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Front cover: Barkbille *(Ips typographus)* etter P. Chr. Asbjørnsen, 1861

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Printing errors and computers

In our last issue (Norw. J. Entomol. Vol. 51, No.1), several printing errors occurred for the sign for degrees. In some places degree looks more like a Greek gamma (γ). The editor wants to apologize to the authors for any inconvenience this may have caused.

One example is on page 3 in the paper by Bergersen et al., where degrees have been replaced by gamma. In spite of this, the editor hopes everybody will understand that Finnmark is situated between 65°N and 71°N, but the use of gamma is rather unfortunate.

Similar errors appear in the article by Naujok & Finch. On page 33 not only degrees for geographical position but degrees for centigrade as well have been substituted by gammas. Even then, the readers will take it for printing errors and understand the correct meaning.

Both the authors and the editor are quite convinced that the signs were correct in the proofs. Something has happened when the files were transferred from the editorial secretary to the printers. I do not want to go into technical details, but the most likely explanation is that our files delivered as Pagemaker for PC were converted to MAC at the printers before being printed. In this process, special signs like degree, may be transformed. In fact, degree is a difficult sign because it can be written in several ways. One way to avoid errors, recommended by our editorial secretary, is to write 0 (zero), reduce the size, and transfer to superscript.

To avoid similar errors in the future, we will have to control proofs and the files from the printer even more carefully before they are printed. We will also from now on deliver the issues as pdf-files with high resolution to the printer.

The Editor

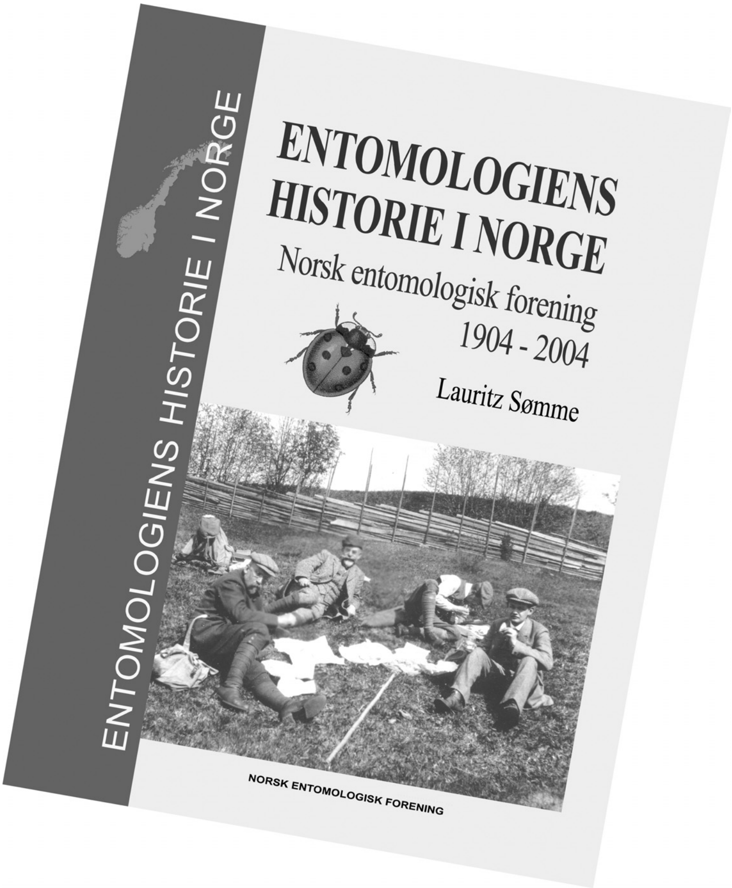
The history of entomology in Norway

ENTOMOLOGIENS HISTORIE I NORGE

Norsk entomologisk forening 1904 - 2004

Den 21. mai 2004 er det akkurat 100 år siden ti entusiastiske herrer møttes i Kristiania og dannet Norsk entomologisk forening. To av dem hadde entomologien - det vil si studiet av insekter - som yrke, de åtte andre var amatører.

Initiativtakeren Thomas G. Münster (1855-1938) var geolog, myntmester og politiker, samtidig som han var landets betydeligste ekspert på billesystematikk. Han representerer noe av det beste i vår entomologiske tradisjon: Amatørens glød og fagmannens ekspertise.



Boka forteller om foreningens mange aktiviteter, i gode dager og i vanskelige tider. Her kan man lese om Norsk entomologisk Tidsskrifts omflakkende tilværelse, og om Insekt-Nytt, som ble et viktig informasjonsblad for foreningens medlemmer. Boka beskriver også hvordan entomologi som fag har utviklet seg ved våre museer, universiteter og anvendte forskningsinstitusjoner.

Forfatteren Lauritz Sømme (født 1931) er professor emeritus fra Universitetet i Oslo, og har drevet forskning og undervisning på insekter gjennom hele sin yrkeskarriere. Han har også skrevet flere bøker innen fagfeltet entomologi.

Bilderedaktør Lars Ove Hansen (født 1958) er cand. scient fra Universitetet i Oslo, og er i dag en av drivkreftene innen det entomologiske miljøet i Norge. Han er også en erfaren insektfotograf, og boka er krydret med mange av Hansens bilder. Til daglig er han knyttet til insektavdelingen på Zoologisk museum ved Universitetets naturhistoriske museer og Botanisk hage i Oslo.

The book can be ordered from The Insect department, Natural History Museum, University of Oslo, POBox 1172 Blindern, NO-0318 Oslo. Price NOK 300,-.

Norw. J. Entomol. 51, 131–135. 2004

The sexual morphs of the endemic Svalbard aphid *Acyrthosiphon calvulus* (Ossiannilsson), with notes on species biology.

Ian D. Hodkinson, Jeremy M. Bird, Elisabeth J. Cooper & Stephen J. Coulson

Hodkinson, I.D., Bird, J.M., Cooper, E.J. & Coulson, S.J. 2004. The sexual morphs of the endemic Svalbard aphid *Acyrthosiphon calvulus* (Ossiannilsson), with notes on species biology. Norw. J. Entomol. 51, 131-135.

The endemic Svalbard aphid *Acyrthosiphon calvulus* was previously known only from 14 apterous females and one nymph. Male and apterous oviparae are described and illustrated from samples collected off *Salix polaris*, *Pedicularis hirsuta* and *Poa arctica* in Adventdalen, West Spitsbergen. The probable true host plant and the life cycle are discussed. High population densities occurred in open top chambers (OTC s) used to examine the ecological effects of climate warming.

Key words: *Acyrthosiphon calvulus*, Oviparae, male, viviparae, *Salix polaris*, *Pedicularis hirsuta, Poa arctica,* open top chamber, climate warming.

Ian D. Hodkinson, Jeremy M. Bird and Stephen J. Coulson, School of Biological and Earth Sciences, Liverpool John Moores University,Byrom St., Liverpool L3 3AF, UK. [Contact: Prof. Ian D. Hodkinson E-mail i.d.hodkinson@livjm.ac.uk]

Elisabeth J. Cooper, The University Centre on Svalbard, P.O. Box 156, N-9171 Longyearbyen, Norway.

INTRODUCTION

Acythosiphon calvulus was described by Ossiannilsson (1958) from two apterous viviparous females collected off *Poa arctica* f. *vivipara* in Saasendalen, W. Spitsbergen by Å. Holm on 1 August 1954. Heikinheimo (1968) described a further 12 apterous viviparous female specimens and 1 nymph collected from under stones at Vestpynten, Isfjord District by J. Kaisila on 9 July 1965. The species has subsequently remained unreported. In summer 2003 *A. calvulus* was found at high population densities on experimental plots in Adventdalen, W. Spitsbergen. These plots had been artificially warmed (both with or without goose grazing), using Open Top Chambers (OTCs) as part of a manipulation experiment to study the effect of goose grazing on the growth and productivity of tundra plant communities (FRAGILE project). Later the aphid was discovered in areas away from the experimental treatments, but at lower densities. This paper describes the sexual morphs of *A. calvulus*, records possible host plants and discusses the probable life-history.

DESCRIPTION OF THE SEXUAL MORPHS

Ossiannilsson (1958) and Heikinheimo (1968) provide line drawings and a photomicrograph of the apterous viviparous female, together with detailed size measurements. The comparative descriptions below of the alate oviparae and male follow a similar format. Illustrations were prepared using SYNCROSCOPY *Automontage* and *Montage Explorer* packages to enhance images captured using a JVC3CCD video camera mounted on a Nikon OPTIPHOT 2 microscope from specimens mounted in Canada balsam on a slide.

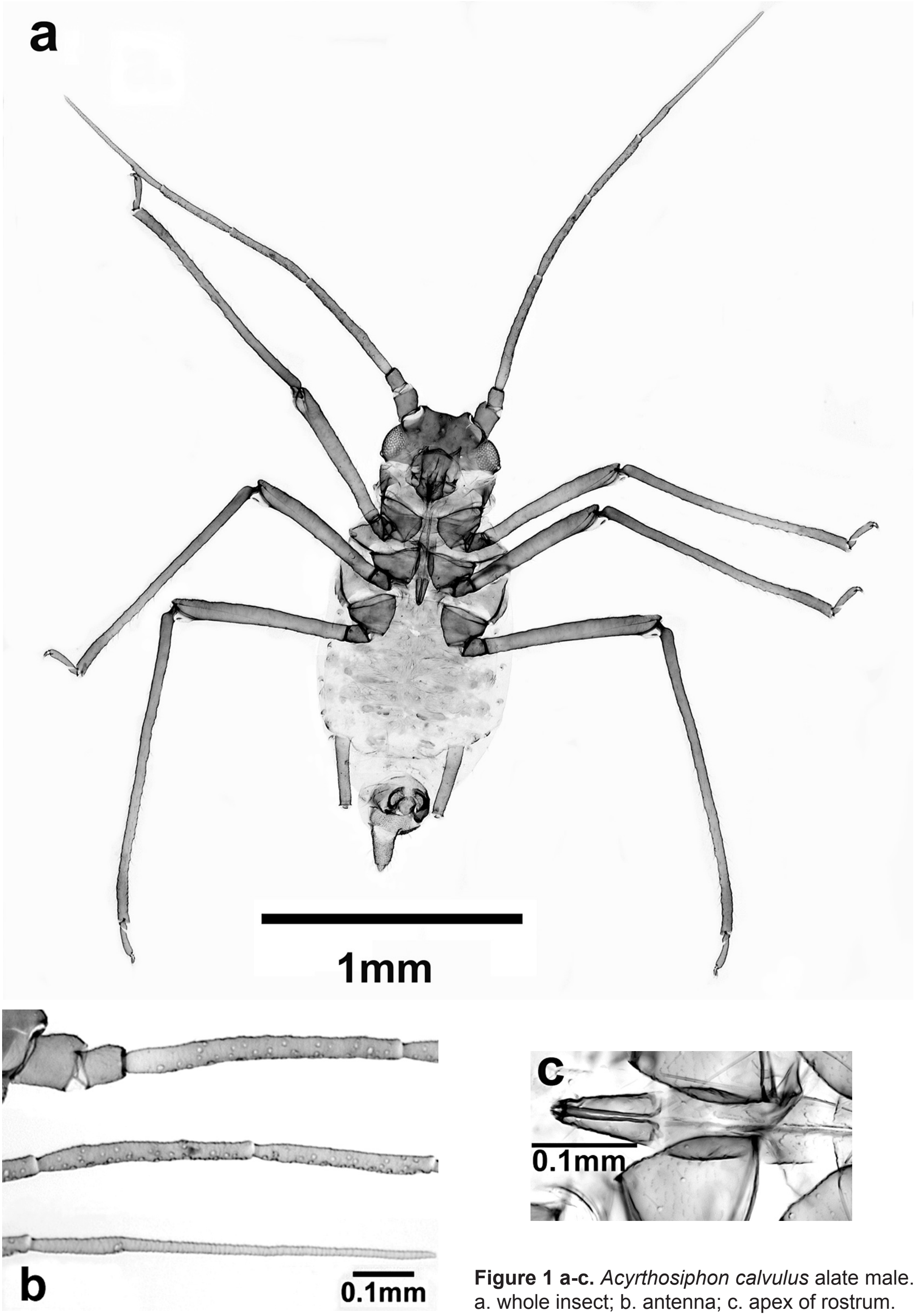


Figure 1 a-c. *Acyrthosiphon calvulus* alate male. a. whole insect; b. antenna; c. apex of rostrum.

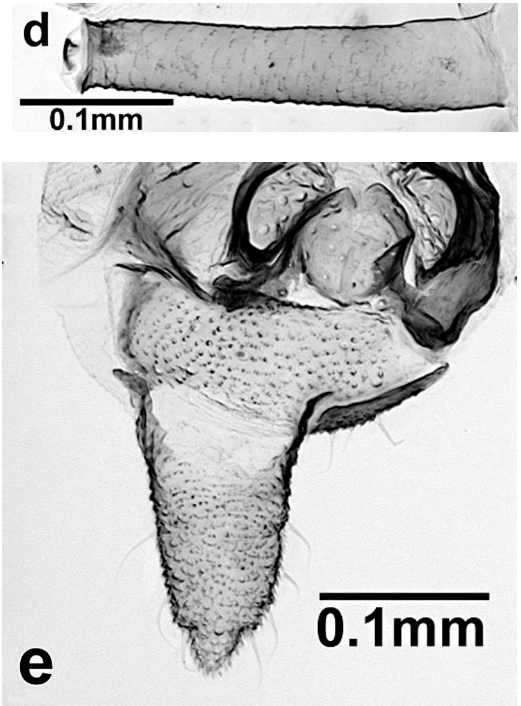


Figure 1 d-e. *Acyrthosiphon calvulus* alate male. d. siphunculus; e. caudal process.

Description

Colour: mature individuals intense but dull bluish green. Larvae occasionally more yellowish green.

Male (Fig. 1 a-e)

All measurements in mm. Body length (Figure 1a) 1.39-1.79. Antennal length (Figure 1b) 1.82. Length of individual segments 3,4,5,6a and 6b are 0.39-0.47, 0.34-0.36, 0.31-0.32, 0.14-0.16, 0.37-0.43 respectively. Length of apical segment of rostrum (Figure 1c) 0.19-0.22. Length of siphunculus (figure 1d) 0.25-0.27. Length of caudal process (figure 1e) 0.18. Length of femur - fore 0.54-0.59, mid 0.53-0.58, hind 0.62-0.70. Length of tibia - fore 0.89-0.93, mid 0.92-0.98, hind 1.15-1.21. Length of apical tarsal segment – fore 0.11-0.12, mid 0.11-0.12, hind 0.11-0.13.

Female ovipara (Fig. 2. a-e)

All measurements in mm. Body length (Figure 2a) 2.03-2.11. Antennal length (Figure 2b) 1.68-1.70. Length of individual segments 3,4,5,6a and 6b are 0.35-0.37, 0.27-0.28,0.28-0.29, 0.15-0.16, 0.43-0.46 respectively. Length of apical segment of rostrum (Figure 2c) 0.21-0.22. Length of siphunculus (figure 2d) 0.34-0.35. Length of caudal process (Figure 2e) 0.21-0.22. Length of femur - fore 0.52-0.55, mid 0.54-0.58, hind 0.64-0.66. Length of tibia - fore 0.78-0.85, mid 0.84-0.90, hind 1.09-1.17. Length of apical tarsal segment – fore 0.11-0.12, mid 0.11-0.12, hind 0.12-0.13.

A long series of males and apterous oviparae collected on 25 July and 5 August 2003 is deposited in The Natural History Museum, UK.

Diagnosis

A.calvulus can be distinguished from the corresponding morphs of *A. svalbardicum* by the bluish-green body colouration, the relatively longer legs and antennae and the more curved siphunculus.

HOST PLANT

A systematic attempt was made to determine food plants. Aphids were collected repeatedly from *Salix polaris* and the above-ground stems of its root parasite *Pedicularis hirsuta*. The presence of honeydew and wax, and the relative difficulty of dislodging aphids, with stylets evidently inserted, suggest that both these species were serving as host plants. Individuals were most commonly found on the upper surface of the small rounded *S. polaris* leaves, head downwards with the stylets apparently inserted into the mid vein. A few specimens were present on *Poa arctica* and other monocots but the aphids did not appear to be feeding at the time of collection. There is a possibility, however, that the concave upper surface of the *S. polaris* leaf acts as a thermally favourable basking site for sexually mature aphids.

DISCUSSION

A. calvulus appears to share several life history features in common with the other endemic Svalbard aphid, *Acyrthosiphon svalbardicum* Heikinheimo, which feeds on *Dryas octopetala* (Strathdee *et al.*1993a,b) . The two *Acyrthosiphon* species

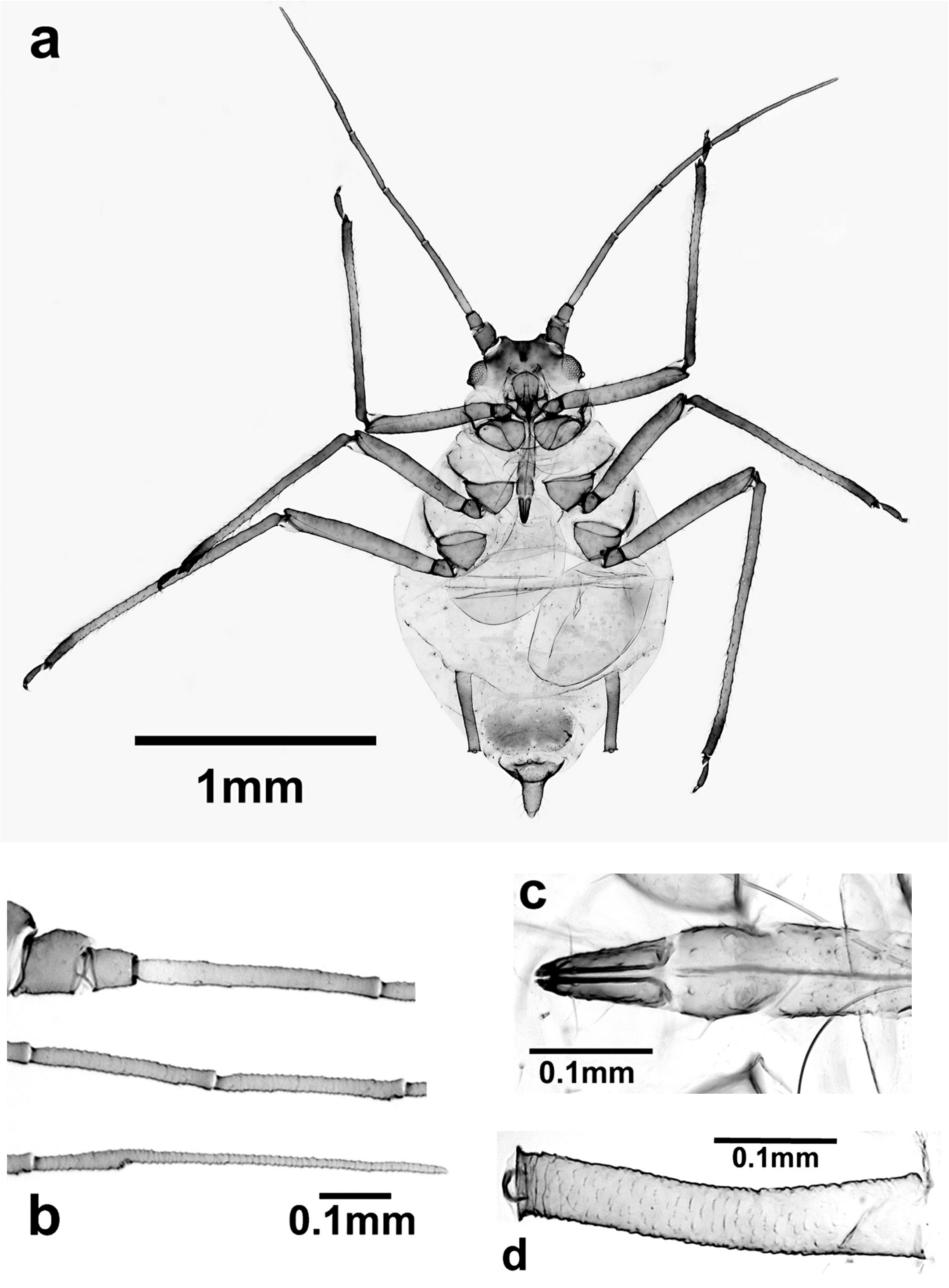


Figure 2 a-d. *Acyrthosiphon calvulus* alate oviparae. a. whole insect; b. antenna; c. apex of rostrum; d. siphunculus.

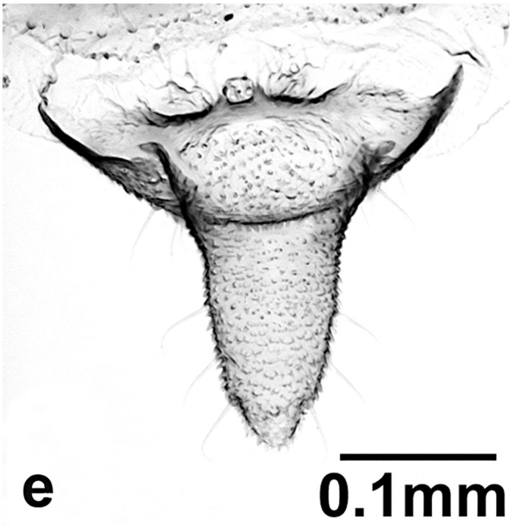


Figure 2 e. *Acyrthosiphon calvulus* alate oviparae. Caudal process.

are found together in drier tundra habitats in Adventdalen. Both species produce viviparous females in summer giving rise to oviparae and males, which mate, late in the growing season (August). *A. svalbardicum* overwinters in the egg stage and it is likely that *A. calvulus* behaves similarly. Alate forms are virtually absent in both species, raising questions about how they disperse on a broader geographical scale (but see Hodkinson et al. 2002). There also appear to be close parallels in their population response to warming. Strathdee *et al*. (1993c) produced a 20-fold increase in one year in *A. svalbardicum* populations using passive cloches to warm small areas of tundra. The OTC chambers appear to have produced similar effects on the population of *A. calvulus* within a single growing season. Another interesting feature of the study is that *A. calvulus* appears to feed on both *S. polaris* and *P. hirsuta*, members of two taxonomically disparate host plant families - Salicaceae and Scrophulariaceae respectively. This suggests some chemical similarity between the host and its root parasite species that influences food-choice behaviour in the aphid.

Acknowledgements. We again thank Roger Blackman for his invaluable assistance in confirming the identity of *A. calvulus* and Jon Martin for preparing slide material.

This paper represents a collaborative contribution towards the EEU-funded FRAGILE project (Fragility of Arctic goose habitat: impacts of land use, conservation, and elevated temperature) in Adventdalen, Svalbard, for which Dr.Lis Cooper is field project manager.

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Ptiolina oculata (Becker, 1900) (Diptera, Rhagionidae) in Norway

Lita Greve & Tore Randulff Nielsen

Greve, L. & Nielsen, T.R. 2004. *Ptiolina oculata* (Becker, 1900) (Diptera, Rhagionidae) in Norway. Norw. J. Entomol. 51, 136.

One male *Ptiolina oculata* (Becker, 1900) (Diptera, Rhagionidae) was collected at Kirkenes (FØ Sør-Varanger) on 6 July 1983. This is the first record from Norway.

Key words: *Ptiolina oculata*, Diptera, Rhagionidae, Norway.

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The family Rhagionidae is an ancient group of flies and one of the dominant fly groups as early as in middle and late Jura. They retain many primitive characters and are usually placed at the base of the stem of all Brachycera (Nartshuk 1995). Nartshuk also gave new distributional data from the northern Palaearctic where Rhagionidae has been insufficiently investigated.

In recent material received by the Zoological Museum, University of Bergen there was a single male belonging to the genus *Ptiolina.* We have identified it as *P. oculata* (Becker, 1900) [Syn. *Omphalophora lapponica* (Frey, 1911)]. We follow the opinion of Nagatomi (1982) who synonymized *Omphalophora* with *Ptiolina.* Nartshuk (1995) is of the same opinion, while Majer (1997), although referring to Nagatomi (1982), keeps *Omphalophora* and *Ptiolina* as separate genera on the basis of key characters already shown by Nagatomi (1982) to be of doubtful value. *Ptiolina* today has 15 species in the Palaearctic, most of them specific of the tundra zone (Nartshuk 1995).

Material

1 ♂ **FØ** Sør-Varanger: Kirkenes (EIS 169), 6 July 1983, leg. Thorvald Arne Nielsen, Kristin Helene Nielsen and Tore Randulff Nielsen.

Ptiolina oculata is the largest species in the genus *Ptiolina.* In fact, one of the characters used to distinguish species of *Omphalophora* from species of *Ptiolina* was actually the size; *Omphalophora* species being larger than all *Ptiolina* species, viz. longer than 5 mm body length. *P. oculata* is approximately the double size of the other *Ptiolina* species recorded from Norway, and thus should be easy to recognize.

Nartshuk (1995) established *Omphalophora lapponica* Frey, 1911 as a synonym for *Ptiolina oculata* (Becker, 1900). She considers *Ptiolina oculata* an arctic to high-boreal species, and she maps the records from Yakutia in the east to Finnish Lapland in the west. She also describes the variation in this species, both in colour between sexes varying from partly yellowish to grey to all grey/brownish, and also variation in colour between specimens from different parts of the distributional area. The Norwegian record is one of the most western known so far.

The Norwegian fauna of Rhagionidae has been recorded in Greve (1982, 1984) and it was noted (Greve 1984) that *P. oculata* (as *Omphalophora lapponica* Frey) was perhaps a species which might occur in North Norway, in Troms and Finnmark.

Acknowledgements. We would like to thank Thorvald Arne Nielsen and Kristin Helene Nielsen for their help in collecting.

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Norw. J. Entomol. 51, 137–143. 2004

A new species of *Cordyla* Meigen from Norway (Diptera: Mycetophilidae)

Jostein Kjærandsen & Olavi Kurina

Kjærandsen, J. & Kurina, O. 2004. A new species of *Cordyla* Meigen from Norway (Diptera: Mycetophilidae). Norw. J. Entomol. 51, 137-143.

A new species of fungus gnats in the genus *Cordyla* Meigen, 1803, *C. bomloensis* **sp. n.**, is described based on adult material from southwestern Norway. Both the male and the female are described, photographed and their terminalia figured. The new species belongs in the *C. fusca*-group. It seems to be most closely allied to *C. brevicornis* (Staeger, 1840) and *C. pusilla* Edwards, 1925 from which it is differing prevalently by structures of the male and female terminalia. Its seemingly isolated distribution in southwestern Norway is briefly commented on.

Key words: Mycetophilidae, *Cordyla*, new species, Norway.

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INTRODUCTION

Kurina (2001) reviewed the current knowledge of the genus *Cordyla* Meigen, 1803 in the Palaearctic region. The genus is a well defined monophyletic group in the fungus gnat family Mycetophilidae, mainly characterised by having short antenna with a reduced number of flagellar segments and by having swollen antepenultimate segment of the maxillary palp. Bechev (1999) listed 19 described species from the Palaearctic region and 10 described species from the Nearctic region. Three species, *C. borealisa* Wu & Zheng, 2000, *Cordyla monegrensis* Chandler & Blasko-Zumeta, 2001 and *C. bidenticulata* Sasakawa, 2003 has later been added to the Palaearctic fauna.

Altogether 11 species of *Cordyla* are so far reported from Norway (Søli 1994, Økland & Zaitzev 1997, Kurina 2001). In this paper we describe a new species collected by the first author on the island Bømlo at the southwestern coast of Norway. The species has subsequently been found at four other localities along the southwestern coast of Norway. The type locality is a rich, mixed deciduous forest dominated by birch *Betula pubescens* and aspen *Populus tremula*. The climate in western Norway is Atlantic usually with much rainfall, mild winters, and cool summers.

MATERIAL AND METHODS

All specimens were collected with Malaise traps. At the type locality, **HOY**: Bømlo, Vorland, a single Malaise trap equipped with a bottle filled with 75% ethanol was operated on a weekly basis between February 15th 2002 and March 25th 2003. By examination of additional Malaise trap collections from the southwestern coast of Norway the species was also found at four other localities: **HOY**: Bømlo, Skogafjellet narturreservat, **HOY**: Os, Raudli, **RY**: Finnøy, Sevheim, and **RY**: Finnøy, Ladesteinvatnet.

Parts of the studied material were cleared and slide mounted in Canada balsam. The Holotype and male and female paratypes of the new species is deposited at the Museum of Zoology, University of Bergen, Norway (ZMUB). Paratypes and additional material in alcohol are further deposited at the Institute of Zoology and Botany, Tartu, Estonia (IZBE), at the Museum of Zoology, Lund University, Sweden (ZMLU), and the Natural History Museum, London, United Kingdom (BMNH). The terminology follows that in Søli et al. (2000).

MEASUREMENTS AND RATIOS

All measurements were made on slide-mounted specimens and are given as the range of measured specimens followed by the mean value when 5 or more specimens were measured. The measurements from holotype are given in square brackets. The head is measured in dorsal view. Head width is measured at the widest point and head length is measured from the vertex to the frontal tubercle. Only the three apical maxillary palpomeres are measured, beginning with the swollen antepenultimate segment. The palpomere ratios are thus given as the ratio of the fourth and fifth palpomere to the length of the antepenultimate (third) segment. The wing length is measured from the distal median plate to apex of wing (Figure 1). The fork length ratio is given as the distance from the distal median plate to the branching of M (A in Figure 1) over the distance from the distal median plate to the branching of CuA (B in Figure 1). The R_5 termination ratio is given as the distance between R_1 and R_5 termination (C in Figure 1) over the distance between R_5 and M_1 termination (D in Figure 1). The fork width ratio is given as the distance between M_1 and M_2 termination (E in Figure 1) over the distance between CuA_1 and CuA_2 termination (F in Figure 1). The M_2 is measured to the wing margin, and since it is breaking before the wing margin a ratio of the breaking distance to its entire length is also given. Otherwise the M-ratios, CuA-ratios and leg ratios follow Søli (1997).

THE SPECIES

Cordyla bomloensis sp. n.

(Figures 2-11)

Material examined

Holotype: 1 ♂ **NORWAY: HOY**: Bømlo, Vorland (EIS 22, UTM: 32VKM863137), 29 April - 06 May 2002, Malaise trap. J. Kjærandsen leg. (on slide, ZMUB type no. 397).

Paratypes: 1 ♀, same data as holotype (slide, ZMUB). 2 ♂♂ (on slides, ZMLU), same data as holotype except 13 - 20 May 2002. 1 M (on slide,

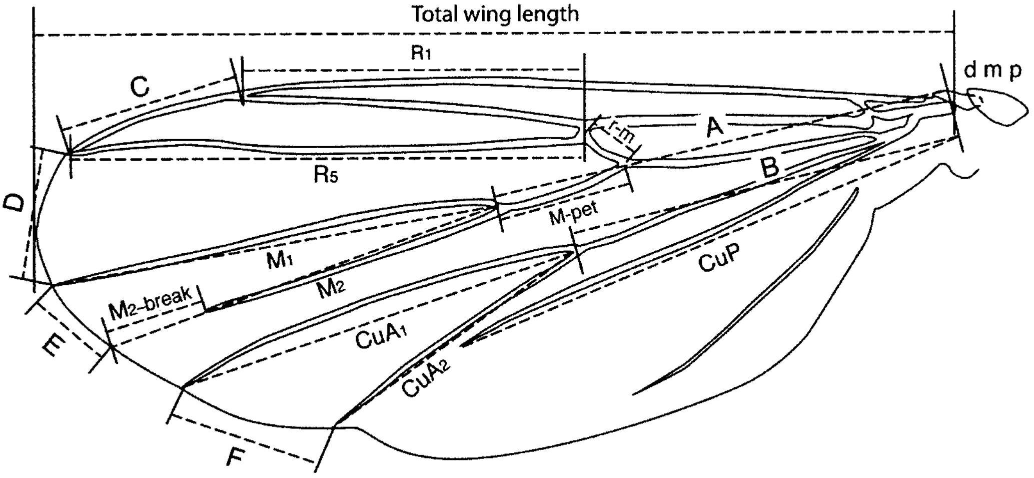


Figure 1. Wing of male *Cordyla bomloensis* sp. n., showing the points and orientation for measurements. A / B measure the fork length ratio. C / D measure the R_5 termination in relation to R_1 and M_1. E / F measure the fork width rations. Abbreviations: d m p = distal median plate.

ZMLU), same data as holotype except 27 May - 3 June 2002. 5 ♂♂ (2 on slides, IZBE, ZMLU), same data as holotype except 3 - 10 June 2002. 1 ♂, **HOY**: Bømlo, Skogafjellet narturreservat (EIS 22), 18 April - 31 May 2003, Malaise trap, J. Kjærandsen leg. (ZMLU). 5 ♂♂, same data as previous except 1 June - 6 July. 17 ♂♂, same data as previous except 30 August - 29 September (ZMUB, ZMLU, BMNH).

Additional material: – 1 ♂, 2 ♀♀ (on slides), **HOY**: Os, Raudli (EIS 31), 2 - 9 May 1991, Malaise trap, G. A. Halvorsen leg. (ZMLU). 1 ♂, **RY**: Finnøy, Sevheim (EIS 14), 11 - 29 May 1993, Malaise trap, J. Skarteveit leg. (ZMLU). 2 ♂♂, **RY**: Finnøy, Ladesteinvatnet (EIS 14), 11 - 29 May 1993, Malaise trap, J. Skarteveit leg. (ZMLU).

Etymology. Named after the type locality Bømlo, an island and a municipality on the western coast of Norway, using the Latin suffix *-ensis* denoting place of origin. A noun in genitive case.

Diagnostic characters. Male antennae 2+10 segmented. Swollen antepenultimate palpal segment brown, about 0.9 times as long as height of compound eye. M_2 does not reach wing margin. Posterior fork begins distinctly before base of median fork. Male mid and hind tibiae with three small spinules-like setae ventroapically. Male eight sternite with short spinules-like setae. Gonostylus longitudinally compressed; dorsal and ventral appendages sub-equal in length. Dorsal appendage of gonostylus without comb, medial appendage undivided with small apical projection. Female tergite VI with pointed apical edge laterally and deeply excavated dorsally

Description

Male

(n = 5, except where otherwise stated). Total length 2.5 – 3.6, 3.1 (n=10) mm. Wing length 2.16 – 2.4, 2.31 [2.16] mm, or 3 – 3.24, 3.12 [3] times as long as profemur. Mesonotum length 0.88 – 1, 0.94 mm, or 0.4 – 0.42, 0.41 [0.41] times as long as wing.

Coloration (Figure 2). Antenna with scape light brown, pedicel and flagellum yellow. Head dark brown. Maxillary palp brown. Thorax dark brown to blackish, without thoracic stripes. Wings unmarked, wing veins yellow with dark setae. Legs variable, mainly yellow but sometimes with darker femora. Abdominal tergites dark brown to blackish, with basal segments generally paler. Terminalia light brown, cercus yellow.

Head. Round, width / length to frontal tubercle 1.21 – 1.36, 1.31 [1.33]. Antenna (Figure 5) short, compressed with 10 flagellar segments, length of antenna 0.51 – 0.62, 0.59 [0.51] mm. First flagellomere 1.5 – 1.82, 1.67 [1.7] times as long as second flagellomere. Second flagellomere 0.4 – 0.44, 0.42 [0.43] times as long as wide. Two ocelli present, set close to compound eyes. Length / width of clypeus 0.29 – 0.42, 0.35 [0.29]. Antepenultimate segment 0.23 – 0.25, 0.24 [0.23] mm long, palpomere ratios 1: 0.63 – 0.71, 0.66 [0.68]: 0.71 – 0.93, 0.84 [0.82].

Thorax. Scutum densely covered with small, decumbent, black setae. Proepisternum covered with black setae of variable size. Anepisternum covered with black, small setae, 3-5, 4 [3] larger setae along posterior margin. Laterotergite with 12-22, 19 [12] long setae centrally.

Wings (Figure 4). Costa and radius with setae both dorsally and ventrally. Wing length to length of R_1 2.45 – 2.55, 2.49 [2.51]. R_5 slightly sinusoid, wing length to length of R_5 1.79 – 1.82, 1.8 [1.8]. Crossvein r-m with small, distinct white spot. Length of r-m to length of M-petiole 0.31 – 0.4, 0.35 [0.4]. Fork length ratio (A/B) 1.1 – 1.28, 1.2 [1.15]. R_5 termination ratio (C/D) 1.13 – 1.18, 1.15 [1.13]. Fork width ratio (E/F) 0.45 – 0.53, 0.48 [0.47]. M-ratios 0.92 – 1.03, 0.99 [1] and 0.98 – 1.13, 1.07 [1.13]. M_2 break 0.21 – 0.25, 0.23 [0.23] of its length before wing margin. CuA-ratios 0.78 – 0.96, 0.86 [0.96] and 1.05 – 1.31, 1.17 [1.31]. CuP distinct basally, length 0.61 – 0.67, 0.64 [0.64] to length of wing. A_1 distinct, shorter.

Legs. Anterior face of forecoxa covered with short, black setae. Mid and hind tibiae with three small, spinules-like setae ventroapically. Leg ratios given for fore, mid and hind leg: LR 0.76 – 0.8, 0.78 [0.76]: 0.77 – 0.84, 0.8 [0.77]: 0.7 – 0.74, 0.72 [0.71]; SV 2.89 – 3.1, 2.99 [3.1]: 2.53 – 2.75, 2.63 [2.62]: 2.76 – 2.92, 2.86 [2.91]; BV 1.65 – 1.84, 1.71 [1.68]: 1.93 – 2.04, 1.99 [193]: 2.25 – 2.38 [2.38] (n=4); TR 1.29 – 1.37, 1.32 [1.3]: 1.53 – 1.63, 1.58 [1.56]: 1.7 – 1.81, 1.75 [1.81].

Terminalia (Figures 7-9). Gonocoxite subsquare in dorsoventral view, with a deep u-shaped incision ventrally. Cercus short, ovate. Dorsal appendage of gonostylus short, round, externally setose; with apicomedial short lobe; without comb. Medial appendage of gonostylus undivided, short, subsquare; with small apical projection and two strong seta. Ventral appendage of gonostylus short, subsquare in ventral view; with heavily sclerotized comb along entire external surface; without setae. Sternite VIII with narrow base, basal half widening and apical half pointed with bluntly rounded tip; apical half densely covered with black, short, strong spinules-like setae.

Female

(n = 3, except where otherwise stated). Total length 3.2 – 4.1 mm. Wing length 2.22 – 2.44 mm, or 3.26 – 3.68 times as long as profemur. Mesonotum length 0.74 – 0.84 mm, or 0.32 – 0.36 times as long as wing.

Coloration (Figure 3). As for male, except more distinctly darker apically on femora and terminalia light brown

Head. Round, width / length to frontal tubercle 1.46 – 1.48. Antenna (Figure 6) short, compressed, with 9 flagellar segments, length of antenna 0.51 – 0.6 mm. First flagellomere 1.5 – 1.92 times as long as second flagellomere. Second flagellomere 0.6 – 0.67 times as long as wide. Two ocelli present, set close to compound eyes. Length / width of clypeus 0.46 – 0.52. Antepenultimate segment 0.2 – 0.22 mm long, palpomere ratios 1: 0.72 – 0.75, 0.73: 0.79 – 1, 0.91.

Thorax. Scutum covered with larger, black setae, intermingled with smaller, decumbent, black setae. Proepisternum covered with black setae of variable size. Anepisternum covered with black, small setae, 2-3 larger setae along posterior margin. Laterotergite with 12-19 setae centrally.

Wings. Costa and radius with setae both dorsally and ventrally. Wing length to length of R_1 2.27 – 2.78. R_5 slightly sinusoid, wing length to length of R_5 1.69 – 2. Crossvein r-m with small, distinct white spot. Length of r-m to length of M-petiole 0.26 – 0.29. Fork length ratio (A/B) 1.04 – 1.06. R_5 termination ratio (C/D) 1.13 – 1.19. Fork width ratio (E/F) 0.62 – 0.73. M-ratios 0.94 – 0.96 and 1.02 – 1.04. M_2 break 0.21 – 0.31 of its length before wing margin. CuA-ratios 1.07 – 1.09 and 1.5 – 1.55. CuP distinct basally, length 0.4 – 0.42 to length of wing. A_1 distinct, shorter.

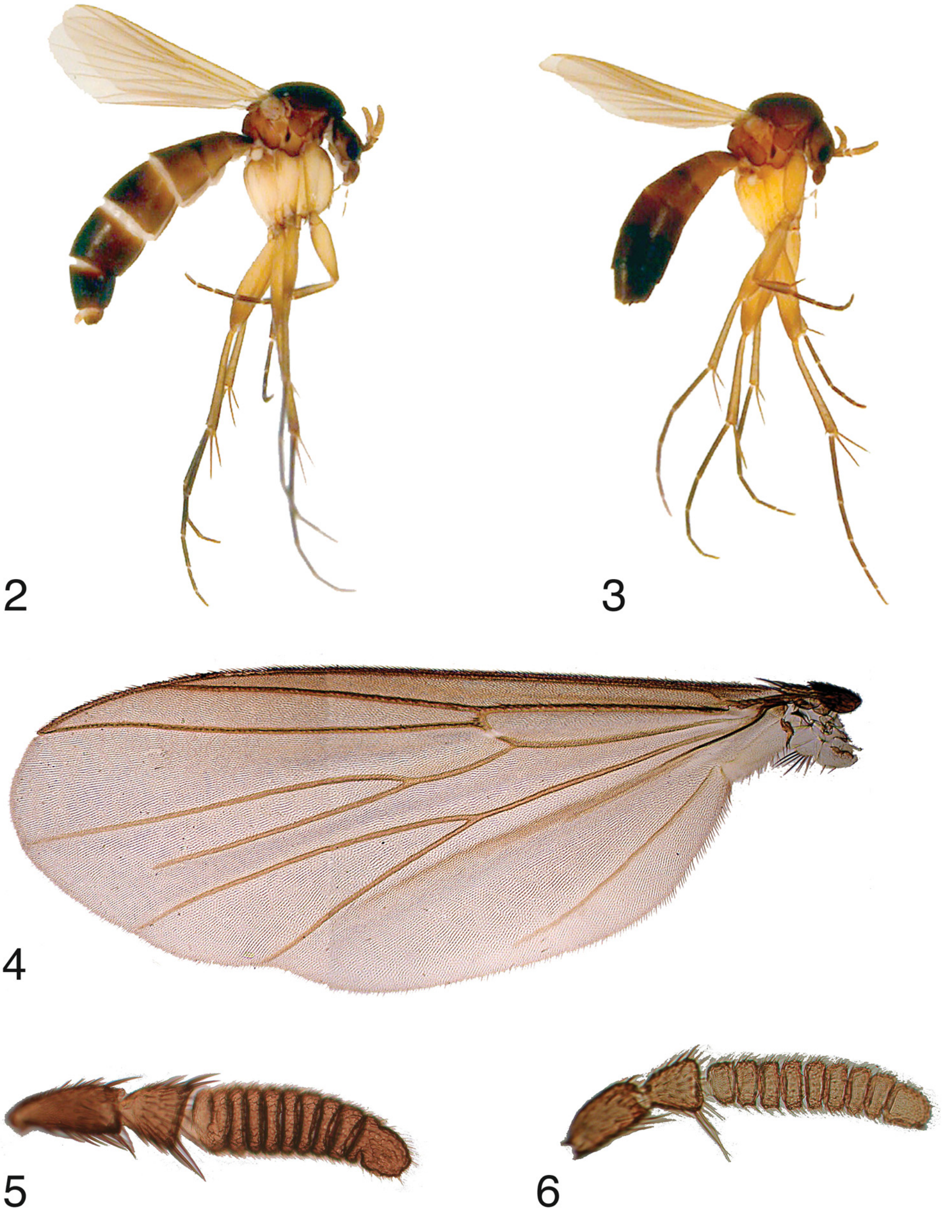
Legs. Anterior face of forecoxa covered with short, black setae. Mid and hind tibiae without spinules-like setae ventroapically. Leg ratios given for fore, mid and hind leg: LR 0.83 – 0.91: 0.75 – 0.8: 0.66 – 0.71; SV 2.75 – 3.01: 2.59 – 2.74: 2.78 – 3.02; BV 1.65 – 1.71: 2.1 – 2.23: 2.69 – 2.86; TR 1.36 – 1.46: 1.68 – 1.71: 2.12 – 2.24.

Terminalia (Figures 10-11). Long oviscapt, usually retracted within segment VI. Tergite VI with pointed apical edge laterally, evenly excavated dorsally. Tergite VII and VIII similar, less pointed apically. Sternite VI - VIII medially divided. Cercus 2-segmented, basal segment long ovate, covered with short, stiff setae; apical segment small, rounded, with a few strong setae apicomedially. Gonapophysis 8 membranous, subtriangular in lateral view; with single apical seta. Labia present as sclerotized strip overlying gonapophysis VIII.

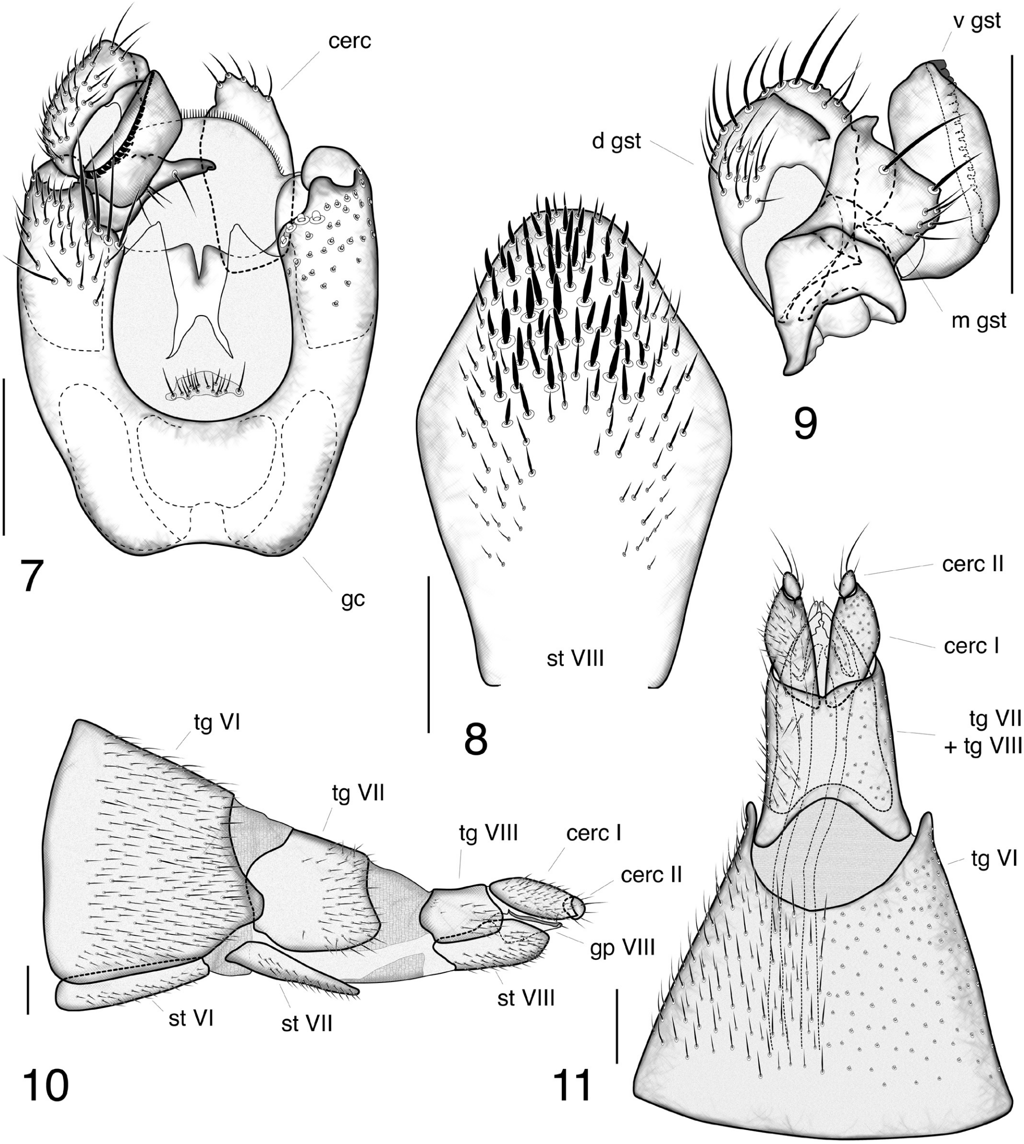
Distribution and flight period. The new species is so far only known from the southwestern coast of Norway where it seems to be locally common at several localities. Based on available material the flight period seems to be primarily in May and in September.

DISCUSSION

Cordyla bomloensis sp. n. belongs to the *C. fusca*-group, which was outlined by Kurina (2001). It is most similar to *C. brevicornis* (Staeger, 1840) and *C. pusilla* Edwards, 1925, differing prevalently by structure of the male and female terminalia. Within the *C. fusca*-group the males of *C. bomloensis* sp. n. shares two characters with *C. brevicornis* and *C. pusilla*: 1) The antenna has 10 flagellar segments, and 2) the dorsal appendage of the gonostylus is without a sclerotized comb. Further the males shares with *C. fusca* Meigen,



Figures 2 – 6. Digital photos of *Cordyla bomloensis* sp. n. **– 2**. Habitus of male paratype. **– 3**. Habitus of female paratype. **– 4**. Left wing of holotype. **– 5**. Antenna of holotype, lateral view. **– 6**. Antenna of female paratype, lateral view.



Figures 7 – 11. Terminalia of *Cordyla bomloensis* sp. n. **– 7**. Male terminalia, ventral view, sternite VIII and left gonostylus removed. **– 8**. Male sternite VIII, ventral view. **– 9**. Internal face of male left gonostylus. **– 10**. Female terminalia, lateral view. **– 11**. Female terminalia, dorsal view. Abbreviations: gc: gonocoxite, gp: gonophysis, d gst: dorsal lobe of gonostylus, m gst: median lobe of gonostylus, v gst: ventral lobe of gonostylus, st: sternite, tg: tergite. Scale bars represent 0.1 mm.

1804 and *C. nitens* Winnertz, 1863 the characteristic of having three spinules-like setae apicoventrally on the mid and hind tibiae. All other *Cordyla* species have normal setae apicoventrally on the mid and hind tibiae, more than 10 flagellar segments, and one or two combs on the dorsal appendage of the gonostylus.

In *C. bomloensis* sp. n. the swollen antepenultimate segment of the maxillary palp is brown, analogous to *C. pusilla*, but it is somewhat more slender than in both *C. pusilla and C. brevicornis*. The gonostylus (Figures 7 and 9) is longitudinally compressed compared to other *Cordyla* species. Both the dorsal and ventral appendages of the gonostylus are uniquely shaped; the dorsal appendage being short, rounded and subequal in length to the subsquare ventral appendage. All other *Cordyla* species have the dorsal appendage longer and/or both appendages remarkably more slender. The medial appendage of gonostylus consists of one undivided lobe, somewhat similar to that of the Nearctic *C. scutellata* Garrett, 1925. The male sternite VIII is very characteristic in *C. bomloensis* sp. n., having short spinules-like setae like no other known *Cordyla* species. The wing venation is like in most of *Cordyla* species, with M_2 not reaching to wing margin (break-off ratio 0.21 – 0.25, 0.23 in the male and 0.21 – 0.31 in the female). The cubital fork begins clearly before the base of medial fork in the male (average fork length ratio 1.2), less clearly so in the female (fork length ratio 1.04 – 1.06).

Despite having studied lots of *Cordyla* material from throughout the Fennoscandian region the second author has not found *C. bomloensis* sp. n. elsewhere. The distribution of the new species is also unlikely to be explained as the result of postglacial immigration from areas outside Scandinavia. Hence, and although admitting that we still have very limited knowledge of the distribution of fungus gnats in Scandinavia, it is intriguing to speculate why this species seems to have a restricted distribution in southwestern Norway. The supposedly endemic distribution associates perhaps best with the theory of glacial refugia in Scandinavia (e.g. Lindroth 1969), where oceanic species may have survived in fluctuating glacial-free areas. The finding of *C. bomloensis* sp. n. on the islands Bømlo and Finnøy conforms well with a postulated refugium around Boknafjorden (see Manglerud 1973). The unique morphology, especially in the male genitalia, points in the direction of a preglacial relict that has not been able to expand its distribution after the last ice age. However, the theory of ice-free refugia in Scandinavia is controversial and has been heavily disputed (e.g. Manglerud 1973, Nordal 1987).

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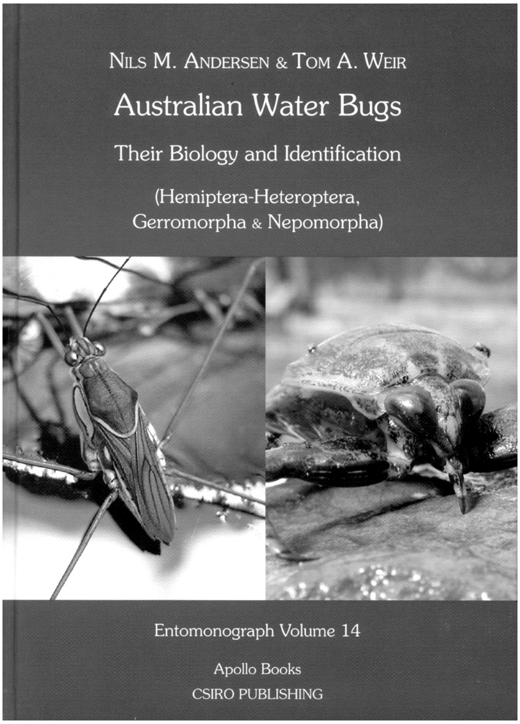
Andersen, N. M. & Wier, T. A. 2004. Australian Water Bugs. Their Biology and Identification(Hemiptera-Heteroptera, Gerromorpha & Nepomorpha). Entomograph Vol. 14. Apollo Books / Csiro publishing. 344 sider, 8 colour plates, line drawings, scanning electron micrographs, distribution maps etc. Hardback. ISBN 87-88757-78-1. Pris DKK 420,00. Bestilles fra: Apollo Books, Kirkeby Sand 19, DK-5771 Stenstrup, Denmark [apollobooks@vip.cybercity.dk].

Forfatterne Nils M. Andersen & Tom A. Wier har publisert mange artikler sammen om vannteger. Deres siste arbeide kom i septemberutgaven av *Invertebrate Systematics* [18 (4), 2004]. Dessverre har Andersen nylig gått bort, noe som må sies å være et hardt slag for Nordisk entomologi. Andersen var ansatt på Zoologisk museum i Kjøbenhavn og var i verdensfronten på forskning innen vannlevende teger. Tom Weir er ansatt ved Australian National Insect Collection, Canberra, der han kuraterer Australias største vanntegesamling.

Vannteger er stort sett predatorer og åtselsetere, og angriper alle de byttedyr de kan mestre, fra små krepsdyr og insekter til rompetroll og små fisk. De spiller en viktig rolle i det akvatiske økosystem og brukes ofte som indikatorer på et habitats kvalitet. De kan også betraktes som «nyttedyr» ved at de angriper mygglarver, samtidig som de er mat for fisk.

Den australske faunaen omfatter 16 familier, og inkluderer kjente grupper som Gerridae, Nepidae og Corixidae. Men som alltid i Australia finner vi en høy andel endemismer. 14 av slektene og over 100 arter finnes kun her. Faunaen er også unik på andre måter. Så mange som 24 % av artene er marine med tilknytning til mangrove skog og tidevanssoner rundt korallrev.

Boka tar for seg gruppene Gerromorpha og Nepomorpha, og innledes med kapitler om morfologi, økologi og systematikk. Man får innledningsvis presentert en nøkkel basert på habitattyper og hele den første delen gir inntrykk av å være skrevet for nybegynnere. Klassifikasjon og fylogeni delen av boka gir en gjennomgang av nyere systematiske arbeider, både morfologisk og molekylært. Et kort kapitel omhandler fossile arter, der fylogeni blir kombinert med geologisk historie. Denne boka viser spennvidden en moderne systematiker må ha i dag, fra å kunne produsere detaljerte genetaltegninger og artslister, til å beskrive fylogeni og lage utbredelseskart.



Den viktigste delen av verket er identifikasjonsnøklene, der både slekter og arter skal la seg bestemme. Disse er rikt illustrert med detaljerte genitalietegninger, fargebilder og en rekke SEM fotografier. Nøkkelen inneholder et minimum av teknisk språk, og kan passe for de fleste. Boken ender opp med ei fyldig referanseliste, og tilslutt gis ei sjekkliste med utbredelse for Australia.

Det er en glede å se en så omfattende og visuelt attraktiv bok som denne. Det er nok mange som ønsker at de hadde like vel illustrerte nøkler og gjennomarbeidede verk tilgjengelig for sine grupper. Utbredelseskartene tar noen ganger litt for stor plass på sidene, spesielt for de artene som bare har noen få punkter på kartet. Men alt i alt er dette en bok man ikke kommer utenom hvis man ønsker å studere Australias vannteger.

Eirik Rindal

Norw. J. Entomol. 51, 145–149. 2004

Classification of Mycetophilidae (Diptera, Sciaroidea)

Øivind Gammelmo

Gammelmo, Ø. 2004. Classification of Mycetophilidae (Diptera, Sciaroidea). Norw. J. Entomol. 51, 145-149.

The classification of Mycetophilidae has varied considerably during the last decades. Today most scientists regard Mycetophilidae as belonging to the superfamily Sciaroidea together with the families Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae, Lygistorrhinidae and Sciaridae. Mycetophilidae includes two subfamilies, Mycetophilinae with the tribes Exechiini and Mycetophilini, and Sciophilinae with the tribes Gnoristini, Leiini, Mycomyini, Sciophilini and Metanepsini. However, the classification is still far from stable and further studies based both on morphological characters and on DNA sequencing are necessary to get a better understanding of the group.

Key words: Diptera, Mycetophilidae, classification, systematics.

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INTRODUCTION

Our present knowledge about the phylogeny and classification of Mycetophilidae is exclusively based on morphological characters, mainly from studies of adult males. The classification has varied much through time. The most comprehensive analysis presented so far is that of Matile (1997).

In the present paper I will summarize the history of Mycetophilidae classification since Edwards (1925) laid the basis for the present classification. The classification is still far from stable and further studies based both on morphological characters and DNA sequencing are necessary to shed light on the many unresolved question.

RESULTS AND DISCUSSION

Edwards (1925) established the present classification of Mycetophilidae by interpreting Mycetophilidae as consisting of ten subfamilies, namely Bolitophilinae, Diadocidiinae, Ditomyiinae, Keroplatinae, Lygistorrhininae, Macrocerinae, Manotinae, Mycetophilinae, Sciarinae and Sciophilinae (Figure 1). Later Edwards included Macrocerinae in Keroplatinae (Edwards 1941). Further, Edwards (1925) recognized two tribes in Mycetophilinae (Exechiini and Mycetophilini) and four tribes in Sciophilinae (Gnoristini, Leiini, Mycomyini and Sciophilini).

The tribes in Sciophilinae have been raised to subfamily level by several authors (Bechev 1999, Henning 1973, Matile 1989, Tuomikoski 1966c, Väisänen 1984, 1986, Zaitzev 1994). However, Søli (1997) rejected this practice. Shaw and Shaw (1951) suggested an additional tribe, Allactoneurini, and Zaitzev (1994) later raised Allactoneurini to the level of subfamily. Today most authors recognize Allactoneurini as being part of Leiini (Søli 1996).

Tuomikoski (1966a) and Henning (1973) raised six of Edwards' subfamilies to separate families, namely Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae, Mycetophilidae and Sciaridae. Lygistorrhininae was placed in Keroplatidae, and has been treated as a subfamily by several authors (Henning 1973, Tuomikoski 1966b, Väisänen 1984). However, Matile (1997) found Lygistorrhinidae to be the sister group of Mycetophilidae.

Tuomikoski (1966c) and Henning (1973) lumped Manotinae and Sciophilinae together with

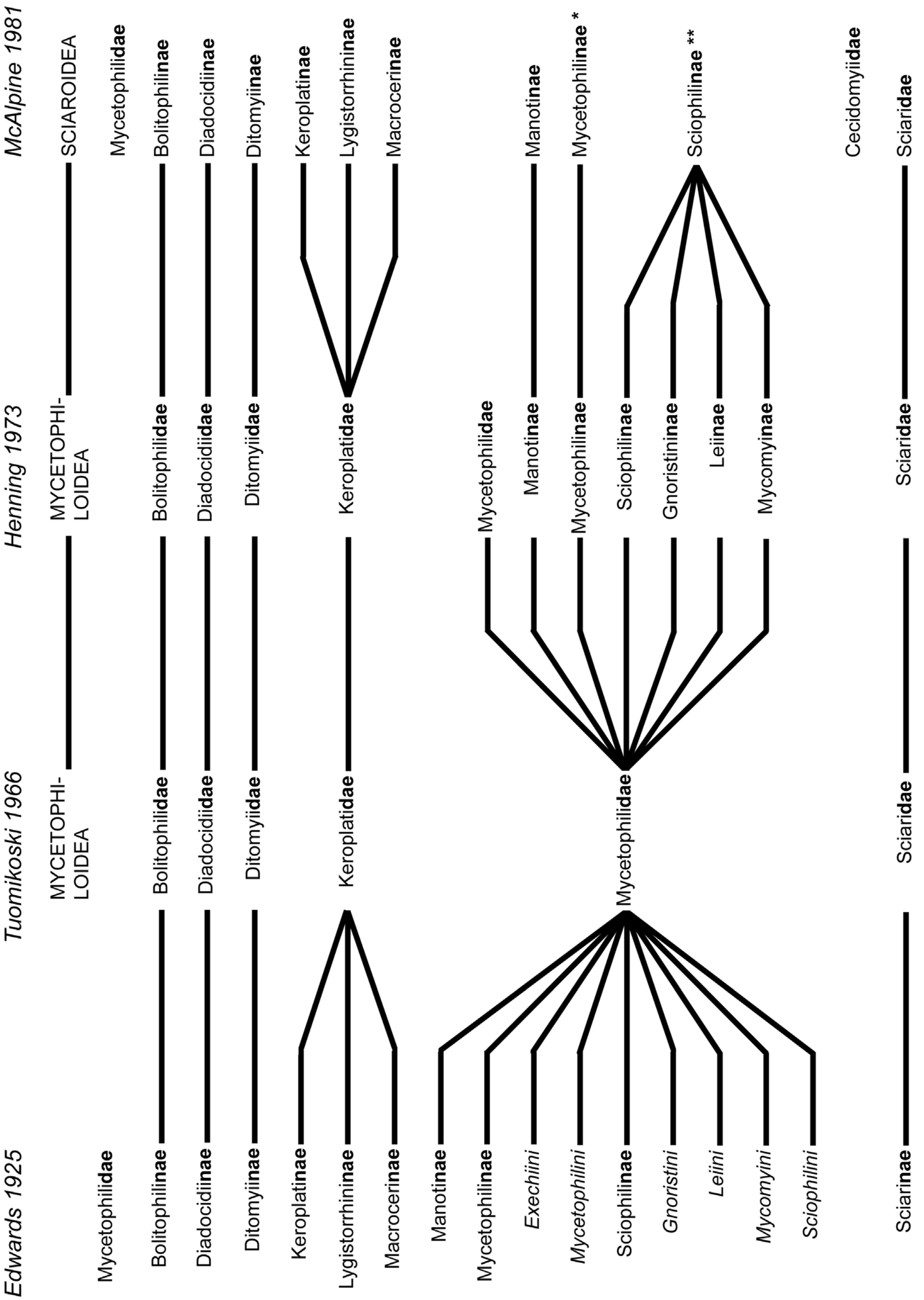

Figure 1. The classification of Mycetophilidae from Edwards (1925) to McAlpine (1981). * = McAlpine divided Mycetophilinae into tribes as suggested by Edwards (1925). ** = McAlpine divided Sciophilinae into tribes as suggested by Edwards (1925), but used the name Teragoneurini for Leiini.

Mycetophilinae in the family Mycetophilidae. Henning (1948) had previously treated Sciophilinae as a separate family. Later, some authors have treated Manotinae as a separate family (Krivosheina & Mamaev 1988, Matile 1989, 1990). In contrast to Tuomikoski (1966c), Henning (1973) further split Mycetophilidae and gave Edwards' tribes the rank of subfamilies, namely Gnoristininae, Leiinae, Manotinae, Mycetophilinae, Mycomyinae and Sciophilinae.

Following the American tradition, McAlpine (1981) treated Mycetophiloidea as one family, Mycetophilidae, excluding Cecidomyiidae and Sciaridae, and he introduced the name Sciaroidea for Mycetophiloidea (Figure 2). Mycetophilidae consisted of eight of Edwards' subfamilies, namely Bolitophilinae, Diadocidiinae, Ditomyiinae, Keroplatinae, Lygistorrhininae, Manotinae, Mycetophilinae and Sciophilinae. McAlpine (1981) also divided Mycetophilinae and Sciophilinae in tribes as suggested by Edwards (1925), but used the name Tetragoneurini for Leiini.

Väisänen (1984) kept Mycetophiloidea and the six families as suggested by Henning (1973), but split Mycetophilidae into eight subfamilies, namely Gnoristininae, Leiinae, Manotinae, Metanepsinae, Mycetophilinae, Mycomyinae, Sciophilinae and Eudicraninae. The latter was erected for the genus *Eudicrana* Loew.

Soós & Papp (1988) split the family Keroplatidae into two families, Macroceridae and Keroplatidae.

The most commonly adopted classification today is that of Matile (1990, 1997) in which the superfamily Sciaroidea is divided into seven families, namely Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae, Lygistorrhinidae, Mycetophilidae, and Sciaridae. This classification is also in accordance with Søli (1997), who kept Edwards' subfamilies and tribes of Mycetophilidae but adding a fifth tribe in Sciophilinae, Metanepsiini.

However, the systematics of Mycetophilidae is still not well understood. Revisions of genera and redescriptions of many taxa based on more detailed morphological characters, as well as zoogeographical analyses are necessary to better understand the evolution and systematics of the group. Today DNA sequencing has become an important tool in systematic studies, and also for Mycetophilidae this technique will undoubtedly help solving many systematic problems.

Acknowledgements. I am indebted to Dr. Geir E.E. Søli, University of Oslo, for all help and encouragement during my study of the fungus gnats.

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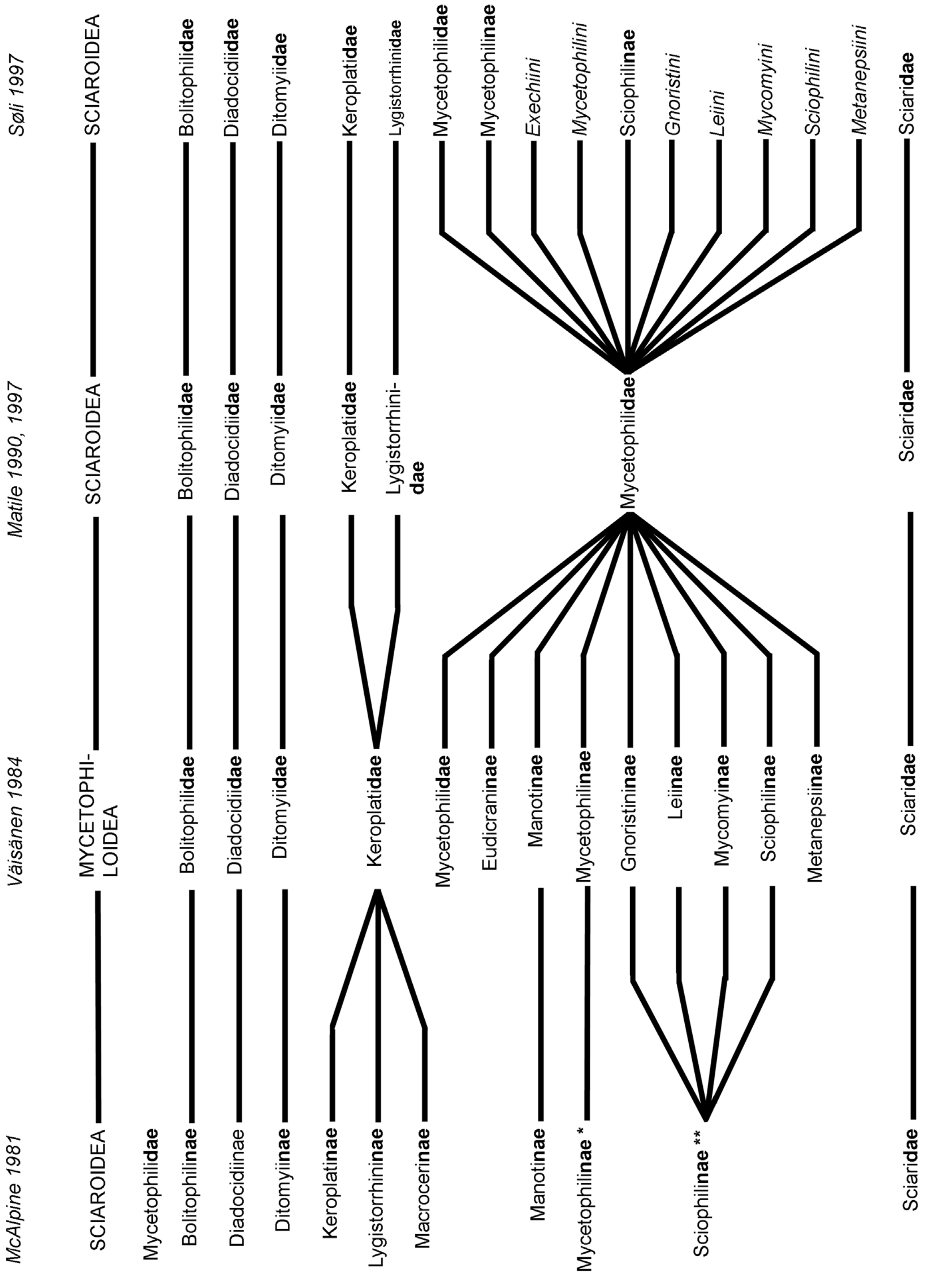

Figure 2. The classification of Mycetophilidae from McAlpine (1981) until present.

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Et nytt nummer av Fauna Entomologica Scandinavica har ankommet og denne gangen er det de tre familiene Nemonychidae, Anthribidae og Attelabidae som omhandles.

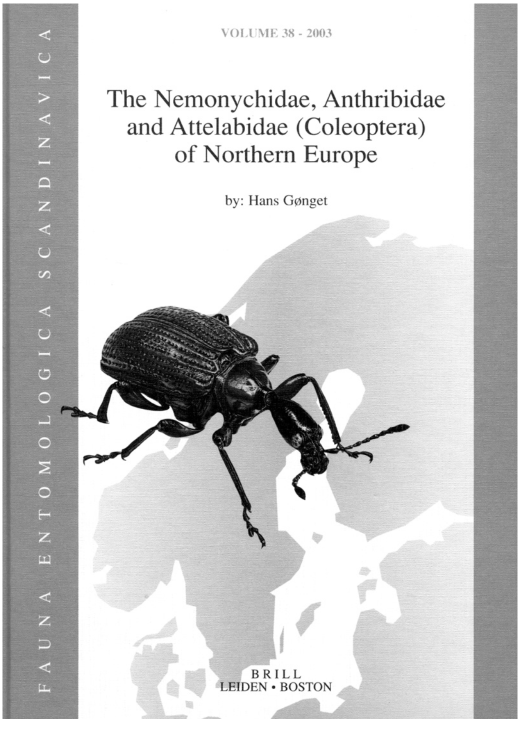
Boken er bygd opp på samme måte som foregående utgivelser i serien, med taksonomisk historikk, innsamlingsmetoder og generell morfologi og økologi. Selve hoveddelen består av nøkler og utførlig beskrivelse av hver enkelt art. Til slutt kommer en utbredelsesoversikt, flotte habitus illustrasjoner og en liste over kjente vertsplanter og parasitoider.

Boken er en oppfølger til vol. 34 som tok for seg Apionidene, også denne skrevet av Hans Gønget. Det er helt tydelig at Gønget kan sine orthocere snutebiller og etter å ha lest igjennom mesteparten av boka, prøvd ut nøklene og lett etter ting å pirke på, satt jeg igjen med kun positive opplevelser.

Som i tidligere bind i denne serien, synes jeg at beskrivelsene av artene kan bli i lengste laget, spesielt når det er snakk om arter som vanskelig kan forveksles med andre. Samtidig ser jeg viktigheten av å gi en utførlig og enhetlig beskrivelse av alle artene slik at eventuelle nyankomne arter kan skilles ut. Gønget har også med en kortere beskrivelse av hver art som kun tar for seg de viktigste karaktertrekkene, noe som korter ned bestemmelsestiden betraktelig.

De tre familiene som boka omhandler er i Norden sparsomt representert og det er hittil bare registrert 23 norske arter. Dette, i tillegg til at de fleste artene er forholdsvis enkle å bestemme, gjør at boken ikke er fullt så etterlengtet som de tidligere bindene i Fauna Ent. Scand. Men for dem som kun har Danmarks fauna å støtte seg til i et forsøk på å komme frem til rett art, må det nevnes at tre norske arter (2 anthribider og 1 nemonychide) mangler i Danmarks fauna. Uansett er det en pen liten bok med fine illustrasjoner som absolutt kan anbefales alle som allerede er interessert i biller, eller som kunne tenke seg å starte med noen familier som er overkommelige også for nybegynnere.

Stefan Olberg



FAUNA ENTOMOLOGICA SCANDINAVICA

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The Nemonychidae, Anthribidae and Attelabidae (Coleoptera) of Northern Europe

by: Hans Gønget

BRILL
LEIDEN • BOSTON

Norw. J. Entomol. 51, 151–158. 2004

Notes on uncommon beetles (Coleoptera) collected during a survey in Hardanger, Western Norway

John Skartveit, Reidun Pommeresche & Torstein Solhøy

Skartveit, J., Pommeresche, R. & Solhøy, T. 2004. Notes on uncommon beetles (Coleoptera) collected during a survey in Hardanger, Western Norway. Norw. J. Entomol. 51, 151-158.

Axinotarsis ruficollis (Olivier) (Melyridae) is reported new to the Norwegian fauna. The following 18 species are recorded for the first time from Western Norway: Ptiliidae: *Acrotrichis cognata* Matthews; Leiodidae: *Anisotoma orbicularis* Herbst; Cholevidae: *Catops subfuscus* Kellner; Staphylinidae: *Lesteva sicula* Erichson, *Euplectus decipiens* Raffray, *Anotylus fairmairei* (Pandelle), *Oxypoda longipes* Mulsant & Rey, *Liogluta longiuscula* (Gravenhorst), *Atheta (s.str.) strandiella* Brundin, *Zyras cognatus* Märkel, *Bolitochara mulsanti* Sharp, *Placusa incompleta* (Sjöberg), *Cypha punctum* (Motschulsky); Histeridae: *Gnathoncus buyssoni* Auzat. Eucnemidae: *Microrhagus pygmaeus* (Fabricius); Rhizophagidae: *Rhizophagus cribratus* (Gyllenhal); Cryptophagidae: *Caenoscelis ferruginea* Sahlberg, *Atomaria ornata* Heer.

Notes are also given on the apparently rare species *Microscydmus minimus* Chaudoir (Scydmaenidae), *Bolitobius inclinans* (Gravenhorst) (Staphylinidae) and *Ilyobates nigricollis* (Paykull) (Staphylinidae). Altogether 91 further species not previously recorded from Inner Hordaland (**HOI**) are listed.

Key words: Coleoptera, new records, Hordaland, Norway.

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INTRODUCTION

During the research program «Miljøregisteringer i skog - biologisk mangfold» (Gjerde & Baumann 2002), focusing on the biodiversity of Norwegian forests, a forest area in Western Norway was extensively sampled for ground-living beetles using pitfall traps and extraction from litter samples. A total of 76 sites in various forest and bog types were sampled with pitfall traps, in addition four sites were sampled with Malaise traps and litter samples were collected and extracted from 54 sites. This resulted in a beetle material of approximately 35 000 specimens belonging to approximately 400 species. The vast majority of these records represent common and abundant species, however a number of uncommon species were also collected. The present paper is a conspectus of the rarer beetle species found during the survey. Additionally, it attempts to fill in some gaps in the knowledge of the distribution of beetles in Western Norway (the districts from Rogaland in the south to Møre og Romsdal in the north), many common species not being previously recorded from these districts (Vik 1991).

MATERIAL AND METHODS

The sample area is located in **HOI:** Kvam, Geitaknottane nature reserve (EIS 31), and includes deciduous and pine forest as well as numerous bogs and ponds around the lake Svevatnet. (60^o 7' N 5^o 52' E, UTM ref. 32 VLM 2668), altitude 100 -

300 m. a.s.l. The area has been divided into 147 squares of 100 by 100 meters. The area was sampled with pitfall traps (altogether 76 series of 8 traps each, operated continuously between April and November), by extraction of litter samples (54 sites sampled, usually six samples, each of 1-3 litres of litter, from each site. Samples collected between May and November) and with Malaise traps (four sites sampled, traps running from May until October). Locality numbers given refer to square numbers used in the research program and by Pommeresche (1999). The specimens have been deposited in the collection of the Zoological Museum, University of Bergen.

LIST OF SPECIES

Ptiliidae

Acrotrichis cognata (Matthews, 1877) (syn. *A. platonoffi* Renkonen, 1945)

This ptiliid is rather easily recognized because of the matt, bluish sheen of the elytra. 11 specimens were collected in litter extraction samples from an alder grove (loc. 70B), about 80 years old, 11 September 1997. The ground on the collection site was covered by grass and mosses, with considerable quantities of dead alder wood. The site was frequently used by grazing cattle and therefore had much dung on the ground. Quite probably, the beetles may have originated from an old cow pat, or from decaying polypore fungi on the dead wood (Koch 1989a). The species has previously been recorded from South-Eastern Norway and from **TRI** and **FØ** in the eastern part of North Norway (Vik 1991).

Leiodidae

Anisotoma orbicularis (Herbst, 1792)

One specimen in a pitfall trap from an alder grove (loc. 1A), 18 June – 27 July 1997. Previously recorded along the coast west to **VAY** (Vik 1991). This is a fungus-feeder found in slime moulds, polypore fungi and on fungi in dead plant matter (Koch 1989a).

Catops subfuscus Kellner, 1846

The species was recorded from pitfall traps in 11 different localities: one (loc. 200) in a heather / pine woodland, three (locs. 25, 69 and 250) in bilberry/pine woodlands, one (loc. 01) in a spruce plantation and six (locs. 1B, 37, 47, 61, 70B, 72) in various kinds of deciduous forest. Altogether 44 specimens were collected. This is a small *Catops* species with black pronotum and dark reddish elytra. Habitually it is rather similar to the common species *Sciodrepoides watsoni* (Spence) but easily distinguished from this species by the sides of pronotum and elytra being curved separately, rather than forming a continuous curve. Apparently quite common in the area in a range of habitats. Previously recorded from South-Eastern Norway as far west as to **AAI** (Vik 1991).

Scydmaenidae

Microscydmus minimus (Chaudoir, 1845)

Collected in a pitfall trap from an alder grove (loc. 70B) and from extraction samples from two mixed forest localities (locs. 50 and 53) and two bilberry/ pine localities (locs. 71 and 94), altogether 13 specimens. *M. minimus* is a tiny beetle, 0.7-0.8 mm long, and is associated with *Lasius* ants in hollow deciduous trees (Koch 1989a). It was listed as «care demanding» by Hanssen et al. (1998). Since a number of specimens of this very inconspicuous species were collected without its supposed special habitat (hollow trees and ant nests) being sampled at all, it probably indicates the species is reasonably common in the area. Previously recorded in Norway from **HOI** (Vik 1991) and **AK** (Hanssen & Hansen 1998).

Staphylinidae

Euplectus decipiens Raffray, 1910

One specimen from a pitfall trap in an alder grove (loc. 70B), 1 May – 5 June 1997. Previously recorded from Eastern Norway west to **AAI**, and also from **NNV** and **TRI**, as well as questionably from **ST** (Vik 1991).

Lesteva sicula Erichson, 1840

Two specimens in pitfall traps, one each from deciduous forest (loc. 9), 23 September – 21 November 1997 and bilberry / pine woodland (loc.

87), 22 September – 20 November 1997. *L. sicula* has previously been recorded from **AK**, **AAY** and **VAY** in Norway (Hansen and Sagvolden 1995). The species was listed as «care demanding» by Hanssen et al. (1998).

Anotylus fairmairei (Pandelle, 1867)

One female in an extraction sample from an alder grove (loc. 70B), 11 September 1997. Previously recorded from South-East Norway only (Vik 1991). The species occurs mainly in dung (Koch 1989 a), which was plentiful at this site due to cattle grazing.

Bolitobius inclinans (Gravenhorst, 1806)

This species has been recorded only from **TEY**, **HOI** and **HOY** (Vik 1991) but proved to be quite common in the study area. *B. inclinans* was recorded in 17 of 50 pitfall trap localities in 1997 and in 5 of 26 different localities in 1998, altogether 42 specimens. It occurred both in bilberry / pine woodlands and in several different types of deciduous woodlands. *B. inclinans* lives in humid microhabitats in forests (Koch 1989a). This is a rather conspicuous and easily recognisable species and ought not to be under-recorded compared to other staphylinids. Apparently *B. inclinans* in Norway is an interesting example of a beetle which has a very limited distribution but is locally quite common.

Oxypoda longipes Mulsant & Rey, 1861

Previously recorded from **Ø**, **AK**, **BØ** and **VE** (Vik 1991). Twelve specimens from eight different localities, mainly in deciduous forest but also in heather / pine and bilberry / pine woodlands. It is an eurytopical species found particularly in small mammal burrows (Koch 1989a).

Ilyobates nigricollis (Paykull, 1800)

Two specimens from a pitfall trap in an alder grove (loc. 02), 23 July – 27 September 1997. Previously recorded from South-Eastern Norway as well as **SFI** (Vik 1991).

Liogluta longiuscula (Gravenhorst, 1802)

One specimen from an extraction sample from bilberry/ pine forest (loc. 87), 12 September 1997. Previously recorded from **TE** and **AA** (Vik 1991).

Atheta (s.str.) *strandiella* Brundin, 1954

Two specimens from pitfall traps, from heather / pine woodland (loc. 112), 17 June – 28 July 1997 and bilberry / pine woodland (loc. 250), 27 July – 23 September 1997. Previously recorded from South-Eastern Norway and from **TRI** (Vik 1991).

Zyras cognatus (Märkel, 1842)

Recorded with single specimens from pitfall traps in a dry oak woodland (loc. 142A), 27 September – 22 November 1997, a bilberry / pine woodland (loc. 135), 29 May – 28 July 1997 and an eutrophic bog (loc. 73), 5 May – 17 June 1997. On the two former sites the species was associated with large numbers of the commoner *Z. humeralis* (Gravenhorst). Also recorded from **HOY**: Askøy EIS 39, Ravnanger, from pitfall traps in a clearcut covered by bracken fern (*Pteridium aquilinum*) and from a dense spruce plantation (locs. VIII and XII of Aakra (1998)), K. Åkra leg. Previously recorded from South-Eastern Norway (Vik 1991).

Bolitochara mulsanti Sharp, 1875

Two specimens from pitfall traps, from a humid deciduous forest (loc. 15), 18 June – 27 July 1997 and from a spruce plantation (loc. 01), same dates. Previously recorded from South-Eastern Norway and **NT** (Vik 1991).

Placusa incompleta Sjöberg, 1934

One specimen in an extraction sample from an ash / alder forest (loc. 9), 12 August 1997. This species has previously been recorded from South-East Norway, **STI** and **FØ** (Vik 1991) and lives under bark of dead trees (Koch 1989a).

Cypha punctum (Motschulsky, 1857)

One male was collected in a litter extraction from a steep hill with alder and birch (loc. 125), 4 November 1997. A female *Cypha* was collected in a different sample from the same locality on the same date, and probably also belongs to this species, although examination of the male genitalia is necessary for certain species identification (Palm 1966). Beetles of the genus *Cypha* are rarely collected, probably due to their tiny size possibly in combination with a late activity period.

Table 1. Further species recorded new to HOI. Species not noted from HOI by Vik (1991). All records are HOI, Kvam (EIS 31), Geitaknottane Nature Reserve, 1997-98, R. Pommeresche & J. Skartveit leg. Spc./Loc. = Number of specimens / number of locations.

Species	Pitfall	Litter	Malaise	Spc./Loc.
Hydraenidae				
Hydraena britteni Joy, 1907	x	x		16/ 6
Ptiliidae				
Euryptilium saxonicum (Gillmeister, 1845)		x		1/ 1
Ptiliolum fuscum (Erichson, 1845)		x		1/ 1
Pteryx suturalis (Heer, 1841)		x		34/ 8
Acrotrichis grandicollis (Mannerheim, 1844)		x		30/ 4
Acrotrichis silvatica Rosskothen, 1935	x	x		5/ 4
Acrotrichis intermedia (Gillmeister, 1845)	x	x		208/ 25
Acrotrichis rosskotheni Sundt, 1971		x		12/ 4
Acrotrichis rugulosa Rosskothen, 1935		x		3/ 2
Leiodidae				
Leiodes polita (Marsham, 1802)	x			2/ 1
Leiodes punctulata (Gyllenhal, 1810)	x			2/ 2
Agathidium nigripenne (Fabricius, 1792)		x		1/ 1
Agathidium atrum (Paykull, 1798)	x	x		29/ 23
Catops nigrita Erichson, 1837	x	x		259/ 39
Colon latum Kraatz, 1850	x			33/ 7
Colon rufescens Kraatz, 1850	x			4/ 2
Scydmaenidae				
Euconnus hirticollis (Illiger, 1798)	x			4/ 4
Staphylinidae				
Philonthus nigrita (Gravenhorst, 1806)	x	x	x	15/ 5
Platydracus fulvipes (Scopoli, 1763)	x			9/ 6
Quedius brevis Erichson, 1840	x			1/ 1
Quedius nigriceps Kraatz, 1857	**x**	**x**		**81**/ 36
Lathrobium quadratum (Paykull, 1789)	x			1/ 1
Euaesthetus bipunctatus (Ljungh, 1804)	x			2/ 2
Stenus ater Mannerheim, 1830	x			1/ 1
Stenus tarsalis Ljungh, 1804		x		1/ 1
Proteinus brachypterus (Fabricius, 1792)	x	x	x	372/ 59
Proteinus crenulatus Pandelle, 1867	x			28/ 11
Proteinus atomarius Erichson, 1840	x			2/ 2
Hapalaraea ioptera (Stephens, 1834)		x	x	2/ 2
Phloeonomus monilicornis (Gyllenhal, 1810)	x			2/ 2
Anthobium unicolor (Marsham, 1802)	x	x	x	1182/ 35
Olophrum piceum (Gyllenhal, 1810)	x	x		997/ 83
Acidota cruentata Mannerheim, 1830	x			6/ 5

Table 1. (continued)

Species	Pitfall	Litter	Malaise	Spc./Loc.
Carpelimus elongatulus (Erichson, 1839)		x		1/ 1
Mycetoporus clavicornis (Stephens, 1832)	x	x		4/ 4
Mycetoporus rufescens (Stephens, 1832)	x	x		111/ 30
Ischnosoma longicorne (Mäklin, 1847)	x			1/ 1
Lordithon exoletus (Erichson, 1839)	x			9/ 5
Bolitobius cingulatus Mannerheim, 1830	x			16/ 12
Bolitobius castaneus (Stephens, 1832)	x			2/ 2
Tachyporus nitidulus (Fabricius, 1781)	x			2/ 1
Tachyporus pulchellus Mannerheim, 1857		x		1/ 1
Oxypoda lugubris Kraatz, 1856	x	x		11/ 7
Oxypoda vittata Märkel, 1842	x			13/ 11
Oxypoda acuminata (Stephens, 1832)	x		x	268/ 8
Oxypoda spectabilis Märkel, 1844	x	x		164/ 54
Oxypoda alternans (Gravenhorst, 1802)	x	x		10/ 8
Meotica exilis (Knoch, 1806)		x		12/ 2
Atheta (Datomicra) nigra (Kraatz, 1856)	x			1/ 1
Atheta (Lypoglossa) lateralis (Mannerheim, 1830)	x	x		8/ 4
Atheta (Alaobia) gagatina (Baudi, 1848)	x			1/ 1
Atheta (Dimetrota) marcida (Erichson, 1837)	x			7/ 5
Atheta (s.str.) incognita (Sharp, 1869)	x			2/ 2
Atheta (s.str.) procera (Kraatz, 1856)			x	1/ 1
Atheta (s.str.) diversa (Sharp, 1869)	x			8/ 5
Atheta (s.str.) pilicornis (Thomson, 1852)	x			1/ 1
Atheta (Bessobia) monticola (Thomson, 1852)	x			9/ 3
Pachyatheta cribrata (Kraatz, 1856)		x		1/ 1
Gyrophaena affinis Mannerheim, 1830	x			3/ 2
Leptusa fumida (Erichson, 1839)	x			10/ 8
*Bibloporus bicolor (*Denny, 1825)		x		2/ 2
Trimium brevicorne (Reichenbach, 1816)		x		7/ 4
Brachygluta haematica (Reichenbach, 1816)	x	x		9/ 5
Histeridae				
Carcinops pumilio (Erichson, 1834)		x		1/ 1
Scirtidae				
Cyphon punctipennis Sharp, 1873	x			1/ 1
Elmidae				
Limnius volckmari (Panzer, 1793)	x			1/ 1
Cantharidae				
Malthodes marginatus (Latreille, 1806)	x		x	2/ 2
Malthodes brevicollis Paykull, 1798	x		x	10/ 8

Table 1. (continued)

Species	Pitfall	Litter	Malaise	Spc./Loc.
Malthodes pumilus Brebisson, 1835	x			1/ 1
Elateridae				
Athous hirtus (Herbst, 1784)	x			1/ 1
Harminius undulatus (Degeer, 1774)			x	1/ 1
Monotomidae				
Monotoma conicicollis Aubé, 1837		x		1/ 1
Cryptophagidae				
Cryptophagus angustus Ganglbauer, 1899	x	x		11/ 9
Cryptophagus badius Sturm, 1845	x			1/ 1
Spavius glaber (Gyllenhal, 1808)	x			1/ 1
Atomaria turgida Erichson, 1846	x			1/ 1
Atomaria procerula Erichson, 1846	x	x		11/ 8
Atomaria pulchra Erichson, 1846	x			11/ 6
Cerylonidae				
Cerylon deplanatum Gyllenhal, 1827	x			1/ 1
Alexiidae				
Sphaerosoma pilosum (Panzer, 1793)	x	x		63/ 23
Coccinellidae				
Coccinella hieroglyphica Linnaeus, 1758	x		x	2/ 2
Cisidae				
Cis lineatocribratus Mellié, 1848	x			2/ 2
Cis bidentatus (Olivier, 1790)	x	x		2/ 2
Salpingidae				
Sphaeriestes castaneus (Panzer, 1796)	x			1/ 1
Melandryidae				
Orchesia undulata Kraatz, 1853			x	1/ 1
Chrysomelidae				
Phratora laticollis (Suffrian, 1851)			x	1/ 1
Psylliodes napi (Fabricius, 1792)	x	x	x	5/ 5
Curculionidae				
Strophosoma sus Stephens, 1831		x		1/ 1
Brachonyx pineti (Paykull, 1792)		x		1/ 1
Coeliodes rubicundus (Herbst, 1795)		x		5/ 3
Trypodendron domesticum (Linnaeus, 1758)	x			1/ 1

Histeridae

Gnathoncus byussoni Auzat, 1917

One specimen was collected in a pitfall trap in a bilberry/pine woodland (loc.60), 18 June – 31 July 1997. The species has previously been recorded from Eastern Norway west to **AAY,** with a questionable record from **VA** (Vik 1991). It is an eurytopical species often found in old bird nests (Koch 1989a).

Melyridae

**Axinotarsus ruficollis* (Olivier, 1790)

One specimen in a Malaise trap in an alder grove (loc. 70), 26 May-23 June 1998. The species has not previously been recorded from Norway, but from Sweden as far north as Västergötland, and from Denmark (Lundberg 2003). This is a heat-loving species found particularly on flowers in sunny forest-edges (Koch 1989b).

Rhizophagidae

Rhizophagus cribratus (Paykull, 1827)

Altogether eight specimens were collected from three different pitfall trap localities, from an elm forest (loc. 82) and from two bilberry/pine woodlands (locs. 84 and 135), and a single specimen in an extraction sample from the elm forest locality. The species is new to Western Norway. *R. cribratus* is mainly found in deciduous forests (Koch 1989b) under the bark of dead wood. It is noteworthy that deciduous trees were almost absent at two of the three sites where the species was collected in the present survey, however in both cases there were deciduous forest within a distance of at most 100 meters.

Cryptophagidae

Caenoscelis ferruginea (Sahlberg, 1820)

This species was collected from pitfall traps in all five localities of elm/lime forest sampled (locs. 1B, 37, 61, 72 and 82, altogether 63 specimens) but not outside this forest type. It is new to Western Norway. *C. ferruginea* occurs in various moulded plant material in forests in Central Europe (Koch 1989b) but seems to be more stenotopical in West-Norway, occurring only in the most productive deciduous forests.

Atomaria ornata Heer, 1841

One specimen was collected in a pitfall trap in a bilberry/pine woodland (loc. 117), 29 April –23 June 1998. New to Western Norway. The species occurs particularly in moulded, decaying coniferous wood but also sometimes in needle litter (Koch 1989b).

Eucnemidae

Microrhagus pygmaeus (Fabricius, 1792)

One female was collected in a pitfall trap in a hazel grove bordering pine forest (locality 59), 18 June – 31 July 1997. *M. pygmaeus* develops in decaying small branches of various deciduous trees, particularly oak (Koch 1989b). It has previously been recorded from Eastern and South-Eastern Norway (Vik 1991) but this is apparently the first record of an eucnemid from the southern part of Western Norway. Members of the family Eucnemidae are generally quite rare beetles, and since they tend to prefer old-growth forest they are considered to be threatened. *Microrhagus pygmaeus* is the only one of the nine species of eucnemids recorded from Norway which is not included in the most recent red list of Norwegian beetles (Hanssen et al. 1998).

FURTHER SPECIES RECORDED NEW TO HOI

Table 1 gives list of more species that are not included from **HOI** by Vik (1991). All records are from Kvam (EIS 31), Geitaknottene Nature Reserve.

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Abundance of parasitoid Hymenoptera on pupae of *Musca domestica* and *Stomoxys calcitrans* (Diptera, Muscidae) on pig farms in Vestfold, Norway

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Birkemoe, T., Soleng, A. & Riddervold, K.W. 2004. Abundance of parasitoid Hymenoptera on pupae of *Musca domestica* and *Stomoxys calcitrans* (Diptera, Muscidae) on pig farms in Vestfold, Norway. Norw. J. Entomol. 51, 159-164.

Fly control on farms predominantly achieved by good cleaning routines and application of insecticides. As an alternative to insecticides, various pupal parasitoids have been released to control house flies, *Musca domestica* L., 1758 and stable flies, *Stomoxys calcitrans* (L., 1758) (Diptera, Muscidae). In Norway, *Nasonia vitripennis* (Walker, 1836) (Hymenoptera, Pteromalidae) has been used on pig farms during the last four years. The natural occurrence of parasitoid wasps on Norwegian farms has, however, never been investigated. Therefore, we examined fly pupae from 16 pig farms located in the South East of Norway for naturally occurring parasitoid wasps. Each farm was visited once during August 2002. On average, 17 % (range 0-97 %) of the fly pupae were parasitised on each farm. We found three species of parasitoid wasps not previously recorded from Norway: *Spalangia cameroni* Perkins, 1910, *S. nigripes* Curtis, 1839 and *Muscidifurax raptor* Girault & Saunders, 1910 (Hymenoptera, Pteromalidae). In addition *Phygadeuon* sp. Gravenhorst, 1829 (Hymenoptera, Ichneumonidae) and *Trichopria* sp. Ashmead, 1893 (Hymenoptera, Diapriidae) were found. As many as 95 % of the natural parasitoids were *S. cameroni*. The species currently used for biological control in Norway, *N. vitripennis*, was only recorded on three farms where the wasp was already released as a controlling agent. We suggest that the potential of *S. cameroni* in controlling house and stable flies in Norway should be examined closer.

Key-words: Pteromalidae, house fly, stable fly, pupal parasitoids.

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INTRODUCTION

House flies, *Musca domestica* L., 1758, and stable flies, *Stomoxys calcitrans* (L., 1758) (Diptera, Muscidae), breeding in manure from cattle and pigs are a nuisance to both livestocks and humans. House flies are also a potential vector for human and animal diseases (Medveczky et al. 1988, Chavasse et al. 1999, Iwasa et al. 1999, Zurek et al. 2001). Fly control on farms is predominantly achieved by good cleaning routines and application of insecticides. As an alternative to insecticides, various pupal parasitoids (Hymenoptera, Pteromalidae) have been applied. The effectiveness of commercially available parasitoids has, however, been variable (Morgan et al. 1975, Rutz & Axtell 1979, Petersen et al. 1983, Meyer et al. 1990, Crespo et al. 1998, Skovgård 2004, Skovgård & Nachman 2004). In Norway, *Nasonia vitripennis* (Walker, 1836) (Hymenoptera, Pteromalidae) has been released on several farms over the last four years. It has previously been found in Norway (Pettersen 1976), however, there has been no investigation to determine the natural fauna of parasitoid wasps on Norwegian farms.

There are numerous examples of problems caused by dissemination of species around the world, and in some cases introduced species have caused dramatic changes in local ecosystems. In order to avoid such potential problems, use of natural occurring parasitoid wasp species is preferred. Additionally, these species are most likely adapted to the ambient environment.

This study aims to identify natural occurring parasitoid wasps on farms located within a major pig production area in Southeast Norway.

MATERIAL AND METHODS

Farms

The present study was carried out on pig farms. We collected fly pupae from 16 farms in Vestfold County **VE** (EIS 19) (including Borre, Våle, Ramnes and Stokke municipality, approximately 100 km southwest of Oslo), one of the major pig production areas in Norway. As Skovgård & Jespersen (2000) found that most pupal parasitoids on house and stable flies were active from August through October, the present survey was conducted from 20-27 August 2002. On three farms *N. vitripennis* was released as a biological control agent. However, as our objective was to identify wasps that occur naturally on farms, hatching *N. vitripennis* from these three farms are not included in the results. (The wasp parasitised 68, 55 and 16 % of the 71, 179 and 194 house fly pupae collected from the three farms, respectively. For details on estimation of parasitism percent, see below.) Insecticides had been applied against flies on fourteen farms on one or more occasion during the summer.

Collection and hatching of fly pupae

Collection of pupae was carried out by two persons. All accessible areas around the livestock were searched. Pupae from all sites of the pig shed were mixed, washed in water at 25 °C, air-dried, and individually placed in gelatine capsules (size 000). The maximum number of puparia collected at each farm was 300. When puparia were scarce, the accumulated number was lower. The capsules were kept separated at 20-25 °C for maximum 24 hours before they were transferred to a climate chamber at 25 °C, 75 % humidity and 24 hours darkness at the Norwegian Institute of Public Health. One to three days after hatching all flies and wasps were transferred to 70 % alcohol and kept for later identification. The pupae were kept in the climate chamber for 60 days.

Percent parasitation of fly pupae

Percent parasitation was calculated from the total number of collected puparia from which flies or wasps emerged. Unhatched puparia were left out of the analysis to ensure that those unsuited for parasitation were excluded from the estimate. Despite the identical treatment the number of unhatched puparia varied strongly between farms, likely caused by chemical exposure, fungi infections, mechanical injury or other factors of mortality.

Identification of wasps and flies

The pteromalids were identified by use of Graham (1969) and an unpublished key to chalcid parasitoides of filth flies in America north of Mexico by Dr. G.A.P. Gibson. The wasps were further verified by Dr. H. Skovgård at the Danish Pest Infestation Laboratory and Dr. G.A.P. Gibson at the Canadian National Collection of Insects**.** Skovgård also identified the Diapriidae. Dr. A. Bennett at the Canadian National Collection of Insects identified the Ichneumonidae**.** Specimen of all new species are deposited at the Zoological Museum, University of Oslo, and some additional specimens are deposited at the Canadian National Collection of Insects, Ottawa, Ontario. The house and stable flies were identified in accordance with Thomsen (1938).

RESULTS

Five species of pupal parasites were found (Table 1). Two of the wasp species (*S. cameroni* and *S. nigripes*) hatched from both house and stable flies, two from house flies only (*M. raptor* and *Phygadeuon* sp.) while one species only hatcehd from stable flies (*Trichopria* sp.).

The solitary wasp *Spalangia cameroni* was, independent of host species, the most numerous and widespread pupal parasite (95 % of all wasps

Table 1. Number of house flies (*Musca domestica*) and stable flies (*Stomoxys calcitrans*) pupae parasitised by naturaly occurring parasitoid wasps collected on pig farms August 2002 in Vestfold, Norway.

Parasitic wasp species	*M. domestica*	*S. calcitrans*	No. of farms
Pteromalidae			
Spalangia cameroni Perkins, 1910	383	39	8
Spalangia nigripes Curtis, 1839	12	7	3
Muscidifurax raptor Girault & Sanders, 1910	2	-	1
Ichneumonidae			
Phygadeuon sp. Gravenhorst, 1829*	1	-	1
Diapriidae			
Trichopria sp. Ashmead, 1893	-	1	1

* Fit the description of *P. fumator*-group by Morley (1907). Revision required according to Dr. Andrew Bennett at the Canadian National Collection of Insects.

collected), followed by *S. nigripes* (Table 1). *Spalangia cameroni* had a female biased sex ratio. This was independent of host species as 255 females and 126 males hatched from house flies and 27 females and twelve males from stable flies. *Nasonia vitripennis*, was only recorded on three farms where the wasp was already released as a controlling agent.

Naturally occurring parasitoid wasps hatched from pupae collected from nine of the 16 farms. The mean level of parasitism was 17 % (range 0-97 %) per farm. On four of the farms, more than 35% of the collected pupae were parasitised and on one farm almost all collected puparia were parasitised (Table 2.). *Musca domestica* was, with one exception (Table 2), substantially more common on all farms than *S. calcitrans*. Parasitoid wasps hatched from both species and a high percentage parasitism of one fly species coincided with high parasitism of the other.

DISCUSSION

Three pteromalid wasp species were identified in the present study and neither of these have been previously recorded from Norway (cf. Thomson 1876, Thomson 1878, Graham 1969, Compton 1981, Hedquist 1982, Noyes 1998). All three species are solitary ectoparasitoids with a preference for indoor sites (Rueda & Axtell 1985) and no investigations of such habitats have previously been conducted in Norway. As all three species are previously recorded from Sweden and Denmark (Noyes 1998, Skovgård & Jespersen 1999), they are likely to be indigenous to Norway and do not indicate a recent introduction to the country. The solitary ichneumonid *P. fumator* has been collected and identified from Norway on several earlier occasions (Jussila 1967). The gregarious Diapriidae, *Trichopria* sp. has also previously been collected in southern Norway (Buhl & Hansen manuscript).

Similar to studies of naturally pupal parasitoids on filth flies in Denmark (Skovgård & Jespersen 1999, Skovgård & Steenberg 2002), *S. cameroni* was found to be the most common and numerous parasitoid on both stable and house flies. *Spalangia cameroni* is also common in German pig and calf dung (Klunker 1994), and occur frequently on North American poultry and cattle farms (Rutz & Axtell 1980, Meyer et al. 1991, McKay & Galloway 1999). Although based on a low number of farms, the total dominance of *S. cameroni* in the present study is not seen on farms from the other countries. In our study as many as 95 % of the house fly parasitoids were *S. cameroni*, whereas in Denmark the comparable number was 59 % (indoor, pig farms: Skovgård & Jespersen 1999).

Table 2. Percent house fly (*Musca domestica*) and stable fly (*Stomoxys calcitrans*) pupae paraitised by naturally occuring parasitoid wasps on pig farms (Vestfold, Norway) in August 2002. The farms are numbered in the order of visiting. n = number of pupae.

Farm no.	*M. domestica*		*S. calcitrans*		Total	
	%	n	%	n	%	n
1	0	221	0	16	0	237
2	0	261	0	0	0	261
10	0	206	0	1	0	207
7	0	42	0	0	0	42
8	0	27	0	0	0	27
14	0	33	0	26	0	59
16*	0	179	0	0	0	179
17	0.4	249	0	4	0.4	253
5	0	222	11	19	1	241
4	27	11	0	210	1	221
13*	6	194	80	5	8	199
6*	20	71	14	14	19	85
15	38	233	0	0	38	233
3	50	138	33	15	48	153
12	37	27	75	40	60	67
11	97	207	100	2	97	209

*Biological control applied; Number of pupae (n) on these farms includes hatched flies, hatched released parasitoids and hatched naturally occurring parasitoids. The released wasps are excluded from the parasitism percentage.

Spalangia nigripes was the second most common species in the present study and was found on three farms. This species was one of the least common species in Danish pig and cattle farms and was not recorded in pig and calf dung from Germany (Klunker 1994, Skovgård & Jespersen 1999). It is generally missing from studies on filth flies on North American farms with various livestock (Rutz & Axtell 1980, Meyer et al. 1991, McKay & Galloway 1999).

Muscidifurax raptor is a common Pteromalidae in Danish, German and North American cattle and pig farms (Petersen & Meyer 1983, Klunker 1994, Skovgård & Jespersen 1999, Floate et al. 1999). In our study, however, only a few specimens were found.

Norwegian governmental regulation demands all sows with piglets to be kept on bedding. To our knowledge, no similar requirement exist in Denmark, Germany or in the USA. *Spalangia* species are known to be good diggers and parasitise fly pupae further below the bedding surface than other pteromalids (Legner 1977, Geden 2002). *Spalangia cameroni* is also more effective in locating buried pupae than other *Spalangia* species and *M. raptor,* the latter species mostly parasitising pupae at the surface (Geden 2002). Possibly, differences in bedding may account for the total dominance of *S. cameroni* in Norway, the higher frequency of *S. nigripes* and the low number of *M. raptor* when compared to Danish and German farms.

Insecticides suppress natural occurring parasitoids on farms. In the present study chemicals had been applied once or regularly during the summer at all but two farms (no. 6 and 12, see Table 2). In spite of the vast use of chemicals, natural parasitoids were found on nine out of the 16 farms. As expected, both farms not applying chemicals had naturally occurring pupal parasitoids. Earlier studies from Denmark have shown an overall rate of parasitism of 10.8 % in pig sheds (Skovgård & Jespersen 1999). Compared to this number, the overall rate of 17 % found in the present study is relatively high.

The absence of natural occurring *N. vitripennis* from the 13 farms where it had not been released as biological control agent is worth noting. *Naso-*

nia vitripennis has previously only been recorded from a Norwegian study of bark beetles (Pettersen 1976). House flies have been shown an inferior host to *N. vitripennis*, reducing developmental time and progeny production, as compared to preferred sarcophagid hosts (Rivers & Denlinger 1995). A natural habitat in Sweden are sarcophagid hosts in bird nests (Molbo & Parker 1996). Thus, based on host preference and natural occurrence *Nasonia vitripennis* might not be the optimal species for biological control of filth flies in Norway. Wylie (1972) found that *N. vitripennis* was competitive superior to *S. cameroni* when parasitising the same pupae. Consequently, the release of *N. vitripennis* might, as a side effect, reduce population densities of naturally occurring *S. cameroni*. This further discredit *N. vitripennis* as the primary biological control agent against filth flies in Norway.

Spalangia cameroni was the most common and numerous parasitoid wasp species encountered in the present study. It has previously proved efficient in controlling filth flies on Danish farms (Skovgård 2004, Skovgård & Nachman 2004). Thus, the potential of *S. cameroni* in controlling house and stable flies on Norwegian premises should be examined closer.

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Use of the parasitoid wasp *Nasonia vitripennis* (Walker, 1836) in the control of *Musca domestica* L., 1758 and *Stomoxys calcitrans* (L., 1758) on two Norwegian pig farms

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Pupal parasitoids have attracted much attention for their potential control of house flies (*Musca domestica* L., 1758) and stable flies (*Stomoxys calcitrans* (L., 1758)). *Nasonia vitripennis* (Walker, 1836) a pteromalid gregarious pupal parasitoid, has been released for control of house flies on Norwegian pig farms during the last four years. There has, however, been no test of the efficiency of this wasp species on Norwegian premises. In the present study, the rate of house and stable flies parasitised by *N. vitripennis* was evaluated on two pig farms in southern Norway. The average number of house-fly pupae parasitised was 17 % (range 0-69 %) and 12 % (range 0-30 %) on the two farms, respectively. Stable flies was only abundant at one farm where the average level of parasitism was 5 % (range 0-17 %). It is possible that more frequent and prolonged release periods of *N. vitripennis* might give a greater parasitism of house flies as well as stable flies. On the farm with the lowest rate of parasitism, the naturally occurring wasp species *Spalangia cameroni* Perkins, 1910, was numerous. The combined parasitism of *N. vitripennis* and *S. cameroni* averaged 40 % (range 20-79 %) and probably contributed to fly control. Two wasp species not previously recorded from Norway, *Spalangia nigra* Latreille, 1805 and *Pachycrepoideus vindemiae* (Rondani, 1875), were observed.

Key words: *Musca domestica, Stomoxys calcitrans*, pupal parasitoids, *Nasonia vitripennis, Spalangia cameroni.*

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INTRODUCTION

House flies, *Musca domestica* L., 1758, and stable flies, *Stomoxys calcitrans* (L., 1758) (Diptera, Muscidae) breed in manure from cattle and pigs, and are a nuisance to both livestock and humans worldwide. House flies are recognised as a potential vector for many human and animal diseases (Chavasse et al. 1999) while stable flies suck blood and may reduce weight gain in calves (Campell et al. 1977) and milk flow in cows (Bruce & Decker 1958). In Norway, due to relatively cold winters, the problem with house and stable flies on farms is mainly confined to warm summer months.

Fly control on farms is predominantly achieved by good cleaning routines and the use of insecticides. House flies have, however, a strong capacity for developing resistance to insecticides (Keiding 1999) which can make chemical control difficult. Furthermore, in production of organic meat and milk, the use of insecticides is banned. Insecticides may also adversely affect humans and livestock as well as eradicate the natural fauna of fly predators and parasites that may contribute in fly control. Thus, it is a general aim to reduce the use of biocides.

Various wasps parasitising Diptera pupae (Hymenoptera, Pteromalidae) have been employed to control fly populations as an alternative to insecticides. The effectiveness of commercially available parasitoids has, however, been variable (Morgan et al. 1975, Rutz & Axtell 1979, Petersen et al. 1983, Meyer et al. 1990, Crespo et al. 1998, Skovgård 2004, Skovgård & Nachman 2004). The pteromalid wasp *Nasonia vitripennis* (Walker, 1836) has been released on several Norwegian pig farms during the last four years but no test on efficiency has been performed.

The aim of the present study was to evaluate the rate of parasitism by *N. vitripennis* on house and stable flies on two Norwegian pig farms, where the wasp has been used as a biological control agent.

MATERIAL AND METHODS

Nasonia vitripennis is a gregarious parasite of Diptera pupae with a life cycle of only two weeks at 25 ºC (Whiting 1967). The wasp searches for fly pupae in relatively dry and illuminated areas (Smith and Rutz 1991) and are sold to control flies around livestock. *Ophyra aenescens* (Wiedmann, 1830) (Diptera: Muscidae), a predator of house and stable fly larvae which is also commercially available for the biological control of flies, thrives in wet manure on shady or dark sites. It was released together with *N. vitripennis* on the farms included in the present study to control flies in the manure cellars.

Farms

The study was carried out on two pig farms. They were visited at three week intervals from the beginning of April to the end of September.

Farm A was studied during the summer of 2002. The farm is situated in Ås municipality, Akershus County, approximately 55 km South East of Oslo (**AK**, EIS 28). *Nasonia vitripennis* was released in two rooms with breeding sows and in one room with piglets (each room 85 m^2). Fly densities and rates of parasitism were monitored in the two rooms with breeding sows. The maximum number of sows in these two rooms was 20**.** The pigs were kept on a thin layer of wood shavings. Manure was removed manually from the pens once a day to a dung cellar below the pigs. The cellar, emptied on August 15, was visited when possible and we collected house fly pupae on four occasions (11 June, 2 July, 23 July and 13 August). The farmer used sticky traps and insecticide spray in September to reduce fly density. *Nasonia vitripennis* was released for the first time in 2002.

Farm B was studied during the summer of 2003. This farm is situated in Stokke municipality, Vestfold County, approximately 100 km South West of Oslo (**VE**, EIS 19). *Nasonia vitripennis* was released in one large room (140 m^2) with a maximum of 13 breeding sows. A smaller room (30 m^2) with four breeding sows was situated adjacent to the large room, with no dividing door between. The pigs were kept on a thin layer of straw bedding. Manure was removed manually from the pens once a day to a dung cellar below the pigs which was emptied at the end of April. As it was difficult to access, we did not collect fly pupae from this site. *Nasonia vitripennis* had been used for four years.

Release of *Nasonia vitripennis*

Nasonia vitripennis was produced in Denmark and sent to the farmer by mail. Following the guidelines of the producer, 10 000 wasps should be released per 100 m^2 every third week. At each delivery, approximately 30 000 wasps (three boxes) were released on Farm A and 20 000 wasps (two boxes) on Farm B. The boxes were kept at fixed sites inside the pig sheds (one box in each room on Farm A, two boxes in the large room on Farm B).

The content of two boxes was checked. The total number of *N. vitripennis* in each box was estimated by multiplying the average number of wasps hatching per pupae (based on a sample of 300 pupae) with the total number of pupae in the box. The estimated number of wasps per box were 10 141 and 17 525. The sex ratio was 0.85:1 females to males in both units. Based on the mean number of wasps per box (13 833), 16 274 wasps were released per 100 m^2 on Farm A and 19 761 wasps per 100 m^2 on Farm B at each time of delivery. Irregularities in wasp release occurred at both farms (Table 1).

Table 1. Pupae sampling and *Nasonia vitripennis* release dates on Farm A in 2002 and Farm B in 2003.

	Farm A	Farm B
Sampling dates	9 April, 30 April, 21 May, 11 June, 2 July, 23 July, 13 August, 3 September, 24 September	10 April, 29 April, 22 May, 12 June, 3 July, 28 July, 14 August, 4 September, 24 September
Release dates	10 April, 8 June, 27 June, 28 July 10 August	4 April, 28 April, 25 May, 6 June 21 June

Estimation of percent parasitism

Two people collected house and stable fly pupae in all accessible areas around the livestock at each sampling date. Pupae from all sites were mixed and as many as possible, although not more than 300, were selected at each sampling. Pupae were rinsed in water at 25 °C, air dried and placed separately in gelatine capsules (size 000). The capsules were kept at 20-25 °C for a maximum of 24 hours. Thereafter, they were stored in a climate chamber at 25 °C, 75 % humidity and 24 hours darkness at the Norwegian Institute of Public Health for a maximum of 60 days. Hatched flies and wasps were transferred to 70 % alcohol for later identification. The percentage of parasitised flies was calculated from the total number of wasps and flies that hatched from the collected fly pupae. The remaining intact pupae were discarded to ensure that pupae unsuitable to be parasitised due to fungal attack, application of insecticides or other factors of mortality were not included in the estimates.

Estimation of fly activity

Fly activity was estimated every third week by counting faecal and regurgitation spots on white A4 paper boards (Geden et al. 1992) that were hung freely for 24 h approximately 2 m above the floor. We used three boards per room on Farm A (a total of six boards) and four boards in the larger room at Farm B. Stable flies do not produce regurgitation spots and the estimate thus mainly represents house flies.

Temperature

Air temperatures was recorded daily using Tinitag plus dataloggers (Gemini Data Loggers, UK) suspended by a wire at a central position, approximately two meters above the floor from April to October.

Identification

The wasps were identified by use of an unpublished key to chalcidoid parasitoids of filth flies in America north of Mexico by Dr. G.A.P. Gibson. Our identifications were verified by Dr. Henrik Skovgård at Danish Pest Infestation Laboratory and finally by Dr. G.A.P. Gibson at the Canadian National Collection of insects. Specimens are deposited at the Zoological Museum, University of Oslo, and at the Canadian National Collection of Insects, Ottawa, Ontario. The house and stable flies were identified in accordance with Thomsen (1938).

RESULTS

Farm A

The daily mean temperature inside the pig shed ranged from 14 to 24 ºC during the summer, with an average of 18.4 ºC for the entire period (Figure 1A). The fly activity remained low from April to start of July (Figure 1B). Thereafter, it increased to mid August before declining during September (Figure 1 A, B).

The average number of parasitised housefly pupae during the whole period was 17 %. House fly pupae were scarce inside the pig shed until May and no wasps hatched from pupae collected in April or May (Figure 1C). The percentage of parasitised pupae increased after the second release of wasps, reaching a peak of 69 % in mid August, before decreasing below 10 % towards the end of Sep-

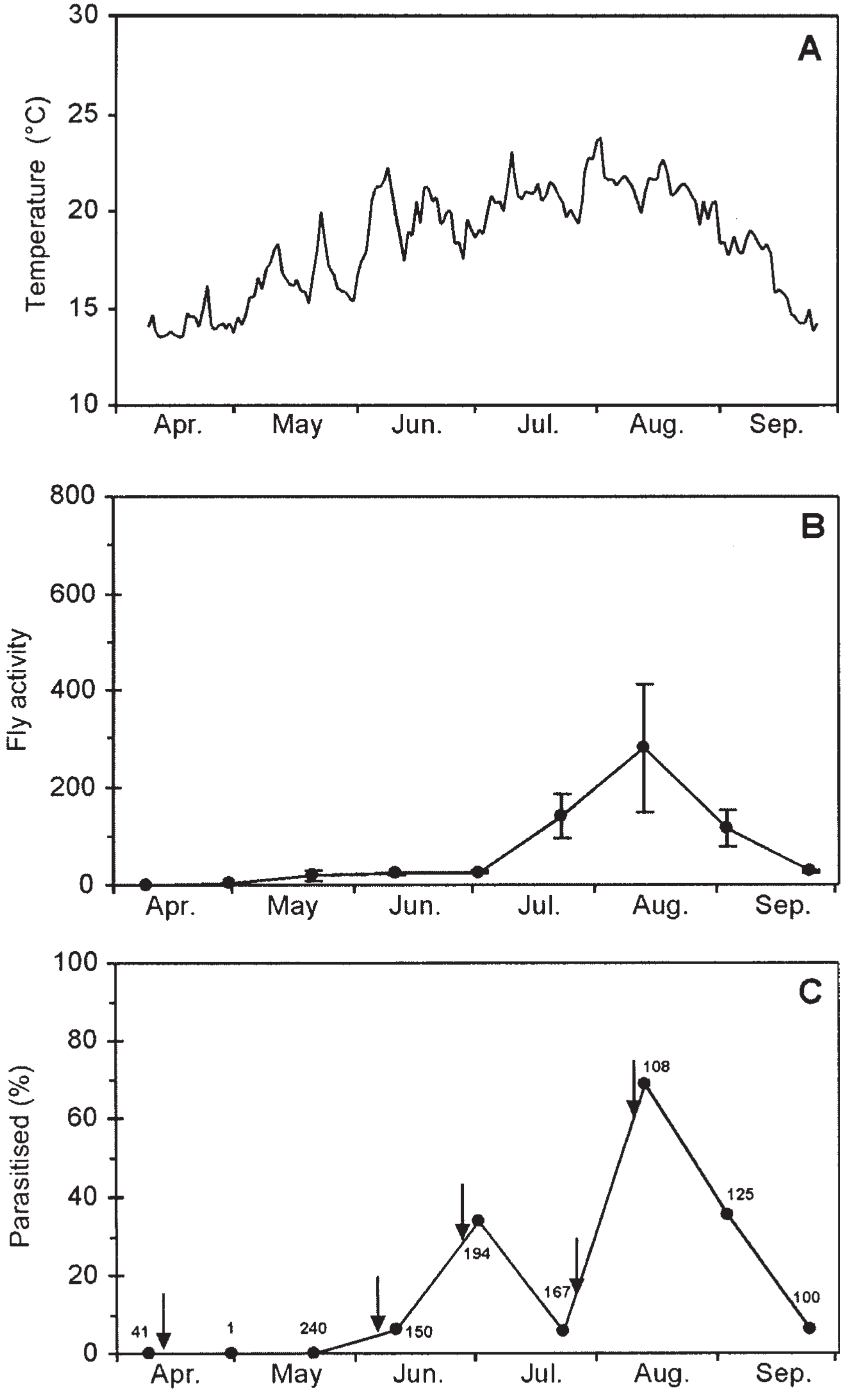

Figure 1. Farm A. (A) Daily mean air temperature. (B) Fly activity (mean ± standard error) as measured by number of faecal and regurgitation spots on white boards. (C) Percent house fly (*Musca domestica*) pupae parasitised by *Nasonia vitripennis*. Numbers close to data points denote sample size. Arrows denote wasp release dates.

tember. The greatest number of parasitised pupae occurred three days after the final release of wasps. This rate of parasitism also followed the warmest time period (Figure 1A, 1C). A decrease in fly activity occurred from the date of the peak rate of parasitism to the next sampling date three weeks later.

Fewer stable fly pupae were collected than house fly. A total of 21 stable fly pupae were collected. *N. vitripennis* hatched from 10 of 12 collected pupae on 13 August.

The manure heap in the dung cellar was searched on 11 June, 2 July, 23 July and 13 August and house fly pupae were present at all dates. A total of 147 pupae were collected (11, 26, 97, and 16 pupae corresponding to the above dates), but *N. vitripennis* did not emerge from any pupae, nor could the wasp be found by dissection of remaining intact pupae.

Four species of naturally occurring wasps were found in small numbers on the farm (Table 2).

Farm B

The daily mean air temperature was never below 18 ºC and reached 28 ºC in July (Figure 2A). The average air temperature for the entire period was 22.5 ºC, approximately 4 ºC higher than at Farm A. Fly activity was high compared to Farm A at the start of the study period and with the exception of one measurement, the peak number was recorded in early April (Figure 2B). The one high measurement in July occured one week after the warmest period (Figure 2A, B). Although temperatures remained high the following three weeks, fly activity decreased to similar values as before.

The average level of parasitism of house flies was 12 % (range 0-30 %) for the entire period. In contrast to Farm A, fly pupae were always numerous inside the pig shed on Farm B. *Nasonia vitripennis* hatched from house fly pupae at all sampling dates except 22 May (Figure 2C). Similarly to Farm A, the peak level of parasitism of house fly pupae occurred after the final release of wasps. Thereafter, the number of pupae parasitised decreased to 24 September when only a few specimens were found. *Nasonia vitripennis* also attained the greatest level of parasitism in stable flies after the last wasp release (Figure 2D) but disappeared from the stable fly population during early August. The average level of parasitism of stable flies was 5 % (range 0-17 %).

Beside the released wasps, Farm B had a natural population of *S. cameroni* which was present at all sampling times and which hatched from a significantly greater number of fly pupae than *N. vitripennis* (Mann-Whitney rank sum test, house flies: T=114, p=0.01, stable flies: T=116.5, p= 0.01). The combined parasitism of *N. vitripennis* and *S. cameroni* on house flies averaged 40 % (range 20-79 %) for the entire period. The mean combined parasitism of *N. vitripennis* and *S. cameroni* on stable flies was 49 % (range 11-100 %).

DISCUSSION

The life cycle of house flies is strongly influenced by temperature (Thomsen 1938). Skovgård &

Table 2. Number of natural occurring wasps hatching from fly pupae on Farm A in Akershus during summer 2002.

Parasitoid wasp species	Pig shed	Cellar
Pachycrepoideus vindemiae (Rondani, 1875)	7[1]	
Spalangia nigripes Curtis, 1839	2[2]	
Spalangia cameroni Perkins, 1910		5[3]
Spalangia nigra Latreille, 1805		1[3]

[1] From house fly pupae collected 23 July and 24 September.
[2] From stable fly pupae collected 13 August.
[3] From house fly pupae collected 13 August.

Nachman (2004) estimated the lower air temperature threshold for population growth to be 11 ºC on Danish farms. In our study, air temperatures never fell below 13 ºC. Based on data from Skovgård & Nachman (2004), and given the ambient temperatures measured on our two farms, fly populations were expected to increase by a factor of 2 to 4 at Farm B and 1.5 to 3 at Farm A between every two sampling dates. The estimated fly activity is likely to partly reflect fly density. Thus, the periods of decrease in activity seen on both farms indicate that factors other than temperature influence the fly populations. Fly activity on Farm B diverged most from the expected development as it decreased rather than increased from April despite the high temperatures. The activity peak in July is unlikely to represent a large increase in density as the activity declined again within three weeks without any additional fly control having been applied.

The two farms in the present study showed very low rates of parasitism during April to June. At each farm, *N. vitripennis* was missing entirely from one sample period. Later in summer however, *N. vitripennis* apparently established a population on both farms as emergence continued until the end of the study, several weeks after the final wasp release. Why *N. vitripennis* did not establish prior to July might be due to several factors but irregular wasp release on both farms, with a six week interval on Farm A and a four week on Farm B is likely to be important. The supplier of the wasps recommends release of wasps at three-week intervals. On Farm A, fly pupae might also have been too scarce inside the pig shed during April.

On Farm A, *N. vitripennis* attained a peak level of housefly pupae parasitism of 69 % in August. Thus, it is possible that the wasp contributed to the subsequent decline in fly activity. The fall in fly activity also coincided with the removal of manure from the dung cellar which may further have reduced fly activity. At Farm B, the highest recorded housefly pupae parasitism by *N. vitripennis* was 30 % with an average of 11.5 %. It is doubtful whether this had any significant effect on the house fly population. However, the combined effect of *N. vitripennis* and the natural occurring *S. cameroni* could have reduced the house fly population as together parasitism averaged 40 % for the whole season and at one point reached 79 %. Thus, the decrease, or only slight increase in fly activity, between sampling dates despite the high temperatures at Farm B is likely to be, at least partly, due to the effect of parasitism.

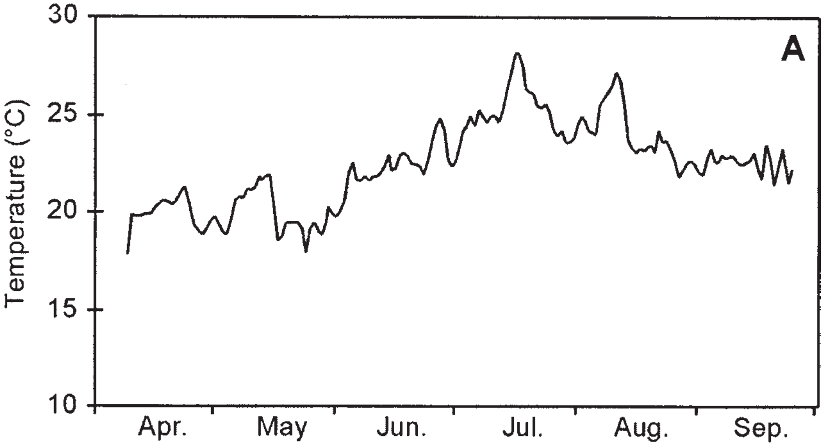

Figure 2. Farm B. (A) Daily mean air temperature. (B) Fly activity (mean ±standard error) as measured by number of faecal and regurgitation spots on white boards. (C) Percent house fly (*Musca domestica) pupae parasitised* by *Nasonia vitripennis* (●) and *Spalangia cameroni* (o), *Musca domestica*. (D) Percent stable fly (*Stomoxys calcitrans)* pupae parasitised by *Nasonia vitripennis* (●) and *Spalangia cameroni* (o). Numbers close to data points denote sample size. Arrows denote wasp release dates.

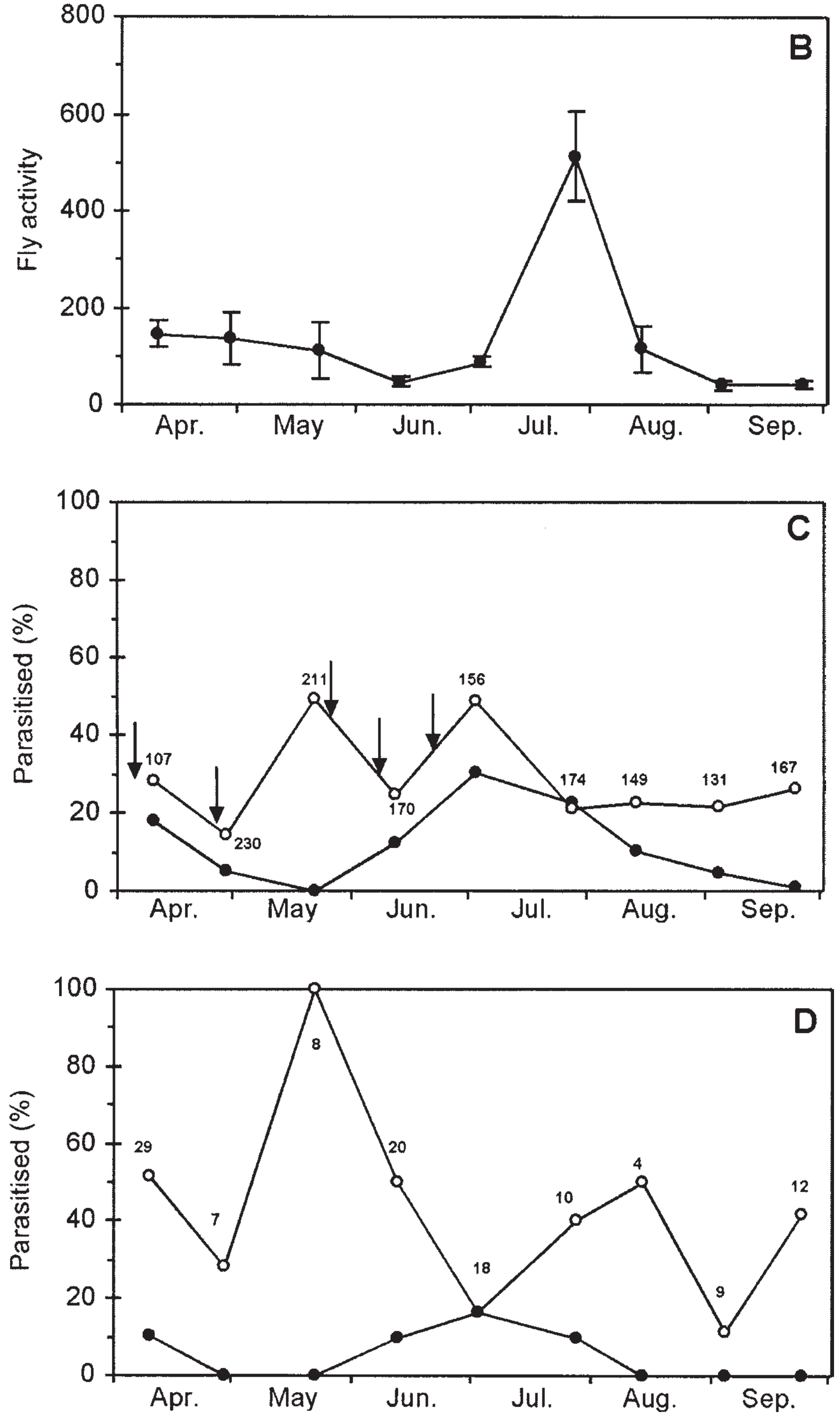

Figure 2. Continued.

The occurrence of *S. cameroni* throughout the summer was unexpected as on Danish farms this species occurred mainly from August to October (Skovgård & Jespersen 2000). However, the temperature on Farm B was high. Recordings taken on Danish farms remained between 14 and 18 ºC from April to June (Skovgård & Jespersen 2000) whereas on Farm B they ranged from 18 to 22 ºC during the same months. According to Geden (1997), the developmental time of *S. cameroni* increased from approximately 48 to 150 days when the temperature decreased from 20 to 15 ºC. Thus, the temperatures on Farm B indicate more favourable breeding conditions for *S. cameroni* during the study period than found on Danish farms.

As Sømme (1959) pointed out, house flies are generally more abundant than stable flies in pig sheds. Only a few stable flies occurred on Farm A, but they were slightly more abundant on Farm B. *Nasonia vitripennis* hatched at several dates on Farm B, but *S. cameroni* was significantly more common. Despite the low parasitism by *N. vitripennis*, the combined parasitism by both *S. cameroni* and *N. vitripennis* averaged 49 % during the summer. Thus, even though the number of stable flies was low, the pupal parasitoid probably affected the stable fly population on Farm B.

Two of the naturally occurring parasitic wasps found in the present study, *Spalangia nigra* and *Pachycrepoideus vindemiae,* are distributed worldwide, but neither have previously been recorded from Norway (cf. Thomson 1876, Thomson 1878, Graham 1969, Compton 1981, Hedquist 1982, Noyes 1998). As both species are previously recorded from Sweden and Denmark (Noyes 1998, Skovgård & Jespersen 1999), they are likely to be indigenous to Norway and do not indicate a recent introduction.

To summarise, *Nasonia vitripennis* did not establish a population before July-August. It might have reduced the fly population at both farms when parasitism was greatest but did not alone control house flies sufficiently on the two farms studied. It is possible that more frequent and prolonged release periods of *N. vitripennis* might give a better control of house flies as well as stable flies. This remains to be tested. Birkemoe et al. (2004) emphasised the importance of studying the potential for the naturally occurring *S. cameroni* in fly control in Norway. This is further supported by the findings in the present study.

Acknowledgements. We are indebted to Dr. Henrik Skovgård at the Danish Pest Infestation Laboratory, Dr. Gary A.P. Gibson and Dr. Andrew Bennett at the Canadian National Collection of Insects for help with verification of wasp species. Lars Ove Hansen at the Zoological Museum, University of Oslo, kindly helped with literature search. Ingeborg Anni Haukvik at Gilde Fellesslakteriet BA and Ove Eriksen at Rovfluen Aps helped us locate suitable pig farms for the study. Ove Eriksen kindly provided us with two boxes of wasps for estimation of release numbers. We also want to thank Roar Norem and Hans Jacob Haslestad for cooperation while conducting the study on their farms. Nina Huyhn gave invaluable help at the laboratory throughout the investigation. Dr. Steve Coulson kindly improved the English.

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Jean-Francois Voisin er knyttet til naturhistorisk museum i Paris og jobber både med gresshopper, biller og fugl. I dette arbeidet har han bearbeidet opplysninger over franske gresshopper og knelere fra mer enn 500 observatører og samlere, og rundt 42600 observasjoner er registrert. Arbeidet strekker seg fra 1960 og fram til 2002.

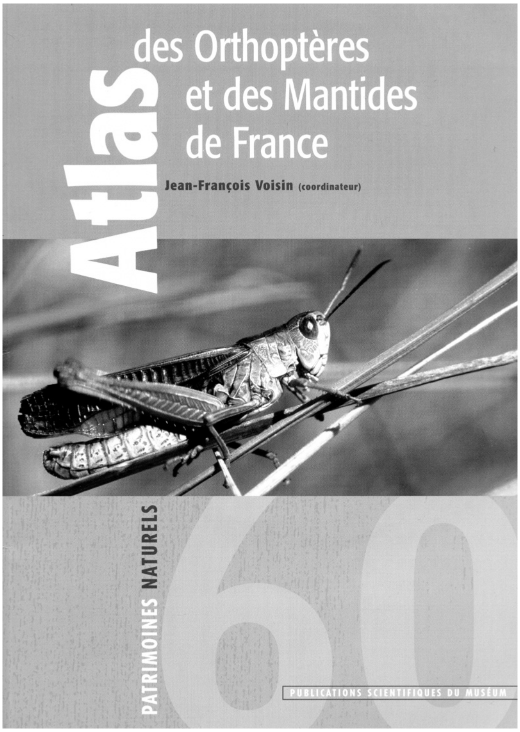
Hele 201 arter av gresshopper ble påvist i denne perioden, hvorav ti tidligere ikke er kjent fra Frankrike. 14 arter som var påvist før 1960 ble ikke gjenfunnet. Seks av de påviste artene må regnes som fremmedelementer i den franske faunaen, og tre av disse er dessverre godt etablerte i dag. 19 arter kan betraktes som endemiske, hvorav ni av disse er lokalisert på Korsika. Sannsynligvis omfatter den franske faunaen nærmere 220 arter, hevder Voisin.

Tre av artene som dukket opp i undersøkelsen viste seg å representere ubeskrevne taxa. Dette gjelder arten *Rhacocleis poneli* Harz & Voisin, 1987 og underartene *Pseudomogoplistes vicentae septentrionalis* Morere & Livory, 1999 og *Anonconotus baracunensis occidentalis* Carron & Wermeille, 2002.

Gresshoppefaunaen i Frankrike er dessverre sterkt truet, først og fremst grunnet ødeleggelse av habitater og kjemisk forurensning. Det høyeste artsmangfoldet finnes i det mediterrane området av landet, og da spesielt Korsika.

Av ni tidligere påviste arter av knelere, ble kun syv gjenfunnet. Arten *Pseudoyersiana brevipennis* er ikke gjenfunnet etter at Yersin beskrev den i 1860. Den regnes derfor som utryddet globalt.

Hver art er forsynt med en forholdsvis kort tekst som blant annet omfatter litt om artens biologi. Også det franske navnet for hver art er angitt. Utbredelsen er gitt på prikkart hvor funnene er plottet inn i 27x20 km ruter. Oppsettet gir et delikat inntrykk, selv om angivelsen nok er noe vel grov.



Det er benyttet forskjellige symboler for funn før 1960 (åpen sirkel), funn fra perioden 1960-1980 (trekant) og funn etter 1980 (lukket sirkel).

Påfallende mange av artene ser ut til å ha en særdeles begrenset utbredelse i Frankrike, gjerne bare angitt med én eller noen få prikker. Forholdsvis få arter er funnet over hele landet.

Fire sider med vakre fargeplansjer er også med, noe som øker verdien av arbeidet ytterligere. Dessverre er verket kun heftet, noe som må sies å være litt beklagelig. Dette arbeidet er så sentralt både for Frankrike, og forsåvidt også Europa, at man burde påkostet innbinding, spesielt når man ser at det er trykket på solid glanset papir. Likevel, ros til Norgesvennen Jean-Francois Voisin for et særdeles omfattende og meget verdifullt stykke arbeid.

Lars Ove Hansen

Norw. J. Entomol. 51, 175–182. 2004

Oviposition pattern of the strawberry blossom weevil *Anthonomus rubi* Herbst (Coleoptera: Curculionidae) in Eastern Norway

Solveig Aasen, Eline B. Hågvar & Nina Trandem

Aasen, S., Hågvar, E.B. & Trandem, N. 2004. Oviposition pattern of the strawberry blossom weevil *Anthonomus rubi* Herbst (Coleoptera: Curculionidae) in Eastern Norway. Norw. J. Entomol. 51, 175-182.

The weevil *Anthonomus rubi* Herbst is a pest in strawberry and raspberry because it oviposits in flower buds and thereafter severs the bud stalks. Few field studies have been conducted on details of the oviposition pattern of *A. rubi*. Such data from strawberry fields of the cultivar «Korona» in the east of Norway are presented. No significant difference in the total number of damaged buds, which corresponds with the number of eggs laid, was found between the edge and the middle of the field. Early in the season more damaged buds were found in plant rows exposed to south or west than those exposed to north or east. Most of the damaged buds, 66 %, contained one egg, 17 % two eggs and 4 % 3-4 eggs, while 13 % contained no eggs. The distribution of eggs could vary over time. Damaged clusters of buds, i.e. several buds damaged simultaneously by a single cut in their common stalk, were reported for the first time, increasing the damage potential of the weevil. The number of eggs in these clusters followed a random distribution.

Keywords: *Anthonomus rubi*, strawberry blossom weevil, oviposition pattern

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INTRODUCTION

The strawberry blossom weevil, *Anthonomus rubi* Herbst, is a well-known pest of strawberry and raspberry throughout Europe (Alford 1984). The species is found as far north as Nord-Trøndelag (Sagvolden & Hansen 2001), and is probably present in nearly all Norwegian strawberry fields. It is most abundant and doing most damage in East-Norwegian districts with a long history of intensive strawberry growing.

Sagvolden & Hansen (2001) recently presented the distribution of *A. rubi* as it is known from museum and private collections, namely Eastern Norway, Møre and Romsdal and Nord-Trøndelag. They suspected the absence of *A. rubi* from the west coast to be an artefact. This is indeed the case, as the weevil and its tell-tale bud cutting are common in strawberry fields in Sogn og Fjordane (Olav Sørum, pers. comm.; Torunn Våge, pers. comm.); Hordaland (leg. T. Våge; det. Godtfred Anker Halvorsen), and have also been observed in Rogaland (N. Trandem, pers. obs.). In addition, the species is increasingly common in Sør-Trøndelag, causing for instance an estimated yield loss of 90 % in an unsprayed (organic) field at Ørlandet in 2003 (Mette F. Graneng, pers. comm.). The very similar species *Anthonomus brunni-*

pennis, which also severs flower buds, does not have strawberry in its host range (Runge 1991).

The ovipositing females and their progeny do the bud damage. The adults appear in the fields in April - May (Stenseth 1970), when the temperature reaches 8-12 °C (Popov 1996b). Oviposition starts in May after mating, and lasts for about a month. The number of eggs per female ranges from 30, at a rate of 1.4 per day at 16 °C (Popov 1996b), to 260 (Jary 1932, Lekic 1963, Easterbrook et al. 2003). The egg is laid inside a closed flower bud, after puncturing it. Following oviposition, the female usually makes a feeding puncture in the stalk beneath the bud, thereby cutting the bud partly or completely off and arresting further development of the bud. The resulting withering buds can be seen either still attached to the stalk or on the ground. Normally, the female deposits only one egg inside the bud (Jary 1932, Leska 1965), since only one weevil can develop from each bud (Lecik 1963). One week later, the larva emerges and develops through three pollen-eating instars (Jary 1932) before pupating inside the bud. The total development time from egg to adult is about 5 weeks, depending on temperature (Alford 1984, Easterbrook et al. 2003). The new adults emerge in July-August. These adults overwinter, and do not start oviposition until the following spring. The hibernation habits are not fully known, but the weevils are able to overwinter among debris both in (Stenseth 1991, Svensson 1999, N. Trandem, pers. obs.) as well as outside (Jary 1932, Leska 1965, Cross et al. 2000) strawberry fields.

Knowledge about the oviposition pattern is important for developing a monitoring procedure and damage threshold, and for predicting the population build up. Details of oviposition pattern in the field are scarce in the literature. Such data are presented here, and is part of a larger study on the biology and yield effect of *A. rubi* in Norwegian strawberry fields (Aasen 2001).

MATERIAL AND METHODS

Nine conventional and two organic strawberry fields of the cultivar «Korona» in the south-east of Norway (Nes and Kolbu municipality, EIS 45; Lier municipality, EIS 28) were studied in 2000. The conventional growers, A-E, all at Nes, used pesticides and artificial fertilizers, and they controlled vegetation between plant rows with herbicides. The organic growers, F and G at Kolbu and Lier respectively, did not apply any insecticides, used only approved organic fertilizers, and mowed the clover grown between rows.

At the growers A-D, one two year old and one four year old field were used. Four quadrangles, 4 x 3 m, were marked and studied per field. The quadrangles were laid out in pairs where within-pair distance was 4-6 m; one pair was in the middle and another pair near the edge of the field. The edge was defined as the part of the field that was less than 2 m from edge vegetation or older strawberry fields, i.e. close to habitats where we expected more *A. rubi* to overwinter than within the field. At grower E only one pair of quadrangles in the middle of a four year old field was laid out. At grower F the quadrangles were arranged diagonally through the field, while at grower G there were middle and edge quadrangles as in the conventional fields. Each of the quadrangles consisted of two double row sections, each 15 plants long, i.e. 2x30 strawberry plants in all. One of the quadrangles from each pair in the conventional fields was not sprayed with insecticides.

Adult weevils were counted once a week in all of the quadrangles by tapping the 30 plants in one of the double rows above a white bowl as described by Tuovinen & Parikka (1997). *A. rubi* dropping into the bowl were registered and then put back on the plant. In the other double row, damaged buds were counted and removed weekly. This was done separately for each row in the double row most of the season, to look at the influence of sun exposure. Damaged buds from some of the bud collections in the second half of May were taken to the laboratory and dissected for eggs or larvae. Furthermore, buds collected from field G twice during the oviposition period in 2001 were dissected.

In the following, we define a «(single) damaged bud» as a single bud with its stalk cut. If several buds were destroyed by one cut through their common stalk, these buds will be referred to as a «damaged cluster» (Figure 1a). The size of berries and buds and the time of maturing vary within an inflorescence (Figure 1b): The primary, apical buds are the biggest and mature first, while the secondary, tertiary and quaternary berries are much smaller and mature later (Neumann et al. 1972, Måge 1998).

A paired t-test was used to test for differences in weevil activity between the two rows in a double row with regard to sun exposure. The edge effect was examined by a split-plot analysis, where blocks were growers (A-D), whole plots were fields of different age (2nd year / 4th year) and subplots were the two insecticide treatments (sprayed / unsprayed) and within-field location (edge / middle). Only the conventional fields were included in this analysis. The distribution of egg number in the different bud samples was compared to a random (Poisson) distribution, using a chi-square test.

RESULTS

Damage related to sun exposure and position in the field

In the first two weeks of registration, i.e. last week of May and first week in June, sun exposure affected the number of buds damaged: Comparing the two rows in a double row, the one exposed to south, south-west or west had more damaged buds than the adjacent one exposed to north, north-east or east (Figure 2, $p < 0.01$, $n = 11$, $t = 4.08$). Later, the difference between the two rows levelled out, and the pooled data for the whole season did not show any significant effect of sun exposure. Position within the field had no effect on the total number of damaged buds ($p = 0.72$, $n = 32$, $F = 0.13$), although in average 26 % fewer adults were found in the middle than in the edge of the field ($p = 0.04$, $n = 32$, $F = 4.99$).

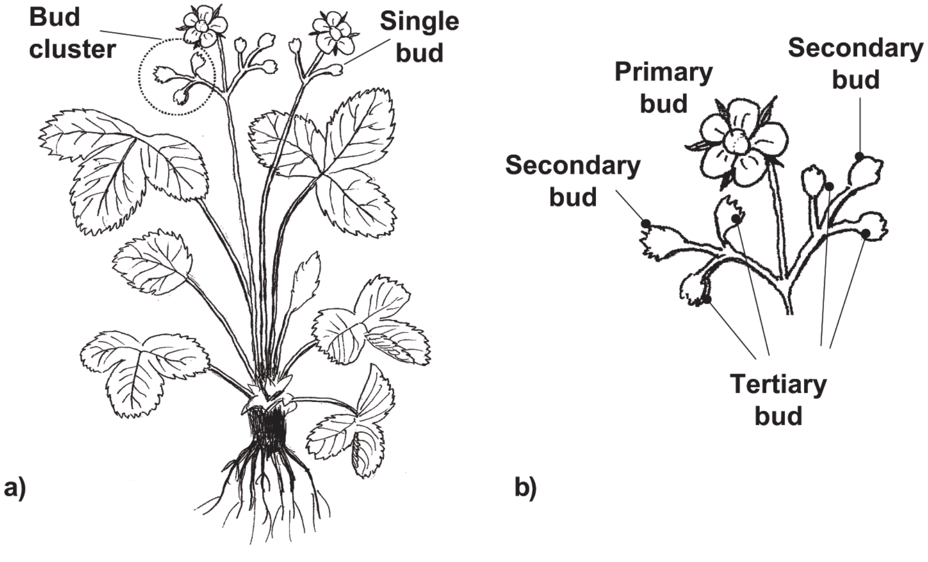

Figure 1. a) A strawberry plant, showing single bud and bud cluster, b) position of the primary, secondary and tertiary buds in a strawberry truss.

The distribution of eggs in the damaged buds

Figure 3 shows the total frequency distribution of the number of eggs in the buds collected in the second half of May 2000. There was no statistical difference in egg distribution between sprayed and unsprayed buds (Figure 4). Of all the (single) damaged buds, 66 % contained one egg, 17 % two eggs, and 4 % three to five eggs. The remaining 13 % apparently contained no eggs (Figure 5, left). There were twice as many buds with one egg as could be expected from a random distribution ($p < 0.05$, χ^2-test, 3 d.f.). In contrast, the distribution of eggs in buds from clusters followed a random distribution. Sixty-five per cent of the buds from damaged clusters were apparently not attacked, whereas the rest mostly contained one egg (Figure 5, right). Seventeen percent, i.e. 99 of the 573 buds, originated from 27 damaged clusters, and 6 of these clusters contained no eggs at all. Each damaged cluster consisted of 2 to 10 buds, thus the damage by cutting off clusters is at least three times larger than when a single bud is cut off during normal oviposition.

Buds collected at two dates, 4 and 24 June 2001, in the organic field of grower G, had different egg distributions (χ^2-test, $p < 0.05$, 2 d.f.): buds with more than one egg occurred only early in the flowering period (Figure 6). This was the only bud sampling made at different times in the same field.

During dissection all buds were thoroughly examined for signs of bud puncture made before oviposition as well as for an egg or larva. Buds with more than one egg also had several punctures, and just one egg or larva was usually found inside each puncture. These buds usually contained several eggs, one larva together with one or several eggs, and only occasionally there were more than one larva in the same bud.

DISCUSSION

Stenseth (1991) showed that the activity of hibernating *A. rubi* from strawberry fields depends on temperature. He measured temperatures in different parts of strawberry fields, and the soil surface was warmer on the southern side of the row than on the northern. The difference was largest on sunny days before flowering, and as the season progressed and temperatures in general increased, these differences evened out. These results correspond well with the bud cutting pattern of the weevils in the present study: activity was higher in rows facing south or west than in those

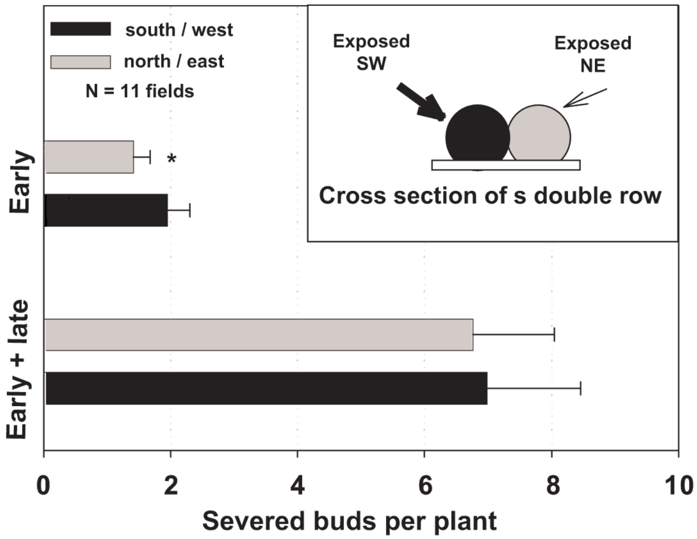

Figure 2. Mean number (±SE) of damaged buds per plant from the entire oviposition period and early (May-June) period in rows exposed to south or west compared with those exposed to north or east. A significant difference at $p < 0.01$ is indicated by *. Arrows on inserted figure show degree of sun exposure (hours and intensity).

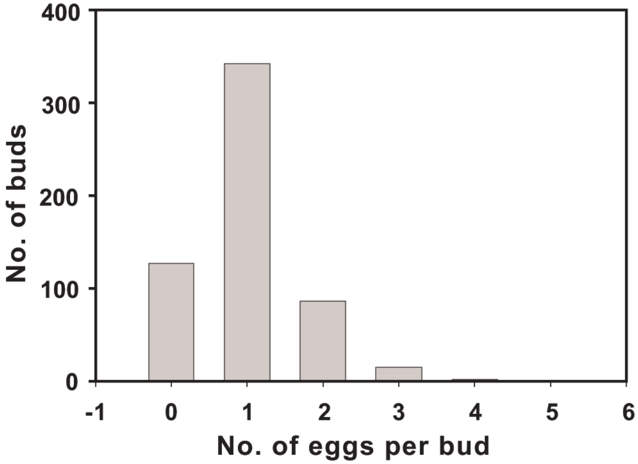

Figure 3. Frequency distribution of eggs in all damaged buds (N=573) examined from conventional and organic fields in the end of May 2000.

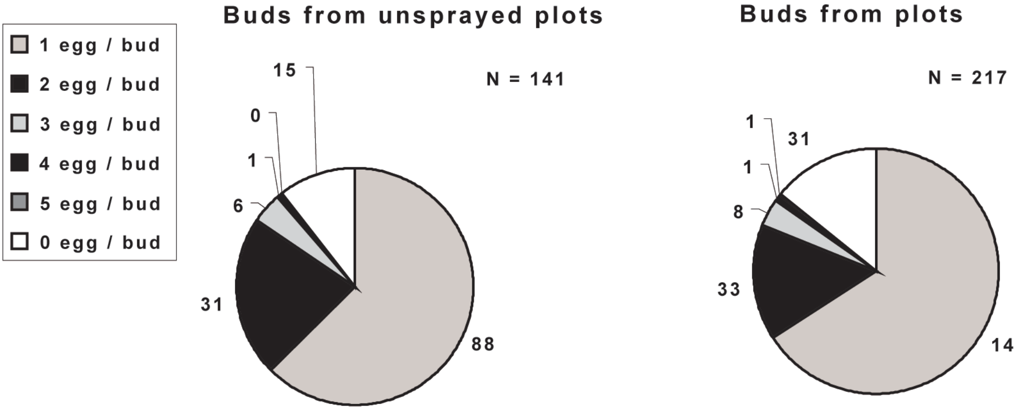

Figure 4. Frequency distribution of *A.rubi* eggs per damaged strawberry bud collected late in May 2000 (buds from damaged clusters not included). Data from unsprayed (left) and sprayed (right) conventional strawberry fields. N=total number of dissected buds.

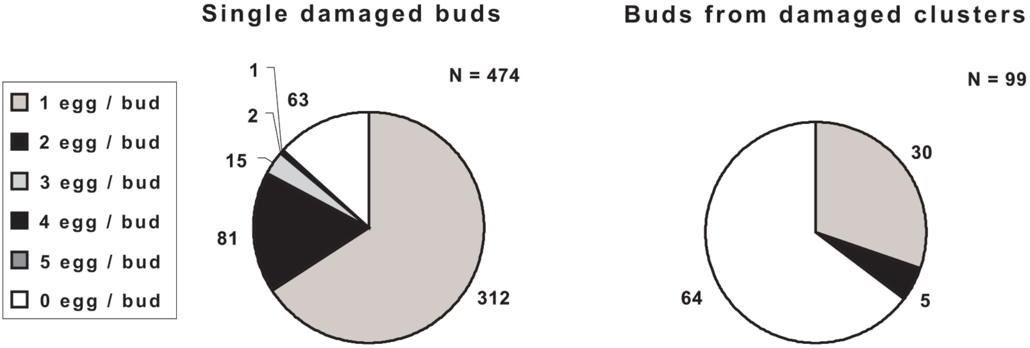

Figure 5. Frequency distribution of *A.rubi* eggs per damaged strawberry bud collected late in May 2000. Pooled data from unsprayed, sprayed, conventional and organic quadrangles. Single buds (left) and buds from clusters (right). N=total number of dissected buds.

facing north or east early in the season, and the differences evened out later in the season.

It is strange that the position within the field had an effect on the number of *A. rubi* but not on the number of damaged buds. There can be several explanations for the high occurrence of *A. rubi* at the edge, without a corresponding high number of damaged buds: Weevils at the edge might have been there for other reasons than oviposition, such as feeding, mating or they were just passing by on their way further into the field. The adults registered in the bowl were not sexed; therefore more males (which do not damage buds) might be present at the edge. The males are probably easier to catch in the bowl since they mature earlier and are more active in the warmer upper parts of the plants (Popov 1996b).

Some of the damaged clusters we dissected contained no eggs at all, and this suggests that the stalk had been damaged from pure feeding activity. The other clusters had eggs in some of the buds. Such damaged clusters cause at least three times the damage of normal oviposition and may result from:

- the female puncturing the stalk «too far» down after oviposition

- one individual feeding on the stalk and another ovipositing without severing the stalk

We have not found any information in the literature on the phenomenon of *A. rubi* severing whole clusters. Eggs found in buds from damaged clusters show that *A. rubi* does not always puncture the stalk directly beneath the bud after oviposition, and other studies support this theory. In strawberry fields in Western Norway, 40 % of 100 undamaged buds chosen at random contained *A. rubi* eggs (T. Våge, unpubl.). Undamaged buds containing an egg will develop to open flowers with a dark spot by the base of the receptacle, made by the pollen-eating larva. The resulting berry is deformed (Hellqvist & Winter 1992). In Sweden, Hellqvist & Winter (1992) found that flowers with dark spots were rather common early in the season, many with living larvae, and suggested that insecticides repelled the weevils from puncturing the stalk after oviposition, or that the flower stalk might be too short to be damaged early in the season.

The reason why females normally puncture the flower stalk after oviposition is probably to prevent the development of an open flower, which could make the larva more exposed to predators, parasites and climatic factors like sunlight and dehydration (Tullgren 1914, Lindblom 1930, Lekic 1962, Blümel 1989). According to Jary

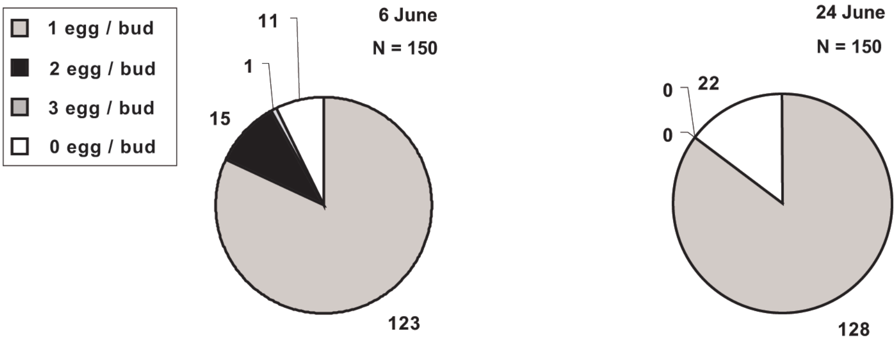

Figure 6. Frequency distribution of *A.rubi* eggs per (single) damaged strawberry bud in organic field G at two dates in 2001. Pooled data from all quadrangles at each date. N=total number of dissected buds.

(1932) dehydration is the most serious mortality factor in the first and second larval stage, while Hellqvist & Winter (1992) argued that open flowers provide enough humidity for weevil development, even in warm, dry summers. Flowers with dark spots or berries with malformation were not commonly observed in the present study. This may indicate that eggs and young larvae in undamaged buds have a high mortality, or that *A. rubi* rarely abstained from cutting the bud after oviposition in the strawberry fields studied here.

Only Jary (1932) has previously noted that some damaged buds do not contain any eggs. In the present study, 13 % of the (single) damaged buds were empty. Jary (1932) suggested that the eggs or larvae in them could have been well hidden and therefore overlooked. Observations in the present study indicate that the phenomenon is more likely to be a result of feeding punctures in the stalk without preceding oviposition, since the empty buds had no signs of punctures from *A. rubi*. Maybe these empty cut buds are the result of males feeding.

Jary (1932) and Popov (1996a) stated that it was unusual to find more than one egg per bud, and more eggs would most likely be the result of bud shortage and experimental conditions. In our fields 21 % of the damaged buds examined in 2000 contained more than one egg. Thus, intraspecific competition seems rather common, possibly between females for oviposition sites and certainly between eggs or larvae inside the bud. Because buds with more than one egg also had several punctures, supernumerary eggs are probably laid through different punctures, by either the same female or different females. In a related American species, *Anthonomus signatus*, most infested strawberry buds (collected in the field) contained only one egg (86 %), one larva (90 % of larva-infested buds) or one pupa (96 % of pupa-infested buds), but up to five eggs, three larvae or two pupae were occasionally found (Mailloux & Bostanian 1993).

Supernumerary offspring is expected if there is a high egg load of the female population relative to the number of buds suitable for oviposition. Hence, the occurrence of supernumerary offspring depends on the level of synchronization between bud and weevil phenology, and can increase with increased weevil density (Popov 1996a). In organic fields the occurrence of supernumerary progeny decreased from early to late flowering season (Figure 6), probably because the late period had more available buds and fewer ovipositing adults, possibly with a lower egg supply.

All the buds damaged during one week in the row sections surveyed were dissected. Using this number of damaged buds per flower truss as an estimate of the degree of competition, no simple correlation between that and the percent of buds with supernumerary eggs was found. This may be due to too little data and an uncertain estimate of competition. Ideally, we should have had data for the percentage of available buds and data for a longer period since the number of supernumerary buds may vary over time (Figure 6).

CONCLUSION

Early in the season, sun exposure affected the oviposition activity of *A. rubi*, while the position within the field had no significant effects. As expected, most of the damaged buds (66 %) contained one egg, but some of the buds were empty (13 %) or had two or more eggs (21 %). Our observation of cut buds and clusters without eggs suggests that *A. rubi* in addition damages buds by pure feeding activity. Since *A. rubi* also cuts off clusters, the damage each weevil do might have been underestimated. When whole clusters are damaged, the potential yield loss is at least three times larger than when single buds are damaged during normal oviposition.

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The wasp spider *Argiope bruennichi* (Scopoli, 1772) (Araneae, Araneidae) observed in Norway

Harald Bratli & Lars Ove Hansen

Bratli, H. & Hansen, L. O. 2004. The wasp spider *Argiope bruennichi* (Scopoli, 1772) (Araneae, Araneidae) observed in Norway. Norw. J. Entomol. 51, 183-185.

The wasp spider *Argiope bruennichi* (Scopoli, 1772) is reported from Norway for the first time. A specimen was photographed by the senior author in a fallow field at Ringshaug, Tønsberg municipality in Vestfold [VE], primo September 2004. The picture was taken when the spider was sitting in its orb web and packing in a grasshopper, most probably a *Chorthippus* sp. (Orthoptera, Agrididae). *A. bruennichi* has been spreading from the Mediterranean area and northwards in Europe during the 20th century. It was recorded from Sweden for the first time in 1989, and Denmark in 1992, and seems well established in both countries now. It is, thus, not surprising that the species now is found in Norway. The Norwegian vernacular name «vepseedderkopp» is suggested.

Key words: Araneae, Araneidae, *Argiope bruennichi*, Norway.

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INTRODUCTION

The wasp spider *Argiope bruennichi* (Scopoli, 1772) is a remarkable and well known species in C and S Europe. In the 20th century it has expanded drastically its distribution in Europe, and has reached Sweden and Denmark the latest decades. The species is now recorded from Norway for the first time.

THE NORWEGIAN RECORD

A specimen of *A. bruennichi* was photographed by the senior author in a fallow field at Ringshaug, Tønsberg municipality in Vestfold [VE], 2 September 2004 (Figure 1). The exact locality was just S of Ringshaug school: UTM[WGS84] NL848724 (EIS 19), 5 m asl. The picture of the spider was taken while sitting in its orb web wrapping in a grasshopper, most probably a *Chorthippus* sp. (Orthoptera, Acrididae).

The species is easily recognizable with transverse black and yellow bands on the abdomen, which give the spider a wasp like impression. The orb web is usually strengthened with a zigzag «stabilimentum», but this is not well developed in the orb web in the picture (Figure 1). The prey is mainly grasshoppers (Orthoptera), most probably of the family Acrididae in N Europe. It occurs in unmanaged rough grassland, perhaps not too dry.

The species is very distinct, and cannot be mistaken for any other N European species. The related *Araneus diadematus* occurs in a variety of colour forms, but never with the black and yellow pattern of *A. bruennichi*.

DISTRIBUTION AND EXPANSION NORTHWARDS

The wasp spider has had a remarkable expansion in Europe during the 20th century. It had around 1900 a S European and Mediterranean distribution with a northern limit through France, but has expanded northwards with an amazing speed (Jonsson & Wilander 1999). It was recorded from Britain as early as 1922, and seemed well established in S England before the second world war

Figure 1. The wasp spider *Argiope bruennichi* photographed in an unmanaged grassland area at Ringshaug, Tønsberg municipality [VE], primo September 2004. The spider is wrapping in a grasshopper, most probably a *Chorthippus* sp. (Orthoptera, Acrididae). *Photo: Harald Bratli.*

(Locket & Millidge 1968). It was recorded from Germany around 1930, but reached N Germany once in the nineties. In Sweden it was observed for the first time at the island Gotland (Gtl) in 1989, and in 1995 in Skåne (Sk) on the mainland (Jonsson & Wilander 1999). In 2002 it was found in Blekinge (Bl), and in 2003 on the locality Nynäs 300 km further north, right south of Stockholm (Sdm) (Landreus 2004, Jonsson 2004). At the same time several new populations were found in southern Sweden, and on some of the older localities the number of specimens has increased (Jonsson 2004). In Denmark it was recorded for the first time in 1992, but now it is found in all parts of the country, and seems well established (Scharff & Langemark 1997).

It is, thus, not surprisingy that the species now is found in Norway. We believe the species will have a similar expansion in Norway as in Sweden, and this report is probably the first of many.

The distribution of the species goes further east through China to Japan (Bjørn 1997). It is also recorded from N Africa, where it is found in Algeria and Morocco.

VERNACULAR NAMES

The vernacular name in English is «wasp spider», in Danish «hvepseedderkopp» and in Swedish «getingspindel», which all mean wasp spider and refer to the wasplike coloration of the spider. Thus, the vernacular name «vepseedderkopp» should be suitable in Norwegian.

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accepted 22 December 2004

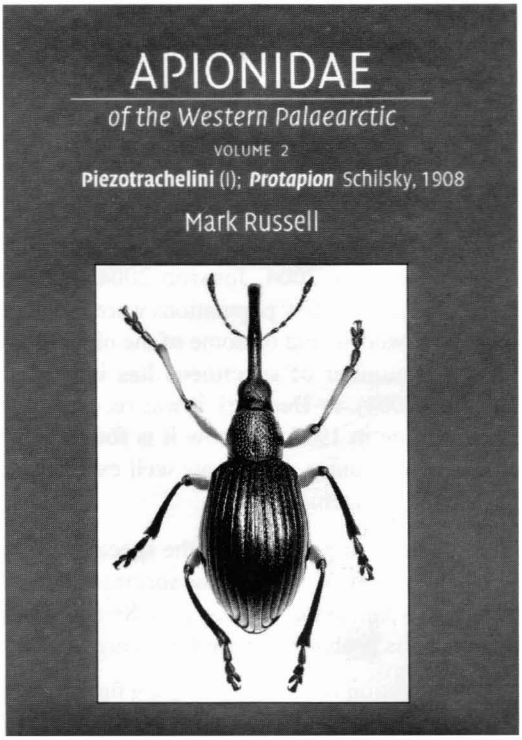
Perfeksjonisme: Mark Russells *Apion*-bøker

Russell, M. 2004. Apionidae of the Western Palaearctic. Vol. 2. Piezotrachelini (I) Protapion Schilsky, 1908. 50 pp. + plate 1- 24. Crocodile Press, U.K. Bind 1 koster £60 + £11 og bind 2 koster £50 + £9 for pakking & forsendelse. Bøkene kan bestilles via e-mail fra forfatteren: Russell-99@lineone.net, eller via «snail-mail» fra forlaget: Crocodile Press, 1 Barnstock, Bretton, Peterborough PE3 8EH, United Kingdom. Bøkene kan også bestilles fra Apollo Books [apollobooks@vip.cybercity.dk].

Det publiseres mange faglig viktige og flotte bøker om insekter til en akseptabel pris. Noen fordeler er det med moderne trykkemetoder. Av og til kommer det også bøker det er nesten kjedelig å omtale. Hvorfor? Fordi det finnes lite å kritisere. Med andre ord nesten bare superlativer.

Engelskmannen Mark Russell har i en årrekke arbeidet med Apionidae. Forståelsen av familiens taksonomi har endret seg radikalt. Den gigantiske slekten *Apion* (sensu lato) er nå delt opp i en rekke nye slekter. Problemene med identifikasjon av Apionidae i Skandinavia er små sett i forhold til andre områder, f. eks. middelhavsområdet. I så måte kunne vi ha greid oss med Gøngets utmerkede bok om artene i Skandinavia, publisert som bind 34 i *Fauna Entomologica Scandinavica* i 1997. Ønsker man derimot å se et større utvalg av arter, fra et videre geografisk område, er Russells bøker et funn. Hans intensjon er å lage moderne oversikter over alle artene i Vest-palaearktis. Den taksonomiske inndelingen over artsnivået baseres i første rekke på arbeider av *Apion*-eksperten Alonzo Zarasaga.

Som alltid er det småfeil å finne, for det meste rene skrivefeil. Viktigere er det at i bind 1 er litteraturlista bare delvis dekkende. For eksempel nevnes det flere arbeider som ikke er tatt med, eksempelvis Vladimir Bohacs illustrerte billebok. Andre feil i bind 1 er kommentert i bind 2. Mindre feil finnes også i bind 2. På tittelsiden burde *Protapion* vært skrevet med kursiv og **Piezotrachelini** hatt fete typer slik at det var enhetlig med smussomslaget. Dette er ikke en absolutt regel, men vanlig praksis. En gjennomgående feil er at Palaearctic mangler en c i signaturen øverst på hver side. I litteraturlista er det henvist til et arbeid av Reiche & De Saulcy (1857), men tittelen er ikke med. I en e-mail nevner Russell at *Protapion ruficrus* ikke er monofag på *Trifolium alpestre*, men at vertsplanten er *T. montanum*. Feilen er en «arv» fra Gøngets bok.



Når man leser bøkene er det viktig å ha i bakhodet at de ikke er ment å være revisjoner, men snarere en moderne guide til gruppen. Forfatteren diskuterer innledningsvis en del faglige avveininger som han måtte gjøre. Likeså gis en grei redegjøring for taksonomiske spørsmål og milepæler i studiet av *Apion* gjennom historien. Det overordnete inntrykket bøkene gir, er Russells store glede av å studere disse billene og ønsket om å formidle hvor vakre de er. Dette har han understreket når han sier: «*..., but beyond the practical purpose lies the desire to reveal the perfect beauty of Nature...*». Og det er nettopp illustrasjonene som løfter bøkene fra å være gode håndbøker til ekte mesterverker. Plansjene er opprinnelig malt med vannfarger i stort format. Stilen er rendyrket og klassisk, og er en videreføring av tradisjonell

PLATE 10
Protapion apricans (Herbst, 1797) female
(× 50)

illustrasjonskunst i naturhistorien. Bildene er på høyde med de beste eksemplene på illustrasjonskunst i naturhistorien. som eksempler kan nevnes arbeidene av Ferdinand Bauer (1760-1826), som regnes blant de aller beste. Han var med Investigator ekspedisjonen til Australia. Et annet eksempel er illustrajonene i Charles Alexander Clercks (1709-65) arbeider om edderkopper og insekter. Helhetsinntrykket av Russells illustrasjoner er en overordentlig nøyaktighet og detaljrikdom. Styrken til klassisk illustrasjon er at detaljer og inntrykk av artene kan rendyrkes og at forstyrrende «støy» kan utelates. I mine øyne har gode tegnede illustrasjoner mange fordeler fremfor fotografier, for eksempel at dybdeskarphet og forvrengninger på grunn av lys kan unngås. Plansjene viser idealiserte bilder uten at det går på bekostning av virkeligheten.

Det første bindet ble trykket i A3 format. Sett i et estetisk perspektiv er det trist at bind 2 ble redusert til A4. Formatet yter ikke full rettferdighet til bildenes kvalitet. Begrunnelsen for å endre format var at A3 er upraktisk. Det kan jeg jo forstå. Likeså er stort format også mye dyrere å produsere. Som Russell selv sier i innledningen til bind 2: «*I apologise to those who particularly appreciated the large size, and also for any bookshelf annoyance, but if the volumes don't get smaller they are in danger of becoming dinosaurs*»

Da jeg så plansjene i første bind tenkte jeg *«Det er slik disse billene egentlig ser ut!»*. Jeg bruker selvfølgelig bøkene som entomologiske arbeider. For meg er de imidlertid like viktige som kunststykker som stadig gleder. Hvis jeg skulle anbefale bøker om biller som både er faglig sterke og som jeg rett og slett bare kan glede meg over, så er det disse. De er mer verdt en prisen.

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The black willow aphid *Pterocomma salicis* (L., 1758) (Hemiptera, Aphididae) in Norway

Lars Ove Hansen & Kjetil Rolseth

Hansen, L. O. & Rolseth, K. 2004. The black willow aphid *Pterocomma salicis* (L., 1758) (Hemiptera, Aphididae) in Norway. Norw. J. Entomol. 51, 189-191.

The black willow aphid *Pterocomma salicis* is recorded from Norway for the first time. A colony was photographed and 45 specimens were collected 12 June 2004 in Folldal municipality, Hedmark (HEN). The locality is situated close to the southern shore of the river Folla, right north of Solvang (EIS 71), approximately 890 m altitude. The colony was found on 2-3 year old twigs of *Salix glauca*, which seems to be a new foodplant for the species.

Key words: Black willow aphid, *Pterocomma salicis*, Hemiptera, Aphididae, Norway.

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The aphid subfamily Pterocommatinae is represented by three genera in N Europe. One of these, *Pterocomma* Buckton, 1879, is represented by six species, where all are associated with different species of *Salix* and *Populus* (Heie 1986). *P. salicis* is the most remarkable of these, with a rather big size, black ground colour with grey and white wax powdered spots, and with bright red sipunculi. (Figure 1). This species is here reported from Norway for the first time.

THE NORWEGIAN RECORD

A colony of *Pterocomma salicis* was photographed 12 June 2004 in Folldal municipality, Hedmark (HEN), by the junior author (Figure 1). The locality is situated close to the southern shore of the river Folla, right north of Solvang UTM32V [WGS84]NP365952 (EIS 71), approximately 890 m altitude. The colony was found on 2-3 year old twigs of *Salix glauca* (Figure 1).

Seven alate ♀♀, 21 apterous ♀♀ and 17 nymphs (all ♀♀) were collected (leg. K. Rolseth), and these are preserved in the insect collections at the Natural History Museum in Oslo.

BIOLOGY AND DISTRIBUTION

Pterocomma salicis is reported to attack a variety of *Salix* spp. Heie (1986) mentions ten different species including *S. viminalis, S. fragilis, S. caprea* and *S. repens*, but not *S. glauca*. The colonies use to attack two year old twigs where they suck phloem fluids through the bark (Heie 1986, Sipura 2002). The colonies are visited by ants, and the aphids appear to benefit strongly from their presence (Sipura 2002). *Myrmica rubra* (L., 1758) and *Formica aquilonia* Yarrow, 1955 are two of the ant species associated with *P. salicis*.

The females occur in both apterous and alate forms, while the males are only apterous (Heie 1986).

The species is common and widespread all over Sweden, from Skåne (Sk) in the south, to Torne Lappmark (T.Lpm.) in the north (Heie 1986). It is also rather common and widely distributed both in Denmark and Finland. The distribution goes further through Europe south to Spain, and eastwards through C and N Asia to Mongolia (Heie 1986). It is also found in N America, and is regarded as an invasive species to New Zealand (El-Sayed & Suckling 2004).

Figur 1. A colony of *Pterocomma salicis* on a twig of *Salix glauca;* Folldal (HEN). *Photo: Kjetil Rolseth.*

P. salicis must have a quite wide distribution in Norway too, and it is surprising that this remarkable species has been completely overlooked in Norway until now.

Acknowledgement. Thanks to Leif Aarvik for comments on the manuscript.

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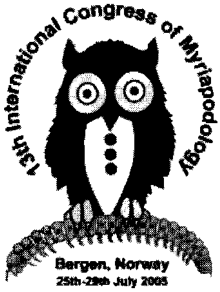

XIIIth International Congress of Myriapodology

Bergen, Norway, July 24th - 30th 2005

The 13th International Congress of Myriapodology will take place at The University of Bergen, Norway in the period of July 24th to July 30th 2005.

The program follows the tradition of former congresses with an informal reception at The Natural History Museum in the afternoon July 24th, four days with scientific sessions in The Law building, and a midweek whole day excursion "Norway in a Nutshell" at Wednesday 27th . The last session at Friday 29th is the General assembly of Centre International de Myriapodologie (CIM). The farewell dinner will take place at Flöyen Restaurant 320 m.a.s.l., accessed by a funicular and with a fantastic view over Bergen city.

Technical Organiser of the conference is Kongress & Kultur AS.

For information regarding registration, accommodation, social events etc, do not hesitate to contact them at mail@kongress.no.

http://www.uib.no/myria2005/

Norw. J. Entomol. 51, 193–201. 2004

Revision of African *Cryptaspasma* Walsingham, 1900 (Lepidoptera, Tortricidae)

Leif Aarvik

Aarvik, L. 2004. Revision of African *Cryptaspasma* Walsingham, 1900 (Lepidoptera, Tortricidae). Norw. J. Entomol. 51, 193-201.

The African members of the genus *Cryptaspasma* Walsingham, 1900 are revised. Two new subgenera of *Cryptaspasma* are proposed. *Afrospasma* subgen. nov. is erected for *Cryptaspasma* (*Afrospasma*) *phycitinana* sp. n., and *Neospasma* subgen. nov. is erected for *Cryptaspasma* (*Neospasma*) *kigomana* sp. n. The Madagascan species *Cryptaspasma* (*Metaspasma*) *subtilis* Diakonoff, 1959 is recorded from mainland Africa for the first time. A key to the subgenera of *Cryptaspasma* is given.

Key words: Lepidoptera, Tortricidae, Microcorsini, *Cryptaspasma*, new subgenera, new species.

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INTRODUCTION

Cryptaspasma Walsingham is the sole genus of the tribe Micorcorsini, the most archaic tribe of the subfamily Olethreutinae (Horak 1999). *Cryptaspasma* has retained the connection between the sterigma and the apophyses anteriores in the female genitalia, a character lost in the other more advanced tribes of the subfamily. Members of *Cryptaspasma* have dark and monotonous wings, often with reticulate pattern and a small whitish discal spot. Thirty-three species have been described, and the genus is represented in all zoogeographical regions of the world (Brown & Brown 2004). The genus occurs as far north as Japan (Horak 1999). One species was recorded from Africa and another close relative from Madagascar (Diakonoff 1959). Diakonoff (1983) added one species from the Comoro Islands. In the present study two new species are described and the species previously known from Madagascar is recorded from the African mainland.

According to characters of the male genitalia *Cryptaspasma* species can be allocated to well-defined groups. These groups also reflect the distribution in regions. Female genitalia are rather uniform through the whole genus. Diakonoff (1959) divided the genus in five subgenera, and the African/Madagascan species were placed in the subgenus *Metaspasma* Diakonoff, 1959. Kuznetsov (1970) elevated the subgenera defined by Diakonoff to genus rank. He also erected the tribe Microcorsini to accommodate the group. Ranking the groups of species within Microcorsini as genera, or subgenera of a single genus, is perhaps a question of subjective judgement. In the present paper these groups are treated as subgenera in accordance with Diakonoff (1959) and Brown & Brown (2004). The two new species described below, display characters deviating strongly from the currently defined subgenera. Two new subgenera are established to accommodate these species.

For an exhaustive discussion of the genus *Cryptaspasma* and the tribe Microcorsini the reader should consult Diakonoff (1959), Kuznetsov (1970) and Brown & Brown (2004). The latter authors give a catalogue of the world's species.

MATERIAL AND METHODS

Material from Musée Royal de l'Afrique Centrale, Tervuren (MRAC) and Zoological Museum, University of Copenhagen (ZMUC) has been studied. The type of *Argyroploce caryothicta* Meyrick was borrowed from Muséum National d'Histoire Naturelle, Paris (MNHN). Further specimens were collected in Tanzania by Anders Bjørnstad from 1989 till 1991 and by myself in 1991-1993, and this material is preserved in the collection of the author (LAA).

The terminology of male and female genitalia follows Diakonoff (1959) and Razowski (2003). The terminology of the pattern elements in the forewing and venation is the one used in standard taxonomic works on Tortricidae, e.g. Razowski (2003). After maceration male and female genitalia were dissected under a stereoscopic microscope and embedded in euparal on glass slides. Photos of the genitalia were taken using a Leica DC 200 digital camera. The digital images were manipulated with Adobe Photoshop 6.0. The depository of examined specimens is indicated by the abbreviated name of the collection/collector in parenthesis.

SYSTEMATICS

Afrospasma subgen. nov.

Type species: *Cryptaspasma* (*Afrospasma*) *phycitinana* sp. n.

Description

Male antenna setose, flattened, basal third swollen (Figure 6); swelling on dorsal side with cavity filled with lamellate scales. Forewing without costal fold. Base of hindwing between veins CuA$_2$ and Sc+R$_1$ with oval patch of small, modified sex scales in males. Cubital pecten lacking. Male hind tibia with brush of hair-scales.

Male genitalia (Figure 7). Tegumen high; uncus and socii not clearly differentiated; uncus without hair-pencil or spines; valva differentiated in sacculus and cucullus, cucullus with group of strong spines and pulvinus in the form of large proximal flap covered with rhopaloid hairs; aedeagus broad, gradually tapering from middle, no cornuti.

Female genitalia (Figure 8). Typical for the genus; signa very large, curved.

Remarks

Afrospasma subgen. nov. is closest to the Asian subgenus *Microcorses* Walsingham, 1900, but differs by the lack of hair-pencil on uncus. Both subgenera lack cubital pecten in the hindwing, and males of both have a patch of sex scales on the upperside of this wing. However, its position and structure are different. In *Microcorses* it is situated between the basal portions of veins 3A and 1A+2A and consists of a fold and vesicle «concealed from above by a shining smooth flap of small and modified scales» (Diakonoff 1959). The position of the scale patch in *Microcorses* can be seen in the figure of *Cryptaspasma* (*Microcorses*) *mirabilis* (Kuznetsov, 1964) given by Kuznetsov (2001, pl. 120, Fig. 5). In *Afrospasma* it is simply an oval patch of modified scales situated basally on the costa of the wing. When the moth is mounted in the conventional manner, the patch is hidden under the lower edge of the forewing. The modification in the male antenna in *Afrospasma* is not present in *Microcorses*.

Cryptaspasma (Afrospasma) phycitinana sp. n.

Type material: Holotype male, KENYA: Taita Hills 1600 m Ngangao, *Ocimum suave* 9.iv.2001 J. & W. De Prins leg., genital slide LAA 23011 (MRAC).

Paratypes, KENYA 1♂ labelled as holotype (MRAC); TANZANIA: East Usambara Mts. Amani, 900 m 3♂♂, 1♀ 1.ix.1981 M. Stoltze & N. Scharff leg., genital slide ♂ LAA 23012 & F LAA 23013 (ZMUC); West Usambara Mts. Mazumbai, 1600 m 1♂ 1.viii.1980 M. Stoltze & N. Scharff leg.; 1♂ 3-7.vii.1995, 1650 m; 1♂, 1♀ 17-28.xi.1995, 1650-1730 m S. McKamey leg. (ZMUC); Uzungwa Mts. Mwanihana Forest above Sanje 1700 m 1♂ 15.viii.1982; 1♀ same locality, 1000 m 1.viii.1982 M. Stoltze & N. Scharff leg., genital slide ♀ LAA 23030 (ZMUC); Muheza Distr.: Amani 900-950 m 1♂ 5.viii.1992 L. Aarvik leg. (LAA).

Etymology

The species name refers to the similarity with knothorn moths, subfamily Phycitinae in the family Pyralidae.

Description

Figure 1. Male. Wingspan 18-22 mm. Labial palp twice the diameter of eye, light grey-brown, mottled with dark brown. Antenna light brown, cavity of basal swelling edged blackish, contrasting strongly with the yellow lamellate scales inside the cavity. Head dark brown, rough scaled; thorax dark brown, smooth scaled. Forewing ground colour light grey, with fuscous reticulate pattern; a blackish brown boat-shaped patch in the middle of wing below cell dominates; smaller spots of the same colour are present in fold, before tornal area, below discal spot and before discal spot; discal spot white; ochreous scales and flecks present particularly in basal part of wing. Hindwing fuscous, darker along veins, with slight transverse striae in distal half; oval patch of sex scales dark brown; the patch is surrounded by lighter area.

Female similar to male, but lacking basal swelling of antenna and patch of sex scales on upperside of hindwing.

Male genitalia. See description of subgenus.

Female genitalia (Figure 8). Ostium bursa trough-shaped, emarginated laterally and with medial convexity at the bottom of the «trough»; ductus bursae with weak sclerite in posterior half, wider medially near the entrance of ductus seminalis; signa large, curved, of different size, situated in posterior part of corpus bursae.

Distribution

Kenya and Tanzania.

Ecology and biology

In mountains between 900 and 1700 m. The holotype and one paratype were bred from *Ocimum suave* Willd. (Lamiaceae).

Remarks

Cryptaspasma phycitinana sp. n. is easily recognizable in the male sex due to the conspicuous swelling of the antenna. This gives the moth a superficial similarity with pyralids in the subfamily Phycitinae, knothorns.

Neospasma subgen. nov.

Type species: *Cryptaspasma* (*Neospasma*) *kigomana* sp. n.

Description

Male antenna setose. Labial palp with terminal segment short, hardly protruding from scale brush of second segment. Forewing without costal fold. Cubital pecten missing in hindwing. Male hind tibia with brush of hair-scales.

Male genitalia (Figures 9, 10). Tegumen an arched band; uncus rounded with two long pencils; socii formed as setose knobs; valva differentiated into sacculus and cucullus, cucullus setose in distal half, sacculus with row of strong spines from base to middle of valva; pulvinus large and membraneous, covered with rhopaloid scales; anellus with lobes forming lateral ears at base of aedeagus; aedeagus strongly narrowed before distal end.

Female genitalia. Not known.

Remarks

Neospasma subgen. nov. shows similarity with species of the American subgenus *Cryptaspasma* Walsingham s. str. and the Asian *Micocorses* Walsingham. It differs from the former by having the outer edge of the male valva emarginate, i.e. differentiated into sacculus and cucullus. It differs from both by the presence of a pair of anellus lobes. It shares with *Cryptaspasma* s.str. the lack of costal fold and the reduced terminal segment of the labial palp.

Cryptaspasma (*Neospasma*) *kigomana* sp. n.

Type material: Holotype male, TANZANIA: Kigoma District: Tubira Forest 1100 m 1♂ 27.x.1989 A. Bjørnstad leg., genital slide LAA 2665 coll. Natural History Museum, University of Oslo.

Etymology

The species name refers to the Kigoma region in Tanzania where the moth was collected.

Description

Figure 2. Male. Wingspan 18 mm. Labial palp brown, length slightly exceeding diameter of eye, second segment with scale brush. Antenna brown, upperside darker. Head dark brown, rough scaled; thorax dark brown, smooth scaled. Forewing ground colour pale yellow; heavily suffused with brown and dark grey, causing the pale ground colour to remain only as costal strigulae and small spots in terminal part of wing; a triangular dark brown mark present in middle of wing; one further dark brown spot in fold at 1/3 from base, partly

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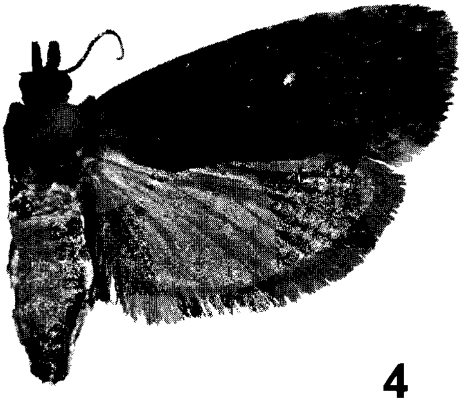

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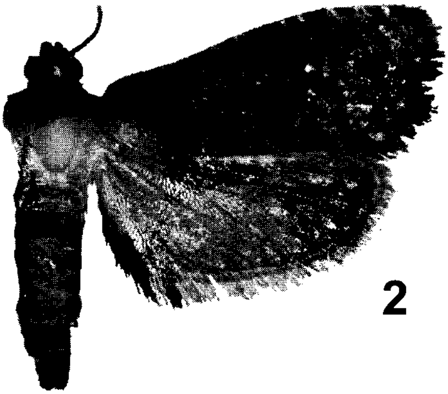

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Figures 1-5. Adults of *Cryptaspasma* Walsingham. **1.** *C. phycitinana* sp. n. **2.** *C. kigomana* sp. n. **3.** *C. subtilis* Diakonoff M. **4.** *C. subtilis* Diakonoff F. **5.** *C. caryothicta* Meyrick. Holotype ♂.

edged with ochreous; discal dot small, pale yellow; fringes greyish brown. Hindwing fuscous, veins darker, fringes fuscous.

Male genitalia. See description of subgenus.

Female genitalia. Not known.

Distribution

Western Tanzania.

Remarks

Only the holotype is known. It was captured at light in a ground water forest.

Subgenus *Metaspasma* Diakonoff, 1959

Type species: *Acharneodes atrinodis* Meyrick, 1926.

Description

Male antenna setose, not thickened. Labial palp 1.5-2 times the diameter of eye, longer in females than in males. Male forewing without costal fold. Hindwing with cubital pecten. Male hind tibia without brush of hair-scales.

Male genitalia. Uncus without hair-pencil, hardly differentiated from tegumen, socii large, pending, with dense scale cover; pulvinus absent; cucullus with row of truncate spines, valva otherwise without spines; aedeagus large, shaped as a bottle.

Female genitalia. Typical for the genus; ostium bursa large, trapezoid.

Remarks

Only three species belong to this subgenus. The two species dealt with here are distributed in sub-Saharan Africa and Madagascar. The differences between them in the genitalia are small, but distinct. Externally *C. subtilis* differs from *caryothicta* by its darker wings. The third species, *C. zigzag* Diakonoff, 1983, is known from a single female from Comoro Islands.

Cryptaspasma (Metaspasma) subtilis Diakonoff, 1959

Cryptaspasma (Metaspasma) subtilis Diakonoff, 1959: 38.

Material examined. KENYA: Mount Kenya, Chorogia 1600 m 1♂ 13-14.iv.2001 J. & W. De Prins leg., genital slide LAA 23014 (MRAC); TANZANIA: Tanga Reg., Lushoto Distr.: Mazumbai For. Res. 1650-1730 m 1♀ 8.vii.1995 S.H. McKamey et al. leg., genital slide LAA 23029 (ZMUC); same as preceding 1♀ 11.xii.1991 L. Aarvik leg., genital slide LAA 2664 (LAA); Arumeru Distr.: Usa River 1170 m 3♂♂ 12-14.ix.1991, 1♀ 22.vii.1991 L. Aarvik leg., genital slide ♂ LAA 2296 & ♀ LAA 2297 (LAA); Mufindi Distr.: Mufindi 1960 m 1♂ 11.vii.1992 L. Aarvik leg., genital slide 2298 (LAA); Muheza Distr.: Amani 900-950 m 1♀ 5.viii.1992 L. Aarvik leg. (LAA).

Description

Figure 3. Male. Wingspan 15-16 mm. Labial palp twice the diameter of eye, greyish brown; antenna light greyish brown; head and thorax greyish brown. Forewing ground colour pale greyish, suffused with purplish brown, and with fuscous reticulate pattern; discal dot pale cream; a fuscous boat-shaped mark present in the middle of wing; a series of fuscous dots, edged outwardly with ochreous, form a terminal line; cilia slightly chequered with pale ochreous and pale greyish, blackish at tornus. Hindwing fuscous, veins darkened.

Figure 4. Female. Wingspan 17-26 mm. Labial palp 2.0-2.5 times diameter of eye. Forewing heavily suffused with reddish brown and violet brown, the fuscous reticulation present in male completely absent or only weakly indicated; discal dot cream; cilia greyish, lighter patch before tornus. Hindwing fuscous, lighter than in male, with weak transverse striae in distal half.

Male genitalia. (Figure 11). See diagnosis of subgenus. Close to those of *C. caryothicta* (next species), differing by distinctly shorter cucullus of valva and shorter row of spines. The spines themselves are shorter in *subtilis* than in *caryothicta*.

Female genitalia. (Figure 12). Ostium bursa large, trapezoid, densely denticulate posteriorly, bands connecting sterigma and apophyses anteriores also denticulate; ductus bursa broadest in middle, with weak sclerite (colliculum) which is pointed posteriorly; signa relatively short and broad. The female genitalia of *caryothicta* differ by shorter ostium bursa, appearing more band-like; they differ further by more strongly sclerotized colliculum and by more slender signa.

Distribution

Madagascar (Diakonoff 1959), Kenya and Tanzania.

Remarks

The present records are the first from the African mainland. The female genitalia figured by Diakonoff (1959: pl. 9, Figs. 70, 71) of a Madagascan specimen match exactly dissected specimens from Tanzania. There are, however, small discrepancies in the male genitalia. The genitalia of the Madagascan specimen figured by Diakonoff (1959: pl. 8, Fig. 69) has the row of spines on cucullus slightly curved (this may be the result of stronger pressure on the cover glass of the slide), and the row is positioned slightly more distad on cucullus. This is considered insufficient to separate the Madagascan and African material on the species level. Further study may show that the African population deserves status as subspecies.

Cryptaspasma (*Metaspasma*) *caryothicta* (Meyrick, 1920)

Argyroploce caryothicta Meyrick, 1920: 65

Acharneodes atrinodis Meyrick, 1926: 327; Diakonoff, 1959: 39 (*Cryptaspasma* (*Metaspasma*))

Material examined. Holotype male of *Argyroploce caryothicta*, KENYA: Afrique or. anglaise, Monts Aberdare, de Nyéré a Naivasha, Alluaud & Jeannel, Mt. Kinangop vers' Est, Prairies alpines 3000-3100 m, Févr. 1912, St. 55, genital slide LAA 99022 (MNHN).

TANZANIA: Tanga Reg., Lushoto Distr.: Mazumbai For. Res. 1650-1730 m 2♂♂ 8. vii.1995 S.H. McKamey et al. leg., genital slide LAA 23028 (ZMUC) (1♂ coll. LAA).

Description

Figure 5. Male. Wingspan 18-24 mm. Labial palp twice the diameter of eye, ochreous brown; head and antennae brown; thorax greyish brown. Forewing ground colour pale ochreous brown, suffused with purple and grey; along dorsum with less suffusion, making this part lighter than rest of wing; a fuscous triangular mark present in the middle of wing; ochreous discal spot edged inwardly and below with fuscous; termen spotted with ochreous and fuscous; fringes similarly chequered ochreous and grey. Hindwing brownish grey, dappled in terminal half, particularly on underside.

Female. Not available for description, but see Diakonoff (1959).

Male genitalia. (Figure 13, 14). Similar to those of *C. subtilis*, but differing by longer cucullus with longer row of spines.

Female genitalia. Not available for study, but see Diakonoff (1959: Pl. 9, Figs. 72-73). Ostium bursa distinctly shorter and signa more slender than in *subtilis*.

Distribution

Republic of South Africa, Uganda (Diakonoff 1959), Kenya and Tanzania.

Remarks

The genitalia of the male holotype of *Acharneodes atrinodis* Meyrick figured by Diakonoff (1959) agree with the genitalia of the male holotype of *Argyroploce caryothicta* Meyrick (MNHN). Consequently the two names are synonyms. This synonymy was communicated to John Brown who included it in their catalogue (Brown & Brown 2004).

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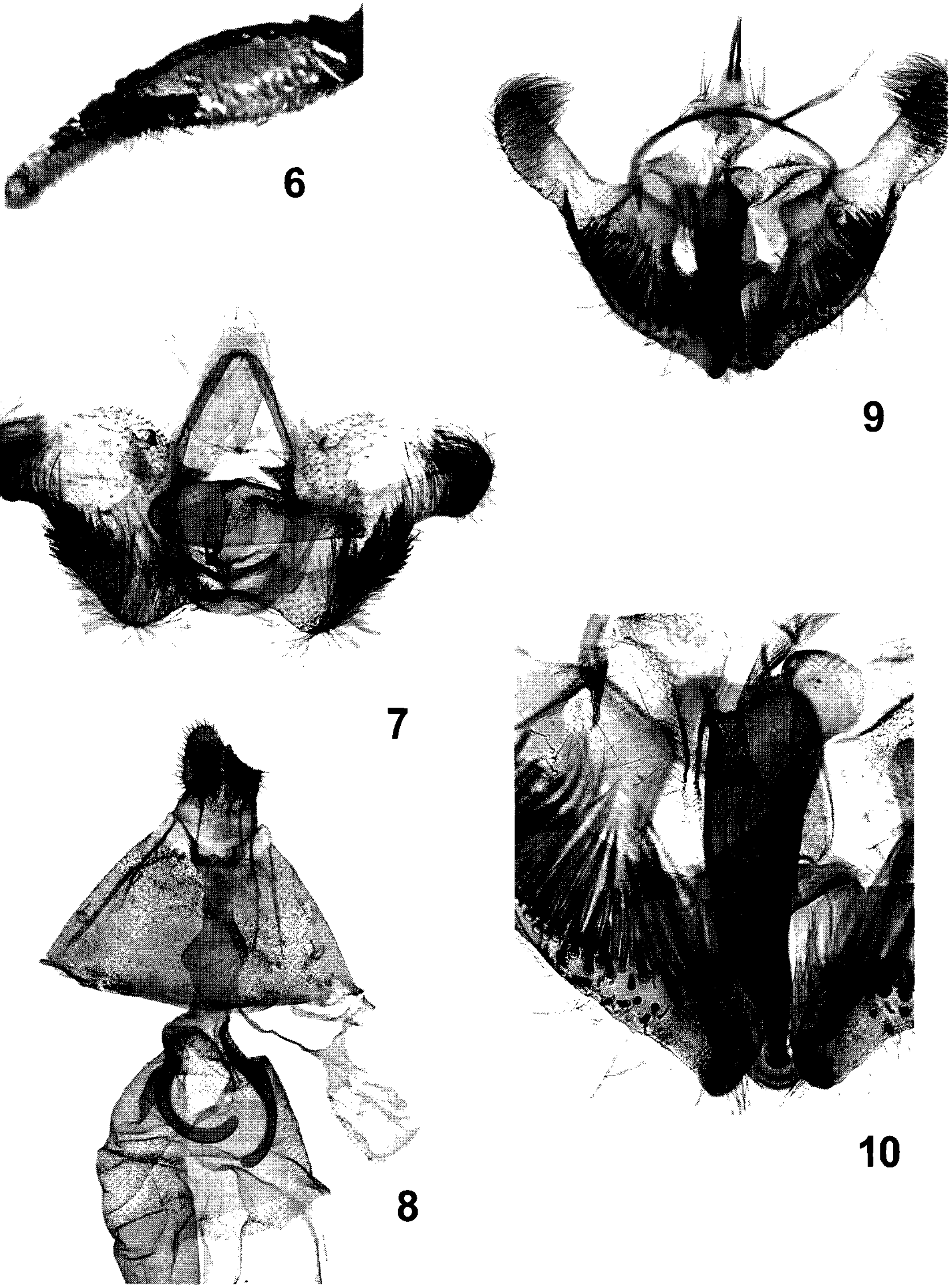
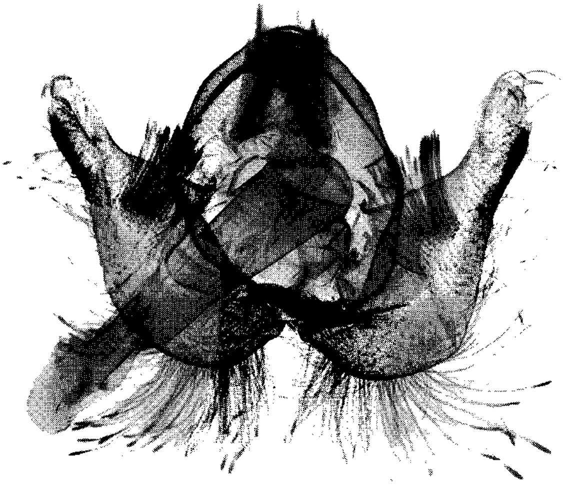


Figures 6-10. 6. Base of male antenna of *C. phycitinana* sp. n. **7-10.** Genitalia of *Cryptaspasma* Walsingham. **7.** Male genitalia of *C. phycitinana* sp. n. **8.** Female genitalia of *C. phycitinana* sp. n. **9-10.** Male genitalia of *C. kigomana* sp. n. **10.** Aedeagus and base of valvae.



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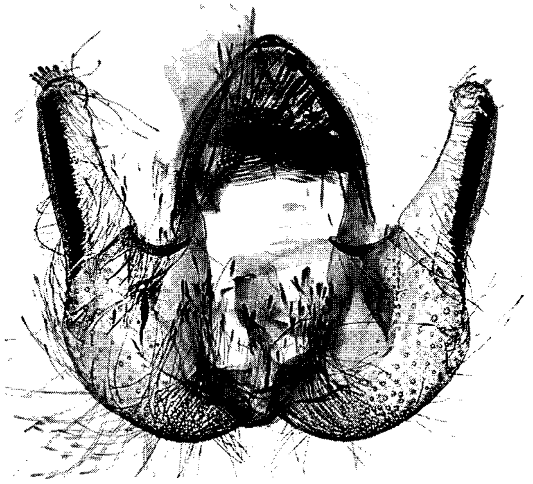

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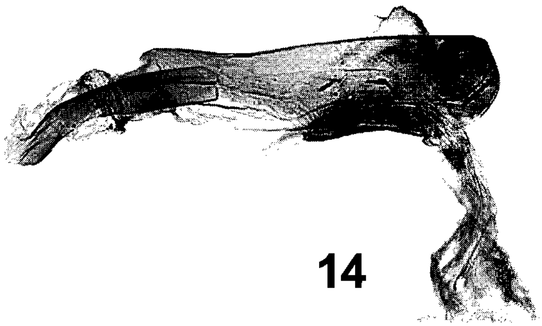

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Figures 11-14. Genitalia of *Cryptaspasma* Walsingham. **11.** Male genitalia of *C. subtilis* Diakonoff. **12.** Female genitalia of *C. subtilis* Diakonoff. **13.** Male genitalia (aedeagus removed) of *C. caryothicta* (Meyrick). Holotype. **14.** Male genitalia, aedeagus, of *C. caryothicta* (Meyrick).

KEY TO SUBGENERA OF *Cryptaspasma* Walsingham

The present key, based on characters of the male genitalia, is modified from Diakonoff (1959).

1. Uncus lacking hair-pencil 2

- Uncus with hair-pencil 3

2. Uncus reduced, cucullus narrow, with row of spines (Afrotropical) (Figure 11, 13) .... *Metaspasma* Diakonoff

- Uncus present as a naked lobe, cucullus broad, with cluster of spines (Afrotropical) (Figure 7) .... *Afrospasma* subgen. nov.

3. Valva swollen, pulvinus smooth, rounded, with large spike (sometimes two) on top (Asia) .... *Allobrachygonia* Fernald

- Valva not swollen, pulvinus without spike(s) 4

4. Sacculus of valva with triangular, pointed prominence (Neotropical) ...... *Anaphorodes* Diakonoff

- Sacculus of valva without triangular, pointed prominence 5

5. Outer edge of valva not emarginate, thus sacculus and cucullus are not differentiated (Neotropical, Nearctic) .... *Cryptaspasma* Walsingham s.str.

- Outer edge of valva emarginate, i.e. sacculus and cucullus differentiated 6

6. Sacculus with numerous spines, cucullus with setae only, anellus with pair of rounded lobes (Afrotropical) (Figure 9, 10) .... *Neospasma* subgen. nov.

- Both sacculus and cucullus with spines, anellus without lobes (Asia) ..... *Microcorses* Walsingham

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debted to Dr. Joël Minet, Muséum National d'Histoire Naturelle, Paris, for arranging the loan of Meyrick types preserved in that museum.

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Biotope preference and size of *Lacinius ephippiatus* (C. L. Koch, 1835) (Opiliones: Phalangiidae) at Karmøy, Western Norway

Ingvar Stol

Stol, I. 2004. Biotope preference and size of *Lacinius ephippiatus* (C. L. Koch, 1835) (Opiliones: Phalangiidae) at Karmøy, Western Norway. Norw. J. Entomol. 51, 203-211.

The presently known distribution of *Lacinius ephippiatus* is summarized and presented as a map. The species is known from the Faroe Islands in west to Ural (Russia) in the east, and southwards to Spain and Bulgaria. *L. ephippiatus* was studied in 14 localities at the island of Karmøy, Ryfylke (EIS 13) in Western Norway from 7 different biotopes during the period of 18 July - 31 August 1997. During this period, 104 males and 455 females were collected with an average of 5 pitfall traps per locality. Notes on the ecology of the species are briefly presented. *L. ephippiatus* preferred gardens, next coniferous woods, mixed woods and beaches. Regarding morphological characters, body length, movable cheliceral finger, pedipalpal tarsus and the femur of the 2nd leg were measured. In both sexes, the smallest body lengths were found in specimens from coniferous wood and heather, whereas the largest body lengths occurred in specimens from the beach. Compared to Great Britain and Central Europe no geographical differences were detected regarding the four characters that were studied. The sizes of the movable cheliceral finger and the pedipalpal tarsus have not previously been reported. The statistical GT2-method was used to compare two means to see if they were significantly different.

Key words: Opiliones, *Lacinius ephippiatus*, distribution, ecology, size.

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INTRODUCTION

A survey of the presently known distribution, ecology and size of *Lacinius ephippiatus* (C.L. Koch, 1835) is presented. The distribution of the species is relatively well-known with the possibly exception of the northern limits. These, however, may be predictable as the vertical distribution of the species is roughly known (Stol 2000). In Norway, Kauri (1966) reported *L. ephippiatus* for the first time from SFI: Flåm (EIS 50), and it is presently known from NNV: Lofoten (EIS 133) at 68°N, and southwards. *L. ephippiatus* has a wide distribution in Europe (Figure 1b). It is known from the Faroe Islands in west to Ural (Russia) in east, southwards to Spain and Bulgaria (Thydsen Meinertz 1962, Martens 1978, Kauri 1980, Novak et al. 1995, Farzalieva & Esyunin 1999, Novak & Gruber 2000, Stol 2002b, 2003).

Ecological comments have previously been published by Thydsen Meinertz (1964a, b), Martens (1978), Stol (1982, 1997, 2002a, 2003) and Hillyard & Sankey (1989). Notes on the life cycle and monthly occurrence of *L. ephippiatus* are found in Thydsen Meinertz (1964b) and Stol (1982, 2002a, 2003).

Fieldwork carried out in 1997 by the author on the island of **RY** Karmøy (EIS 13) in Western Norway has resulted in new insight on the ecology of *L. ephippiatus*, especially on biotope preferences.

The main aim of the present study was to investigate the preference of *L. ephippiatus* to different biotopes. Furthermore, body length, pedipalpal tarsal length, movable cheliceral finger length and femoral length of 2nd walking leg were measured in order to see if there are significant differences among the ranked means in each character.

MATERIAL AND METHODS

This present study is based on material sampled from 14 localities and seven different biotopes in 1997 on the island of **RY** Karmøy (EIS 13) in Western Norway with 4 to 5 pitfall traps installed at each locality. A total of 455 females and 104 males were collected during the period 18 July - 31 August 1997 (Figure 1a, Table 1). The material is deposited at the Zoological Museum, University of Bergen.

To analyze the biotope preferences of *L. ephippiatus* the following seven types were investigated; coniferous-, deciduous- and mixed forests, heathers, grazing lands, gardens and beaches.

The two localities of mixed woods (Table 1) consisted mainly of plants like *Pinus sylvestris* L., *Picea abies* (L.), *Ulmus glabra* Huds., *Fagus sylvatica* L., *Betula pubescens* Ehrh., *Sorbus aucuparia* L. and mosses. Large amounts of dead organic material were present and the light intensity of this biotope was moderate. The two beach localities included plants such as *Elymus arenarius* L., *Filipendula ulmaria* (L.) Maxim., *Atriplex latifolia* Wahlenb., *Plantago lanceolata* L., *Plantago maritima* L., *Potentilla anserina* L., *Holcus lanatus* L. and *Galium aparine* L. Little or no dead organic material was present, while high salinity and high light intensity are typical ecological factors of this biotope type. The grazing land locality mainly included plants like *Agrostis tenuis* L., *Festuca rubra* L., *Trifolium repens* L., *Cirsium palustre* (L.) Scop., *Potentilla erecta* (L.) Räusch., *Poa pratensis* L. and *Poa annua* L. Scanty amounts of dead organic material, hard soil and high light intensity are here prevailing features of this biotope. The two gardens included vegetables, fruit trees and berry bushes, as well as introduced plants. Here the soil was loose, rich in dead organic material and the light intensity was moderate. The three localities of coniferous wood consisted of plants as *Pinus sylvestris* L., *Picea abies* (L.), *Taxus baccata* L., *Juniperus communis* L., *Calluna vulgaris* (L.), *Erica tetralix* L., *Vaccinium vitis-idaea* L., *Vaccinium myrtillus* L. and mosses. In these biotopes the soil was hard with scanty

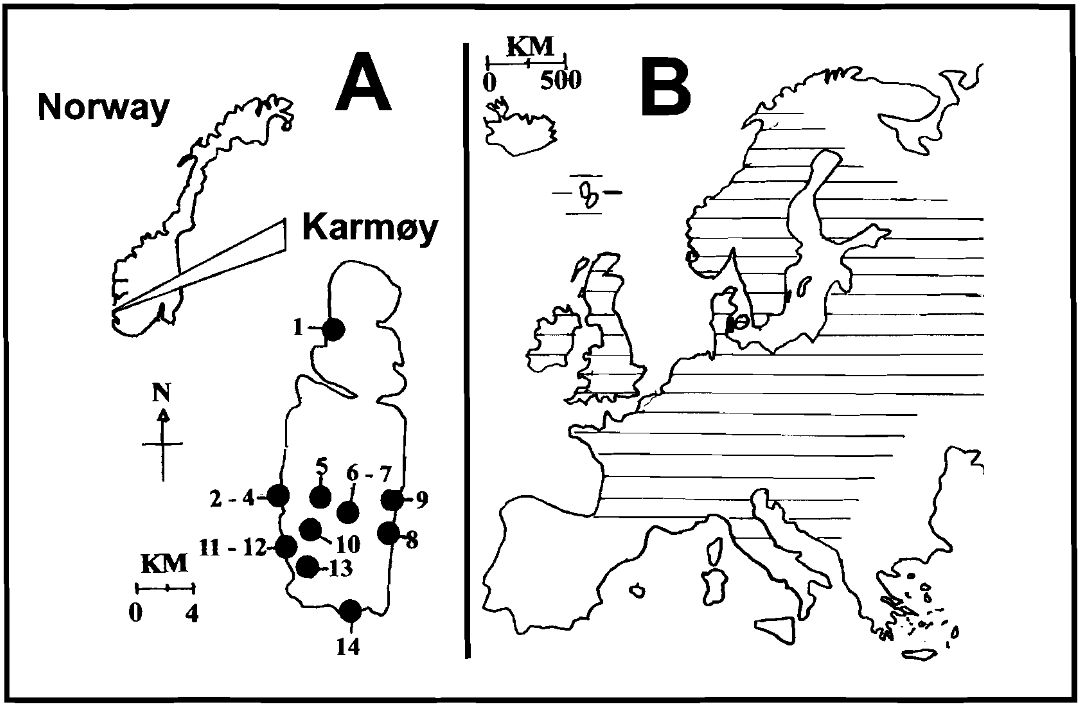

Figure 1. a. Map showing the fourteen localities at Karmøy, Western Norway. See Table 1 for locality numbers. **b.** Map of the approximately presently known distribution of *Lacinius ephippiatus* in Europe.

Table 1. A survey of 14 localities visited at Karmøy, Western Norway in 1997. Locality numbers as in Figure 1a. ♀ = females, ♂ = males of *Lacinius ephippiatus.*

Loc. No.	Name	Biotope	No. of individuals ♀♀	♂♂	No. of traps
1	Fransahagen	Mixed wood	78	8	4
2	Stavasanden	Beach	43	10	4
3	Stava	Grazing land	15	13	4
4	Stol	Garden	109	17	5
5	Sandvatn	Coniferous wood	20	3	5
6	Raunane	Heather	10	2	5
7	Stiklene	Coniferous wood	12	4	5
8	Blikshavn	Coniferous wood	90	24	5
9	Snørteland	Deciduous wood	30	16	5
10	Mjåvatn	Heather	9	2	5
11	Sandvesanden	Beach	4	0	5
12	Sandve	Garden	9	1	5
13	Syre	Heather	4	3	5
14	Dr. Jensens Minde	Mixed wood	22	1	5
		Sum	**455**	**104**	

dead organic material and the light intensity was moderate. The single locality of deciduous wood consisted of plants like *Corylus avellana* L., *Quercus robur* L., *Sorbus aucuparia* L., *Acer platanoides* L., *Lonicera periclymenum* L., *Juniperus communis* L., *Vaccinium myrtillus* L. and mosses. The soil was loose and rich in dead organic material. Very low light intensity is often prevailing in this biotope type. The three localities of heather consisted mainly of plants like *Juniperus communis* L., *Calluna vulgaris* L., *Erica tetralix* L., *Salix aurita* L., *Arctostaphylos uva-ursi* (L.) Spreng., *Empetrum nigrum* L., *Molinia coerulea* (L.) Moench., *Potentilla erecta* L., *Vaccinium vitis-idaea* L. and mosses. The soil was hard or moist. High light intensity and scanty dead organic material is typical for these biotopes. Plant names follow Lid (1974).

Four morphological characters studied were measured and analyzed as described below and the results are shown in Tables 2-5. Body length was measured dorsally from the anterior edge to the most posterior point, the movable cheliceral finger length was measured from the most distant points (Figure 2), the pedipalpal tarsal length includes the claw and the femoral length of 2nd walking leg is the maximum length of the segment. All measures are in mm. The sizes of the movable cheliceral finger and the pedipalpal tarsus have not previously been reported.

Means ($\hat{Y}$), upper and lower limits ($L_{1,2}$), here called ranges with 95 % confidence, standard deviations (± SD), variances, observed sample sizes (n_1) and computed sample sizes (n_2) needed for a statistical test are presented in Tables 2-5. Comparisons among pairs of means were performed using the statistical GT2- method as the observed sample sizes (n_1) were very unequal. A pair of means is declared significantly different if

$$| \hat{y}_i - \hat{y}_j | \geq MSD_{ij}.$$

$$MSD_{ij} = m_{\alpha[K^*,v]} (s^2 \hat{y}_i + s^2 \hat{y}_j)^{1/2}$$

where MSD is the minimum significant difference, and m is the studentized maximum modulus, a constant for a given problem which is found in a table (Rohlf & Sokal 1981). The statistical formulas and the GT2- method applied follow (Sokal & Rohlf 1981, Rohlf & Sokal 1981).

RESULTS AND DISCUSSION

Distribution

In addition to localities from the literature mentioned in the Introduction and the fieldwork in 1997, *L. ephippiatus* has been collected at the following localities, based on material from the Zoological Museums in Bergen and Oslo. The county divisions follow Økland (1981).

Material at the Zoological Museum, University of Bergen: **HOY** Bergen (EIS 31), Os (EIS 31), Haus (EIS 40), Stord (EIS 22). **HOI** Kvinnherad (EIS 31), Strandebarm (EIS 31), Voss (EIS 41). **RY** Tysvær (EIS 14), Sandnes (EIS 7), Nærbø (EIS 7). **RI** Sauda (EIS 24). **TEI** Seljord (EIS 17). **VE** Tjøme (EIS 19). **SFI** Aurland (EIS 51). **MRI** Rindal (EIS 91). **STI** Byneset (EIS 92), Selbu (EIS 92). **NTI** Snåsa (EIS 101), Steinkjer (EIS 101). **NSI** Nordrana (EIS 127), Beiarn (EIS 127). **NNV** Moskenes (EIS 133).

Material at the Zoological Museum, University of Oslo: **Ø** Rygge (EIS 20).

Based on these localities and the literature (Novak et al. 1995, Agnarsson 1998, Farzalieva & Esyunin 1999, Novak & Gruber 2000, Stol 2002b, 2003) the presently known distribution of *L. ephippiatus* in Norway and the rest of Europe is presented in Figure 1b.

Thydsen Meinertz (1962) reported the species from Iceland. As a result of this, Stol (1993, 2002b, 2003) also mentioned *L. ephippiatus* from Iceland. Here, however, one follows Agnarsson (1998) who does not mention *L. ephippiatus* from this country. According to Agnarsson (1998) four species of harvestmen are reported from Iceland; *Nemastoma bimaculatum* (Fabricius, 1775), *Mitopus morio* (Fabricius, 1779), *Oligolophus tridens* (C. L. Koch, 1836) and *Megabunus diadema* (Fabricius, 1779).

Biotopes

A survey of the localities and biotopes studied in 1997 is presented in Figure 1a and Table 1. *L. ephippiatus* was taken in all seven biotopes and was found to prefer the garden (Loc. 4) with a mean of 25.2 specimens per trap, next to coniferous wood (Loc. 8) and mixed wood (Loc. 1). The two other localities of coniferous woods (Loc. 5 and 7), however, had only dead pine needles and spruce needles on the ground, and for this

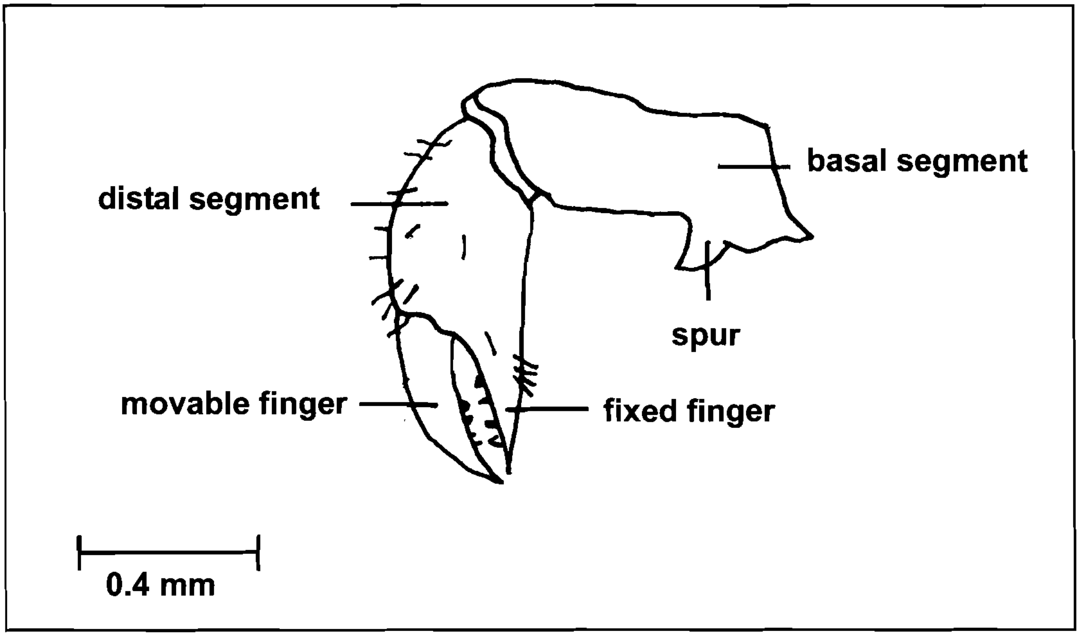

Figure 2. Lateral view of the chelicer of *Lacinius ephippiatus* showing the different parts.

Table 2. Body length of *Lacinius ephippiatus* with means, standard deviations (SD), ranges, variances and observed sample sizes (n_1). Computed sample sizes (n_2) > 7 of females and > 12 of males. Measures in mm.

Loc. no.	Locality	Mean	± SD	Range	Variance	n_1
			Females			
10	Mjåvatn	4.88	0.81	3.97 - 5.79	0.663	9
8	Blikshavn	4.96	0.52	4.82 - 5.11	0.268	90
6	Raunane	5.10	0.63	4.36 - 5.65	0.391	10
14	Dr. Jensens Minde	5.20	0.65	4.81 - 5.59	0.426	22
1	Fransahagen	5.22	0.56	5.10 - 5.39	0.309	78
5	Sandvatn	5.38	0.56	5.10 - 5.74	0.312	20
7	Stiklene	5.39	0.54	4.91 - 5.88	0.293	12
9	Snørteland	5.39	0.54	5.12 - 5.67	0.292	30
12	Sandve	5.56	0.49	5.10 - 6.11	0.239	9
4	Stol	5.78	0.44	5.67 - 5.89	0.192	109
3	Stava	5.84	0.57	5.41 - 6.28	0.326	15
2	Stavasanden	5.97	0.62	5.71 - 6.22	0.381	43
			Males			
8	Blikshavn	3.73	0.31	3.56 - 3.91	0.094	24
1	Fransahagen	3.78	0.29	3.42 - 4.14	0.086	8
9	Snørteland	4.10	0.30	3.78 - 4.22	0.092	16
3	Stava	4.10	0.35	3.75 - 4.34	0.119	13
4	Stol	4.13	0.29	3.93 - 4.33	0.082	17
2	Stavasanden	4.15	0.28	3.86 - 4.43	0.076	10

reason very few specimens were collected. Hillyard & Sankey (1989) reported that the species mainly prefer deciduous wood in Great Britain. In the present study, deciduous wood (Loc. 9) was the fifth best preferred biotope, whereas the poorest biotope was heather (Loc. 6, 10 and 13) with approximately 2.5 individuals per trap.

L. ephippiatus is a hygrophilous, ground living and a very euryecious species (Martens 1978, Stol 1982, 2002a, 2003, Hillyard & Sankey 1989). In Norway it is reported to approximately 300-400 m a. s. l., whereas in the Alps it reaches an elevation of up to 1650 m a. s. l. (Martens 1978, Stol 2000). *L. ephippiatus* is active during the summer with a top in density in July and August (Thydsen Meinertz 1964b, Stol 1982, 2002a, 2003). Hillyard & Sankey (1989) reported that in a good season in Great Britain some individuals may mature as early as in the month of May.

Morphology

The mean measures of the body length, the femoral length of the 2nd walking leg, the movable cheliceral finger length and the pedipalpal tarsal length and their ranges are presented in Tables 2-5.

In some cases the computed sample sizes (n_2) needed for a statistical test became greater than the observed sample sizes (n_1). In these cases the corresponding means in Tables 2-5 could not be used in the GT2- tests. Of approximately 300 comparisons among pairs of means nearly 110 were significantly different. These are presented below and the localities refer to the ranked means in Tables 2-5. The GT2-method could not be applied on movable cheliceral finger length in males as the computed sample sizes (n_2) were too great.

Table 3. Femoral length of 2nd walking leg of *Lacinius ephippiatus* with the same calculations as in Table 2. Computed sample sizes (n_2) > 2 of females and > 15 of males. Measures in mm.

			Females			
Loc. no.	Locality	Mean	± SD	Range	Variance	n_1
2	Stavasanden	3.13	0.18	3.10 - 3.18	0.031	82
14	Dr. Jensens Minde	3.16	0.24	3.10 - 3.26	0.059	44
12	Sandve	3.21	0.26	3.10 - 3.39	0.068	18
4	Stol	3.24	0.21	3.20 - 3.27	0.042	204
3	Stava	3.28	0.18	3.19 - 3.37	0.034	30
8	Blikshavn	3.30	0.19	3.26 - 3.33	0.034	178
1	Fransahagen	3.33	0.19	3.28 - 3.37	0.038	152
10	Mjåvatn	3.38	0.62	2.92 - 3.84	0.389	16
9	Snørteland	3.41	0.22	3.33 - 3.48	0.046	60
5	Sandvatn	3.47	0.25	3.36 - 3.57	0.064	40
7	Stiklene	3.62	0.18	3.52 - 3.72	0.032	24
6	Raunane	3.71	0.15	3.61 - 3.80	0.023	20
			Males			
3	Stava	3.36	0.16	3.27 - 3.44	0.024	26
2	Stavasanden	3.37	0.15	3.27 - 3.46	0.021	20
8	Blikshavn	3.50	0.23	3.41 - 3.59	0.052	46
4	Stol	3.51	0.29	3.36 - 3.65	0.086	32
1	Fransahagen	3.52	0.23	3.35 - 3.69	0.052	16
9	Snørteland	3.61	0.22	3.50 - 3.72	0.050	32

Regarding body length (Table 2), specimens of both sexes from coniferous wood and heather were significantly smallest, whereas specimens of both sexes from the beach were significantly largest. At the beach, the rich and high vegetation at the grass-limit possibly harbors much food, such as insects, which could explain the large body size of *L. ephippiatus*. In the coniferous wood, vegetation and food were sparse, and for this reason the animals may have a smaller body size. In the females (Table 2), the following means are significantly different: Loc. 10 from Loc. 4, 3 and 2; Loc. 8 from Loc. 9, 4, 3, 2; Loc. 6 from Loc. 4, 3, 2; Loc. 14 from Loc. 4, 3, 2; Loc. 1 from Loc. 4, 3, 2; Loc. 5 from Loc. 2; Loc. 9 from Loc. 4, 2. Considering body length in the males, the only significant difference is found in Loc. 8, which is significantly different from all other locations.

Considering the length of femur of 2nd walking leg (Table 3), specimens of both sexes from the beach were among the smallest in size, whereas specimens from heather and deciduous wood showed the largest measures. In the females (Table 3), the following means are significantly different: Loc. 2 from Loc. 3, 8, 1, 10, 9, 5, 7, 6; Loc 14 from Loc. 8, 1, 10, 9, 5, 7, 6; Loc. 12 from Loc. 9, 5, 7, 6; Loc. 4 from Loc. 1, 9, 5, 7, 6; Loc. 3 from Loc. 5, 7, 6; Loc. 8 from Loc. 9, 5, 7, 6; Loc. 1 from Loc. 5, 7, 6; Loc. 10 from Loc. 7, 6; Loc. 9 from Loc. 7, 6; Loc. 5 from Loc. 6. Regarding the femoral length of the 2nd walking leg in males, the following means are significantly different: Loc. 3 only from Loc. 9; Loc. 2 only from Loc. 9.

The length of the movable cheliceral finger (Table 4) was smallest in specimens from heather, largest in females from grazing land, smallest in specimens from mixed wood and greatest in males at the beach. In the females, the following means are significantly different: Loc. 10 from all localities; Loc. 14 from Loc. 8 and upwards with the

Table 4. Movable cheliceral finger length of *Lacinus ephippiatus* with the same calculations as in Table 2. Computed sample sizes (n_2) > 4 of females and > 107 of males. Measures in mm.

Loc. no	Locality	Mean	± SD	Range	Variance	n_1
			Females			
10	Mjåvatn	0.40	0.07	0.35 - 0.45	0.005	18
14	Dr. Jensens Minde	0.47	0.05	0.45 - 0.49	0.003	44
12	Sandve	0.50	0.04	0.47 - 0.53	0.002	18
8	Blikshavn	0.50	0.03	0.50 - 0.51	0.001	180
6	Raunane	0.50	0.03	0.48 - 0.53	0.001	20
9	Snørteland	0.50	0.03	0.49 - 0.51	0.001	60
7	Stiklene	0.51	0.05	0.48 - 0.53	0.002	24
2	Stavasanden	0.51	0.03	0.50 - 0.52	0.001	86
1	Fransahagen	0.51	0.03	0.51 - 0.52	0.001	154
4	Stol	0.51	0.03	0.51 - 0.52	0.001	218
5	Sandvatn	0.52	0.03	0.50 - 0.53	0.001	40
3	Stava	0.53	0.03	0.51 - 0.54	0.001	30
			Males			
1	Fransahagen	0.42	0.03	0.39 - 0.44	0.001	16
8	Blikshavn	0.42	0.03	0.41 - 0.43	0.001	48
3	Stava	0.42	0.05	0.40 - 0.45	0.002	26
9	Snørteland	0.42	0.03	0.41 - 0.44	0.001	32
4	Stol	0.43	0.03	0.41 - 0.44	0.001	34
2	Stavasanden	0.43	0.03	0.41 - 0.45	0.001	20

increasing means in the localities; Loc. 12 from none of the localities; Loc. 8 from Loc. 3, 4.

Both the smallest and the largest pedipalpal tarsal length (Table 5) were found in the females from the heather, whereas the length in the males showed the smallest size in specimens from mixed wood and greatest size in specimens from the beach. In the females the following means are significantly different: Loc. 10 from all other locations; Loc. 14 from Loc. 8, 9, 12, 5, 6; Loc. 1 from Loc. 5, 6; Loc. 2 from Loc. 5, 6; Loc. 4 from Loc. 5, 6. Regarding the pedipalpal tarsal length in males the following means are significantly different: Loc. 1 only from Loc. 2; Loc.9 only from Loc. 2.

The measures of the last three characters most probably must be considered to be genetically based and not a result of different environmental conditions, as may be the case with the body size. Almost all characters were smallest in females from heather, whereas almost all characters in the males were largest in specimens from the beach (Tables 2-5).

Measurements of body length in females and males of *L. ephippiatus* from Central Europe showed ranges of 4.5 - 4.8 mm and 3.7 - 4.3 mm, respectively (Martens 1978). Hillyard & Sankey (1989) found ranges of 4.5 - 5.5 mm and 3.5 -4.5 mm in females and males, respectively, from Great Britain. Martens (1978) also found mean femoral length of 2nd walking leg to be 3.6 mm in females and 4.1 mm in males. All these figures are within the range and variation of the present study, suggesting that there are no geographical differences.

Concerning the chelicera of *L. ephippiatus*, Jürgen Gruber (pers. comm.) points out that a small retrolateral or backwardly directed tooth on the side on the movable finger (not shown in Figure

Table 5. Pedipalpal tarsal length of *Lacinius ephippiatus* with the same calculations as in Table 2. Computed sample sizes (n_2) > 6 of females and > 13 of males. Measures in mm.

Loc no.	Locality	Mean	± SD	Range	Variance	n_1
			Females			
10	Mjåvatn	1.15	0.18	1.03 - 1.27	0.031	18
14	Dr. Jensens Minde	1.30	0.08	1.27 - 1.34	0.006	42
1	Fransahagen	1.33	0.05	1.32 - 1.34	0.002	156
2	Stavasanden	1.33	0.06	1.32 - 1.35	0.003	86
4	Stol	1.34	0.06	1.32 - 1.35	0.003	216
8	Blikshavn	1.35	0.06	1.34 - 1.36	0.003	180
3	Stava	1.35	0.05	1.32 - 1.38	0.003	30
9	Snørteland	1.35	0.06	1.33 - 1.37	0.003	60
7	Stiklene	1.35	0.06	1.32 - 1.39	0.003	24
12	Sandve	1.37	0.11	1.30 - 1.44	0.011	18
5	Sandvatn	1.38	0.07	1.35 - 1.41	0.005	40
6	Raunane	1.39	0.06	1.35 - 1.43	0.004	20
			Males			
1	Fransahagen	1.21	0.05	1.18 - 1.25	0.003	16
9	Snørteland	1.23	0.05	1.20 - 1.25	0.002	32
8	Blikshavn	1.24	0.04	1.22 - 1.26	0.002	48
3	Stava	1.25	0.06	1.22 - 1.28	0.004	26
4	Stol	1.25	0.04	1.23 - 1.27	0.002	34
2	Stavasanden	1.27	0.03	1.25 - 1.29	0.001	20

2), is a good character to separate adults males from males of *Oligolophus tridens* (C. L. Koch, 1836).

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