. Borgersen, Hedrum, Seierstad (EIS 19) 11 July 1986 1 ♂ leg. B. Borgersen. **TEI** Vinje: Bøgrend, west (EIS 25) 10 July 1980 1 ♀ leg. B. Borgersen. **VAY** Sirdal: Tonstad (EIS 8) 3 Aug. 1996 1 ♂ leg. L. Greve. **HOY** Bergen: Isdalen (EIS 39) 1 June 1966 1 ♀ leg. L. Greve, Nordre Starefoss (EIS 39) 6 July 1983 2 ♂♂ 2 ♀♀ leg. A. Fjeldså, Bergen: Fana, Espegrend (EIS 30) 23 May 1974 1 ♀ leg. L. Greve, Bergen: Fana, Store Milde, Geitaneset (EIS 30) (UTM 32V KM 941.859) 15 ♂♂ 16 ♀♀ leg. L. Greve, Bergen: Åsane, Åstveit (EIS 39) 25 May 1968 1 ♀ leg. T.R. Nielsen; Etne: near Frette (EIS 23) 27 June 1985 2 ♂♂ 1 ♀ leg. L. Greve,

Skånevik (EIS 23) 28 June 1985 1 ♀ leg. L. Greve; Tysnes: Øyjord (EIS 23) (UTM 32V LM 113.495) 24 June 1989 13 ♂♂ 5 ♀♀ leg. L. Greve, Storsøy (EIS 23) 25 May 1968 ♀ leg. Field course; Fusa: Sundvor (EIS 31) 24 June 1984 1 ♂ L. Greve; Os: Lepsøy (EIS 30) 25 May 1967 1 ♀ leg. Field course; Vaksdal: Eidslandet (EIS 40) 1 Aug. 1968 2 ♂♂, 27 June 1969 1 ♂ 1 ♀ leg. L. Greve; Øygarden: Hjelme (EIS 39) 21 June 1983 1 ♂ leg. L. Greve; Lindås: Hodneli (EIS 39) 12 June 1988 1 ♀ leg. L. Greve. **HOI** Kvinherad: Ljosmyr (EIS 30) May 1969 1 ♀ leg. Field course, Løfallstrand (EIS 31) 10 June 1966 1 ♀ leg. L. Greve, Rosendal (EIS 31) 22 May 1969 1 ♂ leg. Field course, Varaldsøy, Djuvslund (EIS 31) 6 June 1967 1 ♂ leg. Field course; Ulvik: Ulvik (EIS 41) 26 June 1984 1 ♀ leg. L. Greve. **SFY** Gulen: Brosvik (EIS 48) 1 July 1983 3 ♂♂ leg. L. Greve. **STI** Trondheim: Dragsvoll (EIS 92) 6 July 1988 1 ♂ leg. L. Greve. **NSI** Rana: Altermark (EIS 123) 27 July 1989 1 ♀ leg. S. Lundmo/E. Dahl (RM), Jamtlia (EIS 123) 28 June 1985 1 ♂, Straumen (EIS 123) 16 July 1988 1 ♀ leg. P. Straumfors, Tverråga (EIS 123) 24 June 1989 1 ♂. **NSY** Nesna: Hamarøy (EIS 118) 17 June 1985 1 ♀ leg. P. Straumfors/S.Z.L./W.H.

C. guttella was first recorded from Norway by Merz (1994), but he did not list any localities. Nearly all the material listed here has been seen and determined by Merz. The material from Bergen: Store Milde has been published under the synonym *Paroxyna achyrophori* (Loew, 1869) by Greve (1987).

C. guttella was earlier often confused with *C. achyrophori* (Loew, 1869), a species recorded from middle Europe, but not from Scandinavia (Merz 1994). *C. guttella* is not rare and is at least distributed north to the southern parts of Nordland province.

**Campiglossa plantaginis* (Haliday, 1833)

Paroxyna plantaginis: Foote 1984, p. 116

Ø Fredrikstad: Gansrød, Øra (EIS 20) 27 June 1995 1 ♂ leg. T.J. Olsen. **VE** Tjøme: Sunnane (EIS 19) 10 July 1985 1 ♂ leg. A. Fjeldså, Treidene (EIS 19) 5 July 1964 1 ♂ 1 ♀ leg. A. Fjellberg. **TEY** Kragerø: Portør (EIS 11) 2 Aug. 1996 1 ♂ 4

♀♀ leg. L. Greve; Porsgrunn: Sandøy East (EIS 11) 10 July 1986 1 ♂ leg. A. Fjeldså.

C. plantaginis is here recorded from Norway for the first time. This species was not listed from Norway by Persson (1958) in his revision of Zetterstedt's material, and it was neither mentioned from Norwegian shores by Ardö (1957).

Merz (1994) gives the distribution as sea shores along the Baltic Sea, the North Sea and the Atlantic Ocean and some areas with salty marshes inland in Middle Europe. Ardö (1957) lists one locality in Skåne, Sweden and there are material from Jutland, Denmark in ZMB. *C. plantaginis* is recorded from Finland (Hackman 1980), and it is distributed along the coast of England, except in the north-west and in Wales. Also recorded from the east coast of Ireland (White 1988). Hedström (1995) records this species fra Skåne to Uppland in Sweden.

The larvae live in the head of *Aster tripolium* which is common along the coast in Norway to the north part of Nordland province (Lid & Lid 1994).

C. plantaginis seems to have a restricted distribution along the coast in SE Norway while the hostplant *Aster tripolium* has a much wider distribution in Norway from the south along the coasts up to northern Norway. *C. plantaginis* must be considered rare.

Campiglossa solidaginis (White, 1986)

Paroxyna solidaginis: White 1986, p. 153–156

Paroxyna solidaginis: Greve 1988, p. 44

VE Tjøme: Treidene (EIS 19) 26 Sept. 1984 2 ♂♂ 8 ♀♀ leg. A. Fjeldså. BØ Drammen: Underlia (EIS 28) 1–31 Aug. 1992 1 ♀ leg. L.O. Hansen. VAY Farsund: Viksvann, west (EIS 1) (UTM 32V LK 762.422) 9 July 1978 1 ♂ leg. L. Greve. RY Hå: Ognå (EIS 3) 2 MT 17 July - 21 Aug. 1996 5 ♀♀ leg. L. Greve & I. Greve Korsnes.

C. solidaginis was recorded from Norway in 1988 as *Paroxyna solidaginis* (Greve 1988), and it is now, in addition to the British Isles, also recorded from Jugoslavia (Merz 1994).

The hostplant is the common *Solidago virgaurea*.

C. solidaginis is another species with a restricted southern distribution in Norway.

Oxyna flavipennis (Loew, 1844)

AK Oslo: Kværner (EIS 28) 30 July 1851 1 ♂ (ZMO). RY Finnøy: N. Vignes (EIS 14) 6 July 1987 1 ♂ leg. J. Skartveit. NTI Verdal: Nes (EIS 92) 1 ♂ leg. J. Zetterstedt, Zetterstedt's collection, Lund.

The specimen from NTI Verdal: Nes is referred to as *Tephritis parietina* L. by Siebke (1877). This specimen was listed as *Oxyna flavipennis* Loew, 1844 by Persson (1958). The male in ZMO bears a handwritten label probably written by Siebke, but is not listed by Siebke in 1877. Merz (1994) records *O. flavipennis* species as distributed over all Europe and he has verified the determination of the specimen from Finnøy. The hostplant *Achillea millefolium* is widely distributed in Norway (Lid & Lid 1994).

**Oxyna nebulosa* (Wiedemann, 1817)

AK Oslo: Oslo (Kristiania) (EIS 28) 1 ♂ leg. Esmark (ZMO). BØ Nedre Eiker: Hagatjern, Ryghsetra (EIS 28) LT 27 June – 3 July 1994 1 ♀ leg. Devegge Ruud.

Merz (1994) records *O. nebulosa* as distributed all over Europe. The hostplants are *Leucanthemum vulgare* and *Tanacetum corymbosum*, only the first is distributed, widely, in Norway.

The genus *Oxyna* is represented by three species in Europe, viz. *O. flavipennis* (Loew, 1844), *O. nebulosa* (Wiedemann, 1817) and *O. parietina* (L. 1758), but only the first two are present in Norway.

Several authors have mixed these species or have not recognized all three species. Persson (1958) in his revision of Zetterstedt's material clearly recognized all three. Hackman (1980) records *O. flavipennis* from Finland, but he has *Oxyna nebulosa* (Wiedemann, 1817) as a synonym for *O. parietina* (L. 1758). Hedström (1995) presents reliable new records from Sweden. Rikhter (1970) refers to all three species from NW Russia, viz.

the area bordering to Finland from Murmansk south including the Baltic states.

The Norwegian material clearly shows that both species of *Oxya* must be considered very rare. *Oxya flavipennis* is recorded from three widely separated localities in south and middle Norway. Persson (1958) recorded *O. flavipennis* from northern provinces in Sweden while Hedström (1995) lists Skåne in southern Sweden and Hälsingland in middle Sweden. The hostplant is common in most of Norway.

The two Norwegian records of *Oxya nebulosa* are from SE Norway, which matched well with Hedström's records from SE Sweden. Specimens of *O. nebulosa* in Zetterstedt's collection (Persson 1958) were from southern and middle Sweden. The host plant is common and widespread.

More material is needed to state anything definite about distributional areas for both species.

Tephritis angustipennis (Loew, 1844)

Ø Fredrikstad: Gansrød (EIS 20) 30 July 1991 1 ♀, Gansrød, Øra (EIS 20) 12 June 1995 1 ♂, 10 June 1996 1 ♀ leg. T.J. Olsen; Fredrikstad: Borge, Persnes (EIS 20) 9 July 1993 1 ♀ leg. T.J. Olsen. **AK** Oslo: Tøyen (EIS 28) July 1850 1 ♂ 1 ♀ leg. Siebke (ZMO), Ryenberg (EIS 28) 22 June 1850 1 ♀ leg. Siebke (ZMO).

T. angustipennis was first recorded from Norway by Siebke (1877) from **AK** Oslo: Tøyen and Ryenberg. The new records are the first for more than 140 years. *T. angustipennis* is known from southern Sweden north to Dalarna (Hedström 1995), and also in Finland (Hackman 1980). *T. angustipennis* is holarctic distributed and in the palaeartic known from North- and Middle-Europe east to Kazakhstan according to Merz (1994).

T. angustipennis seems to have a restricted distribution in SE Norway and must also be considered rare. The hostplant for the larvae is *Achillea ptarmica*, a common and widespread plant in most parts of Norway (Lid & Lid 1994).

Trupanea stellata (Fuessly, 1775)

Tephritis radiata Schrank: Siebke 1877, p. 150

AK Oslo: Tøyen (EIS 28) 1 Aug. 1851 1 ♀ leg. Siebke (ZMO). **VE** Tjøme: Mostrandå (EIS 19) MT 10 – 20 July 1985 1 ♀ leg. A. Fjeldså, Sandøy (EIS 19) 7 Aug. 1984 1 ♂ 2 ♀♀ leg. A. Fjeldså. **AAY** Iveland: Grodås (EIS 5) 6 – 22 July 1982 1 ♂ leg. A.-J. Nilsen. **VAY** Flekkefjord: Gausdal, Gyland Store Eikås (EIS 4) 15 – 22 July 1982 1 ♀ leg. A.-J. Nilsen, Hydra, Dragøy (EIS 4) MF 14 – 17 July 1982 1 ♀ leg. A.-J. Nilsen, Hydra, Råga (EIS 4) MT 11 Sept. 1982 1 ♀ leg. A.-J. Nilsen. **RY** Hå: Ognå (EIS 3) 7 Aug. 1986 1 ♂ leg. A. Fjeldså, 2 MT 17 July – 21 Aug. 1996 2 ♀♀ leg. L. Greve/I.G. Korsnes.

T. stellata was first recorded from **AK** Oslo: Tøyen by Siebke (1877) as *Tephritis radiata*. There is one female in ZMO from 1. Aug. 1851 collected by Siebke and he describes the locality as «horto botanico» viz. The Botanical Garden, Tøyen. For description of the Ognå locality see Greve et al. (1997). Hedström (1995) records *T. stellata* from SE Sweden, and Hackman (1980) from Finland. *T. stellata* is also known from the British Isles.

T. stellata has a coastal distribution in southern Norway and the westernmost locality is Ognå in Rogaland province.

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***Gampsocera numerata* (Heeger, 1858) (Diptera, Chloropidae) new to Norway**

Lita Greve

Greve, L. 1999. *Gampsocera numerata* (Heeger, 1858) (Diptera, Chloropidae) new to Norway. *Norw. J. Entomol.* 46, 8.

The chloropid fly *Gampsocera numerata* (Heeger, 1858) (Diptera, Chloropidae) is recorded for the first time in Norway. One male was caught in Frogn in 1984 and another male in Drammen in 1992; both localities are in southern Norway.

Key words: *Gampsocera numerata*, Diptera, Chloropidae.

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The chloropid fly *Gampsocera numerata* (Heeger, 1858) is recorded for the first time from Norway. Two males were sorted out from Malaise trapped material from **AK** Frogn: Håøya and **BØ** Drammen: Underlia in Southern Norway.

G. numerata was described from Austria and has been recorded from Great Britain, Denmark, Finland, Czech Republic, Slovak Republic, Hungary, Italy and the former USSR in Europe (Klasa 1998). The male of this species is easy to recognise on account of the characteristic pattern of black spots, wings of females are clear. The length of the body is 2.2-2.4 mm, dorsal part of thorax black and shiny while parts of head, legs and distal part of the abdomen are yellow.

One male was sorted out among material from a Malaise trap located at **AK** Frogn: Håøya (EIS 28) 19 April – 5 May 1984, leg. Fred Midtgaard. The Malaise trap at Håøya was located at a plateau at approximately 120 m a s l at the southernmost part of the island. The ground here is marine deposits and the vegetation is rich. The trap was placed near an old dead oak with open deciduous forest dominated by *Tilia cordata*, *Ulmus glabra* and

Quercus robur. There were some pines, *Pinus silvestris*, south of the trap. A second male was sorted out from a Malaise trap located at **BØ** Drammen: Underlia (EIS 28) June 1992, leg. Lars Ove Hansen. The Underlia locality is a garden which was formerly a pine forest. Today the garden has open patches with grass and some flowers and deciduous herbage.

G. numerata has according to Klasa (1998) not been recorded from either Norway or Sweden. Klasa (1998) refers to *G. numerata* as a very rare species, however, it has a very wide distribution recorded from Sibiria and the Far East (Nartshuk 1984). Larvae of *G. numerata* live in fungal decay of dead tree trunks (Klasa 1998).

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The moth (Lepidoptera) fauna of coastal spruce forest at Almdalen Forest Reserve, Namsos, and continental forest in Lierne, Central Norway

Leif Aarvik & Alf Bakke

Aarvik, L. & Bakke, A. 1999. The moth (Lepidoptera) fauna of coastal spruce forest at Almdalen Forest Reserve, Namsos, and continental forest in Lierne, Central Norway. *Norw. J. Entomol.* 46, 9–17.

Two light traps were operated in the coastal spruce forest reserve, Almdalen in Namsos during the 1996 season. In addition two traps were placed out for comparison in a more continental type forest, Østborg in Lierne, in the same part of central Norway. Totally 150 species in 23751 specimens were collected. The two sites had 62% of the species in common, most of which are widely distributed species. The coastal site had a higher proportion of species with a southern distribution in Norway. No special western fauna element of Lepidoptera was apparent in the material. The species found in this coastal spruce forest, also occur in other forest types in Norway. Typical continental species, on the other hand, also seem to be able to adapt to the coastal spruce forest environment.

Key words: Lepidoptera, moth fauna, spruce forest.

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INTRODUCTION

In recent years there has been a strong focus on the biodiversity of the Atlantic forests of Norway, in particular on the lichen flora of coastal spruce forests in Trøndelag. A number of lichen species have their only or main European distribution in this area (Holien & Tønsberg 1996). The insect fauna of this forest type has, until recently, not been studied specifically. Tømmerås & Breistein (1995) and Tømmerås et al. (1997) sampled beetles in a coastal forest area (1 km²), in Mosvik in inner Nord-Trøndelag. Their sampling showed a fauna of beetles which was rather poor in species, with 368 species, of a total of 3400 beetles registered in Norway.

Only a few of the approximately 2100 Lepidoptera species occurring in Norway have a distribution restricted to the coastline of western and central parts of the country (Database of Norwegian

Lepidoptera). The purpose of the present study was to see whether otherwise continental species, characteristic of natural spruce, *Picea abies* (L.) Karst., forests in eastern Norway, have been able to adapt to the very humid conditions of the coastal spruce forest. Furthermore, we have a very limited knowledge of the composition of the Lepidoptera fauna of coastal spruce forest in Norway, and the present work was carried out to improve this knowledge.

MATERIALS AND METHODS

The conifer forest reserve Almdalen (NTY Namsos, UTM 32WPS343658) (Fig. 1) was chosen as one of the study sites. The reserve is situated in an east-west going valley at the bottom of the fjord Vetterhusbotten. The protected area is dominated by a Eu-Piceetum dryopteridetosum forest type and with the poor Chamaemoro-Piceetum in depressions. It has a rich flora of rare lichens, fa-



Figure 1. Map of Norway showing geographic position of Almdalen and Østborg.

voured by the very humid climate (Haugen 1991). The annual average precipitation was 1346 mm in the period 1961-1990 at Bangdalen (Norwegian Meteorological Institute), a site situated approximately 28 km to the south-west of Almdalen and with similar topographic and climatic conditions.

Two light traps were in operation during the 1996 season. One of them was placed ca. 5 m from the river Dunaelva on its southern bank. The other trap was placed on a plateau about 10 m above the river approximately 50 m apart.

The spruce forest at the locality was mixed with

birch, *Betula pubescens* Ehrh., and some rowan, *Sorbus aucuparia* L. The field layer around the lower trap was dominated by bilberry, *Vaccinium myrtillus* L., and around the trap on the plateau, by brackens. The steep southern side of the valley 400 m further south was covered with pine, *Pinus sylvestris* L., forest.

The traps were each fitted with one 40 W actinic light tube which emits a great portion of ultraviolet light. Ultraviolet light has been shown to attract moths more efficiently than ordinary light (e.g. Heath 1970).

In order to compare the fauna of Almdalen with the fauna of a more continental region, two similar traps were in operation during the 1996 season at Østborg (NTI Lierne, EIS 103, UTM 33WVM 499102) (Fig. 1) in inner Nord-Trøndelag, approximately 120 km from Almdalen. The two traps were placed about 100 m apart. This locality was situated about 200 m from the northern shore of Lake Rengen, at an altitude of 370 m. The average annual precipitation in the period 1961–1990 at Sørli, approximately 13 km to the north-east, was 683 mm (Norwegian Meteorological Institute). The site is in a spruce forest of the *Eu-Piceetum myrtilletosum* type in which the field layer is dominated by bilberry, *Vaccinium myrtillus*. The forest is mixed with some rowan, *Sorbus aucuparia*, and birch, *Betula pubescens* Ehrh. The forest gives the impression of being old, but selected logging took place in the 1950's (G. Nordbakk, pers. comm.).

The traps at Almdalen were in operation from 5 June till 9 September, the ones at Østborg from 1 July till 10 September. The traps at Almdalen were emptied once a week except in the last part of August when they were emptied twice a week. The traps at Østborg were emptied every second week, after mid-August once a week.

Some specimens in the material were worn and difficult to identify. In such cases the identification was done by the aid of genitalia preparation. In a few cases it was considered too time consuming to identify every difficult specimen, and they were left uncounted. However, the number of these uncounted specimens was insignificant.

The faunal districts NTY and NTI were defined by Økland (1981), and the EIS grid squares by Økland (1976). Botanical classification of forest types is according to Fremstad & Elven (1987). Information on the distribution of Lepidoptera in Norway was retrieved from the database on Norwegian Lepidoptera (Leparb).

RESULTS

At Almdalen 120 moth species were trapped (Table 1). Of these 62% were also caught at Østborg. At Østborg 95 moth species were recorded alto-

gether. At both sites the bilberry feeding Geometridae species *Eulithis populata*, *Entephria caesiata*, *Chloroclysta citrata* and *C. truncata* dominated. At Almdalen they represented 51.3% of the total catch and at Østborg 76.6%.

When the species were grouped corresponding to their host plants (Svensson 1993), we found that the faunas of Almdalen and Østborg differed very little (Table 2) in number of species on the different host plants. Of the species trapped at Almdalen 9.1% were conifer feeders, and the corresponding number for Østborg was 8.6%.

The record of *Xestia rhaetica* (Staudinger) at Almdalen represented the westernmost record of the species in Europe.

DISCUSSION

According to information retrieved from the database of Norwegian Lepidoptera, Coastal Nord-Trøndelag (NTY) is the poorest investigated faunal region in Norway with respect to Lepidoptera. When data from Almdalen was included, the number of species known from the region rose to 175. Of the present 120 species 118 were recorded in the region for the first time. Inner Nord-Trøndelag (NTI) is much better investigated. The reason for this is that the main roads from southern to northern Norway pass through the region. Our material from Østborg resulted in an increase of 48 species, increasing the number of recorded species from 413 to 461. The actual number of species of both faunistic regions is probably close to 600. In central Norway the best investigated faunistic region, Inner Sør-Trøndelag (STI), has 637 species according to the database.

Of the 120 species trapped at Almdalen, the greater portion (60%), are widely distributed from southern to northern Norway. 21% are «southern species», in this context meaning that they have their northern limit in Trøndelag or Nordland. 17% are boreal species; and 2.5% must be considered as immigrants (Database of Norwegian Lepidoptera). The faunas of the two sites were exactly similar with regards to the percentage of widely distributed species (60%), but Almdalen had a higher

Table 1. Lepidoptera species captured at Almdalen and Østborg in 1996. The numbers of individuals of each species captured are shown. The type of geographical distribution (D) is indicated for each species. V=widespread, S=southern, B=boreal, A=alpine, I=immigrant. The nomenclature and sequence of taxa are according to Svensson et al. (1994).

Name	D	Almdalen	Østborg
Hepialidae			
<i>Hepialus hecta</i> (Linnaeus, 1758)	V	1	
<i>Hepialus fusconebulosa</i> (DeGeer, 1778)	V	60	17
Prodoxidae			
<i>Lampronia rupella</i> (Denis & Schiffermüller, 1775)	B		1
Tineidae			
<i>Monopis weaverella</i> (Scott, 1858)	V	1	1
Yponomeutidae			
<i>Argyresthia pygmaeella</i> (Denis & Schiffermüller, 1775)	V	2	13
<i>Argyresthia sorbiella</i> (Treitschke, 1883)	V		40
<i>Argyresthia conjugella</i> Zeller, 1839	V	2	3
<i>Argyresthia pulchella</i> Lienig & Zeller, 1846	B	1	
<i>Yponomeuta evonymella</i> (Linnaeus, 1758)	V	106	13
<i>Yponomeuta padella</i> (Linnaeus, 1758)	V		1
<i>Swammerdamia compunctella</i> Herrich-Schäffer, 1855		1	
Plutellidae			
<i>Plutella xylostella</i> (Linnaeus, 1758)	V	4	
Ypsolophidae			
<i>Ypsolopha parenthesella</i> (Linnaeus, 1761)	V	179	4
Oecophoridae			
<i>Depressaria badiella</i> (Hübner, 1796)	V	10	
<i>Agonopterix angelicella</i> (Hübner, 1813)	V	1	
Coleophoridae			
<i>Coleophora obscenella</i> Herrich-Schäffer, 1855	V		3
Momphidae			
<i>Mompha locupletella</i> (Denis & Schiffermüller, 1775)	V	1	
<i>Mompha conturbatella</i> (Hübner, 1819)	V		4
Blastobasidae			
<i>Hypatopa binotella</i> (Thunberg, 1794)	V	1	
Gelechiidae			
<i>Teleiopsis diffinis</i> (Haworth, 1828)	V	1	
<i>Chinodes lugubrella</i> (Fabricius, 1794)	B		1
<i>Chinodes continuella</i> (Zeller, 1839)	V		1
<i>Neofaculta infernella</i> (Herrich-Schäffer, 1854)	B	1	3
<i>Gnorimoschema epithymella</i> (Staudinger, 1859)	B		1
<i>Caryocolum cassella</i> (Walker, 1864)	B	2	
<i>Caryocolum pullatella</i> (Tengström, 1848)	B	2	
Tortricidae			
<i>Pandemis cerasana</i> (Hübner, 1786)	V	6	
<i>Lozotaenia forsterana</i> (Fabricius, 1781)	V	27	84
<i>Cnephasia asseclana</i> (Denis & Schiffermüller, 1775)	V	78	12
<i>Eana osseana</i> (Scopoli, 1763)	B	25	5
<i>Eana penziana</i> (Thunberg, 1791)	V	11	4
<i>Acleris laterana</i> (Fabricius, 1794)	V	6	

Table 1. Cont.

Name	D	Almdalen	Østborg
<i>Acleris variegana</i> (Denis & Schiffermüller, 1775)	S	3	
<i>Acleris emargana</i> (Fabricius, 1775)	V	5	2
<i>Olethreutes lacunana</i> (Denis & Schiffermüller, 1775)	V	10	6
<i>Olethreutes bipunctana</i> (Fabricius, 1794)	B		4
<i>Pseudohermenias abietana</i> (Fabricius, 1787)	S		1
<i>Epinotia indecorana</i> (Zetterstedt, 1839)	B	3	
<i>Epinotia solandriana</i> (Linnaeus, 1758)	V	56	11
<i>Epinotia brunnichana</i> (Linnaeus, 1767)	V		3
<i>Epinotia maculana</i> (Fabricius, 1775)	S	3	
<i>Epinotia caprana</i> (Fabricius, 1798)	S	1	
<i>Epinotia ramella</i> (Linnaeus, 1758)	S	3	
<i>Epinotia nisella</i> (Clerck, 1759)	S	5	
<i>Epinotia tenerana</i> (Denis & Schiffermüller, 1775)	V	8	
<i>Rhopobota naevana</i> (Hübner, 1817)	V	26	22
<i>Zeiraphera ratzeburgiana</i> (Saxesen, 1840)	V	26	
<i>Zeiraphera griseana</i> (Hübner, 1799)		62	732
<i>Epiblema grandaevana</i> (Lienig & Zeller, 1846)	S		1
Pterophoridae			
<i>Platyptilia calodactyla</i> (Denis & Schiffermüller, 1775)	V	1	
<i>Platyptilia gonodactyla</i> (Denis & Schiffermüller, 1775)	V	2	1
Pyralidae			
<i>Dioryctria abietella</i> (Denis & Schiffermüller, 1775)	V	4	
<i>Dioryctria schuetzella</i> Fuchs, 1899	S		1
<i>Pyla fusca</i> (Haworth, 1811)	V	1	
<i>Assara terebrella</i> (Zincken, 1818)	V		1
<i>Catoptria permutatella</i> (Herrich-Schäffer, 1848)	V	1	16
<i>Catoptria margaritella</i> (Denis & Schiffermüller, 1775)	V	1	
<i>Eudonia murana</i> (Curtis, 1827)	B		8
<i>Eudonia trunciolella</i> (Stainton, 1849)	S	1	
<i>Eudonia sudetica</i> (Zeller, 1839)	V		39
<i>Loxostege sticticalis</i> (Linnaeus, 1761)	I	2	
<i>Udea lutealis</i> (Hübner, 1809)	V	2	1
<i>Udea nebulalis</i> (Hübner, 1796)	B		2
<i>Nomophila noctuella</i> (Denis & Schiffermüller, 1775)	I	2	
<i>Pleuroptya ruralis</i> (Scopoli, 1763)	S	8	12
Drepanidae			
<i>Falcaria lacertinaria</i> (Linnaeus, 1758)	V		1
Geometridae			
<i>Geometra papilionaria</i> (Linnaeus, 1758)	V	14	5
<i>Rhodometra sacraria</i> (Linnaeus, 1767)	I	1	
<i>Xanthorhoe munitata</i> (Hübner, 1809)	V	11	17
<i>Xanthorhoe montanata</i> (Denis & Schiffermüller, 1775)	V	36	12
<i>Epirrhoe alternata</i> (Müller, 1764)	V	3	
<i>Entephria caesiata</i> (Denis & Schiffermüller, 1775)	B	839	7250
<i>Eulithis prunata</i> (Linnaeus, 1758)	V		1
<i>Eulithis testata</i> (Linnaeus, 1761)	V	76	14
<i>Eulithis populata</i> (Linnaeus, 1758)	V	3013	2439
<i>Ecliptopera silaceata</i> (Denis & Schiffermüller, 1775)	V		1
<i>Chloroclysta citrata</i> (Linnaeus, 1761)	V	1412	225
<i>Chloroclysta truncata</i> (Hufnagel, 1767)	V	408	95

Table 1. Cont.

Name	D	Almdalen	Østborg
<i>Plemyria rubiginata</i> (Denis & Schiffermüller, 1775)	S	92	73
<i>Thera firmata</i> (Hübner, 1822)	S	39	
<i>Thera variata</i> (Denis & Schiffermüller, 1775)	V	49	24
<i>Thera obeliscata</i> (Hübner, 1787)	V	92	1
<i>Thera cognata</i> (Thunberg, 1792)	V	161	98
<i>Colostygia pectinataria</i> (Knoch, 1781)	S	2	
<i>Hydriomena furcata</i> (Thunberg, 1784)	V	1250	87
<i>Hydriomena ruberata</i> (Freyer, 1831)	V	1	
<i>Coenocalpe lapidata</i> (Hübner, 1809)	B		1
<i>Spargania luctuata</i> (Denis & Schiffermüller, 1775)	V		1
<i>Epirrita autumnata</i> (Borkhausen, 1794)	V	60	120
<i>Perizoma taeniata</i> (Stephens, 1831)	B	16	91
<i>Perizoma alchemillata</i> (Linnaeus, 1758)	V	1	
<i>Perizoma parallelolineata</i> (Retzius, 1783)	S	19	
<i>Eupithecia satyrata</i> (Hübner, 1813)	V		1
<i>Eupithecia pusillata</i> (Denis & Schiffermüller, 1775)	V	177	9
<i>Carsia sororiata</i> (Hübner, 1813)	V	3	
<i>Venusia cambrica</i> Curtis, 1839	B	85	7
<i>Itame wauaria</i> (Linnaeus, 1758)	V	1	1
<i>Itame brunneata</i> (Thunberg, 1784)	V	60	8
<i>Opisthograptis luteolata</i> (Linnaeus, 1758)	S	3	
<i>Epione repandaria</i> (Hufnagel, 1767)	S	2	
<i>Epione paralellaria</i> (Denis & Schiffermüller, 1775)	S		1
<i>Selenia dentaria</i> (Fabricius, 1775)	V	1	
<i>Selenia tetralunaria</i> (Hufnagel, 1767)	V	1	
<i>Crocallis elinguaris</i> (Linnaeus, 1758)	S	197	
<i>Lycia hirtaria</i> (Clerck, 1759)	V	1	
<i>Alcis jubata</i> (Thunberg, 1788)	B	6	1
<i>Cabera pusaria</i> (Linnaeus, 1758)	V	5	
<i>Hylaea fasciaria</i> (Linnaeus, 1758)	V	15	
<i>Parietaria vittaria</i> (Thunberg, 1788)	B	18	3
Lasiocampidae			
<i>Poecilocampa populi</i> (Linnaeus, 1758)	V		1
<i>Trichiura crataegi</i> (Linnaeus, 1758)	V	2	
<i>Dendrolimus pini</i> (Linnaeus, 1758)	S	1	
Notodontidae			
<i>Ptilodon capucina</i> (Linnaeus, 1758)	V	3	
Lymantriidae			
<i>Dicallomera fascelina</i> (Linnaeus, 1758)	V	1	
Noctuidae			
<i>Hypena proboscidalis</i> (Linnaeus, 1758)	V	2	1
<i>Lygephila pastinum</i> (Treitschke, 1826)	S		1
<i>Autographa gamma</i> (Linnaeus, 1758)	V, I	36	1
<i>Autographa pulchrina</i> (Haworth, 1809)	V	7	5
<i>Autographa bractea</i> (Denis & Schiffermüller, 1775)	S		1
<i>Syngrapha diasema</i> (Boisduval, 1829)	B, A		1
<i>Syngrapha interrogationis</i> (Linnaeus, 1758)	V	163	24
<i>Enargia paleacea</i> (Esper, 1788)	S	3	1
<i>Parastichtis suspecta</i> (Hübner, 1817)	V		5
<i>Cosmia trapezina</i> (Linnaeus, 1758)	S		1

Table 1. Cont.

Name	D	Almdalen	Østborg
<i>Hyppa rectilinea</i> (Esper, 1788)	V	1	
<i>Apamea crenata</i> (Hufnagel, 1766)	V	1	1
<i>Apamaea lateritia</i> (Hufnagel, 1766)	V	20	
<i>Apamea maillardi</i> (Geyer, 1834)	B, A	1	1
<i>Amphipoea crinanensis</i> (Burrows, 1908)	S	1	
<i>Hydraecia micacea</i> (Esper, 1789)	S	28	
<i>Celaena haworthii</i> (Curtis, 1829)	V	8	1
<i>Brachylochia viminalis</i> (Fabricius, 1766)	V	66	53
<i>Hillia iris</i> (Zetterstedt, 1839)	B	2	33
<i>Dasyptolia templi</i> (Thunberg, 1792)	V		1
<i>Lithomoia solidaginis</i> (Hübner, 1803)	V	621	85
<i>Agrochola helvola</i> (Linnaeus, 1758)	S	2	
<i>Xanthia togata</i> (Esper, 1788)	V	22	1
<i>Lasionycta proxima</i> (Hübner, 1809)	S		3
<i>Cerapteryx graminis</i> (Linnaeus, 1758)	V	273	
<i>Chersotis cuprea</i> (Denis & Schiffermüller, 1775)	B	31	1
<i>Noctua pronuba</i> (Linnaeus, 1758)	S	2	
<i>Graphiphora augur</i> (Fabricius, 1775)	S	4	1
<i>Protolampra sobrina</i> (Duponchel, 1843)	B	39	1
<i>Lycophotia porphyrea</i> (Denis & Schiffermüller, 1775)	S	1	
<i>Diarsia mendica</i> (Fabricius, 1775)	V	10	13
<i>Diarsia florida</i> (F. Schmidt, 1859)	V	1	
<i>Xestia rhaetica</i> (Staudinger, 1871)	B	7	567
<i>Xestia speciosa</i> (Hübner, 1813)	B	158	579
<i>Xestia alpicola</i> (Zetterstedt, 1839)	B, A	2	2
<i>Xestia tecta</i> (Hübner, 1808)	A		1
<i>Xestia baja</i> (Denis & Schiffermüller, 1775)	S	99	14
<i>Eurois occulta</i> (Linnaeus, 1758)	V	12	11

Table 2. Host plant association of Lepidoptera caught at Almdalen and Østborg. Information on host plants is extracted from Svensson (1993).

Host plant	No. of species	
	Almdalen	Østborg
<i>Picea abies</i>	6	5
<i>Pinus sylvestris</i>	3	1
<i>Juniperus communis</i>	2	2
<i>Betula/Alnus</i>	14	10
<i>Salix/Populus</i>	16	10
<i>Sorbus/Prunus</i>	6	5
<i>Vaccinium</i> sp.	12	11
<i>Calluna</i>	1	0
Herbs	38	31
Polyphagous	13	10
Lichens/Mosses	5	4
Ferns	2	1
Others	4	3

percentage of southern species and Østborg a correspondingly higher percentage of boreal moths.

Surprisingly few species caught in the spruce forests relate to conifers as host plants; most of them feed either on deciduous trees or herbs (Svensson 1993). Although spruce does not serve as foodplant for many species of Lepidoptera, it plays an important role ecologically, creating a favourable habitat for many species (Atlegrim 1991, Imby & Palmqvist 1978). It has been shown (Atlegrim 1991) that bilberry growing in various types of shaded forest, mire forest and late successional forest, is the preferred food source for folivorous Lepidoptera and sawfly species feeding on this plant. Bilberry growing at sun-exposed sites differs from bilberry growing in shade both chemically and morphologically. In our light traps the bilberry-feeding species of the family Geometridae were captured in huge numbers. This suggests that these moths play a dominant role in the late succession spruce forest ecosystem.

The light traps used in the study are most efficient in the darkest part of the season, particularly in August. The number of moths trapped in June and first half of July is low. Consequently, the information on the species composition of the first part of the season is limited.

COMMENTS ON INDIVIDUAL SPECIES

Geometridae

Coenocalpe lapidata (Hübner, 1809)

The single specimen trapped at Østborg represents the third record from Norway. Previous records (Skou 1984) are from OS Gjøvik and ON Lom. Thus, the species seems to have a pronounced easterly distribution in Norway. In Sweden it is widespread in central and northern parts where it is «locally not rare»; in Finland «rather rare» (Skou 1984). Foodplants are *Anemone* L. and *Galium* L. (Skou 1984).

Alcis jubata (Thunberg, 1788)

This species, characteristic of old forest, is on the Norwegian «Red List» (Hansen & Aarvik in

press). The larvae feed on lichens of the genera *Usnea* Adanson and *Alectoria* Acharius (Skou 1984) growing on trees. Suitable habitats are becoming scarce because of modern forestry methods (Hansen & Aarvik in press). In Norway there are scattered records of the moth in the southeast, and in the inner parts of Trøndelag and Nordland (Database of Norwegian Lepidoptera, Skou 1984). The present record from Almdalen is the first from coastal Norway. However, the distribution pattern of this species (Skou 1984) indicates a more widespread distribution in the Palaearctic region, with its westernmost records from the British Isles and old records from western Jutland in Denmark. It is now considered to be extinct in Denmark (Skou 1984).

Noctuidae

Xestia rhaetica (Staudinger, 1871)

This species is confined to boreal spruce forests, and it seems to be dependent on forest with an old character; open, with lichen-covered twigs, and the field layer dominated by *Vaccinium myrtillus* (Imby & Palmqvist 1978) which is the foodplant (Fibiger 1993). One could assume that the lichen-covered twigs of spruce play an important role in this species' biology as it does for the closely related *Xestia sincera* (Herrich-Schäffer, 1851) (Hydén & Sjökvist 1993). An interesting ecological adaption in the boreal species of *Xestia* (and also in northern species of other noctuid genera) is their synchronized alternative year flight. Various explanations for this have been proposed, but none has gained general acceptance. One hypothesis is that this is adaptive to reduce infections by parasites with a one-year cycle (Mikkola 1976). In Norway *X. rhaetica* has been recorded from high altitude spruce forests in the southeast, and from scattered localities in inner Trøndelag and Nordland (Database of Norwegian Lepidoptera, Skou 1991). In this country it has always been considered a great rarity, and is included on the «Red List» (Hansen & Aarvik in press.). The record from Almdalen, where altogether 7 specimens were caught, represents the first from a coastal spruce forest. It is an indication that some continental species have been able to adapt to very humid

conditions. It is noteworthy that in 1996 altogether 567 specimens of *rhaetica* were trapped at Østborg. Of the noctuids only its congener *Xestia speciosa* (Hübner, 1813) was slightly more frequent (579 specimens) in this locality.

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***Hydraecia ultima* (Holst, 1965) (Lep., Noctuidae) recorded in Norway**

Bjørn Magne Fjellstad

Fjellstad, B.M. 1999. *Hydraecia ultima* (Holst, 1965) (Lep., Noctuidae) recorded in Norway. *Norw. J. Entomol.* 46, 18.

Hydraecia ultima (Holst, 1965) is reported for the first time from Norway. The biology and world distribution are briefly described. The species must be considered as a rare migrant.

Key words: *Hydraecia ultima*, Noctuidae, migrant.

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A single male of *Hydraecia ultima* (Holst, 1965) was captured in a light trap at Ø Råde: Sognshøy (EIS 20), 17 August 1996 (Leg. BMF). The locality is situated 2 km north east from Kurefjorden, Oslofjord. The area is farmland interspersed with deciduous and spruce forests. The specimen is deposited in the authors private collection.

H. ultima is distributed from Japan, through the Amur and Ussuri areas, Siberia and southern and middle Russia to western Europe. In Denmark, Finland and Sweden it is considered as a rare migrant (Skou 1991). The larva is known to feed on *Rumex hydrolapathum*, and the habitat is wet meadows and boggy areas covered with trees and larger herbaceous plants (Skou 1991).

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Notes on Norwegian ants (Hymenoptera, Formicidae)

Torstein Kvamme

Kvamme, T. 1998. Notes on Norwegian ants (Hymenoptera, Formicidae). *Norw. J. Entomol.* 46, 19–22.

Lasius carnolicus Mayr, 1861 and *Myrmica microrubra* Seifert, 1993 are reported for the first time from Norway. *Lasius platythorax* Seifert, 1991, the sibling species of *L. niger* (Linnaeus, 1758), is documented from Norway. *L. platythorax* is a common and widespread species in Norway. The true *L. niger* is restricted to warmer habitats in the southern parts of the country. In Scandinavia *Myrmica lonae* Finzi, 1926 has been considered a form of *Myrmica sabuleti* Meinert, 1861, but is now treated as a separate species. *M. lonae* is more widely distributed than *M. sabuleti* in Norway, and is documented from the country for the first time. Except one record, all specimens previously identified as *M. sabuleti* belong to *M. lonae*. *Lasius psammophilus* Seifert, 1992, has been split from *L. alienus* (Förster, 1853). So far all examined specimens previously identified as *L. alienus* belong to *L. psammophilus*. No evidence that *L. alienus* occurs in Norway has been found, and the species is consequently deleted from the list. Presently, a total of 50 outdoor living ant species have been published from Norway.

Keywords: Hymenoptera, Formicidae

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INTRODUCTION

The ant species recorded from Norway, was first listed by Siebke (1880). When the list is corrected to the present day's knowledge on taxonomy, a total of 16 outdoor living species were included. Holgersen (1944) published an overview with 33 species. In 1982, 46 ant species were known to occur in Norway (Kvamme 1982). The real number was 45 species. *Formica nigricans* Emery, 1909, was later shown to be an ecomorph of *F. pratensis* Retzius, 1783 (Seifert 1992b). *Monomorium pharaonis* (Linnaeus, 1758) is a true synanthropic species, living only in houses in Norway. The known number of outdoor living ant species was therefore 44 in 1982.

Myrmecina graminicola (Latreille, 1802) was later added to the list (Kvamme & Midtgaard 1984). In

addition to the species presented in this paper, *Camponotus vagus* (Scopoli, 1763) was found in Norway in 1998 (Kvamme, in prep).

The total number documented in Norway has by now reached 50 outdoor living ant species. In Sweden 72 outdoor living ant species have been registered (Douwes 1995). The true number of ant species belonging to the Norwegian fauna is likely to pass 60 when comparing it with the Swedish fauna.

Extensive changes in ant taxonomy have taken place in recent years. A number of new species have been described, lower taxa have been raised to species level – and nomenclature has altered. This paper updates the Norwegian ant list according to the current taxonomy and additional records.

ADDITIONS AND CORRECTIONS TO THE NORWEGIAN ANT LIST

The data presented is based on material in the reference collection of the Norwegian Forest Research Institute, Ås. Beside the specimens sampled by myself (Leg. TK), specimens collected by Alf Bakke (leg. AB) have been included.

Abbreviations used for regional codes are in agreement with Økland (1981). Later administrative changes of county and community borders are included. The numbers in parenthesis, after locality names, refer to the standardised 50 km x 50 km grids introduced by the European Invertebrate Survey (EIS) (Økland 1976).

Lasius carniolicus Mayr, 1861

A small colony of a yellow *Lasius* sp. was found on 8 May 1977 in TEY Bamble: near Helle (EIS 11). The colony was located under a stone in a dry and sandy area covered sparsely with grass and herbs. The ants had a strong citrus-like smell when fresh. The specimens were identified to *L. carniolicus* Mayr, 1861 by Dr. Per Douwes, Lund University.

A dealate queen found in the same nest was identified to *Lasius mixtus* (Nylander, 1846). *L. mixtus* is a temporary social parasitic ant. Mated queens establish their own colonies by adopting colonies of *L. niger* and *L. alienus* (Collingwood 1979). Seifert (1988, 1996) mentions only *L. niger* as host species. The presence of the *L. mixtus* queen in the colony should be considered accidental. When stones are turned around, ants from different colonies etc. might be mixed. No evidence has been found that *L. mixtus* uses colonies of *L. carniolicus* as temporary hosts.

In Sweden *L. carniolicus* is considered a rare species limited to warmer areas rich in lime, in open and dry fields. This fits with the circumstances under which the record in Norway was done. So far the species is known only from Öland, Gotland and Småland in Sweden (Douwes 1995). In Germany the species is considered the rarest of the *Lasius* spp. and restricted to dry areas with lime and sand (Seifert 1996). The presence in Norway

was unexpected. *L. carniolicus* is probably restricted to the warmest areas in the south and limited to the few localities with limestone. It should be considered a rare species, both with respect to range and population density. In 1997 I searched at suitable localities in the same area, but I did not find any colonies at all. Until more knowledge on the species in Norway has been gathered, *L. carniolicus* should be classified as insufficiently known (I) in the red list.

Lasius platythorax Seifert, 1991 and *Lasius niger* (Linnaeus, 1758)

The two species form a pair of siblings that are distinguished morphologically mainly by different shape of the alitrunk of the queen. The workers can best be discriminated by differences in hairiness on clypeus (Seifert 1991). This is the first documentation of *L. platythorax* from Norway. Up to now the two species have been confused under the name «*L. niger*» (Kvamme 1982). Examination of specimens indicates that the range of *L. platythorax* in Norway is similar to the distribution of what formerly was called «*L. niger*» (Kvamme 1982). The «true» *L. niger* prefers warmer habitats and has a more southern distribution in Norway. This species is favoured by human activities (Douwes, pers. comm.). *L. platythorax* is the commoner of the two in Norway. This is in agreement with the Swedish experience (Douwes 1995).

According to Seifert (1991, 1992a) and Douwes (1995) the habitat choice can be summarised as follows:

L. niger prefers open, warm and dry to semidry areas. The nests are usually constructed in the soil, rarely in decaying wood.

L. platythorax can be found in bogs and fens and in all kinds of not too dense lowland forests, including wood edges. Nests are constructed in decaying wood and in soil. *L. platythorax* prefers more humid environments than *L. niger*.

All the Norwegian material labelled *L. niger* needs revision. Unfortunately, as for many other common species, little material has been preserved. New

material is needed to reveal the true distribution pattern. Material examined are from the following localities:

L. platythorax: **VE** Borre: Horten (EIS 19) (Leg. TK), Sandefjord: Svinesmyra and Svines (EIS 19) (Leg. TK), **BØ** Ringerike: Steinsletta (EIS 36) (Leg. TK), **TEY** Bamble: Grassmyrhallen (EIS 11) (Leg. TK), **TEI** Seljord: Flatdal (EIS 26) (Leg. TK), **AAV** Arendal: Arendal (EIS 6) (Leg. AB), Grimstad: Roresand (EIS 6) (Leg. TK), **RY** Strand: Tau (EIS 14) (Leg. TK), **SFI** Lærdal: Hedler (EIS 51) (Leg. TK), **NTI** Snåsa: Finsås (EIS 102) (Leg. AB).

L. niger: **AAV** Grimstad: Reddal (EIS 6) (Leg. TK), **TEY** Bamble: Langøya (EIS 11) (Leg. TK), **VE** Larvik: Mølen (EIS 11) (Leg. TK), Tjøme: Sandøy (EIS 19) (Leg. TK).

Lasius psammophilus Seifert, 1992

The taxonomy of the subgenus *Lasius* was studied by Seifert (1992a). *L. alienus* (Förster, 1850) was split in three species and *L. psammophilus* and *L. paralienus* were described. I have examined specimens earlier identified as *L. alienus* (Kvamme 1982). All examined specimens from the following localities are *L. psammophilus*: **AAV** Arendal: Tromlingene (EIS 6) (Leg. TK), Arendal: Tromøy, Bjelland (EIS 6) (Leg. AB), **VE** Tjøme: Sandøy (EIS 19) (Leg. TK), Tjøme: Sandøysund (EIS 19) (Leg. TK), **BØ** Kongsberg: Pikerfoss (EIS 27) (Leg. TK).

According to Seifert (1992a) *L. psammophilus* has a strong preference for sandy ground, while *L. alienus* has a preference for habitats rich in lime. None of the localities mentioned are particular rich in lime. All localities mentioned, except one, are sandy areas with sparse vegetation close to seashores. The record from Pikerfoss was done at a corresponding habitat on a riverbank.

So far no evidence has been found that *L. alienus* occurs in Norway. It is consequently deleted from the list.

Myrmica microrubra Seifert, 1993.

The discussion of the status of the microgyne form

of *Myrmica rubra* (Linnaeus, 1758) has been going on for years (Brian & Brian 1955, Elmes 1976, Pearson & Child 1980, Pearson 1981, Seifert 1988, Elmes & Brian 1991). The microgyne form was described as a separate social parasitic species and named *Myrmica microrubra* (Seifert 1993a).

On 27 April 1979 I found two nests under stones in a meadow at **AK** Nes: Kjærnsmo (EIS 37). The nests contained hibernating immobile ants in the frozen ground. More than 30 alate and 10 dealate small queens were found. *M. rubra* nests do not contain alate queens during hibernation, which indicates a difference in biology between the two species.

This record is so far the first and only of *M. microrubra* in Norway. In Sweden the species has been found only in Skåne (Douwes 1995). *M. microrubra* is probably an overlooked species, since it has been considered a form of *M. rubra*. Focus on and search for *M. microrubra* is likely to show both a wider distribution and a higher abundance than indicated by present Scandinavian records.

Myrmica lonae Finzi, 1926 and *Myrmica sabuleti* Meinert, 1861

Myrmica lonae was not considered a separate species in Scandinavia (Douwes 1976, Kvamme 1982) before the last review of Swedish ants (Douwes 1995) and Finnish ants (Saaristo 1995). However, Collingwood (1979) mentioned it as a form of *M. sabuleti* equivalent to the form described as var. *lonae* Finzi. Bolton (1995) listed *M. lonae* as a subspecies. I follow the opinion of Seifert (1996) although it is still not clear whether it is a distinct species isolated reproductively or a morph. Differences in habitat preference support the status as a separate species:

M. lonae inhabits bogs etc., while *M. sabuleti* can be found in warm dry habitats. *M. lonae* inhabits bogs and dry, warm sites both in forests and in the open, whereas *M. sabuleti* seems to be restricted to open, dry and warm places. *M. sabuleti* is a more xerophilous species than *M. lonae*.

Also the differences in distribution and abundance

support species status. *M. lonae* is clearly more common in Scandinavia compared to central Europe (Seifert 1993b, 1996). Examination of material previously identified as *M. sabuleti* shows that *M. lonae* and *M. sabuleti* have been confused in Norway. Preliminary results indicate that *M. lonae* is more widely distributed with higher abundance in Norway compared with *M. sabuleti*. The true range of the species cannot be inferred from the material and data presently available. Material examined so far gives the following localities for the species:

M. sabuleti: Two colonies were found under stones in a sunexposed south facing slope at **SFI** Lærdal: Hedler (EIS 51) (Leg. TK). *M. schenki* Emery, 1894, was abundant in the same locality. So far, these are all specimens identified as *M. sabuleti* from Norway.

L. lonae: **Ø** Fredrikstad: Rauer (=Rauøy) (EIS 19) (Leg. TK), Moss: Jeløy, Alby area (EIS 19) (Leg. TK), **VE** Larvik: Fornet (EIS 19) (Leg. TK), **TEY** Kragerø: Oterøy (EIS 11) (Leg. TK), Bamble: near Rugtveit (EIS 11) (Leg. TK), **AAV** Arendal: Tromøya (EIS 6) (Leg. AB, TK), Tvedestrand (Leg. TK), **AAI** Åmli: Simonstad (EIS 10) (Leg. TK), **VAY** Kristiansand: Frikstad (EIS 2) (Leg. TK), **RY** Time: Bryne (EIS 7) (Leg. TK) (The locality at Bryne was a meadow with an extreme density of colonies of *M. lonae* and *Formica lemani* Bondroit, 1917), **AAV** Grimstad: Omre (EIS 6) (Leg. TK).

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Hansen, Michael. 1998. World Catalogue of Insects. Volume 1. Hydraenidae (Coleoptera). 168 pp. Apollo Books, Stenstrup. ISBN 87-88757-27-7. DKK 290,—.

Når nå Apollo Books lanserer ikke bare et bind, men en hel serie av verdenskataloger over insektfaunaen, kan man bare glede seg. Det er et ambisiøst tiltak på grensen til det dristige.

Et av de store problemene entomologer konfronteres med, er mangelen på moderne oversikter, etter hvert som nye arter beskrives. Endringen av storsystematikken synes å foregå i bølger, og det er ikke alltid like lett å være oppdatert. Mangelen på standardisert og enhetlig nomenklatur er viktig, ikke minst i oppbyggingen av databanker. De latinske navnene kan være bindeledd mellom de ulike basene. Navnene må derfor være de samme.

De innledende kapitlene i boka er kortfattede og klare, og vidner om at forfatteren har solide kunnskaper om familien. Dette er ikke noe nytt i og med at forfatteren har en stor produksjon bak seg. Det er greie redegjørelser for historisk bakgrunn, kilder og metoder. Utbredelsesdataene er summariske og gis i henhold til de overordnede biogeografiske regionene. Hansen har, av praktiske og lett forståelige grunner, modifisert regionene. Grensene mellom dem er delvis problematiske, som det påpekes. Men, det kan spørres om det i stedet burde ha vært brukt den «ortodokse» inndelingen for å slippe enda en variant.

Nyttig, klar og oversiktlig er diskusjonen av klassifikasjonen som ligger til grunn for familiens underfamilie- og tribusinndeling.

Hoveddelen av boka er selve katalogen. Den er klar og oversiktlig og følger et fast oppsatt mønster. En rask gjennomlesing av boka avslører ingenting som umiddelbart er feil. Det kan bare avsløres av spesialister etter inngående vurdering. Bibliografien er meget omfattende, og vil være en nyttig inngang for alle som vil arbeide videre med familien.

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Som konklusjon kan jeg bare si følgende: En velfortjent gratulasjon til forfatteren og de beste ønsker til Apollo Books med videreføringen av serien.

Torstein Kvamme

Saproxylic beetles visiting living sporocarps of *Fomitopsis pinicola* and *Fomes fomentarius*

Sigmund Hågvar

Hågvar, S. 1999. Saproxylic beetles visiting living sporocarps of *Fomitopsis pinicola* and *Fomes fomentarius*. Norw. J. Entomol. 46, 25–32.

A total of 61 beetle species from 16 families were observed sitting on living sporocarps of the common bracket fungi *Fomitopsis pinicola* and *Fomes fomentarius* (Polyporaceae). The highest number of species were attracted to *F. fomentarius*, and only 11 species were common to both fungal species. Most of the collected beetle species do not breed in the respective fungi, but develop in other saproxylic habitats. Beetles were continuously coming and leaving, and arrival around midnight (between 21 and 03 h) was observed in 34 species. Night activity was especially typical within Leiodidae, Latridiidae, Trogossitidae and the genus *Epuraea* within Nitidulidae. It is suggested that saproxylic beetles seek to living sporocarps either 1) for feeding, 2) that they follow the odour from living sporocarps in order to come close to dead wood, in which they are going to breed (kairomone effect), or 3) both. Most of the beetles could breed in the tree species on which the sporocarp was growing (spruce or birch). Since visiting beetles were often covered with fungal spores and thus could spread them by flight, the relationship between living bracket fungi and visiting saproxylic beetles may be symbiotic. *Bolitophagus reticulatus*, breeding in dead sporocarps of *F. fomentarius*, was found to visit living sporocarps of the same species to feed on the hymenium, especially during the night.

Key words: Saproxylic beetles, Coleoptera, sporocarps, Norway.

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INTRODUCTION

Two common species of bracket fungi in Scandinavia are *Fomitopsis pinicola* (Fr.) Karst. and *Fomes fomentarius* (L. ex Fr.) Kickx. (Ryman & Holmåsen 1992). Both produce conspicuous fruiting bodies (sporocarps) on stems of dead or weakened trees. In the study area, the former grows mainly on spruce (*Picea abies* (L.) Karst.) and the latter mainly on birch (*Betula verrucosa* Ehrh. or *B. pubescens* Ehrh.). Dead sporocarps of both fungus species contain several characteristic beetle species, which breed there and contribute to the decomposition process (e.g. Økland & Hågvar 1994, Thunes 1994, Økland 1995, Jonsell & Nordlander 1995, Thunes & Willassen 1997). However,

few beetle species are able to breed in living sporocarps. The only regularly breeding beetle in living *F. pinicola* is *Gyrophæna boleti* (L.) (Staphylinidae), whose larvae are spore-eaters and live in the pores (Ashe 1984, Økland & Hågvar 1994). Occasionally, certain Cisidae (mainly *Cis glabratus* Mellié) may breed in dead or weakened parts of living *F. pinicola* (Økland & Hågvar 1994, Hågvar & Økland 1997), but the internal matrix of living sporocarps in this fungus is usually undamaged. Living sporocarps of *F. fomentarius* may often contain burrowing larvae of Lepidoptera, but rarely beetle larvae, except for pioneer colonies of *Cis jacquemartii* Mellié in weakened parts (Midtgaard 1985, Midtgaard et al. 1998, Thunes & Willassen 1997).

Studies with interception traps by Økland & Hågvar (1994) and Hågvar & Økland (1997) indicated that a large number of saproxylic (dead wood-dependent) beetle species were attracted towards living sporocarps of *F. pinicola*. Such window trap catches reflect flight activity close to sporocarps, but do not tell if the beetles are actually landing on the sporocarps. However, Hågvar & Økland (1997) observed that certain saproxylic beetle species were often sitting on the underside of living *F. pinicola* sporocarps. Their final destination for egg-laying was not living sporocarps, but various other saproxylic habitats. Therefore, Hågvar & Økland (1997) suggested that living sporocarps in various ways may have a positive function for a large number of saproxylic beetle species. The purpose of the present study is to address the following questions:

Which beetles are sitting on living sporocarps, and are the species mainly saproxylic? Do *F. pinicola* and *F. fomentarius* attract different beetle faunas, and do beetles arrive both during day and night? May the relationship between beetle and fungus be symbiotic?

MATERIAL AND METHODS

The study was performed during 1993-94 near Tappenberg Lake (UTM: N 636100, E 148000) in Østmarka Nature Reserve (12.5 km², about 20 km east of Oslo). Old spruce forest dominates the landscape, with scattered deciduous trees. On 43 occasions, at different times of the year and the day, 100 numbered sporocarps of *F. pinicola*, and 40 of *F. fomentarius*, were sampled for beetles. Most of the sporocarps were situated within a rather small area of approximately 100 x 50 m. It was noted whether sporulation occurred (by observation of a white spore layer below or on the top surface of the sporocarp), and if the beetles were sitting on the upper or under side of the sporocarp. During 1993, 29 samplings were made from April to August, and during 1994, 14 samplings from May to August. Sometimes, samplings were made with only a few hours intervals, including the night. Because the beetles were removed, new arrivals could be observed. *Bolitophagus reticulatus* (L.), was sampled only during April and May 1993.

During the rest of the time, numbers were counted, so that natural variations in their occurrence on living *F. fomentarius* could be observed. *G. boleti* was not sampled on *F. pinicola*. Several hundred individuals of this staphylinid could be observed on one sampling, and in Table 1, the term «numerous» has been used.

Nomenclature of beetles is from Silfverberg (1992) and information on host trees from an extensive data base compiled from Northern European literature by Stokland (pers. comm.). The categories of breeding substrates in Table 1 are from Koch (1989-1992): xylo-detriticol (decomposing wood), corticol (bark), mycetophil/mycetobiont (various fungi), polyporicol (bracket fungi, Polyporaceae), and boleticol (cap fungi with tubes, of Bolet family).

RESULTS

Living sporocarps attracted many beetle species. Altogether, 61 species from 16 families were collected (Table 1). Nearly all recorded species, 56 of 61, were saproxylic. Of these were 37 obligate saproxylic and 19 were facultative saproxylic.

Most of the species listed in Table 1 do not breed in the respective sporocarp species. Their substrate for egg-laying and larval life is often dead wood or bark, or fungi associated with decomposing woody material. Many species show a broad range of host trees.

Rather different beetle faunas were attracted to each of the two fungal species. They had only 11 beetle species in common. A total of 45 species was found on *F. fomentarius*, and 27 on *F. pinicola*. Since it was sampled from fewer specimens of *F. fomentarius*, this fungus clearly attracted the highest number of beetle species. Furthermore, while almost all beetles on *F. pinicola* were sitting on the underside, i.e. on the hymenium, a great part of the beetles on *F. fomentarius* were collected from the upper surface of the sporocarp (Table 1). Examples of species sitting mainly on the upper side were *Anisotoma humeralis* (Fabricius), *Epuraea variegata* (Herbst), *Corticaria lapponica* (Zetterstedt) and *C. jacquemartii*.

Beetles were present on sporocarps during all times of the day. Arrival occurred both during the day and the night, and «night» arrival (i.e. between 21 and 03 h) was observed in as many as 34 species (Table 1). This was especially typical within Leiodidae, Latridiidae, Trogossitidae and the genus *Epuraea* within Nitidulidae. *B. reticulatus*, breeding in dead sporocarps of *F. fomentarius*, visited living sporocarps of this fungus around midnight to feed, producing small depressions in the hymenium. Their night activity was evident both in May 1993 when beetles were removed each time, and later, when the beetles were only observed and counted (Table 2). Also among *Rhizophagus dispar* (Paykull) and *A. humeralis*, there were indications of a maximum in the activity during the night. On *F. fomentarius*, there were often many beetle species present at midnight (Table 2). These had arrived recently, since the sporocarps had been emptied for beetles 2–3 hours earlier. The more limited species numbers recorded on *F. pinicola* also documents a certain night activity.

A great number of the species were sampled in early spring, especially during the month of May (Table 1), when sporulation was observed in both sporocarp species. At that time, the body of the beetles often had a white cover of fungal spores. Another phenological observation was that during May and June, one fourth of the *B. reticulatus* individuals present during night on *F. fomentarius* were in copulation. Only two other beetles were observed in copulation, both on *F. fomentarius*: *E. variegata* and *Anisotoma glabra* (Kugelann).

DISCUSSION

Why do saproxylic beetles seek to living sporocarps?

The present paper shows for the first time that a high number of saproxylic beetles actually sit on living sporocarps, and not only fly or crawl close to them (interception traps close to sporocarps do not distinguish between these possibilities). On the basis of more limited observations of beetles sitting on living sporocarps, Hågvar & Økland (1997) discussed four possible reasons for this behaviour: Breeding, feeding, kairomone effect and spore

dispersal. Since most of the observed species do not breed in the sporocarps (Table 1), feeding may be a main reason for several species. The food may be spores, the hymenium, or various prey. During sporulation, which typically occurred just after snow melt in both species (usually in the first half of May), as much as 17 beetle species were observed on *F. pinicola* and 24 on *F. fomentarius*. The high number of beetles found on the upper side of the sporocarps in *F. fomentarius* may be explained by the observation that in this fungus, spores accumulate in thick layers on the upper side. In certain years, both fungi were observed to sporulate also shortly in autumn, for instance in moist weather after a midsummer drought. During most of the snow-free season, there was no sporulation, but growth of a new layer of hymenium was observed during periods of sufficient moisture.

The hymenium may also represent a hunting ground for predacious beetles, e.g. Staphylinidae and Rhizophagidae (Hågvar & Økland 1997). Some living sporocarps of *F. pinicola* contained mites in more than half of the pores. It was observed that these and various insect larvae in the pores sometimes came to the surface to change pore. Even other visiting beetles may serve as prey. The third possible food source, the hymenium itself, may be used by species within Cryptophagidae and Lathridiidae. During June and July, *B. reticulatus* was often observed to feed actively on the hymenium of living *F. fomentarius*, creating small depressions in the surface. Nilsson (1997) also observed this phenomenon. For all feeders, the high moisture of the pore layer may be advantageous. Only during special drought periods in midsummer, a majority of the sporocarps were observed to be temporarily dry.

In addition to feeding, there could be two other main reasons to seek to sporocarps: Finding a mate and finding dead wood. *B. reticulatus* obviously uses living sporocarps of *F. fomentarius* regularly for copulation, a phenomenon also observed by Nilsson (1997). The use of the odour from living sporocarps as a kairomone for saproxylic beetles to find dead wood was discussed by Kaila (1993) and Hågvar & Økland (1997). With the present confirmation that almost all beetles that sit on

Table 1. Beetles collected on living sporocarps of *Fomitopsis pinicola* and *Fomes fomentarius* during 43 samplings in 1993 and 1994. Figures in brackets indicate number of individuals situated on the upper/ under side of the sporocarps. Num. = numerous. 4 - 8 indicates the months (April - August) when each species was found. Presence on sporocarps is indicated by D (day, between 06 and 18h) or N (night, between 21 and 03h). For time of arrival, Day = 03-21h and Night = 21-03h. O = obligate saproxylic, F = facultative saproxylic. Hosts are indicated by C = coniferous trees, B = birch, D = other deciduous trees, pi = *F. pinicola*, fo = *F. fomentarius*, Tra = *Trametes* sp., Ste = *Stereum* sp. The preferred host is indicated in bold types. Substrate is indicated by: Xy = xylodetriticol, Co = corticol, My = mycetophil/ mycetobiont, Po = polyporicol, Bo = boleticol.

Family and species	Numbers per 100 sporocarps of:			Month	Pre- sence Day/ Night	Arri- val: Day/ Night	Sapro- xylic	Host	Substrate
	<i>F. pinicola</i>	<i>F. fomentarius</i>							
LEIODIDAE									
<i>Anisotoma humeralis</i> (Fabricius)	1 (0/1)	132.5 (90/42.5)	5,6	D N	D N	0	C B D	My	
<i>A. castanea</i> (Herbst)		7.5 (0/7.5)	6	N	N	0	C B D	My	
<i>A. glabra</i> (Kugelann)		20 (12.5/7.5)	5,6	N	N	0	C B D	My	
<i>Agathidium nigripenne</i> (Fabricius)		10 (2.5/7.5)	5	D N	N	0	C B D	Co, My	
STAPHYLINIDAE									
<i>Quedius xanthopus</i> Erichson	1 (0/1)		7	N	N	F	C B D	Xy, Co	
<i>Q. plagiatus</i> (Mannerheim)		2.5 (0/2.5)	6	N	N	F	C B D	Xy	
<i>Stenus impressus</i> Germar		2.5 (2.5/0)	5	D	D	-			
<i>Phloeonomus monilicornis</i> (Gyllenhal)		5 (0/5)	4	D		0	C B D	Co	
<i>P. lapponicus</i> (Zetterstedt)		2.5 (0/2.5)	6	D		0	C B D	Co	
<i>Scaphisoma agaricinum</i> (L.)	2 (0/2)		5	N		F		Xy, My	
<i>Lordithon trinotatus</i> (Erichson)		2.5 (0/2.5)	5	D		-		My	
<i>L. lunulatus</i> (L.)		10 (5/5)	5,6	D N	N	F	C B D	My, Po, Bo	
<i>Sepedophilus littoreus</i> (L.)	1 (0/1)	15 (2.5/12.5)	5,6	N	D N	F	C B D	Xy, My	
<i>Oxyopoda alternans</i> (Gravenhorst)		2.5 (0/2.5)	6	D		F		My, Po	
<i>Gyrophana boleti</i> (L.)	Num. below	7.5 (0/7.5)	4,5	D N	D	0	pi	Po	
<i>Phymatura brevicollis</i> (Kraatz)	1 (0/1)		6	D		0	C	My, Po	
<i>Leptusa pulchella</i> (Mannerheim)	5 (0/5)	15 (2.5/12.5)	4,5,6	D N	D N	0	C B D	Co	
TROGOSSITIDAE									
<i>Ostoma ferruginea</i> (L.)	14 (0/14)		5,6	D N	D N	0	C B D	Co	
<i>Thymalus limbatus</i> (Fabricius)	7 (0/7)	2.5 (0/2.5)	5,6,7	N	N	0	C B D	Co, My, Po	
NITIDULIDAE									
<i>Eपुरaea pygmaea</i> (Gyllenhal)		2.5 (2.5/0)	7	N	N	0	C	Xy, Co	
<i>E. variegata</i> (Herbst)	17 (0/17)	37.5 (30/7.5)	4,5,6,7,8	D N	D N	F	C B D	Co, My, Po	
<i>E. muehli</i> Reitter		5 (0/5)	5	N	N	0	C	Xy	
<i>E. silacea</i> (Herbst)		2.5 (0/2.5)	6	N	N	0	B D	My, Po	
<i>Pocadius ferrugineus</i> (Fabricius)		7.5 (5/2.5)	5	D	D	F	B D	My	
<i>Glischrochilus hortiensis</i> (Geoffroy)		2.5 (2.5/0)	5	D		F	B D		
<i>G. quadripunctatus</i> (L.)		2.5 (0/2.5)	6	D		0	C B D	Co	
SPHINDIDAE									
<i>Arpidiphorus orbiculatus</i> (Gyllenhal)		17.5 (12.5/5)	5,6	D N	N	F	C B D	My	
RHIZOPHAGIDAE									
<i>Rhizophagus dispar</i> (Paykull)	8 (0/8)	175 (75/100)	4,5,6	D N	D N	0	C B D	Co	
<i>R. bipustulatus</i> (Fabricius)		2.5 (0/2.5)	5	N		0	C B D	Co	
<i>R. nitidulus</i> (Fabricius)		2.5 (0/2.5)	5	N		0	C B D	Co	
<i>R. parvulus</i> (Paykull)		7.5 (2.5/5)	5,6	D N	D	0	C B D	Co	

Table 1. Cont.

Family and species	Numbers per 100 sporocarps of:		Month	Pre- sence Day/ Night	Arri- val: Day/ Night	Sapro- xylic	Host	Substrate
	<i>F. pinicola</i>	<i>F. fomentarius</i>						
CUCUJIDAE								
<i>Dendrophagus crenatus</i> (Paykull)	3 (0/3)		5	D		0	C B D	Co
CRYPTOPHAGIDAE								
<i>Henoticus serratus</i> (Gyllenhal)	33 (0/33)	2.5 (0/2.5)	5,6	D N	D N	F	C B D	Xy
<i>Pteryngium crenatum</i> (Fabricius)	10 (0/10)		4,5	D N	D N	0	C B D	Xy,Po
<i>Cryptophagus abietis</i> (Paykull)		2.5 (0/2.5)	5	D	D	F	C	
<i>Atomaria alpina</i> Heer	1 (0/1)		5	D N	D	0	C B D	Xy,Po
<i>A. wollastoni</i> Sharp	18 (0/18)		5,6	D N	D N	F		
<i>A. pulchra</i> Erichson	3 (0/3)		4,5,6	D N	D	F	C	
EROTYLIDAE								
<i>Triplax russica</i> (L.)		2.5 (0/2.5)	6	N	N	0	B D	My,Po
CERYLONIDAE								
<i>Cerylon ferrugineum</i> Stephens		5 (2.5/2.5)	5,6	D	D	0	C B D	Xy,Co
LATRIDIIDAE								
<i>Latridius consimilis</i> Mannerheim		2.5 (2.5/0)	5	N	N	F	C B D	Co,Po
<i>L. pseudominutus</i> (Strand)		10 (10/0)	4,5	D N	N	-		
<i>Enicmus rugosus</i> (Herbst)	1 (1/0)		5	D		0	C B D	My
<i>E. testaceus</i> (Stephens)	2 (2/0)	17.5 (17.5/0)	5,6	D N	D N	0	C B D	My
<i>Aridius nodifer</i> (Westwood)		2.5 (0/2.5)	5	N	N	0	C B D	My
<i>Corticaria lapponica</i> (Zetterstedt)		57.5 (45/12.5)	5,6	D N	D N	F	B D	Xy, Bo
<i>C. serrata</i> (Paykull)		2.5 (0/2.5)	5	N	N	F	D	
<i>C. rubripes</i> Mannerheim		2.5 (0/2.5)	6	D N	D N	F	C B D	Xy
<i>C. longicollis</i> (Zetterstedt)	2 (0/2)		5,6	D N	N	F	C B D	Xy
<i>Corticarina fuscula</i> (Gyllenhal)	1 (0/1)		5	D	D	-		
CISIDAE								
<i>Cis jacquemartii</i> Mellié	3 (0/3)	105 (87/18)	5,6,7,8	D N	N	0	fo	My,Po
<i>C. glabratus</i> Mellié	40 (3/37)	12.5 (5/7.5)	5,6,7	D N	D N	0	pi	My,Po
<i>C. boleti</i> (Scopoli)	2 (0/2)		6	D N	N	0	Tra	My,Po
<i>C. quadridens</i> Mellié	2 (0/2)		6	D	D	0	pi	My,Po
<i>C. dentatus</i> Mellié	2 (0/2)		6	D N		0	pi	My,Po
<i>Orthocis festivus</i> (Panzer)	1 (1/0)		6	D		0	Ste	Xy,My
<i>Rhopalodontus strandi</i> Lohse		2.5 (2.5/0)	5	D		0	fo	My,Po
SALPINGIDAE								
<i>Salpingus ruficollis</i> (L.)		2.5 (2.5/0)	6	N	N	0	C B D	Xy,Co
TENEBRIONIDAE								
<i>Bolitophagus reticulatus</i> (L.)		642.5 (180/462.5)	5,6,7,8	D N	D N	0	fo	My,Po
CHRYSOMELIDAE								
<i>Syneta betulae</i> (Fabricius)		2.5 (2.5/0)	5	D	D			
SCOLYTIDAE								
<i>Dryocoetes autographus</i> (Ratzeburg)		2.5 (2.5/0)	5	N	D	0	C	Co

living sporocarps are saproxylic, this hypothesis seems probable. It may be that many of the relevant beetles use the living sporocarps both as a feeding ground and as an olfactorial guide to find dead wood.

For the fungus, the visiting saproxylic beetles may be beneficial if they remove mites and insect larvae that more or less block the pores. Furthermore, beetles may spread spores to other logs and inoculate them under bark, in crevices etc. during egg-laying (cf. substrates in Table 1). Transport of viable fungal material has been demonstrated in several bark beetles and a fire adapted beetle,

which all have special hollows on their body surface (mycangia) for this purpose (Crowson 1981, Beaver 1989, Wikars 1997). According to Wikars (1997), many species in the families Cryptophagidae and Latridiidae possess mycangia, but this has been poorly studied.

How do the beetles arrive at the sporocarps?

According to Hågvar & Økland (1997), at least the following «visiting species» are active flyers through the forest, and not only close to sporocarps: *Enicmus testaceus* (Stephens), *Enicmus*

Table 2. Numbers of individuals or species of beetles collected on living sporocarps with some hours intervals (40 sporocarps of *Fomes fomentarius* and 100 sporocarps of *Fomitopsis pinicola*). Except for the last sampling, 13-14 May 1994, all samplings were from 1993.

Hour:	12	14	16	18	20	22	24	2	4	6	8	10	12	14	16	18	Date	
<i>Bolitophagus reticulatus</i> on <i>F. fomentarius</i>				1									1		1		11 - 12 May	
			1		5	13							0				19 - 20 May	
					1	17		0	0	0	0		0				29 - 30 May	
					0	29					2							4 - 5 June
					3	38												11 - 12 June
						35						0						18 - 19 June
					3	31						2						20 - 21 July
					19	16								0				24 - 25 August
				13	16		2	1	0				0	0	5		13 - 14 May	
Number of species on <i>F. fomentarius</i>				6									3		8		11 - 12 May	
			5		5	9							5				19 - 20 May	
					7	9		6	3	0			3					29 - 30 May
					7	7					5							4 - 5 June
					8	10												11 - 12 June
						4					2							18 - 19 June
					2	4					1							20 - 21 July
					2	1					0							24 - 25 August
				9	9		4	3	1		1			0	2		13 - 14 May	
Number of species on <i>F. pinicola</i>	7		3	3								2		1	3		11 - 12 May	
	3		1	3	3								3				19 - 20 May	
				7	4	3	1	2	1									29 - 30 May
				5	5			6										4 - 5 June
				2	1			0	1									11 - 12 June
				3	2			2										18 - 19 June
				1	1			0										20 - 21 July
				1	0				0									24 - 25 August
			3	3		3	2	0	3					0	3		13 - 14 May	

rugosus (Herbst), *Leptusa pulchella* (Mannerheim), *H. serratus*, *Cryptophagus abietis* (Paykull) and *Dryocoetes autographus* (Ratzeburg).

Jonsell & Nordlander (1995) tested the flight attraction to chopped, living sporocarps of *F. pinicola* and *F. fomentarius*, and found a significant attraction in 28 saproxylic beetle taxa. The following results agree with the present study: An attraction to *F. pinicola* in *Cis quadridens* Mellié, *C. glabratus* and *Pteryngium crenatum* (Fabricius), and an attraction to *F. fomentarius* in *Glischrochilus hortensis* (Geoffroy), *Cerylon ferrugineum* Stephens, *Salpingus ruficollis* (L.) and *A. glabra*. Jonsson et al. (1997) showed that females of *Dorcatoma robusta* Strand were attracted to the host odour of *F. fomentarius*, while the males were strongly attracted to conspecific females by pheromones. In *C. glabratus*, both sexes were attracted to the odour of their host, *F. pinicola*.

Some beetles may hide close to the sporocarp, and visit the fungal substrate at certain intervals. In the present study, *Ostoma ferruginea* was sometimes found behind bark scales close to sporocarps of *F. pinicola*, and it was also observed hiding behind the sporocarp when disturbed. By marking beetles individually, Nilsson (1997) showed that *B. reticulatus* walks from dead sporocarps, where it develops, to living sporocarps on the same stem for mating and feeding on the hymenium. His observations showed both a strong midnight activity, as well as an afternoon activity. Maybe also this species hides in crevices quite near the sporocarp during the day.

A combination of flight and creeping is possible: First an olfactorial orientation and landing on or very close to the sporocarp, and then periodic visits by creeping back and forth between the sporocarp and a hiding place.

Why visit the sporocarps by night?

Nights are colder, but could still be more advantageous for flight, olfactorial orientation, copulation and feeding than during the day. Increased humidity might be favourable, and perhaps predation

is reduced at night. Sometimes, a very intense spore production in *F. fomentarius* was observed around midnight. There is also a possibility that the smell from the sporocarps is stronger during the night.

Differences in visiting fauna between the two fungi

The easiest explanation to the great difference in species composition on the two fungi would be that they produce different odours. Jonsell & Nordlander (1995) found great differences in the saproxylic beetle fauna attracted by flight to the odour of chopped samples of *F. fomentarius* and *F. pinicola*. If species breeding in sporocarps are discarded in Table 1, all the remaining 17 species found on *F. pinicola* (where the host trees are known) can breed in coniferous wood, and 30 of 35 species found on *F. fomentarius* can breed in birch wood. This means that if the observed species had arrived by means of fungal odour, most of them had been led close to a suitable breeding substrate.

Conclusion

The two most important aspects are:

1. A great number of saproxylic beetles seek to living sporocarps of *Fomes fomentarius* and *Fomitopsis pinicola*, although they do not breed there. The two sporocarp species attract a rather different beetle fauna. Living sporocarps may be of importance either as feeding places, by leading the beetles to dead wood (kairomone effect), or both.
2. A mutualistic relationship may exist between living sporocarps and saproxylic beetles, since visiting beetles may transport spores to a suitable new substrate.

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Lejogaster tarsata (Megerle in Meigen, 1822) (Diptera, Syrphidae) new to Norway

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Falck, M. 1999. *Lejogaster tarsata* (Megerle in Meigen, 1822) (Diptera, Syrphidae) new to Norway. *Norw. J. Entomol.* 46, 33–34.

The hoverfly *Lejogaster tarsata* (Megerle in Meigen, 1822) is reported new to Norway. A note on the biology of the species is given, and the locality is discussed. The same area is also the sole Norwegian locality for the related species *Orthonevra erythrogonia* (Malm, 1863), rare across its entire range, but here found in numbers.

Key words: Diptera, Syrphidae, *Lejogaster tarsata*, Norway.

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INTRODUCTION

A male specimen of the hoverfly species *Lejogaster tarsata* (Megerle in Meigen, 1822) was caught in a Malaise trap at AK Oslo: Østensjøvann, Abildsø gård (EIS 28) in June 1997. It has a distinct yellow spot at the base of 3rd antennal joint, yellow-coloured tarsi and the lustre of the abdomen is metallic red. These are characters that separates it from the common species *Lejogaster metallina* (Fabricius, 1781). Thus both of the European *Lejogaster* species of the genus are now known from Norway.

L. tarsata is known from Sweden, Denmark, Finland, and throughout Europe from Great Britain to Spain, Italy and the Balkans. It has a wide distribution throughout the Caucasus, Iran, Afghanistan, Central Asia, to Mongolia, Siberia and the Far East (Peck, 1988). Though it may be frequent on certain localities, it seems to be rare all over Europe. Röder (1990) states that in Germany it is generally rare, though it may occur in numbers on favourable localities. According to Maibach & Goeldlin de Tiefenau (1994) it is very rare in Switzerland. Stubbs & Falk (1983) notes that «this seems to be a particularly scarce and local species, though occasionally abundant within a very small area.» Torp (1994) records it as «rare,

but widespread» in Denmark. Hedström (1990) reports it from Skåne and Uppland in Sweden. The occurrence in the Oslo area thus seems to mark the northern boundary of the species' western distribution. The author and other collectors have collected Syrphidae for many years on different localities at lake Østensjøvann, and the fact that *Lejogaster tarsata* has not been recorded earlier, indicates that it is a rare species.

BIOLOGY

The fly is known from moist places, mostly along the coast, but also from lake shores, bogs and ditches and other freshwater biotopes. The flight period stretches from May with a peak in the end of May and June, through August (Stubbs & Falk 1983, Torp, 1994, Stubbs 1996) The larva is described by Hartley (1961), who gives the following biological notes:

«The larva (–) has been found in the decaying vegetation of a floating mat of *Typha* and other plants in an old pond. There appears to be only one generation a year, overwintering as larvae. Puparium formation occurs in the surface layer of the decaying vegetation just above water level. The eggs are laid in batches on the undersides of leaves

just above the mud.». Rotheray (1993) has a photograph of the larva.

DISCUSSION

The lake Østensjøvann is a hyper-eutrophic lake in the outskirts of the city of Oslo, surrounded by old farm land but under strong pressure from the surrounding city. The lake itself has been protected as a nature reserve, but the surroundings are still disputed, though the protection of these areas are essential for the extremely rich fauna and flora that makes Lake Østensjøvann known.

Lake Østensjøvann is also the only Norwegian locality of the related hoverfly species *Orthonevra erythrogona* (Malm, 1863). This species, rare across its range, is rather abundant on one locality, making Lake Østensjøvann a very special locality. Both *O. erythrogona* and *L. tarsata* should undoubtedly be placed on a Norwegian Red Data list, and the flowering meadows around the lake, which are essential for the survival of the adult flies, should be protected.

Acknowledgements. The Malaise trap at Abildsø gård was part of a project funded by the organisation Østensjøvannets Venner to register the insect fauna of the area around the lake. It was set up with kind permission from the landowner, Hallgrim Thon.

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Demography and population densities of *Folsomia quadrioculata* (Collembola, Isotomidae) on Spitsbergen

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Sømme, L. & Birkemoe, T. 1999. Demography and population densities of *Folsomia quadrioculata* (Collembola, Isotomidae) on Spitsbergen. *Norw. J. Entomol.* 46, 35–45

Demography and population densities of *Folsomia quadrioculata* were studied in a range of habitats at the Brøggerhalvøya, Spitsbergen. The distribution of juvenile and adult size classes were different in a *Cassiope* heath, a wet moss field and a bird cliff. New groups of juveniles may appear at different times of the summer and it is concluded that this species has a non-synchronised life cycle. Large differences in population densities of *F. quadrioculata* were found between habitats. Although the species is relatively susceptible to desiccation, there was no clear relationship between moisture content of the soil and population densities. To wet or to dry habitats, however, may be unfavourable. At a moraine ridge, the densities of *F. quadrioculata* and *Folsomia bisetosa* were higher outside than inside a fence raised to protect against reindeer grazing. At the bird cliff, densities of this and fifteen other Collembola species varied through a gradient from the sea shore to the top of the bird colony. In a habitat of sorted stone circles significant differences in population densities of *F. quadrioculata* were observed within a distance of less than 1 m. Population densities also differed between years in some of the habitats. Due to differences in population fluctuations within and between years, it is pointed out that if reliable comparisons are to be made, e.g. in relation to climate changes, densities of arctic Collembola have to be studied through several years.

Key words: Collembola, *Folsomia quadrioculata*, demography, population densities

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INTRODUCTION

The isotomid Collembola *Folsomia quadrioculata* (Tullberg, 1871) has a holarctic distribution and is probably the most common species on the arctic islands of Svalbard (Fjellberg 1994). Recently it has been recorded from Nordaustlandet and Sjuøyane in the northernmost parts of the archipelago (Fjellberg 1997). At the Brøggerhalvøya, Wüthrich (1989) found that more than 80 % of the Collembola in five tundra habitats belonged to this species. The eurytopic species lives in both wet and dry habitats, but was not found in the dry and stony polar deserts at Nordaustlandet (Fjellberg 1997).

During the Norwegian Arctic Terrestrial Ecology

Programme the population dynamics and demography of Collembola were extensively studied in a habitat of patchy *Carex* tussock by a lagoon (Hertzberg et al. 1994; Hertzberg 1998) and in a dry *Cassiope* heath (Birkemoe & Sømme 1998). Among the Collembola species, *F. quadrioculata* often occurred in the highest numbers. Densities and distribution of size classes, however, varied greatly with habitat, season and year.

Earlier studies also show great variations in life cycles and population densities of *F. quadrioculata*. In a Scots pine forest in Scotland, Usher (1970) found that juveniles formed a considerable proportion of the population in late winter and spring, but both adults and juveniles were present all year around. In Belgium, Grégoire-Wibo (1976)

found that juveniles hatching in February reached sexual maturity in May. There are probably three generations per year. Under more severe climatic conditions, Agrell (1941) found two generations per year in the sub-alpine birch forest of Swedish Lapland, while Fjellberg (1975) reported one generation in alpine meadows at Hardangervidda, Norway. In contrast, Birkemoe & Sømme (1998) concluded that development from newly hatched juveniles to adults on Spitsbergen takes two summers to complete. Adults were present in the *Cassiope* heath during the entire summer. Hertzberg et al. (1994) found considerable heterogeneity in the size distribution of *F. quadrioculata*, indicating different demographic patterns within *Carex* tussocks at the Brøggerhalvøya.

F. quadrioculata is remarkable by being present in almost all kind of arctic habitats, but density shows great variations. More information is needed to understand why this species has such a large success. The main purpose of the present investigation was to study changes in population densities and composition of size classes in *F. quadrioculata* from three selected typical habitats. In addition, population densities were estimated at a moraine ridge to study the effect of reindeer grazing and from sorted circles to study changes in densities over short distances. Samples were also collected from a gradient in a bird cliff to see if the density of *F. quadrioculata* is affected by densities of other Collembola species.

MATERIAL AND METHODS

Sample collection and extraction

The investigation was carried out at the Brøggerhalvøya (78°55'N, 11°40'W) in western Spitsbergen. A range of habitats were chosen, including a *Cassiope* heath, a wet moss field, a bird cliff, sorted circles and an area of a moraine ridge protected from reindeer grazing.

Samples of soil and vegetation were collected at random in the different habitats with a 10 cm² steel soil corer. The samples were 3-5 cm deep, which includes the depths in which most arctic microarthropods are found. The samples were

transferred to plastic cylinders, which fitted into a holder for 54 samples in a MacFadyen high gradient extractor modified from Petersen (1978). The extraction had a duration of approximately one week, during which the heat from thermostatically controlled light bulbs was gradually increased. The bottom of the apparatus was cooled by running tap water.

Demography

The distribution of different size classes of *F. quadrioculata* was studied in three of the habitats described below; the bottom site of the *Cassiope* heath, the wet moss field and the plain area below the bird cliff. Samples were collected three times during 1992 and once in the spring of 1993, and size distribution was studied on each occasion. The specimens were divided in size classes of 0.07 mm. According to Birkemoe & Sømme (1998), specimens of *F. quadrioculata* reach reproductive maturity at a size of 0.92 mm.

Population densities

Cassiope heath

The habitat was situated at Brøggerhalvøya in a slightly declining slope 2 km east of Ny-Ålesund corresponding to a similar habitat described by Coulson et al. (1993) as a tundra heath of the *Cassiope tetragona* zone. Soil samples were collected from patches of *Cassiope* vegetation at two sites as described by Birkemoe & Sømme (1998). In addition to *C. tetragona*, vascular plants included *Dryas octopetala* and *Salix polaris* growing in a mat of mixed bryophytes dominated by *Racomitrium lanuginosum*. For studies on demography and population densities of *F. quadrioculata*, eighteen soil samples were taken from each site three times during 1992 and once in the spring of 1993.

Wet field

Samples were taken from a wet field close to a small lake at Knudsenheia 3 km west of Ny-Ålesund three times during 1992 and once in the spring

of 1993. Due to the snow melt, the habitat was partly flooded at the latter date of collection. According to Brattbakk (1981, 1986), the type of vegetation is a wet field with *Arctophila fulva*. Dominating moss species are *Scorpidium revolvens* and *Warnstorfia sarmentosa*; nomenclature according to Frisvoll & Elvebakk (1998). On each date of collection thirty samples were taken with a steel soil corer.

Bird cliff

The small north-east facing bird cliff at Krykkjefjellet in Kings Bay is a breeding site for kittiwake (*Rissa tridactyla*) and Brünnich's guillemot (*Uria lomvia*) (Sendstad 1978). The cliff itself is only 100 m high and 250 m wide. Between the cliff and the beach there is a plain field, about 60 m wide. The inner part of the plain has a continuous cover of mosses, probably dominated by *Sanionia uncinata*, and scattered vascular plants, while the moss vegetation closer to the beach is broken up into small patches. Eighteen samples were collected three times during the summer of 1992, and once in the spring of 1993.

Moraine ridge

In 1978 a reindeer fence was built at Stuphallet, Brøggerhalvøya in the same year as new reindeers were released on the peninsula (Øritsland & Alendal 1986, Wegener et al. 1992). The purpose of the fence was to retain 1000 m² as a reference area free from reindeer foraging. The vegetation is typical of moraine ridges with rich cover of lichens (Brattbakk 1981). For the present study, 28 samples of soil and vegetation were collected from inside and 28 samples from outside the fence in July 1993.

Sorted circles

Sorted circles are formed by repeated freezing and thawing in the soil. According to Hallet & Prestrud (1985) the sorted circles in western Spitsbergen are among the most spectacular in the world. The circles, 3–5 m in outer diameter, consist of a central

area of fine-grained soil outlined by a broad ridge of gravel.

In 1995 an area of sorted circles at the Brøggerhalvøya, 2 km west of Ny-Ålesund, was chosen for studies on population densities. The circles had an inner diameter of 1.5 to 2 m. The coarse gravel ridges were covered by dense vegetation of lichens, mosses and flowering plants (*Poa alpina*, *Saxifraga oppositifolia*, *Polygonum viviparum*, *Pedicularis hirsuta* and *Salix polaris*). At the bottom of the 10 cm high inner edge, this vegetation continued in a 5–10 cm wide belt. The transition to the fine domain was abrupt. The fine soil was covered by a layer of cyanobacteria with scattered vegetation of lichens and flowering plants similar to those at the ridge. With the addition of mosses the vegetation was denser at the central part of the domain, which was raised 10 cm above the lowest part of the edge. In this way a strong biological gradient exists from the edge to the top of the central domain within a distance of less than 1 m.

Twelve samples of soil and vegetation were taken from each of the following sites: A. Dense vegetation at the top of edge; B. Dense vegetation at the inner bottom of the edge; C. Fine soil with cyanobacteria; D. Top of the central domain.

Faunal composition

In the bird cliff, further studies were conducted in 1995 to investigate the faunal composition of Collembola from the beach and up to the top of cliff (Sørlibråten 1997). Twenty-seven samples were collected at each of five sites in this gradient: I. Patchy moss vegetation close to the beach; II. Continuous vegetation of the plain with mosses and low densities of *Sagina intermedia*, *Poa alpina*, *Cochlearia officinalis* and *Saxifraga cernua*; III. Dense layers of moss at the inclination of the slope with flowering plants similar to those at site II, plus *Cerastium arcticum*; IV. Steep slope with rocks covered by mosses and flowering plants as in II and III, dominated by *Saxifraga* spp. and with the addition of *Draba* sp. and *Polygonia viviparum*; V. Rock shelves within the bird colony with vascular plants, dominated by *Cochlearia*

officinalis and *Saxifraga cernua*.

In samples from the moraine ridge, the densities of three dominating species were estimated outside and inside the fence to detect any effect of reindeer grazing.

RESULTS

Demography

The distribution of size classes of *F. quadrioculata* from three habitats during 1992 and the early summer of 1993 are shown in Figure 1. Higher numbers of specimens were available from the wet field and the bird cliff than from the *Cassiope* heath.

From Figure 1 it clearly appears that the distribution of different size classes of Collembola are different in the three habitats. In the *Cassiope* heath, the size classes had a uniform distribution in early July, while medium sized or large juveniles dominated at the end of this month. A more uniform distribution was again observed the following spring.

In contrast to the *Cassiope* heath, the population of both the wet field and the bird cliff was divided in two distinct peaks in early July. At this date, the juveniles in the wet field mostly consisted of larger size classes than those in the bird cliff. In the wet field, the juveniles from early July had increased in size by the end of the month and were apparently included in a distinct peak of large juveniles and adults. This peak was also seen in August. A new group of juveniles appeared in the wet field in the end of July. This cohort increased slightly in size by the middle of August, but still consisted of small juveniles. The population was dominated by adult size classes the following spring.

In the bird cliff, the cohort of juveniles from 6 July had grown but did not reach adult sizes at the end of July. In August most specimens of this cohort were included in a large peak consisting of adults and large juveniles. A new group of juveniles appeared in August, slightly later than in the wet field. In the bird cliff this cohort could still be detected the following spring.

Changes in size distribution from mid-August

1992 to early summer 1993 differed between the three habitats, and suggest that size-dependent winter mortality is influenced by local conditions. In the wet field almost all juveniles appeared to have been lost during the winter.

From these results it appears that all stages of *F. quadrioculata* are present during the short summer season. New groups of juveniles may appear at different times of the summer.

Population densities

A comparison of population densities of *F. quadrioculata* from different habitats is presented in Figure 2A,B. Very large differences were found in mean numbers.

In the *Cassiope* heath, the densities of *F. quadrioculata* were considerably higher in the lower site compared to the top site. The difference is apparent in samples from July 1992 and June 1993, and Figure 2A also shows how the densities may change from year to year.

In the wet field, the density of *F. quadrioculata* during the sampling period was highest in July 1992 and lowest in June 1993. Both values are shown in Figure 2A.

In 1992 and 1993 highest mean densities were found in the bird cliff (Figure 2A). Data from the two years are not significantly different. The latter habitat corresponds to the plain moss field (site II) in the bird cliff gradient, where more than 85,000 specimens m^{-2} were recorded in 1995 (Figure 2B). At higher levels in the bird cliff (sites III-V), the densities decreased. In contrast, the patchy mosses (site I) contained less than 200 specimens m^{-2} of *F. quadrioculata*, while two other Collembola species were quite numerous (Table 1).

Relatively low densities were recorded from the moraine ridge (Figure 2B), but the number of *F. quadrioculata* was significantly higher outside than inside the reindeer fence. In the sorted circles, densities of *F. quadrioculata* were highest at the top and bottom of the edge, but significantly lower in the fine soil and top of the central area.

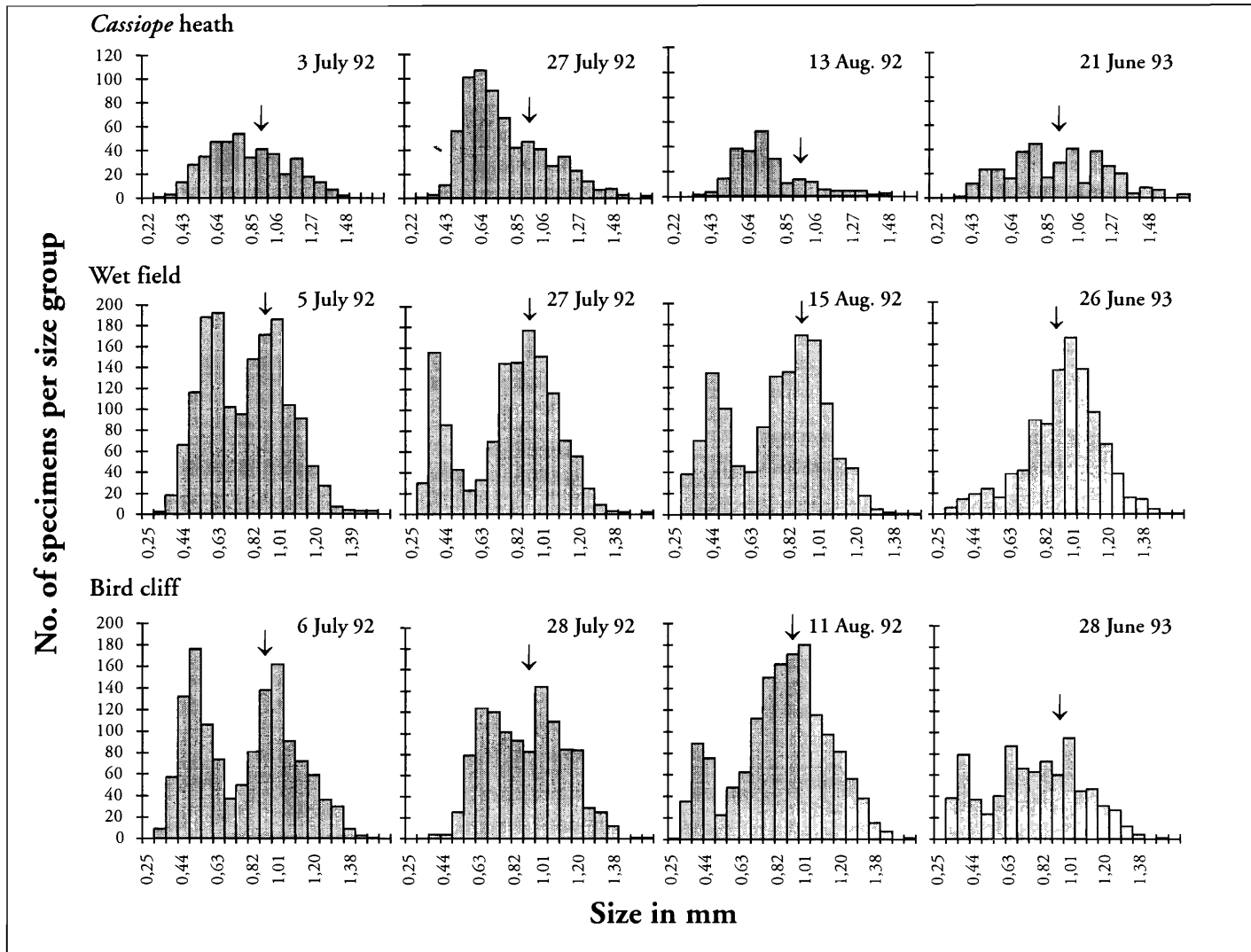


Figure 1. Size distribution of specimens of *Folsomia quadrioculata* from different sampling dates in the Cassiope heath, wet field and bird cliff. Each size class is 0.06 or 0.07 mm. The arrows indicate change in size from juveniles to adults.

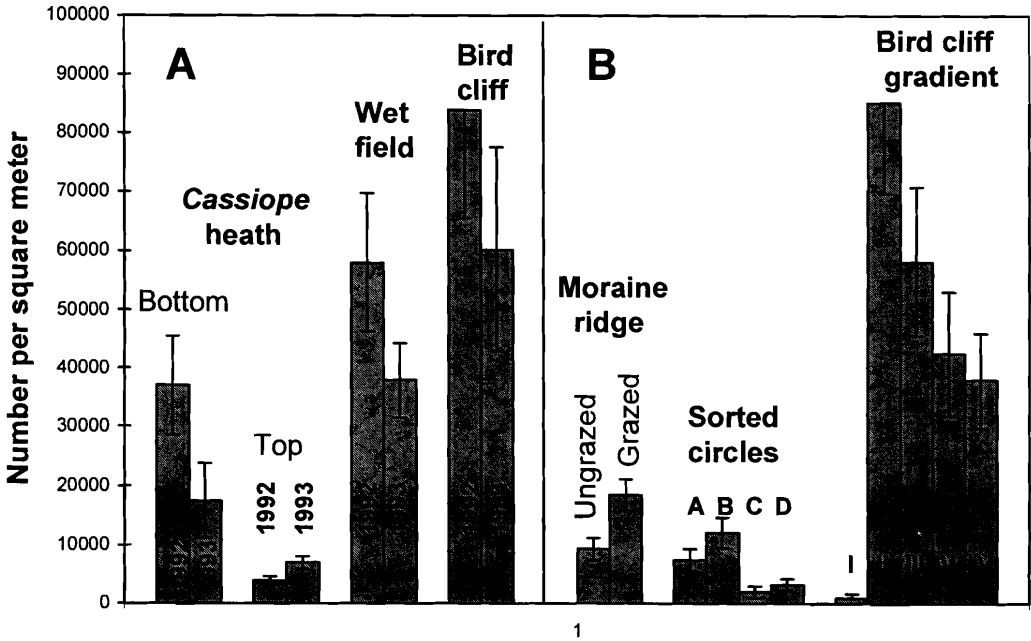


Figure 2. Densities (mean±SE) of *Folsomia quadrioculata* from different habitats at the Brøggerhalvøya. A. Samples for 1992 and 1993 are compared for the three main habitats - *Cassiope* heath, wet field and bird cliff. B. Moraine ridge inside and outside fence; Different sites within sorted circles A-D; Different sites in the bird cliff gradient I-V. See text for further explanation.

Faunal composition

Bird cliff

The faunal composition of Collembola in the gradient from the beach to the top of the bird cliff is presented in Table 1. Only few specimens of *F. quadrioculata* were found in the patches of moss close to the beach (site I), while *Willemia scandinavica* and *Folsomia bisetosa* occurred in remarkably high densities. In the continuous moss cover (site II), however, *F. quadrioculata* was one of the dominating species together with *F. bisetosa*. The great flexibility of *F. quadrioculata* is also illustrated by the high densities in sites III, IV and V.

While five species only of Collembola were present in the patchy moss, the number of species increased in the continuous vegetation (Table 1). The highest diversity was present in the steep slope (IV) and the rock shelves (V), where flowering

plants are more dominating. In the two latter sites, species like *Hypogastrura tullbergi*, *Xenylla humicola* and *Onychiurus groenlandicus* were present in high numbers. *O. duplopunctatus* is the only species that was present in relatively high densities in all five sites. Thus, within this gradient, the large differences in faunal composition was found over short distances.

Moraine ridge

At the moraine ridge, *F. quadrioculata* was the most abundant Collembola species, and appeared in significantly higher numbers in the grazed areas outside the reindeer fence compared to the inside (Table 2). Similarly, *Folsomia bisetosa* appeared in significantly higher numbers outside the fence. In contrast, *Hypogastrura tullbergi* did not show any difference between the sites inside and outside

Table 1. The faunal composition of Collembola along a vegetation gradient in the bird cliff Krykkjefjellet at Spitsbergen. The figures represent total numbers of specimens in 27 samples of 10 cm² from each site. I. Patchy moss close to the beach, II. Continuous moss cover of the plain below the cliff, III. Inclination of slope, IV. Steep slope with mosses and flowering plants, V. Rock shelves. See text for more details. From Sørlibråten (1997).

Species	I	II	III	IV	V
<i>Hypogastrura viatica</i> (Tullberg)	15	151	1	0	11
<i>Hypogastrura tullbergi</i> (Schäffer)	0	0	49	251	298
<i>Ceratophysella succinia</i> (Gisin)	0	4	0	2	24
<i>Xenylla humicola</i> (Fabricius)	0	17	1	22	105
<i>Willemia scandinavica</i> Stach	1554	292	0	40	32
<i>Friesea quinquespinosa</i> Wahlgren	0	0	0	0	19
<i>Micranurida pygmaea</i> Börner	0	0	0	16	4
<i>Anurida polaris</i> (Hammer)	0	100	53	29	14
<i>Onychiurus groenlandicus</i> (Tullberg)	0	236	43	41	60
<i>Onychiurus duplopunctatus</i> (Strenzke)	82	552	181	64	146
<i>Onychiurus arcticus</i> (Tullberg)	0	0	0	1	21
<i>Tetracanthella arctica</i> Cassagnau	0	93	0	0	0
<i>Folsomia regularis</i> Hammer	0	0	180	0	0
<i>Folsomia bisetosa</i> Gisin	5098	2613	0	49	82
<i>Folsomia quadrioculata</i> (Tullberg)	3	2299	1572	1190	1025
<i>Isotoma notabilis</i> Schäffer	0	0	4	28	0
<i>Isotoma anglicana</i> Lubbock	0	0	0	24	7
<i>Lepidocyrtus lignorum</i> Fabricius	0	0	2	4	1
<i>Sminthurinus concolor</i> (Meinert)	0	1	77	5	0
No. of species per site	5	11	11	15	15

Table 2. Population densities of Collembola in numbers per m² (mean ± SE) from inside and outside the reindeer fence at Stuphallet, Brøggerhalvøya.

Species	Inside fence	Outside fence	Mann-Whitney U-test
<i>Folsomia quadrioculata</i>	9405±1919	18589±2637	P<0.01
<i>Folsomia bisetosa</i>	627±159	1940±373	P<0.05
<i>Hypogastrura tullbergi</i>	5875±1032	4107±786	P>0.2

the fence. Other Collembola species from the moraine ridge included *Onychiurus groenlandica* and *Isotoma anglicana*, neither of which appeared in sufficient numbers for statistical comparison.

Sorted circles

In samples from the sorted circles, *F. quadrioculata* represented 60 % of the total number of Collembola. In addition, *Onychiurus* sp. and *Hypogastrura tullbergi* were dominating species. Densities of the latter reached 2,700 to 4,900 m⁻² in the more vegetated areas, but only a density of 200 m⁻² in the fine soil with cyanobacteria.

DISCUSSION

Demography

The large differences in the duration of the life cycle of *F. quadrioculata*, as mentioned in the Introduction, reflects the flexibility of this species under different climatic conditions. From one to three generations per year have been reported (Agrell 1941, Usher 1970, Fjellberg 1975, Grégoire-Wibo 1976). Agrell (1941) also reported that in the alpine zone of Swedish Lapland newly hatched juveniles appeared at all times during the snow-free season. Birkemoe & Sømme (1998) concluded that development takes two years in the *Cassiope* heath, and that *F. quadrioculata* may reproduce throughout the summer.

Data from the present study suggest that the life cycle may be relatively short even under arctic conditions. The juvenile cohort from 5 July in the wet field (Figure 1) may have become adults at the end of the summer, and may have been able to start reproduction the same autumn. Since this cohort probably originated from eggs laid the previous summer, the life cycle would have been completed in less than two years. The juveniles present in the bird cliff on 6 July 1992 are less likely to reproduce within the summer since most of them did not become adults before mid-August. The life cycle in this habitat may have a slightly longer duration than in the wet field.

Population densities

The population densities of *F. quadrioculata* clearly show very large differences in the different habitats. In the wet field and the *Cassiope* heath there were also marked differences between the two years. In the latter habitat, considerable fluctuations were observed for another three years by Birkemoe & Sømme (1998). In their study, *F. quadrioculata* did not show significant winter mortality and the decrease in population densities usually took place during the summer. In contrast, Hertzberg (1998) reported high winter mortality in *F. quadrioculata* from the *Carex* tussock, where the density of this species was reduced from approximately 79,000 per m² in August 1992 to 30,000 per m² in June 1993. Winter conditions, like the formation of a compact ice cover, may be more unfavourable in the *Carex* tussock and explain the difference from the *Cassiope* heath.

While some of the highest densities of *F. quadrioculata* were reported from the *Carex* tussocks, Hertzberg et al. (1994) found only 440 specimens m⁻² in soil covered by cyanobacteria between the tussocks. At Hardangervidda, Norway, Fjellberg (1975) reported 7 specimens m⁻² from a dry lichen heath, 21,700 m⁻² from a dry meadow and 8,440 m⁻² from a wet meadow. In Scotland, Usher (1970) reported that the average population density of *F. quadrioculata* was 5,470 m⁻² in a Scots pine forest.

In the bird cliff gradient high densities of *Folsomia bisetosa* in the patchy mosses (site I) (Table 1) was replaced by high densities of *F. quadrioculata* at the other sites. This is a striking parallel to populations in the *Carex* tussock (Hertzberg et al. 1994), where *Folsomia sexoculata* was replaced by *F. quadrioculata* as the densities of tussocks increased with distance from the lagoon.

Data from the literature as well as from the present study demonstrate that population densities of arctic Collembola cannot be accurately determined by a single collection of soil samples. If comparisons are to be made, e.g. in relation to climate changes, sampling should be conducted through several years to include patterns of population fluctuations.

The effect of moisture

Soil moisture is known to affect the spatial distribution of the Collembola (e.g. Verhoef & van Selm 1983, Leinaas & Fjellberg 1985), and Harrison et al. (1990) summarised data on cuticular permeability to water vapour of 16 species of Collembola from habitats with different moisture conditions.

Birkemoe & Sømme (1998) did not find any clear relationship between moisture and densities of *F. quadrioculata* in the *Cassiope* heath, but Hertzberg (1998) suggested that drought during an unusually dry summer kept the population of *F. quadrioculata* and other Collembola in the *Carex* tussock at low levels. In the laboratory, Hertzberg & Leinaas (1998) showed that *F. quadrioculata* is relatively susceptible to desiccation. At 10, 15 and 20 °C and 80 % relative humidity, mortality was higher in *F. quadrioculata* than in *Folsomia sexoculata* and *Hypogastrura viatica*. Similarly, Eriksen (1998) found relatively high water losses in *F. quadrioculata* compared to other species from Spitsbergen. At 10 °C and 75 % relative humidity, the mean rate of water loss in *F. quadrioculata* was 11.6 % of fresh weight per hour, 4.9 % fw h⁻¹ in *Hypogastrura viatica*, 8.5 % fw h⁻¹ in *Hypogastrura tullbergi*, but 14.3 % fw h⁻¹ in *Ceratomylla longispina*.

In spite of the relative high susceptibility to desiccation in *F. quadrioculata*, Hertzberg & Leinaas (1998) concluded that this species preferred the driest part of the *Carex* habitat. The density decreases with increasing distance between the tussocks, which also correspond to decreasing moisture content in the gradient (Hertzberg et al. 1994). Close to the lagoon the soil is saturated with water, and the habitat may be too wet for *F. quadrioculata*. Concurrently, there is a decrease in salt concentrations of the soil with distance from the lagoon (Hertzberg 1998). In this way the population densities of the Collembola may be affected by several factors.

During the present study, water contents of soil samples were determined following the extraction of microarthropods. In the sorted circles there was a clear relationship between mean water contents (from 18 to 68 %) and the densities of *F. quadri-*

oculata, but this relationship was not found in samples from the *Cassiope* heath (45 to 63 % water contents at the lower site, and 49 to 54 % at the top site). At the bird cliff, sandy soil with patches of moss contained little water and few *F. quadrioculata* (Table 1). The highest density of this species was found at site II, although the median water content of the soil samples was lower than those of sites III and IV (Sørlibråten 1997). Samples from the wet field had mean water contents of approximately 85 % and a high density of *F. quadrioculata*. Data on soil moisture from the moraine ridge is not available.

In conclusion, in samples taken during the present study, there is no clear relationship between soil moisture content and population densities of *F. quadrioculata*. To wet habitat (Hertzberg & Leinaas 1998) as well as dry polar deserts (Fjellberg 1998), however, may be unfavourable. Low densities in samples from the sorted circles also suggest that moisture may be a limiting factor.

Determination of water content in soil samples from a single collection, however, may be misleading. Population densities are not a result of soil moisture on the day of collection, but rather of conditions during the preceding time period. The water content may change horizontally over short distances, and may change considerably in the vertical direction with different structure of soil, litter and vegetation. Even in the driest habitats, microniches within the soil may offer better moisture conditions. *F. quadrioculata* is an active species and may migrate to deeper layers to avoid desiccation. In the Scot pine forest in Scotland, juveniles were found at deeper layers in winter than in summer, but Usher (1970) explained this as a temperature effect.

Reindeer grazing

At the moraine ridge, Sendstad & Sveum (1986) found that the density of *F. quadrioculata* increased significantly from 1980 to 1985 outside the reindeer fence, which was built in 1978. *Hypogastrura tullbergi*, however, showed a clear but not significant reduction in numbers. The results of the present study (Table 2) are quite in agree-

ment with this. According to Sendstad & Sveum (1986), the densities of oribatid mites were also affected. Wegener et al. (1992) concluded that the vegetation is considerably reduced outside the fence due to heavy reindeer grazing, while the composition is little affected. The lichens *Cetraria* sp. and *Cladonia* sp., the moss *Racomitrium lamiginosum*, as well as *Salix polaris* are particularly susceptible to grazing. It appears that reindeer grazing affects the vegetation and soil fauna in different ways, and more investigations should be conducted to understand the importance of these changes.

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***Adistemia watsoni* (Wollaston) (Col., Latridiidae) recorded from Norway**

John Skartveit

Skartveit, J. 1999. *Adistemia watsoni* (Wollaston) (Col., Latridiidae) recorded from Norway. *Norw. J. Entomol.* 46, 46.

Adistemia watsoni (Wollaston) (Col., Latridiidae) was found in the laboratory at the Zoological (HOY Bergen: Nygårdshøyden, EIS 39). This is the first record of this synanthropic species in Norway.

Key words: *Adistemia watsoni*, Coleoptera, Latridiidae, Norway.

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The synanthropical latridiid *Adistemia watsoni* (Wollaston) is recorded for the first time from Norway. One specimen of this species was found in a litter extraction sample from a bilberry/pine forest in West Norway. However, this is a synanthropic species in Central Europe (Koch 1989) and the specimen almost certainly originated from the extraction lab in Bergen (HOY Bergen: Nygårdshøyden, Realfagbygget, EIS 39), where it may have entered the Tullgren funnel during the extraction. *A. watsoni* is a mould feeder which has been recorded from decaying hay, herbaria, and, particularly, from pigeon nests (Koch 1989, Hansen & Pedersen 1991). The species is keyed (to genus) in Vik (1995) but not illustrated. An illustration is given by Hansen & Pedersen (1991). Numerous old litter samples were stored in the lab at the time of the extraction and *A. watsoni* may have fed on moulds in these. The specimen is deposited in Zoological Museum, Bergen (ZMUB).

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New records of Triozidae (Hem., Psylloidea) from Norway

Lars Ove Hansen & Lita Greve

Hansen, L.O. & Greve, L. 1999. New records of Triozidae (Hem., Psylloidea) from Norway. *Norw. J. Ent.* 46, 47–48.

The two psylloids *Trioza galii* Foerster, 1848 and *T. flavipennis* Foerster, 1848 are recorded for the first time in Norway. A new record of *T. rhamni* (Schrank, 1801) and a high altitude record of *T. cerastii* (Linnaeus, 1758) are also presented. Biology and distribution of the species are briefly discussed.

Key words: *Trioza*, Triozidae, Psylloidea.

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INTRODUCTION

Since the revision of the N European psylloids (i.e. Ossiannilsson 1992), very few accounts of this superfamily have been presented from Norway. This article deals with two species not previously recorded from Norway and two other interesting records. These finds increase the number of Norwegian psylloid species to 75 (cf. Ossiannilsson 1992, Hansen 1996, Greve & Sagvolden 1997). Localities are given in accordance with Økland (1981). The material of *T. galii* is deposited at the Zoological Museum of Bergen, the rest at the Zoological Museum of Oslo.

THE SPECIES

Trioza rhamni (Schrank, 1801)

About twenty specimens were hatched from branches of *Rhamnus catharticus* from **BØ** Hole: Søhol (EIS 36) in 1998 (leg. LOH). Branches with clearly visible nymphs on the leaves were picked during July and adults emerged from ultimo July to medio August. *T. rhamni* has previously been recorded from Bamble (TEY), Oslo, Ås and Bærum (AK) (Ossiannilsson 1992). This record is, however, the first from **BØ**, and also the first inland record of the species in Norway. *T. rhamni* is solely associ-

ated with *R. catharticus* and may follow the distribution of this host-plant in Norway. In Denmark *T. rhamni* is only recorded from Bornholm (B), and in Sweden it is found fairly common from Skåne (Sk) north to Upland (Upl) (Ossiannilsson 1992). The further distribution ranges from W Europe and eastwards to Caucasus.

T. galii Foerster, 1848

A single male was sweep-netted at **RY** Klepp: Orresanden (EIS 7) on 6 June 1998 (leg. LG). The locality is a sandy area and *Galium* is abundant in the area. *T. galii* is in N Europe associated with certain *Galium* species, e.g. *G. palustre*, *G. uliginosum*, *G. verum* (Ossiannilsson 1992). The nymphs develop in leaf-galls, and adults have been found from April to October. *T. galii* has previously not been recorded from Norway. It has been found in S Sweden (Sk. – Upl., Dlr., Gtl., Hrl.), S Finland (Al, Ab, N, Sa, Kb) and Denmark (F, LFM, NEZ, EJ, WJ, SZ). The further distribution ranges from W Europe and eastwards to Mongolia, Amur, Japan and Taiwan (Ossiannilsson 1992).

T. flavipennis Foerster, 1848

Leaves of *Aegopodium podagraria* with typical pit-galls (Figure 1) were picked at **BØ** Røyken:

Kinnartangen (EIS 28) July 1998 (leg. LOH), and about 50 adults emerged from ultimo July to medio August. Some leaves were also picked at Ø Halden: Remmendalen (EIS 20) primo August 1998 (leg. LOH), and 5 adults emerged a few weeks later. This species is, according to Ossiannilsson (1992), solely associated with *A. podagraria*, which in Norway is common in gardens almost throughout the country (Lid & Lid 1994). The nymph makes a typical pit-gall on the host-plant (Figure 1), and these galls have been observed at several localities in the Oslofjord area (e.g. Oslo, Bærum, Lier, Drammen, Nedre-Eiker), and should indicate that the species is common in these areas. However, the pit-galls were not observed at populations of *A. podagraria* examined in Tromsø (TRY). *T. flavipennis* has previously not been recorded from Norway. It has been recorded from S Sweden (Sk., Sdm, Upl.), Denmark (F, NEZ), Finland (Ab), and through W Europe southwards to Spain and Romania (Ossiannilsson 1992).

T. cerastii (Linnaeus, 1758)

A few plants of *Cerastium alpinum* with ball-like deformations were picked at BV Ål: Haslehiet, W of Fødalsvatnet (EIS 42) primo August 1998, at 1260 m asl (leg. LOH). Three adults emerged about a week later. *T. cerastii* has previously been recorded from several localities in W, S and SE Norway north to Nnø, but not from BV (Ossiannilsson 1992). Any upper limits in altitude of the

distribution are not given, but records from T.Lpm in Sweden (Ossiannilsson 1992), should indicate that this is a robust species. The species has been recorded from Denmark (B, NEZ), Finland (Ab), almost throughout Sweden (Sk. – T.Lpm.), in most of W Europe and further eastwards to China (Ossiannilsson 1992).

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Figure 1. Upperside of leaves of *Aegopodium podagraria* showing the typical pit-galls caused by *Trioza flavipennis*. Photo: Lars Ove Hansen.

INSTRUCTIONS TO AUTHORS

The language is English or occasionally Norwegian with an extended English summary.

Manuscripts, double spaced on one side of the paper must be submitted in duplicate. Separate sheets should be used for (1) title page with authors names, (2) abstract followed by the name(s) and postal address(es) of the author(s), (3) tables, (4) numbered figures and (5) legends to figures. *Acknowledgements* should be gathered under a single heading at the end of the text. All manuscripts will be considered by referees before acceptance.

Abstract should not exceed 300 words and should cover the main results and conclusions of the paper. A list of up to five *key words* may be added on a separate line below the abstract.

Tables are typed on separate sheets and numbered consecutively. Each table must have a heading. Write "Table" in full both in the text and table heading. Avoid vertical lines in the table.

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Nomenclature. Scientific names of genera and species should be written in italics. The name of the author and year of description (if appropriate), separated by a comma, should be included the first time the name of an insect or another terrestrial arthropod is mentioned in the text, e.g. *Rhyacophila nubila* (Zetterstedt, 1840). Names of authors should be written in full, except L. for Linnaeus.

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Examples:

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Book

Hågvar, E.B. 1998. Det zoologiske mangfoldet. Dyrgruppenes systematikk, bygning og levevis. 2. utgave. 384 pp. Universitetsforlaget, Oslo

Chapter in book

Dennis, R.L.H. & Williams, W.R. 1995. Implications of biogeographical structures for the conservation of European butterflies. Pp. 213-230 in Pullin, A.S. (ed.), *Ecology and conservation of butterflies*. Chapman & Hall, London.

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