

# NORSK

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# Larvae of the Norwegian Species of *Phryganea* and *Agrypnia* (Trichoptera, Phryganeidae)

JOHN O. SOLEM

Solem, J. O. 1971. Larvae of the Norwegian Species of *Phryganea* and *Agrypnia* (Trichoptera, Phryganeidae). *Norsk ent. Tidsskr.* 18, 79-88.

A taxonomic study of the Norwegian larvae of the genera *Phryganea* and *Agrypnia* has been carried out. Five species, *Phryganea grandis* L., *P. bipunctata* (Retzius), *Agrypnia obsoleta* (Hagen), *A. varia* (Fabricius), and *A. pagetana* Curtis, were available from Norwegian collections, while larvae of *A. picta* Kolenati could only be obtained from Finland. The study showed that coxal combs on the coxa of the first and second pair of legs have taxonomical value at both the generic and the species level. A key to the species is provided.

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Six species of the genera *Phryganea* and *Agrypnia* have been recorded in Norway, and, following the nomenclature of Botosaneanu (1967), the species are: *Phryganea grandis* L., *P. bipunctata* (Retzius) (*P. striata* L.), *Agrypnia obsoleta* (Hagen) (*Phryganea obsoleta* Hagen), *A. pagetana* Curtis, *A. picta* Kolenati, and *A. varia* (Fabricius) (*Phryganea varia* (Fabricius)).

Recent studies in North America (Wiggins 1960) and Britain (Bray 1967) have shown that taxonomic features other than those used by Silfenius (1904), Ulmer (1909), Esben-Petersen (1916), and Lestage (1921) have validity in the identification of the larvae. The purpose of the present study was to study these taxonomic characters in the larvae of Norwegian Phryganeidae. The Norwegian material also appeared to show sufficient variation to invalidate certain characters used in the keys made by Ulmer (1909), Esben-Petersen (1916), Lestage (1921), and Hickin (1967).

## MATERIAL

Specimens of all species except *Agrypnia picta* have been available from Norwegian collections. However, the Entomological Department of the Zoological Museum, Helsinki, Finland, has kindly lent me three specimens of *A. picta*.

Below is a list with number of larvae and the localities from which morphological examinations of larvae have been carried out. Abbreviations used for the counties follow that of Strand (1943).

*Phryganea grandis*, about 90 specimens examined from the localities: VE: Borrevann, Borre; AK: Olsbusjøvann, Oslo; Padderuddvann, Asker; STi: Jonsvann, Trondheim.

*Phryganea bipunctata*, about 140 specimens examined from the localities: VE: Borrevann, Borre; STy: Isdammen and Stakslettjern, Agdenes; STi: Jonsvann, Trondheim; Fö: Pasvik, Sör-Varanger.

*Agrypnia obsoleta*, about 400 specimens examined from the localities: VE: Borrevann, Borre; AK: Tömte, Nannestad; HEn: Stor-sömmeltjern, Konandertjern, Storhestskotjern and Svarttjern, Engerdal; HOy: Blådalen and Ånuglo, Tysnes; HOi: Finse, Ulvik; STy: Isdammen and Stakslettjern, Agdenes; STi: Klokkertjern, Bangtjern and Jonsvann, Trondheim; Målsjöen, Klæbu; NTi: Dyenvann and Reintjern, Steinkjer; Fö: Elnvann, Sör-Varanger; Gargia fjellstue, Alta.

*Agrypnia varia*, 9 specimens examined from the localities: VE: Borrevann, Borre; AK: Tömte, Nannestad; HOy: Åsane, Byrkjeland, Fana; Småtjern at Haukenes, Samnanger; Ånuglo, Tysnes.

*Agrypnia pagetana*, 6 specimens examined from the localities: HEn: Storsömmeltjern, Engerdal; HOy: Istatjern, Samnanger; HOi: Blådalen, Kvinnherad; STi: (Gammelvoll-sjöen?), Tydal; Fö: Pasvik, Sör-Varanger.

#### DESCRIPTION OF LARVAE

Larvae belonging to the family Phryganeidae can be distinguished from all other larvae of Trichoptera by the following features.

1. On the thorax only pronotum is heavily sclerotized. Meso- and metanotum are membranous, except for a pair of plates on the anterior dorsolateral region. Each plate has a tuft of long setae.

2. The abdomen has a well-marked lateral line extending from the third to the eighth segment, and a maximum of six single gills on each side of each segment. The posterior lateral gills are covered with hair.

3. The cases are built of fragments of stems and leaves, arranged longitudinally in a typical pattern to form a cylinder.

4. The head has an obtuse angled position in relation to the thorax and abdomen.

5. The habitat of the larvae is still water and slowly running water.

*Head* (Figs. 1,2,3,4,5, and 6). The dorsal surface of the head has three brown to black bands. On the clypeus there is a median band extending from the oral towards the aboral end. On the genae two bands, one on each side of the clypeus, run from the anterior margin to the cervical region, where they almost meet. Lateral bands are present on the genae. The species *Agrypnia obsoleta* and *A. varia* also have two brown bands on the ventral surface (Fig. 7b). These ventral bands are absent in the other species (Fig. 7a). The basic color of the head is yellow.

The median band of the clypeus varies greatly and is of no value in the identification of the species in the gen. *Phryganea*. In the gen. *Agrypnia*, the median band is used as a taxonomic feature to separate the species *A. pagetana* and *A. picta*. Another distinctive character present in the examined specimens of

*A. pagetana* and *A. picta* is the lateral bands. In *A. picta* the lateral bands are nearly twice as broad as in the examined specimens of *A. pagetana* (Figs. 8 and 9).

The dark bands on the ventral surface of the head of *A. obsoleta* are nearly always present, but they may be absent or not distinctly marked. Sufficient material to check this point in *A. varia* has not been available.

As pointed out by Silfenius (1902) a reliable character to separate *P. grandis* and *P. bipunctata* is the pale patch on the anterior margin of the labrum. This pale patch is larger in *P. grandis* than in *P. bipunctata* (Fig. 10). The mid-anterior pale patch extends almost to the base of the two bristles in *P. grandis*, which is not the case in *P. bipunctata*, and, as Fig. 10 shows, the shape of the pale patch is somewhat different in the two species. In *P. bipunctata* the size of the pale mid-anterior patch has been found to vary greatly, and Fig. 10 is drawn from one of the largest pale patches found.

*Thorax* (Figs. 1, 2, 3, 4, 5, and 6). Only pronotum is sclerotized, and it has two sclerotized plates divided by a median longitudinal suture. In the gen. *Phryganea* and the species *Agrypnia obsoleta* and *A. varia*, a conspicuous dark band runs along the anterior margin of the pronotum. *A. pagetana* and *A. picta* have two distinct brown bands or patches on the anterior region. The posterior margin of pronotum is dark, and the middle region is yellow, which is also the basic color. On the ventral side of the prothorax, and between the coxae of the forelegs, is a prosternal horn. In the gen. *Agrypnia* there is also a sclerotized patch called sternellum (Fig. 11). In *Phryganea* the sternellum is absent. This is a valuable generic feature, which may be used from the second instar on.

The meso- and metanotum are membranous, with only two small sclerotized patches situated on the anterior dorsolateral region, and they are furnished with several setae.

*Abdomen*. The abdomen varies in color, and may be whitish, reddish, or greenish. In

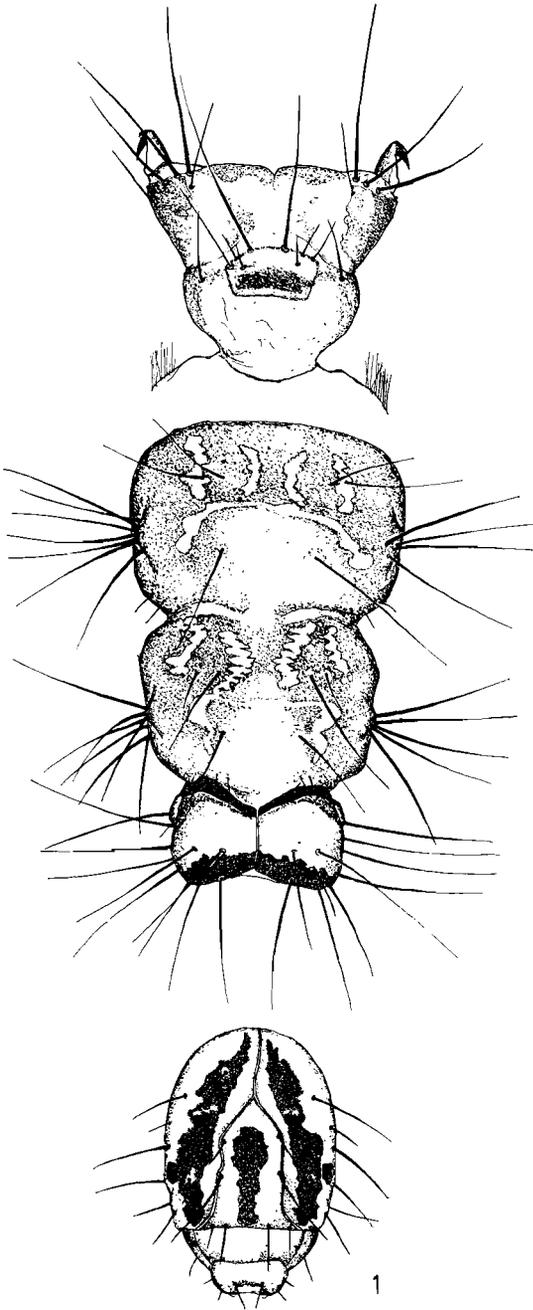


Fig. 1. Dorsal view of head, thorax, and last abdominal segments of larva of *Phryganea bipunctata*.

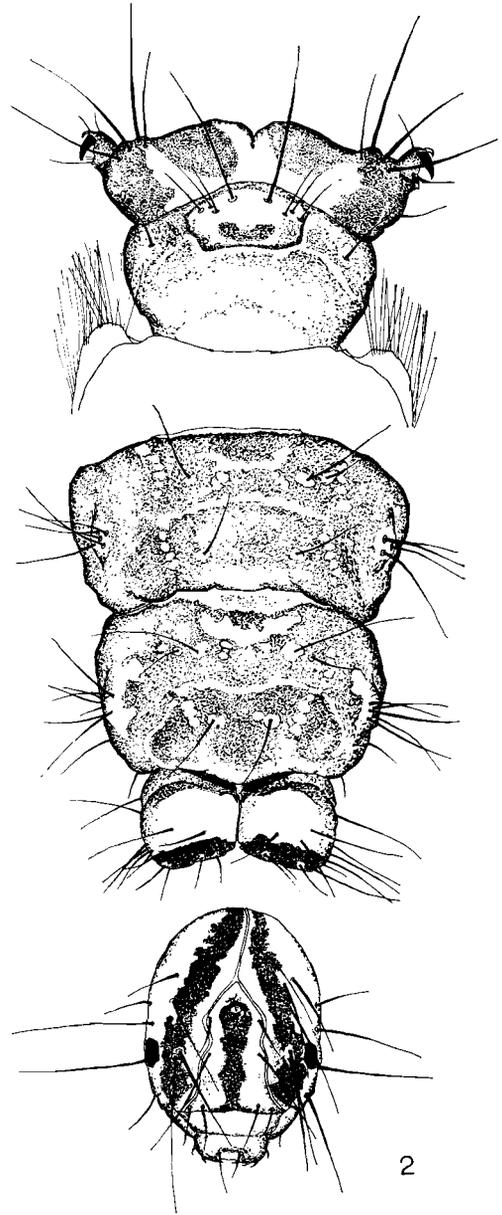


Fig. 2. Dorsal view of head, thorax, and last abdominal segments of larva of *Phryganea grandis*.

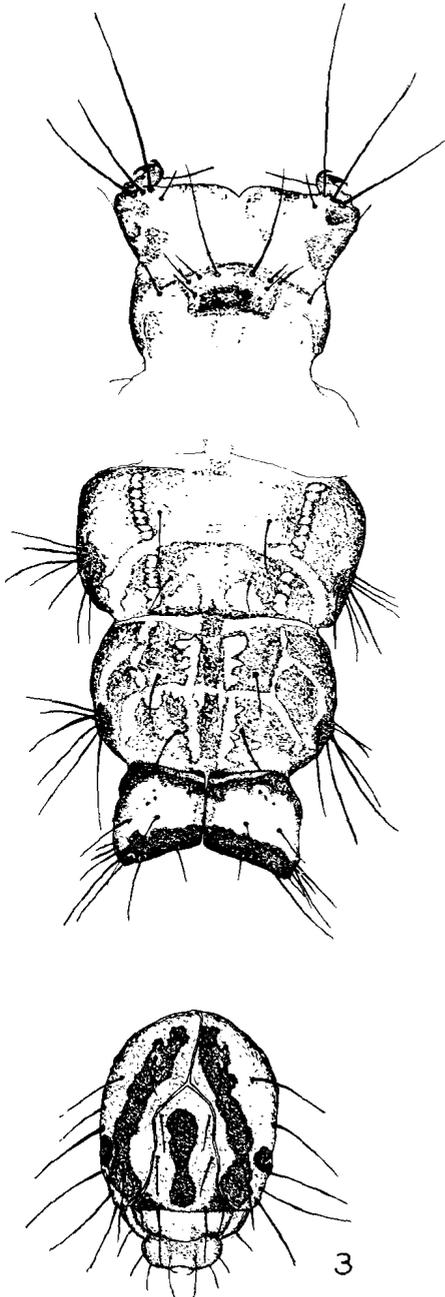


Fig. 3. Dorsal view of head, thorax and last abdominal segments of larva of *Agrypnia obsoleta*.

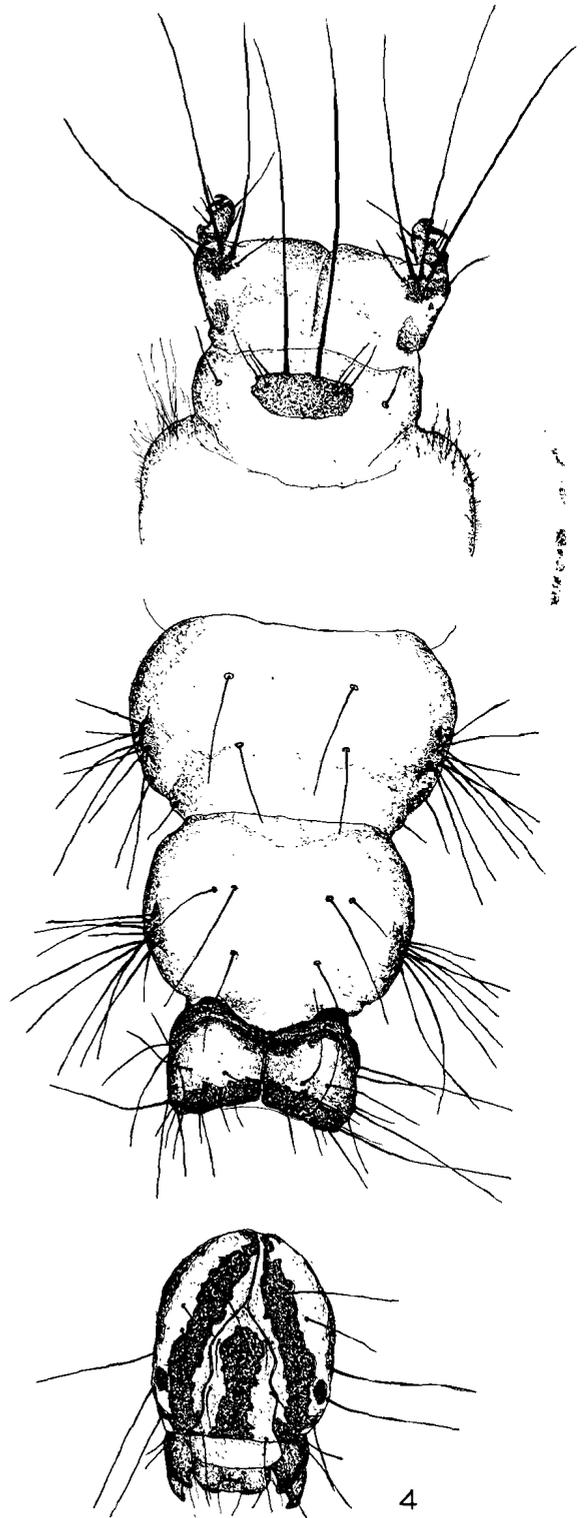


Fig. 4. Dorsal view of head, thorax, and last abdominal segments of larva of *Agrypnia varia*.

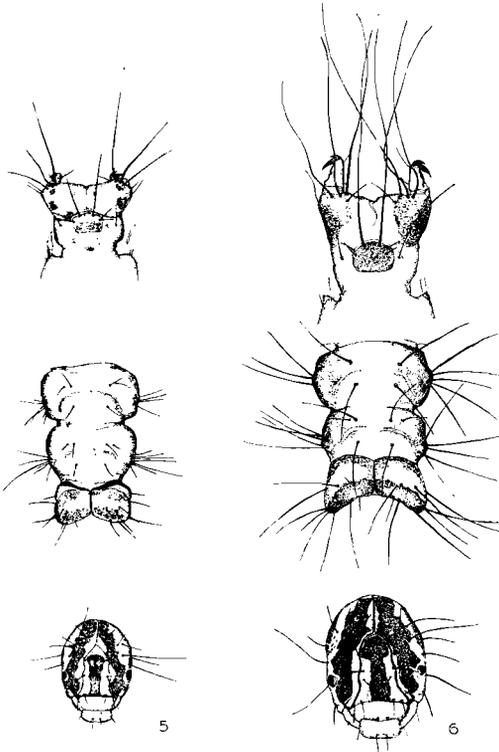


Fig. 5. Dorsal view of head, thorax, and last abdominal segments of larva of *Agrypnia pagetana*.

Fig. 6. Dorsal view of head, thorax, and last abdominal segments of larva of *Agrypnia picta*.

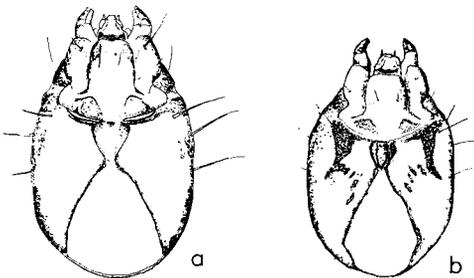


Fig. 7. Ventral view of head of *Phryganea bipunctata* (a) and *Phryganea grandis* (b).

*Phryganea*, gills are present on the segments one to eight. The gill formula for *P. bipunctata* is usually  $2 + 6 + 6 + 6 + 6 + 6 + 6 + 3 = 41$ , while that of *P. grandis* is usually  $2 + 6 + 6 + 6 - 6 - 6 + 6 + 2 = 40$ .

As the gill formulas show, *P. bipunctata* and *P. grandis* have the same number of gills on segments one to seven. On segment eight, *P. bipunctata* has gills on the ventral, lateral, and dorsal sides all situated on the anterior region. *P. grandis* normally has only the ventral and lateral gills. Dorsal gills may be present in some cases, but in the Norwegian material examined in this study they were seldom found. This is in agreement with Silfenius (1902) but is opposite to Bray (1967), who in British larvae of *P. grandis* found the ventral gills to be absent and the dorsal to be present. The lateral gills on the eighth segment are always present. These results are not in agreement with the keys made by Ulmer (1909) and Esben-Petersen (1916).

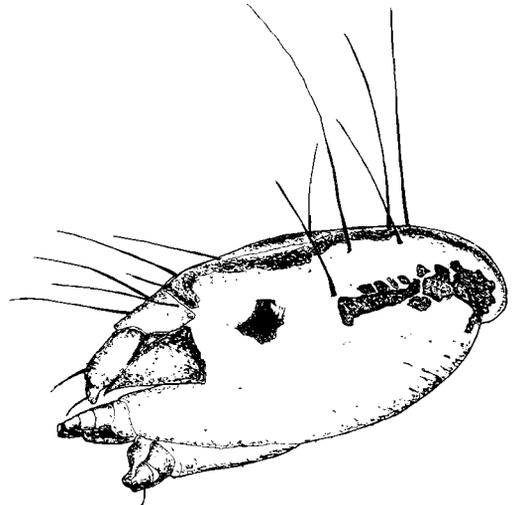


Fig. 8. Lateral view of head of *Agrypnia pagetana*.

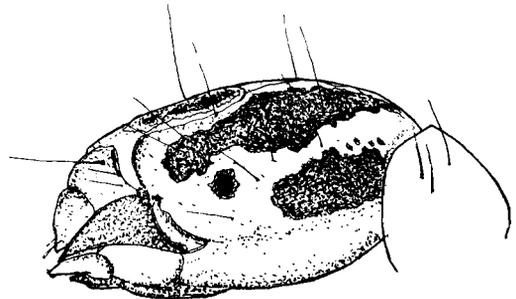


Fig. 9. Lateral view of head of *Agrypnia picta*.

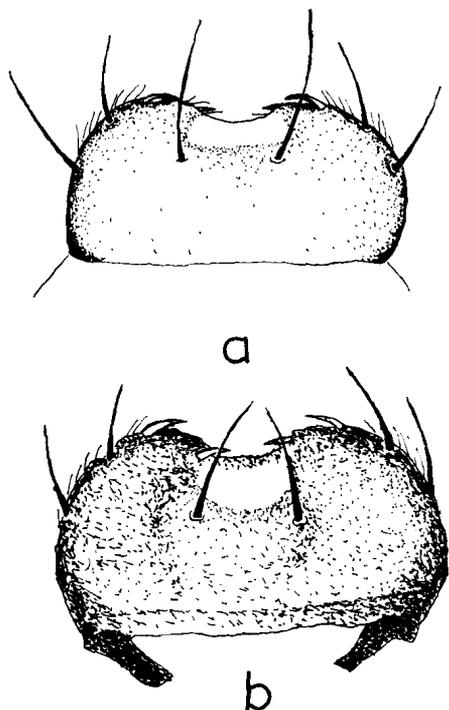


Fig. 10. Dorsal view of labrum of *Phryganea bi-punctiata* (a) and *Phryganea grondis* (b).

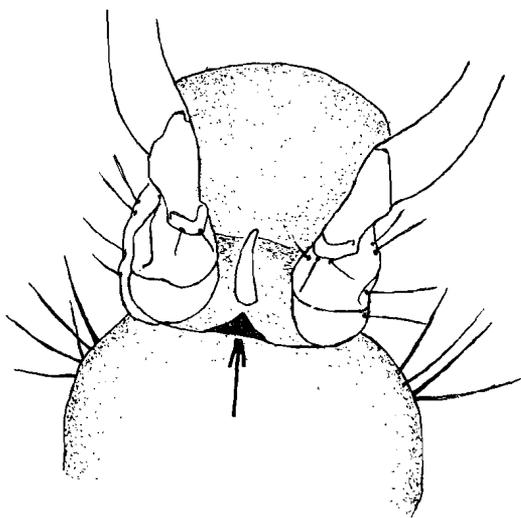


Fig. 11. Ventral view of prothorax of *Agrypnia obsoleta*, with the sternellum, indicated by the arrow, and the prosternal horn.

The full-grown larvae of *A. varia* and *A. obsoleta* may be separated by the gills. In *A.*

*varia*, the gills are usually reduced on several of the last dorsal segments, and no gills are to be found on the eighth segment. In *A. obsoleta*, the gills are usually fully developed on segments one to seven, and on segment eight the lateral gills are always present, and usually those on the dorsal side as well. On the ventral side no gills have been found.

According to Silfenius (1904) and Siltala (1907), the gills are not a reliable feature for separating *A. paigetana* and *A. picta*. When considering *A. paigetana*, the studies of Siltala (1907) and Bray (1967) agree very closely with respect to the gill arrangement on the few full-grown larvae examined from Norway. The number of gills on segments six and seven varies considerably, and the anteriolateral gill on segment eight may be absent. The variations described by Siltala (1907) and Bray (1967) can also be attributed to the Norwegian larvae.

**Coxal combs.** The coxal combs are comb-like sclerotized structures situated on the coxa of the legs of the phryganeid larvae. They are well developed on the first and second pairs of legs in the genera *Phryganea* and *Agrypnia*, and are visible even under moderate magnification ( $\times 50 - \times 100$ ). In the other genera of the fam. Phryganeidae, the coxal combs are very small and can only be seen under magnification of  $\times 450$  or more (Wiggins 1960).

The coxal combs are teeth fastened together basally and rising at an angle from the surface of the coxa. Their size varies greatly, from small thin raised points to large well-developed combs, and when using them as a taxonomic character it must be pointed out that references are made to the most well-developed combs.

The coxal combs were mentioned as belonging to the larvae of the phryganeids by Silfenius (1902), who called them 'Spitzenkämme', but they were introduced for the first time into a key of North American species by Wiggins (1960). Later, they were used in a key to the British species by Bray (1967).

According to Wiggins (1960) and Bray (1967), the coxal combs of larvae belonging to the gen. *Phryganea* are strongly developed on

both the first and second pair of legs, while in the gen. *Agrypnia* they are much less strongly developed on the second than on the first pair of legs. This feature cannot always be used on Norwegian material because in most larvae of *P. bipunctata* the coxal combs on the second pair of legs are less strongly developed than on the first pair of legs.

However, examination of the Norwegian species of the gen. *Phryganea* and *Agrypnia* has shown that the position of the coxal combs is a reliable feature for an identification at the generic level, and for the species *P. grandis*, *P. bipunctata*, *A. obsoleta*, and *A. varia*, at the species level as well. In the gen. *Phryganea*, the coxal combs, on both the first and second pair of legs, are fastened to the coxa in a transverse position in relation to the longitudinal axis of coxa (Fig. 12). In the gen. *Agrypnia*, the coxal combs on the first pair of legs are fastened in a transverse position, while on the second pair of legs they have both a transverse and a longitudinal, or only a longitudinal, position in relation to the longitudinal axis of the coxa (Fig. 13).

When searching for features at the species level, the present material was too small to find differences between the larvae of *A. picta* and *A. pagetana*. However, in the rest of the material the coxal combs showed specific features at the species level.

In the gen. *Phryganea*, the species *P. bipunctata* has well-developed coxal combs on the first pair of legs in fairly straight rows, the number of rows being between two and four (Fig. 12a), and they are situated more or less along the extreme posteroventral edge of the coxa. This also applies to the second pair of legs, where the coxal combs may be smaller than that on the first pair of legs. In *P. grandis*, there are usually more than four rows of coxal combs, and they are of the same size on both the first and second pair of legs. Usually the rows are much more irregular and cover a broader area than in *P. bipunctata* (Fig. 12b).

The specific features of the coxal combs, useful for identifying *A. obsoleta* and *A. varia*, are to be found on both the first and second pairs of legs. In *A. varia* the combs are more

concentrated along the extreme posteroventral edge than in *A. obsoleta*. The differences are very conspicuous on the first pair of legs (Fig. 13a, c), where the well-developed combs in *A. varia* are concentrated in two or three rows, while in *A. obsoleta* they make up more rows, are more irregularly situated, and cover a broader area on the coxa. Normally, the combs on the second pair of legs in *A. obsoleta* are fastened longitudinally or together with an intermediate position between the longitudinal and transverse (Fig. 13b), while those of *A. varia* are orientated both longitudinally and transversely.

In *A. varia* the area of the coxa of the second pair of legs which is covered with combs in the transverse position (Fig. 13d), varies greatly, but in all the larvae examined, well developed coxal combs in the transverse position have been present in the area nearest to femur. In this area a few combs in the transverse position have also been found in a very few larvae of *A. obsoleta*. In spite of these similarities between a few larvae of *A. varia* and *A. obsoleta*, the coxal combs are an important feature in the identification of the species when studied on both the first and second pairs of legs.

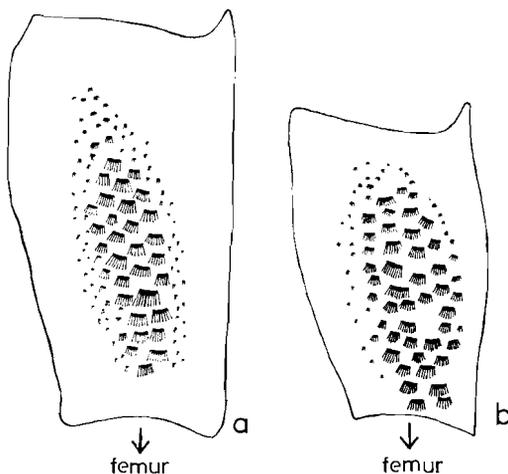


Fig. 12. Coxa of the right prothoracic leg of *Phryganea bipunctata* (a) and *Phryganea grandis* (b), showing the coxal combs and their position.

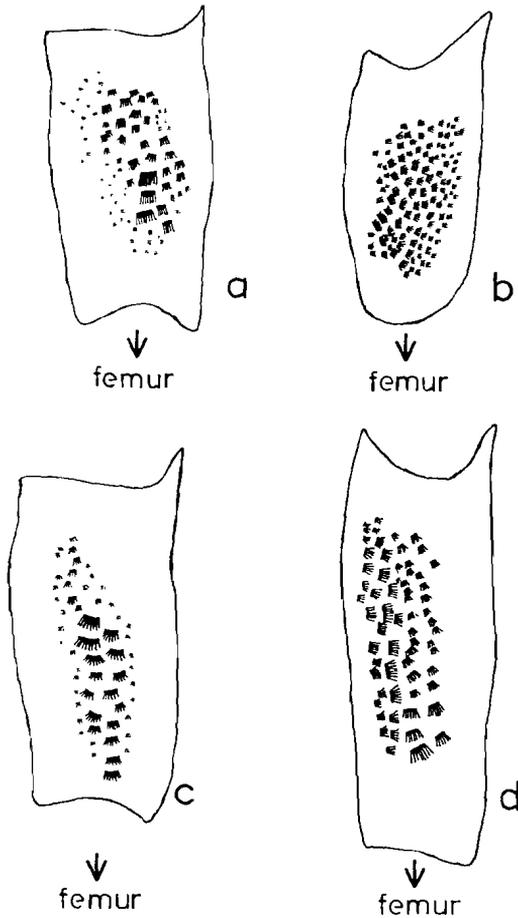


Fig. 13. Coxa of the right pro- and mesothoracic legs of *Agrypnia obsoleta* (a and b), and *Agrypnia varia* (c and d), showing the coxal combs and their position.

#### DISCUSSION ON TAXONOMIC FEATURES

The taxonomic features used in the key are most clearly seen in the fourth and fifth larval instars. Investigations of the first instar larvae of *P. bipunctata* and *A. obsoleta* showed that the generic and species features given in the key are of no value. In spite of this, the two-species showed differences that may be used at the generic level, with respect to the markings on the head (Fig. 14). The markings of the first instar larvae of *P. bipunctata* and *A. obsoleta* are restricted to the aboral part of the head, and in *P. bipunctata* these markings are dark brown and distinct, while those of *A.*

*obsoleta* are light brown and fairly indistinct. These differences are also to be found in the second instar larvae, but the markings have by then extended to the oral part of clypeus and genae. In the second larval instar the sternellum and the coxal combs can also be seen.

The specific species features of the coxal combs of *P. bipunctata* and *P. grandis* are not clearly seen before the larvae reach the third instar, and this probably applies to the species *A. obsoleta* and *A. varia*. When the gills, which are an important feature in the identification of *A. obsoleta* and *A. varia*, are used as taxonomic features, it is necessary to be very careful, because several larvae of *A. obsoleta* in the fourth instar had not developed the gills on the eighth segment. The only reliable character for the identification of *A. obsoleta* and *A. varia* below the fifth instar seems to be the coxal combs.

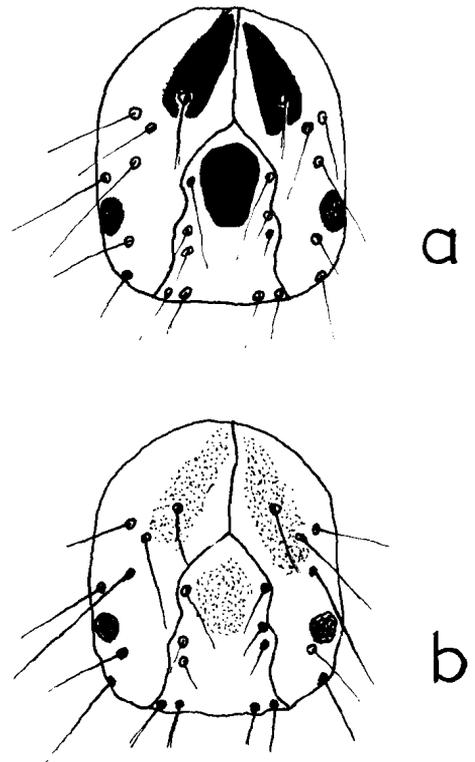


Fig. 14. Dorsal view of head of first instar larvae of *Phryganea bipunctata* (a) and *Agrypnia obsoleta* (b).

Although no small larvae of *A. picta* and *A. pagetana* were examined, the development of the head markings must be expected to follow that of *A. obsoleta*. According to this, the identification of *A. picta* and *A. pagetana* can be made in larvae, at least from the second instar on.

#### KEY TO THE LARVAE OF THE NORWEGIAN SPECIES OF *PHRYGANEA* AND *AGRYPNIA*

1. Coxal combs at the posteroventral edge of the pro- and mesothoracic coxae well developed and orientated only transversely (Fig. 12). No sternellum between the prothoracic coxae.....Genus *Phryganea*  
Coxal combs at the posteroventral edge of the prothoracic coxa orientated transversely. On the mesothoracic coxa, the combs are either longitudinally or both longitudinally and transversely orientated (Fig. 13). Sternellum between the prothoracic coxae present (Fig. 11)..... Genus *Agrypnia*

##### Genus *Phryganea*

1. Labrum with a small mid-anterior pale patch (Fig. 10a). Dorsal gills on eighth abdominal segment usually present. The well-developed coxal combs in 2 or 4 more or less regular rows along the posteroventral edge (Fig. 12a).....  
..... *Phryganea bipunctata* (Retzius)  
Labrum with larger mid-anterior pale patch (Fig. 10b). Often only one to two gills on the eighth abdominal segment. The dorsal gill usually absent. The well-developed coxal combs in 4 or more irregular rows along the posteroventral edge (Fig. 12b).....  
.....*Phryganea grandis* L.

##### Genus *Agrypnia*

1. A brown to black band running along the anterior margin of the pronotum (Figs. 3 and 4). On the ventral side of the head 2 dark bands (Fig. 7b). The coxal combs on the mesothoracic coxa almost of the same

size as that on the prothoracic coxa.....2  
Anterior region of the pronotum with two distinct brown patches of pigment (Figs. 5 and 6). No dark bands on the ventral side of the head. The coxal combs on the mesothoracic coxa smaller than that on the prothoracic coxa..... 3

2. Coxal combs on the prothoracic legs in more than 3 rows and irregularly situated. Normally the combs on the mesothoracic coxa are longitudinally orientated (Fig. 13a, b). Gills present on the eighth abdominal segment. Gills formula 2.6.6.6.6.6.1, (2) ..  
.....*Agrypnia obsoleta* (Hagen)  
Coxal combs on the prothoracic legs in 2 or 3 rows along the extreme posteroventral edge. On the mesothoracic coxa the combs are orientated both longitudinally and transversely (Fig. 13c, d). No gills on the eighth abdominal segment. The gills usually reduced on segments 5, 6 and 7.....  
..... *Agrypnia varia* (Fabricius)

3. Frontoclypeal band of uniform width or posteriorly very little widened (Fig. 5). Lateral bands on genae narrow (Fig. 8). Case a hollow stem or of usual type.....  
.....*Agrypnia pagetana* Curtis  
Frontoclypeal band very much widened posteriorly (Fig. 6). Lateral bands on genae broad (Fig. 9). Case of usual type.....  
.....*Agrypnia picta* Kolenati

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Received 15 May 1971

# Distribution of Prolonged Diapausing Larvae in Populations of *Laspeyresia strobilella* L. (Lep., Tortricidae) from Spruce Cones

ALF BAKKE

Bakke, A. 1971. Distribution of Prolonged Diapausing Larvae in Populations of *Laspeyresia strobilella* L. (Lep., Tortricidae) from Spruce Cones. *Norsk ent. Tidsskr.* 18, 89-93.

In the investigated populations of *Laspeyresia strobilella* (L.) some last instar larvae remained in diapause for nearly two years, whereas other larvae terminated the diapause during the first hibernation. Larvae in the same cone behaved differently with regard to duration of diapause, and larval density in the cones did not influence the percentage of larvae entering prolonged diapause. The percentage of larvae in prolonged diapause was significantly different in adjoining areas which varied in climate because of different elevation. Larvae which pupated after one hibernation were significantly heavier than larvae in prolonged diapause when weighed in autumn. The study is based on larvae taken out of the cones in autumn and stored individually in glass tubes under outdoor conditions.

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## INTRODUCTION

Cones of *Picea abies* in Northern Europe are often heavily infested with larvae of *Laspeyresia strobilella*. The larvae feed on seeds and cause great damage to the seed harvest. When the larvae are full-grown in July-August they enter a diapause which suppresses further development during the fall. Part of the population pupates and emerges the following spring when the spruce start pollinating. However, in some years a considerable percentage of the larvae enter prolonged diapause which lasts for a year or more.

Prolonged diapause is described in many cone insects from Europe and North America (Bakke 1963, Hedlin 1967). The observations indicate that the percentage of the population which enters the prolonged diapause varies from year to year and between localities. A connection between the percentage of larvae in prolonged diapause and the amount of cone

crops in certain years has previously been demonstrated (Bakke 1963). The factors which influence the mechanism of prolonged diapause in cone insects has not been clarified yet. The ecological aspects of prolonged diapause are comprehensive and have to be cleared up step by step. The present investigation intends to describe the distribution of prolonged diapausing larvae in individual cones and trees and at sites with different climates within the same area. Some results concerning the weight of larvae in different states of diapause were also obtained.

## MATERIAL AND METHODS

Cones of Norway spruce infested with larvae of *Laspeyresia strobilella* were collected in the autumns of 1967 and 1969. Table I gives the localities and the material collected.

Studies on cone insects have previously been carried out in the Fåvang area. The locality



Table III. Percentage of PD-larvae in cones with different larval density. Larval number in each group in parentheses

Locality	Year	No. of larvae per cone							Average
		1	2	3	4	5	6	6 <	
Granlia	1967	89 (186)	87 (172)	83 (132)	93 (56)	87 (15)	83 (6)	—	87
	1969	57 (103)	50 (206)	52 (339)	56 (356)	53 (285)	50 (192)	52 (254)	53
Grorudlia	1967	72 (199)	73 (204)	63 (126)	69 (88)	60 (10)	67 (12)	—	69
	1969	15 (150)	20 (250)	23 (255)	24 (188)	10 (60)	17 (72)	4 (29)	20

were kept separate. In the Fåvang material only larvae from the same tree were kept separate. The larvae were stored during the winter under outdoor conditions in an insectary at Ås. In June-July the next year all specimens were examined and classified into four groups: 1) prolonged diapausing larvae (PD-larvae), 2) imagines and dead pupae of *Laspeyresia strobilella*, 3) imagines and dead pupae of Hymenopterous parasites, and 4) dead *Laspeyresia* larvae. The percentage of the population in prolonged diapause is based on figures for the first three groups. Parasitized larvae in prolonged diapause are difficult to separate from healthy larvae. Therefore, the calculation will be more correct by adding the emerged parasites and dead pupae (Group 3) to the emerged *Laspeyresia* (Group 2) in the material. The percentage of parasites in prolonged diapause cor-

responds well to the percentage of their host (Bakke 1963, p. 79). The mortality was 5-8 per cent and the parasitization 4-18 per cent.

RESULTS

Larvae developing inside the same cone do not behave identically with regard to prolonged diapause. In Table II the material from Granlia and Grorudlia is divided into groups based on larval number per cone. The distribution of PD-larvae in the various groups gives good evidence for this assertion.

The larval number per cone does not influence the percentage of PD-larvae (Table III). Approximately the same percentages of larvae in prolonged diapause were found in all groups regardless of number of larvae per cone.

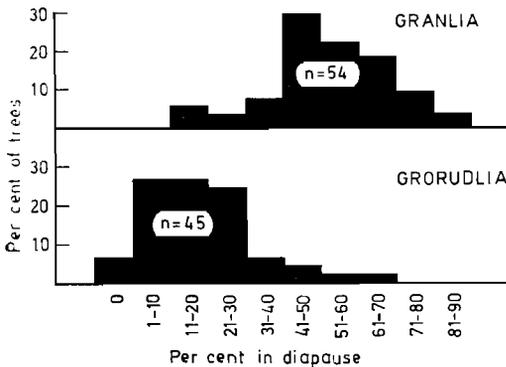


Fig. 1. Distribution of PD-larvae in trees from two localities. Only trees with more than 10 larvae are included.

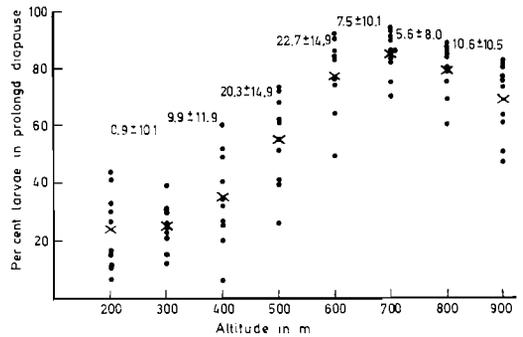


Fig. 2. Percentage of larvae in prolonged diapause from various trees at different altitudes on a mountain slope in Fåvang, 1969 and 1970. The 5 per cent confidence intervals are given for the contrasts.

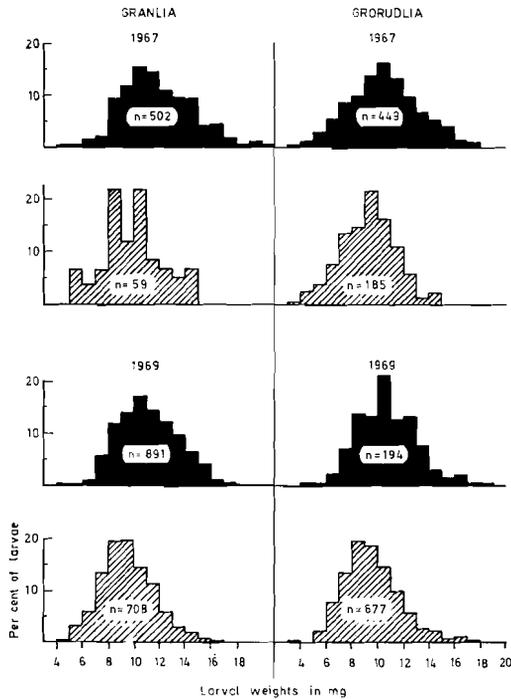


Fig. 3. The weights in autumn of larvae in prolonged diapause and of larvae which pupated after one hibernation. Black columns: PD-larvae. Striated columns: Larvae which pupated after one hibernation.

In the 1969 cones from Granlia and Grorudlia, the percentages of PD-larvae were 53 and 20 respectively. When analysing each single tree in the stands, they were distributed as indicated in Fig. 1. The same trend is obvious in the Fåvang material (Fig. 2), which includes 10 trees from each altitude.

The material from Fåvang gives possibilities for analysing the larval diapause in adjoining areas with various climatic conditions. The distance between the sites (at each altitude) is about 2 km, and from the site of 200 m to the site of 900 m altitude, the absolute difference is only about 12 km (Bakke 1963, Fig. 5). In spite of this there is a significant difference between the percentages of PD-larvae in lower and higher altitudes (Fig. 2). The differences in the percentages of PD-larvae between the sites of 500 m and 600 m altitude are statistically significant, as indicated in Fig. 2.

Larvae which pupated after one hibernation were significantly lighter ( $p = 0.001$ ) than larvae in prolonged diapause when weighed in autumn (Fig. 3).

## DISCUSSION

Investigations on prolonged diapause in spruce-cone insects have previously been carried out with cones from the same area (Bakke 1963). The method used at that time differs from the method of the present study. In the 1963 studies the insects emerged from cones stored in emergence boxes, and the figures for prolonged diapause were based on number of insects emerging from the same cones during three years. Some objections can be made to that method. The initial number of specimens in cones put into the boxes cannot be counted and the mortality during the three years is unknown. Therefore, the figures for percentages of larvae in prolonged diapause at various altitudes presented in the 1963 paper are debatable. The method of the present paper excludes this objection. However, the principal results from the 1963 paper are confirmed: Prolonged diapause is common in the life cycle of *Laspeyresia strobilella*, and the percentage of the population entering prolonged diapause varies among altitudes in a comparatively small geographical area.

The figures for percentages of larvae in prolonged diapause previously given (Bakke 1963), represent the mean of larvae from many cones and trees. In the present paper the situation in single cones and trees is described, which gives new information for analysing the ecological aspect of prolonged diapause.

The intensity, or as a consequence of it, the duration of diapause, varies considerably in population of *Laspeyresia strobilella* (Bakke 1970). Prolonged diapause is a consequence of a diapause intensity, above a certain level, which requires more than one winter for termination. When the mean percentage of PD-larvae in a population increases as indicated in Fig. 2, the intensity of diapause in every single individual of the whole population has increased. This must have happened under influ-

ence of one or more factors acting upon all individuals.

The possibility that water content and/or chemical composition of the cones are factors inducing prolonged diapause in cone insects has previously been mentioned (Bakke 1963, p. 100). The present investigation, which indicates that larvae from the same cone behave differently concerning prolonged diapause (Table II), minimizes these probabilities. It is reasonable to assume that larvae living in the same cone have access to approximately the same diet.

The significant differences between the percentages of PD-larvae at various altitudes in Fåvang (Fig. 2) are of certain interest. When cones from the Fåvang area in 1954 and 1959 were studied, a distinct difference was found between cones of the two years with respect to PD-larvae of *Laspeyresia strobilella* (Bakke 1963). The average for all altitudes in the 1954 cones was 42.9 per cent, and no distinct differences could be found between the altitudes. In the 1959 cones the average of PD-larvae was 95.5 per cent, and a significant difference was found between larvae of lower altitudes, where the percentages of PD-larvae were highest, and larvae of higher altitudes. The present study also demonstrates great variation in percentage of PD-larvae at different altitudes. The differences are more pronounced than found before. In contrast to the results from the 1954 cones, the highest percentages of PD-larvae were found at the higher altitudes. Unpublished data from cones collected by the author from other parts of Norway also indicate that the percentage of PD-larvae varies at different altitudes, but not systematically. In one year PD-larvae dominate at higher altitudes, in another year at lower altitudes.

The distance between the sites at 400 m, 500 m, and 600 m altitudes in Fåvang is about 2

km. Even if *Laspeyresia strobilella* must be considered as a stationary species, the populations are hardly different with regard to genetic constitution. Factors other than heredity are likely to be the reason for the differences found between the altitudes.

The edafic factors on the slopes in the Fåvang area are approximately equal from one year to another. Climate, however, varies and influences the phenology of the trees as well as the insects associated with the trees. The differences found in percentage of PD-larvae at different altitudes, therefore, support the assumption that climatic factors at work during the period of larval growth influence the induction of prolonged diapause in *Laspeyresia strobilella*.

#### ACKNOWLEDGEMENTS

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# Spiders (Araneae) in Mosses from Son, Norway

PER F. WAALER

Waalder, P. F. 1971. Spiders (Araneae) in Mosses from Son, Norway. *Norsk ent. Tidsskr.* 18, 95-98.

A total of 616 spiders was collected from different moss communities at Son, Norway, during the period May-July 1968. More than 80 per cent of the specimens belonged to the family Linyphiidae. Dominating species were *Centromerus arcanus*, *Minyriolus pusillus* and *Dicymbium tibiale*. A total of 29 species was recorded.

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In the summer of 1968 I collected spiders in the mosses on Sonsåsen west of Son on the Oslofjord, 60 km south of Oslo. Sonsåsen is a 116-m high wooded hill situated between the Bay of Son and the Oslofjord. Geology dates back to the pre-Cambrian and consists of metamorphic formations, mainly varied gneisses with gabbro and amphibolites, which provide a good basis for vegetation. In this particular area the knolls lie in a north-south direction, giving the terrain a hilly character. The forest is a mixed type, mainly consisting of spruce and pine, although the following species also occur: birch, mountain ash, aspen, oak, hazel and European bird cherry. The vegetation of the woodland floor is referable to the *Myrtilus* and *Dryopteris* types with an element of the *Calluna* type on the highest situated pine knolls. The collecting period was from 18 May to 7 July, i.e. phenologically from the spring aspect to the summer aspect.

## METHODS

Handfuls of mosses from study plots were carefully separated and sifted over a white linen cloth. No frame system was used. The spiders were picked up with a small brush dipped in 96 % alcohol. Several sources of error are implicit in this method. The sieving is in itself a drastic interference whereby many animals are likely to be damaged or killed. Moreover, during the entire process one has to take into ac-

count the fact that many animals will be lost through their hiding, their assuming a 'drop-dead' attitude, or their escaping attention and getting lost due to wind, unfortunate light and shadow effects during the collecting, and so forth. All of the 10 discontinuous study plots were located in mosses. The localities were heterogeneous and the samples were unequal. Therefore the collection gives a relative picture of the quantitative circumstances, and a species-area curve would give a non-representative picture of the population. The 10 study plots are described in Table I.

## RESULTS

The collection consisted of 616 spiders. In spite of my criticisms of the method, the population density from the sampling plots of mosses was determined. A similar investigation has been carried out on mosses in Ringsaker, Hedmark (Waalder, in prep.). In addition a small investigation from Nordmarka outside Oslo has been published (Palmgren 1964). The figures for the 10 samples from the study plots are as follows: 86, 91, 48, 23, 38, 71, 47, 73, 41, and 98. When converted into individuals per m<sup>2</sup> the figures read: 215, 300, 192, 46, 76, 284, 117, 91, 136, and 163, averaging 162. This is a greater density than in Palmgren's investigation ( $x = 120$ ) and in my collection from Ringsaker ( $\bar{x} = 121$ ). These differences might be due to coincidence, but I have the impression that the spider fauna

Table I. Description of the 10 study plots

No.	Date	Area in m <sup>2</sup>	Habitat	Mosses
1	18 May	0.4	Spruce, by a forest road	<i>Sphagnum girgensohnii</i>
2	26 May	0.3	Spruce, by a forest road	<i>Sphagnum girgensohnii</i>
3	26 May	0.25	Mixed forest, on the border of a drainage ditch	<i>Sphagnum girgensohnii</i> (thin layer)
4	26 May	0.5	Samples 4 and 5 under the same spruces	<i>Polytrichum commune</i>
5	26 May	0.5		<i>Sphagnum girgensohnii</i>
6	2 June	0.25	Spruce, by a forest road	<i>Sphagnum girgensohnii</i>
7	2 June	0.4	Mixed forest	<i>Sphagnum girgensohnii</i>
8	22 June	0.8	Spruce, birch, alder, in a ditch	<i>Sphagnum squarrosum</i> and <i>Thuidium tamariscinum</i>
9	7 July	0.3	Under birch and spruce	<i>Sphagnum girgensohnii</i> and <i>Pleurozium sehreberi</i>
10	6 July	0.6	Pines, higher locality	<i>Sphagnum quinquefarium</i> and <i>Dicranum undulatum</i>

of Son is characterized by a marked abundance.

Samples from mosses are always dominated by the family Linyphiidae s.lat. Of the 216 adult individuals collected, the linyphiids constitute 84.7 %, being equally divided between Erigoninae and Linyphiinae, with 92 and 91 specimens respectively. In addition to being the most dominant group, the linyphiids also show the greatest diversity in the number of species, constituting 21 out of the 29 species collected.

As could be expected, the early collecting period resulted in many juvenile specimens. The majority of these, 319 out of 400, belong to the Linyphiidae. With some uncertainty a few of them were identified as *Minyriolus pusillus* and *Centromerus arcanus*.

Females occurred much more frequently than males. Of 216 adults 48 were males and 168 females. Thus the average sex ratio is 1:3.5, a proportion which agrees with other more extensive investigations (Casemir 1951, Huhta 1965). Three species stand out in their high frequency: *Centromerus arcanus* with 61, *Minycolus pusillus* with 37, and *Dicymbium tibiale* with 16 specimens. Together these 114 spiders constitute 52.8 % of the adult collection. Of the other families Theridiidae is represented by two males, nine females, and nine juvenile specimens. Another distinctive feature of these dominating species is their preponderance in the various study plots: *Robertus scoticus* in 6 out of 10, *D. tibiale* in 7, *M. pusillus* in 8 and *C. arcanus* in all 10 samples.

#### LIST OF SPECIES

*Dictyna pusilla* Thorell, one male 2 June, sample 6, *Sphagnum girgensohnii*. Moss is not a common habitat for this species. The spider had probably fallen from taller vegetation.

*Anyphaena accentuata* (Walck.), one juvenile 6 July, sample 10. This species is not typical of the moss, but might have fallen down from a tree. It is usually found in deciduous forests, but may be encountered in coniferous woods.

*Neon reticulatus* (Blackw.), one male, three subad. males, five females, one subad. female, and seven juveniles, samples Nos. 1, 2, 6, 9, and 10, mainly *Sphagnum girgensohnii*. The only Salticidae in the collection. It seems to be frequent in the Oslo area, from where I have several unpublished finds.

*Pardosa pullata* (Clerck), one female, 2 June, sample 7, *Sphagnum girgensohnii*. The only adult lycosid in the collection. In samples 1, 2, 6, and 7 juvenile lycosides were of fairly frequent occurrence, totalling 52.

*Cryphoeca silvicola* (C. L. Koch), one male, 26 May, sample 3, *Sphagnum girgensohnii*. According to Strand (1900), it occurs in all forest regions of Norway both on twigs and in mosses.

*Hahnina pusilla* (C. L. Koch), seven females, eight juveniles, 6 July, sample 10, *Sphagnum*

*quinquefarium*. Possibly local distribution. (Cf. Locket & Millidge 1953, p. 31).

*Robertus lividus* (Blackw.), one male, one female, 22 June sample 8, *Sphagnum squarrosum*.

*R. scoticus* Jacks., two males, nine females, and nine juveniles, 18 May–6 July, samples 1, 2, 6–8, and 10, *Sphagnum girgensohnii*, *Sphagnum squarrosum*, *Sphagnum quinquefarium* + *Dicraum undulatum*. Frequent in the floor vegetation of forests in south-eastern Norway.

*Ceratinella brevipes* (Wider), two females, 18 May, 22 June, samples 1 and 8, *Sphagnum girgensohnii* and *Sphagnum squarrosum* + *Thuidium tamariscinum*.

*Trachynella nudipalpis* (Westr.), one female, 26 May, sample 2, *Sphagnum girgensohnii*.

*Cornicularia cuspidata* (Blackw.), two females, 18 May, 22 June, samples 1 and 8, *Sphagnum girgensohnii* and *Sphagnum squarrosum* + *Thuidium tamariscinum*.

*Dicymbium tibiale* (Blackw.), two males, fourteen females, 18 May–22 June, samples 1–3 and 5–8, *Sphagnum girgensohnii* and *Sphagnum squarrosum* + *Thuidium tamariscinum*. Mosses in deciduous forests appear to be an optimal habitat for this species. In Sweden it is stated to be more frequent than *D. nigrum*. In my experience this also applies to Norway.

*Maso sudevalli* (Westr.), one female, 7 July, sample 9, *Sphagnum girgensohnii* and *Pleurozium schreberi*.

*Cnephalocotes obscurus* (Blackw.), two males, seven females, 18 and 26 May, samples 1 and 2, *Sphagnum*.

*Minyriolus pusillus* (Wider), fourteen males, twenty-three females, 18 May–2 June, samples 2–7 and 9–10, *Sphagnum*. Frequent in mosses in the south-eastern part of Norway.

*Tapinocyba pallens* (O. P.-Cambr.), one male, five females, 26 May, 6 July, samples 4 and 10, *Polytrichum commune* and *Sphagnum quinquefarium* + *Dicranum undulatum*. Of this species which dominates the finds in Huhta's work from Finnish forests (Huhta 1965) the author has only few specimens. Locket & Millidge (1953) characterize its distribution to be local. Probably its optimal habitats occur in less humid mosses. In Finland *Hylocomium*

*splendens* and *Pleurozium schreberi* are stated to be the most common mosses (Huhta 1965, p. 263).

*Monocephalus parasiticus* (Westr.), three females, 18 May, sample 1, *Sphagnum girgensohnii*.

*Erigonella hiemalis* (Blackw.), two females, 2 June, sample 7, *Sphagnum girgensohnii*.

*Diplocephalus latifrons* (O. P.-Cambr.), one male, one female, 26 May, samples 3 and 5, *Sphagnum girgensohnii*.

*Asthenargus paganus* (Sim.), one female, 2 June, sample 6, *Sphagnum girgensohnii*.

*Eboria* sp., three males, seven females, 26 May, sample 5, *Sphagnum girgensohnii*.

*Hilaira excisa* (O. P.-Cambr.), three females, 18 and 26 May, samples 1 and 2, *Sphagnum girgensohnii*.

*Agynera* sp., six females, 6 and 7 July, samples 9 and 10, *Sphagnum quinquefarium* + *Dicranum undulatum* and *Sphagnum girgensohnii* + *Pleurozium schreberi*.

*Meioneta* sp., three males, one female, 26 May–2 June, samples 2, 6 and 7, *Sphagnum girgensohnii*.

*Centromerus arcanus* (O. P.-Cambr.), eight males, 53 females, 18 May–7 July, the only species found in all samples. Frequent also in inland forests.

*Centromerus expertus* (O. P.-Cambr.), three females, 22 June, sample 8, *Sphagnum quinquefarium*. Only one previous record from Norway, Strand (1901) from Hadsel, Nordland.

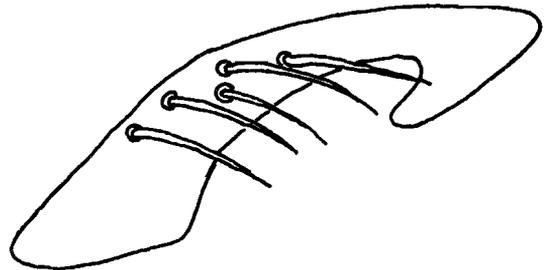


Fig. 1. *Bathyphantes parvulus* (Westr.), ♂, paracymbium of palp.

*Bathyphantes concolor* (Wider), four females, 26 May–22 June, samples 5, 7, and 8, *Sphagnum*.

*B. parvulus* (Westr.), two males, two females, 2 and 22 June, samples 6–8, *Sphagnum*. This species is often considered a subspecies of *B. gracilis* (Blackw.). I present it as a good species on the following criteria: Abdomen uniform black, hairs on paracymbium on male palp in a row (cf. Locket & Millidge 1953, p. 367, and Wiehle 1956, p. 256). Paracymbium of *B. parvulus* shown in Fig. 1.

*Lepthyphantes obscurus* (Blackw.), one male, 22 June, Sample 8, *Sphagnum squarrosum*.

*L. cristatus* (Menge), one male, three females, 18 and 26 May, 2 June, samples 1, 4, and 6, *Sphagnum*.

*Linyphia clathrata* Sundev., one male, 2 June, sample 7, *Sphagnum*.

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# Contribution to the Knowledge of the Odonata of Trøndelag

KAARE AAGAARD & DAG DOLMEN

Aagaard, K. & Dolmen, D. 1971. Contribution to the Knowledge of the Odonata of Trøndelag. *Norsk ent. Tidsskr.* 18, 99-101.

A species list of Odonata from the counties of South and North Trøndelag is given. Three of the species, *Lestes sponsa*, *Coenagrion pulchellum* and *Sympetrum flaveolum*, are reported new to the area.

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Most of this collection of Odonata was made by the authors (KAa & DD) during the period 1964-1970. In addition we are allowed to publish findings by R. Dahlby (RD), L. Faye (LF), T. Guttormsen (TG), A. Moksnes (AM), A. Paulsen (AP), J. Solem (JS) and O. D. Östhus (OÖ). Records of Odonata from Trøndelag have previously been reported by Sömmé (1937) and Tjønneland (1952).

The sampling area of Trondheim has been investigated continually during the whole flying season, while only occasional collecting trips to other areas have been made.

Species such as *Coenagrion hastulatum* (Charp.), *Enallagma cyathigerum* (Charp.), *Aeshna juncea* (L.), *A. grandis* (L.), *Somatochlora metallica* (v.d.Lind.) and *Leucorrhinia dubia* (v.d.Lind.) are known to be common in all parts of Trøndelag, and are therefore omitted from the species list given.

The material is deposited at the Royal Norwegian Society of Sciences and Letters, The Museum. District abbreviations are according to Strand (1943).

## *Agrion virgo* (L.)

STi: Trondheim, Gjeddevatnet, 7 Aug. 1967, larvae, leg. DD, 12 June 1968, larva, leg. KAa, 3 July 1968, leg. KAa & DD, 7 July 1969, leg. DD; STy: Åfjord, July 1970, leg. TG; NTi: Stjørdal, Gråelva, observed by AM, Steinkjer, Kvernbekken at Stod, 30 June 1969, leg. KAa

& DD, Overhalla, Vestrå statsallmenning July 1969, leg. unknown.

## *Lestes sponsa* (Hans.)

STi: Melhus, Horg, Hovindammen, 10 July 1969, leg. DD; STy: Vallersund, Vasö, 17 Aug. 1970, leg. DD, Lysöysund, 13 July 1970, leg. DD; Örlund, Rønne, 13 Aug. 1967, leg. R.D. NTi: Tautra, 2 July 1968, leg. KAa & DD.

## *Pyrrhosoma nymphula* Sulz.

STi: Trondheim, Gjeddevatnet, 29 Aug. 1967, larva, leg. KAa, 10 June 1968, leg. KAa, 11 July 1968, leg. DD, 7 July 1969, leg. DD. Gorrtjønne at Jonsvatnet, 5 July 1968, leg. KAa & DD, Melhus, Hovin, Krogstaddammen, 17 July 1969, leg. DD; STy: Agdenes, tarn at Isdammen, 19 June 1969, leg. DD, Lysöysund, 13 July 1970, leg. DD; NTi: Steinkjer, Vallöy, Godtjernheia, 2 July 1969, leg. KAa & DD, Bangdalen, Auntjernmyra, 31 July 1969, leg. KAa & DD; NTy: Gravvik, Märkespynten, 29 July 1969, leg. KAa & DD..

## *Coenagrion concinnum* Joh.

STi: Trondheim, Engelsåsen, 3 July 1968, leg. KAa & DD, Jovassåsen, 6 July 1968, leg. KAa & DD, Hestsjöberget, 25 July 1968, leg. DD, Malvik, Jervfjellet, 30 July 1968, leg.

DD; NTy: Gravvik, Lavvatnet, 30 July 1969, leg. KAa & DD.

*Coenagrion pulchellum* (v.d.Lind.)

STy: Lysöysund, Asseröytjerna, 13 July 1970, leg. DD, 17 July 1970, leg. DD.

*Aeshna coerulea* (Ström)

On: Fokstumyra, 14 July 1965, leg. KAa; STi: Trondheim, Bymarka, 19 Aug. 1964, leg. DD, Hestsjöberget, 25 July 1968, leg. DD, Malvik, Jervfjellet, 30 July 1968, leg. DD, Selbu, Langåsen, 2 Aug. 1968, leg. DD, Balstad, 8 Sept. 1968, leg. DD, Klæbu, Husbyjern, 2 Aug. 1968, leg. DD; NTi: Bangdalen, Auntjernmyra, 31 July 1969, leg. KAa & DD; NTy: Gravvik, Kilsvatnheia, 29 July 1969, leg. KAa & DD.

*Aeshna subarctica* Walker

STi: Malvik, Jervfjellet, 30 July 1968, leg. DD.

*Cordulegaster annulatus* (Latr.)

STy: Jössund, river at Olden, 2 Aug. 1968, leg. KAa, 16 July 1970, nymphal cuticle, leg. DD, Kvernvatnet, 17 Aug. 1970, leg. DD; NTi: Steinkjer, Stod, Kvernbekken, 30 June 1969, larva, leg. KAa & DD, Snåsavatn, 4 Sept. 1969, imago dead, leg. LF & KAa. Haran, Fiskum, 1 July 1885, leg. unknown.

*Cordulia aenea* (L.)

STi: Trondheim, Vikaraunetjönna, 1965, leg. KAa, Engelsåsen, 3 July 1968, leg. KAa & DD, Gjeddevatnet, 3 July 1968, leg. KAa & DD; STy: Agdenes, Isdammen, July 1964, leg. JS.

*Somatochlora alpestris* (de Sel.)

STi: Malvik, Jervfjellet, 30 July 1968, leg. DD; NTi: Stjørdal, Grønnlivatna, 22 June 1968, leg. DD.

*Somatochlora arctica* (Zeit.)

STi: Trondheim, Estenstad, 10 Aug. 1966, leg. KAa; STy: Vallersund, Vasö, 15 June 1970, leg. AP.

*Libellula quadrimaculata* L.

STi: Trondheim, Gjeddevatnet, 7 June 1964, leg. DD, 6 June 1965, leg. DD, 30 July 1967, leg. KAa, 10 June 1968, leg. KAa, 7 July 1969, leg. DD, tarn southwest of Jonsvatnet, 7 June 1968, leg. DD; STy: Agdenes, Litlevatn, 18 June 1969, leg. DD, Isdammen, July 1964, leg. JS, 11 June 1969, leg. DD, Bjugn, Vardeheia, 7 June 1970, leg. DD, Vallersund, 20 June 1970, leg. DD, Teksdalen, 28 July 1970, leg. DD; NTi: Steinkjer, Godtjernheia, 2 July 1969, leg. KAa & DD.

*Sympetrum flaveolum* (L.)

STy: Örand, Rønne, 2 July 1958, leg. RD; STi: Melhus, Horg, Hovindammen, 10 July 1969, leg. DD, Ruddammen, 20 Sept. 1969, leg. KAa & DD.

*Sympetrum danae* (Sulz.)

STi: Trondheim, Stavne, 9 Aug. 1967, leg. DD, 23 Aug. 1967, leg. KAa, 29 July 1968, leg. DD, Gjeddevatnet, 15 Aug. 1967, leg. KAa, 29 Aug. 1967, leg. KAa, Melhus, Horg, 20 Sept. 1969, leg. KAa & DD; STy: Örand, Rønne, 2 Aug. 1958, leg. RD, Lörberen, 16 Aug. 1958, leg. RD, Jössund, Storbekken, 8 Aug. 1968, leg. KAa, Vallersund, Vasö, 14 July 1970, leg. DD, Olden, Sætervatnet, 17 Aug. 1970, leg. DD, Åfjord, Nordsæterelva, 18 Aug. 1970, leg. DD; NTi: Stjørdal, 23 Aug. 1966, leg. KAa, Tautra, 27 Aug. 1967, leg. KAa; NTy: Gravvik, Lavvatnet, 28 July 1969, leg. KAa & DD.

*Sympetrum striolatum* (Charp.)

STy: Lysöysund, Vikanvatnet, 16 July 1970, leg. DD.

*Leucorrhinia rubicunda* (Charp.)

On: Fokstumyra, 14 July 1965, leg. KAA; STi: Flå, Langelandssetervatn, 5 July 1968, leg. OÖ, Trondheim, Gjeddevatnet, 30 July 1968, leg. KAA.

## DISCUSSION

Species new to Trøndelag are *L. sponsa*, *S. flaveolum* and *C. pulchellum*. These species are classified by Tjønneland (1952) as 'southeastern forms' (*S. flaveolum*, *C. pulchellum*), or as 'southern forms' (*L. sponsa*).

Other species classified as southern forms by Tjønneland (1952) are *C. annulatus* and *S. danae*, the latter with the remark 'possibly rather a semitotal form'. As *S. danae* has been found to be common up to the northern border of the county North-Trøndelag, this assumption should now have been verified. When comparing the distribution of the species classified as southeastern and southern forms with the biotic zonation given by Sjörs (1963), they have a wide distribution in the nemoral zone, and the northernmost distribution of these species in Fennoscandia seems to be con-

nected to the areas of the southern- and main boreal subzones, which also include the area of the Trondheimsfjord.

## ACKNOWLEDGEMENTS

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# Wind Dispersal of the Winter Moth Larvae *Operophtera brumata* L. (Lep., Geometridae) and Its Relevance to Control Measures

TORGEIR EDLAND

Edland, T. 1971. Wind Dispersal of the Winter Moth Larvae *Operophtera brumata* L. (Lep., Geometridae) and Its Relevance to Control Measures. *Norsk ent. Tidsskr.* 18, 103-105.

Extensive wind dispersal of young *Operophtera brumata* L. larvae took place during the spring 1967 in western Norway. Spider webs and sticky vertical traps were used in catching air-borne larvae. The dispersal, closely correlated to the temperature, was abundant even at very low wind velocities. Some days more than 30 larvae per m<sup>2</sup> were captured about 50 m from the infestation source. The expansion of the outbreak areas and heavy reinfestations in sprayed orchards indicated that numerous winter moth larvae were dispersed by wind for several hundred meters. This interfered strongly with the population development and the control measures in the orchards.

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The winter moth *Operophtera brumata* L. is a potential pest of great importance in many fruit-growing areas in Europe (e.g. Speyer 1953) and in Nova Scotia (Cuming 1961). In western Norway this geometrid is more abundant on and injurious to fruit trees and deciduous forests than any other leaf-feeding pest. In this area severe outbreaks, each lasting three or four years, have occurred at intervals of 10-15 years during the last century (Schöyen 1892-1913, Schöyen 1914-1941).

The most recent outbreak in the area of Lofthus, Ullensvang, Hardanger, occurred during 1965-1967 and progressed in a characteristic way very similar to that of former periods. The outbreak started on the forest slope at 200-300 m altitude, where only limited spots and narrow belts of the forest were defoliated during the first year. During the second year the area of outbreak was greatly extended, in some places covering the whole forest from the seashore to the tree boundary near 1000 m al-

titude. During the spring of that year, the fruit orchards, even at great distances from the infested forest, became heavily reinfested by winter moth larvae. In most orchards, therefore, additional sprays had to be applied to prevent severe damage. In the last year of the period the area of outbreak was again reduced to only a few, small, scattered spots on the lower part of the forest slope.

The regularity of the outbreaks and the rapid build-up of the winter moth population is not yet understood. However, the great expansion of the outbreak area and the heavy reinfestation in sprayed orchards indicated an efficient dispersal of this pest. Since the female winter moth's inability to fly precludes dissemination of this species during the adult stages, it was assumed that wind dispersal of small larvae had taken place. Brigg (1957) has shown that young larvae of the winter moth may be dispersed by wind, but his study did not include the extent of such dispersal, nor how far

the larvae may be borne. Brown (1962) found that young larvae of the related species *Operophtera bruceata* Hulst. could be borne at least 850 m away from the infested stand.

The present investigation, carried out during the end of the recent outbreak period, was designed to test the hypothesis of larval dispersal by wind and to clarify its time and extent in relation to climatic factors.

## MATERIAL AND METHODS

The experiments were carried out during the spring of 1967 at Brurastol, Ullensvang, Hardanger. This locality consists of a small grassland plateau, situated at about 120 m altitude in the steep westward exposed hillside ca. 2 km south of Lofthus. The grassland is surrounded by a fruit orchard on the southeastern side and by deciduous forest on the others.

Examination of this area in early spring showed only the fruit trees and a few forest trees nearest to the orchard heavily infested by winter moth. Here, a density of more than 100 eggs pr dm<sup>2</sup> of the trunks, and later a mean number of 8 larvae per bud, showed this to be an important infestation source.

In recording larval dispersal spider webs and sticky traps were used.

On a wire fence along the orchards a few

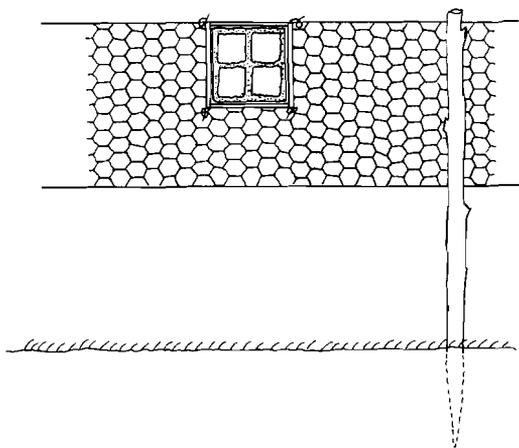


Fig. 1. Drawing of the 50 × 50 cm vertical sticky trap with the belts of adhesive (prickly area), mounted on poultry wire with the top about 2 m above ground.

meters from the nearest trees numerous spider webs were formed before the dispersal period. The webs, varying between 10 and 20 cm in diameter, were scattered on the wires at a level of 0.5-1.5 m above the ground. Air-borne larvae caught by these webs could easily be counted.

Four vertical sticky traps were made from wooden frames (50 × 50 cm) and covered with transparent plastic. Adhesives were put on both sides of the plastic in a 3 cm broad belt near the edges of each frame and in a cross through the center (Fig. 1). Tanglefoot was used on one trap and grease (Vaseline) on the others.

The traps were mounted on poultry wires, about 5 m apart, with the base of each trap 1.5 m above ground. They were all placed in the middle of the open grassland about 20 m from the nearest woodland, and about 50 m northwest of the fruit orchard. Two of the traps were arranged facing north-south, and the other two east-west. The poultry wires were erected on May 13, while the sticky traps were mounted on May 24. They were examined daily and all larvae removed.

Meteorological data were obtained from the weather station at Ullensvang Research Station, situated about 1 km north of the experimental area. Records of temperatures and wind conditions were made three times a day, at 7:00, 13:00 and 19:00 local time. The terms for wind velocity used in this paper are those of Koeppel & DeLong (1958).

## RESULTS

On May 1, when numerous newly emerged winter moth larvae were found on the fruit trees growing just above the fjord, apparently none or very few eggs of this species had hatched in the experimental area. During the following two weeks, the daily maximum temperatures increased from 6 °C on May 1 to 14.4 °C on May 14, resulting in extensive egg hatching and dispersal of small larvae.

The first record of dispersal was made on May 14, by which time a total of 283 larvae were caught in 36 spider webs. The number of

Table I. Captures of air-borne winter moth larvae in spider webs, Ullensvang 1967

Number of larvae per web	Number of webs recorded
0	9
1-5	14
6-10	2
11-20	4
21-30	6
36	1

larvae in each web varied from none to 36, indicating a rather uneven spatial dispersal (Table I). Removal of the larvae destroyed most of the webs so much that they became unsuitable for further trapping.

Also, many winter moth larvae were observed on the poultry wires on May 14 and 15. Then the temperature declined markedly (Fig. 2) and the larval dispersal seemed to discontinue for a week. Thus, no larvae were observed on the wires or in the remaining spider webs until May 23 and 24. At that time a temperature increase led to another period of active hatching and dispersal.

A total of 183 larvae were captured by the sticky traps. Fig. 2 shows the daily capture and the maximum temperatures prior to and during the trapping period. A close correlation was found between captures and temperatures for the actual period of dispersal.

The capture varied considerably with regard to the direction of the sticky sides and to the different adhesives used on the traps. No less than 83% of all the larvae were trapped on the sides facing east and south toward the source of infestation. The capture on the tanglefoot trap facing east-west was 69 larvae, compared to 28 larvae on the grease trap arranged in the same direction. On the other two traps, also covered with grease but facing south-north, the captures were 40 and 46 larvae.

Since the larval capture was recorded only once a day, it was impossible to correlate the dispersal to the wind conditions, which often changed considerably between each recording. This study, however, demonstrated that exten-

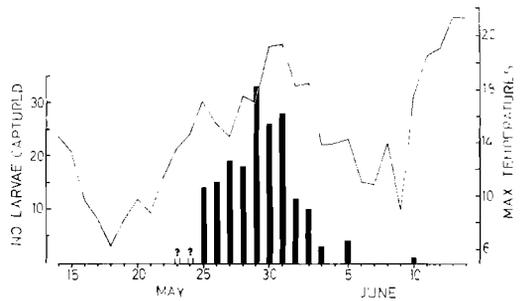


Fig. 2. Relationship between the daily maximum temperatures (line) and the captures of winter moth larvae on sticky traps (columns), Ullensvang 1967.

sive larval dispersal may take place even at very low wind velocities. Thus, during May 31 to June 2, when 50 larvae were trapped (equal to a horizontal dispersal of 17 larvae per m<sup>2</sup> per day), the air condition was calm all the time, except for a few very short periods with light air. On May 29, when the peak of dispersal was recorded, the prevailing air current was from ESE, or directly from the infested stand towards the traps. On most days of capture the wind direction, at least for a part of the time, was somewhere between S and E. During the first part of June the larval captures decreased rapidly, even on days with a prevailing air current from S or E, indicating that the larval dispersal was about to discontinue.

The majority of the larvae, trapped between May 25 and 27, were examined under a bino-

Table II. Widths of head capsules of 30 geometrid larvae captured on sticky traps, Ullensvang 1967

Width of head capsules in mm	Number of larvae captured
0.25	1
0.28	2
0.30	5
0.33	7
0.35	3
0.38	9
0.40	1
0.45	1
0.50	1

cular microscope, and the width of the head capsules measured. All the larvae were geometrids, with head-capsule widths varying between 0.25 and 0.50 mm (Table II). The two peaks of widths, one at 0.30-0.33 mm another at 0.38 mm, indicate that both the first and second instar of winter moth larvae may be airborne, and that more first instar larvae are dispersed in this way than in the second. During the trapping period about a hundred living larvae were collected on the wires and reared in the laboratory for identification of the species. With no exception all the individuals that survived this treatment (ca. 90 %) were larvae of *O. brumata*.

## DISCUSSION

The present results show that extensive wind dispersal of young winter moth larvae takes place from densely populated areas. Under favorable conditions, a horizontal dispersal of more than 30 larvae per m<sup>2</sup> per day was recorded at a distance of 50 m from the infestation source. This study did not demonstrate the maximum distance through which the larvae may be airborne. Observations of heavy reinfestation in sprayed orchards in relation to infestation sources strongly indicate, however, that air-borne larvae can be spread several hundred meters. Furthermore, it may be concluded that larval dispersal by wind is the main factor responsible for the wide expansion of the outbreak area of this pest in western Norway.

It has not yet been fully clarified whether this dispersal is a result of active competition among the individuals or an evolutionary adaptation of the species. However, further studies by the author, not yet published, indicate that the dispersal depends greatly upon larval density. Thus, when newly hatched larvae were placed singly on leaf clusters of apple, all individuals remained on the clusters until they were too large to be airborne. In comparison, more than 80 % of the larvae emerging on the most infested trees in the outbreak area disappeared, probably through emigration, during their first and second instars.

In steep woodlands, like those of western Norway, emigration of winter moth larvae seems to have an upward as well as a downward dispersal. Tenow (personal communication) studied the changes in population density of this species in the Lofthus area in 1965-1966 when the great expansion of outbreak took place. He found that the most striking increase in larval density in 1966 occurred at high altitudes, between 350 and 450 m above the area where outbreaks occurred the previous year.

In the trapping experiment the largest number of larvae were captured on the sticky sides facing the source of infestation. Furthermore, tanglefoot captured far more larvae than did grease, suggesting that choice of adhesives may be of great importance in selecting reliable methods for quantitative measurements of dispersal. It is also possible, however, that local variations in the density of dispersing larvae may affect the results significantly.

The daily dispersal of larvae increased with increasing temperature during and after the egg-hatching period until the larval density had decreased to a level at which the remaining larvae were being established on trees. As egg hatching at high altitudes normally takes place later than in the lower fruit-growing areas, larvae dispersed from outbreak areas in the forest often reinfest sprayed orchards so much that additional treatments are needed. This fact is of great importance, especially in orchards where the system of integrated control is being established. To avoid such detrimental interference with the control program, intensive work on the population regulation of the winter moth is needed. Different regulating mechanisms might be involved, among which certain potential biological control agents such as virus should be considered.

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# Feeding Activity of the Pine Weevil, *Hylobius abietis* L. (Col., Curculionidae), During a Hot Period

ERIK CHRISTIANSEN & ALF BAKKE

Christiansen, E. & Bakke, A. 1971. Feeding Activity of the Pine Weevil, *Hylobius abietis* L. (Col., Curculionidae), During a Hot Period. *Norsk ent. Tidsskr.* 18, 109-111.

During a hot period (17-19 June 1970) pine weevils, *Hylobius abietis* L. (Col., Curculionidae) exhibited a strongly nocturnal feeding activity in cages exposed to direct solar radiation. Plants in vegetation were preferred to detached ones, especially in exposed cages.

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Studies on damage to small conifer plants by *Hylobius abietis* L. reveal that the density of the ground vegetation may be of major importance to the degree of injury (e.g. Sylvén 1927, Fischer 1932, Nenonen & Jukola 1960, Juutinen 1962, Lekanger & Söderström 1969). One important effect of the vegetation is the influence on the receipt and disposal of radiant energy in the stem zone of the seedlings, and thereby on the microclimate to which the weevils are exposed during feeding. Given a choice, the weevils are likely to seek out feeding places where their climatic demands are satisfied.

In the laboratory, adult pine weevils mostly preferred temperatures between 19 ° and 28 ° C during feeding, when moving freely in a temperature gradient. Above 30 ° and below 10 ° C very little feeding activity was observed (Christiansen & Bakke 1968). The preference temperature has been shown to vary in the field, being higher during summer than in spring and autumn (Tsankov 1970).

The present paper reports an attempt to relate the feeding activity of *H. abietis* to climatic conditions in the field.

## MATERIAL AND METHODS

From 17-19 June 1970, weevil activity was recorded in a location at Kongsberg (county of Buskerud). The altitude was 530 m, and the

latitude 59 ° 40' N. The weevils were enclosed in netting cages, shaped like truncated cones, with a bottom diameter of 60 cm, a top diameter of 20 cm, and a height of 40 cm. The mesh size was 3 mm. Four cages were exposed to direct sunshine all day long, whereas four others were shaded from direct solar radiation. Half of the circular cage bottom was covered by a sod, mainly consisting of grasses and *Vaccinium* heather, the surface of the other half being covered with sand. In each cage, two four-year-old spruce plants were placed in the vegetation and two in the open area. To ensure that no direct solar radiation hit the stems of the plants in vegetation, a 20 cm high shade made of jute canvas was placed at a distance of 10 cm from these two plants in each of the four exposed cages.

To facilitate observation, the weevils were marked with three droplets of daylight fluorescent paint, one on the dorsal side of the thorax, and one on each of the elytra. Twenty specimens were released in each cage.

Temperatures in the cages were recorded by means of copper/constantan thermocouples, insulated with epoxy glue, and inserted into dry specimens of *H. abietis*. Previous measurements had shown that thermocouples inserted in the weevils recorded about three degrees higher temperatures in bright sunshine than naked thermocouples. No difference could be

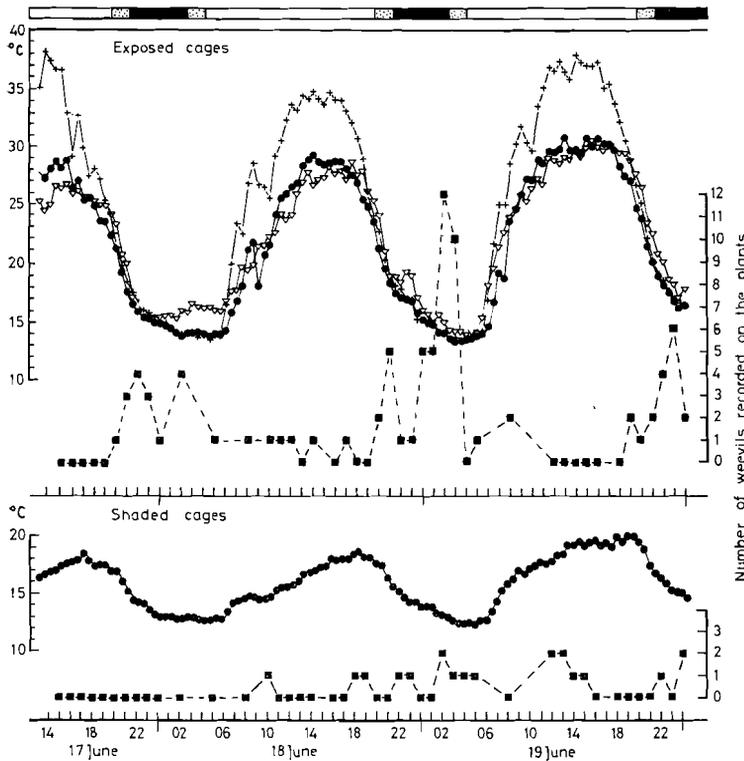


Fig. 1. Activity of *Hylobius abietis*. ■ = Number of specimens recorded on the plants. ● = Temperature 2 cm above ground in bottom vegetation inside cage. + = Temperature inside dead weevils laying on vegetation-free sand surface inside cage. ∇ = Air temperature 2 m above ground. The bars on top of the figure show periods of light, civil twilight, and darkness.

found between temperatures in dry weevils and in recently killed ones. The difference between temperatures measured inside and outside the cages was quite small.

At intervals, generally one hour, the number of weevils found on the plant stems was recorded. At the end of the experimental period the amount of damage to the plants was assessed, according to a scale from 0 (no damage) to 5.

RESULTS

The number of weevils found on the plant stems at different times is given in Fig. 1, which also shows relevant temperature graphs.

The weather was bright and day temperatures were extremely high during the whole period. In the four cages exposed to direct solar radiation, the main feeding of the weevils appeared to start around 8 p.m. and to continue during the night. In the shaded cages no distinct pattern was found.

All weevils observed on plant stems in the four exposed cages were found on plants in vegetation (85 observations). As for the shaded cages, the number of observations was very small, i.e. 19. Seventeen of these were found on plants in vegetation. The assessment of damage to the plants in the exposed cages revealed that practically all injury was done to plants standing in vegetation, whereas plants on bare sand were left undamaged. In the shaded cages, 3/4 of the damage was found on plants in vegetation.

DISCUSSION AND CONCLUSIONS

The study shows that under extremely warm conditions around mid-summer, feeding activity is strongly nocturnal in exposed sites. Furthermore, it confirms that weevils prefer plants in vegetation to detached ones, a fact demonstrated previously by several workers (e.g. Fischer 1932, Nenonen & Jukola 1960, Leksander & Söderström 1969). This preference

appeared to be more pronounced in an exposed site than in a shaded site.

Whether the distinct feeding rhythm in the exposed cages was due to changes in temperature (possibly in combination with moisture) or to changes in light conditions was not clarified. This could be studied under controlled climatic conditions. It should be mentioned that during a cool period (9–14 June), weevils in an exposed site fed in the evening, but not during the day.

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# Observations on Some Scandinavian Tabanidae (Diptera)

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In the Rendalen region of Norway, on a boreal plateau near the tree-line at 640 m a. s. l. and 61°43'N latitude, female tabanids were collected from buildings, cows, and humans in the summers of 1967 and 1968. Tabanid activity fluctuated mainly with the daily maximum atmospheric temperature. Thirteen species were collected, belonging to the three genera: *Chrysops* (2 spp.), *Haematopota* (1 sp.) and *Hybomitra* (10 spp.). No *Tabanus* spp. were found. Additional collections were made at lower altitudes and latitudes in Norway, Sweden, and Finland, where the genera *Haematopota* and *Tabanus* were more abundant, and *Hybomitra* spp. scarce.

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Many species of the haematophagous family Tabanidae are of economic importance because of their attacks on humans and other mammals. They may be detrimental to their hosts in various ways through loss of blood, toxic and allergic manifestations, or even through the agitation caused simply by their flying and landing on the animals as well as by their biting (Surcouf 1924, Olsoufieff 1937, Tashiro & Schwardt 1949). In addition, they have been implicated in the transmission of disease-organisms (Olsoufieff 1937, Leclercq 1952, Anthony 1962).

During the summers of 1967 and 1968, we had an opportunity of conducting research on bloodsucking flies, mainly simuliids and tabanids, in eastern Norway about 270 km by road north of Oslo and about 70 km from the Swedish border. The locale was in the environs of Renådalen seter (60° 43' N, 11° 24' E) in the Rendalen region (Y. Rendal, Hedmark), at an elevation of approximately 640 m a.s.l. just below the tree-line. The topography of the region is low mountainous, with plateaus interspersed with a few deep valleys which drain into Storsjøen, a large lake to the west at an elevation of about 251 m. The ground is covered with vegetation which consists primarily of grasses

(Gramineae), sedges (Cyperaceae), cloudberry, *Rubus chamaemorus* L. (Rosaceae) and shrubs, mainly dwarf birch, *Betula nana* L. and those of the family Ericaceae, of which *Vaccinium* spp. and *Calluna vulgaris* (L.) are the most abundant. At higher elevations a gradual transition of ground cover occurs in which lichen, mainly *Cladonia* spp., becomes abundant, especially at and above the tree line. At lower elevations the forest consists of a heterogeneous growth of coniferous and deciduous trees of which Scot's Pine, *Pinus silvestris* L., and white birch, *Betula pubescens* Ehrh., are dominant. Scot's Pine becomes more dominant, but less dense, with increasing altitude, and above 700 m shrubs replace trees and eventually lichen predominates.

The area where most of the collections were made was a grassy field, about 100 m<sup>2</sup>, on which four cows grazed for most of the day. It sloped from the cabin (seter) at the road in a southwesterly direction to the Renåa River. There were some swampy areas bordering the field as well as others, more extensive, in the vicinity, all suitable for tabanid breeding.

Tabanids and other Diptera were netted periodically from the cows, humans, and buildings from late June until early August. Atmo-

Table I. Abundance of adult female tabanids caught wild in the Rendalen region of Norway in 1967 and 1968

Species	Numbers (Percentage)			
	from cows		all sources	
	1967	1968	1967	1968
<i>Chrysops nigripes</i> Zetterstedt	3 ( 1.2)	13 (14.5)	9 ( 1.6)	15 ( 6.7)
<i>C. relictus</i> Meigen	10 ( 4.0)	14 (15.6)	50 ( 8.9)	63 (28.3)
<i>Haematopota pluvialis</i> (Linné)	1 ( 0.4)	5 ( 5.6)	4 ( 0.7)	6 ( 2.7)
<i>Hybomitra arpadi</i> (Szilady)	3 ( 1.2)	2 ( 2.2)	12 ( 2.1)	3 ( 1.3)
<i>H. aterrima</i> (Meigen)	30 (12.0)	6 ( 6.7)	50 ( 8.9)	12 ( 5.4)
<i>H. borealis</i> (Fabricius)	1 ( 0.4)	—	1 ( 0.2)	—
<i>H. conformis</i> (Frey)	15 ( 6.0)	—	30 ( 5.3)	7 ( 3.1)
<i>H. kaurii</i> Chvála & Lyneborg	64 (25.6)	42 (46.7)	169 (30.0)	86 (38.6)
<i>H. lundbecki</i> Lyneborg	57 (22.8)	1 ( 1.1)	97 (17.2)	2 ( 0.9)
<i>H. lurida</i> (Fallen)	51 (20.4)	—	100 (17.8)	12 ( 5.4)
<i>H. montana flaviceps</i> (Zett.)	13 ( 5.2)	7 ( 7.8)	40 ( 7.1)	15 ( 6.7)
<i>H. tarandina</i> (Linné)	2 ( 0.8)	—	2 ( 0.4)	1 ( 0.45)
<i>H. tropica</i> (Linné)	—	—	—	1 ( 0.45)
Totals	250	90	564	223

spheric temperature and relative humidity were recorded with a thermo-hydrograph in a white Stevenson-type screen on a grassy knoll 100 m north of the cabin.

## OBSERVATIONS

Three genera of Tabanidae were collected in the Rendalen region (Table I): two species of *Chrysops*, one of *Haematopota* and ten of

*Hybomitra*. *Chrysops relictus* was generally much more abundant than *C. nigripes*, but the numbers taken from cows were more similar, especially in 1968. Few *Haematopota pluvialis* were taken in either year. Of the *Hybomitra*, *H. kaurii* was the most abundant especially in 1968, but in 1967 *H. lurida* and *H. lundbecki* were also numerous, with *H. aterrima* and *H. montana flaviceps* being next in abundance. *H. arpadi* is reported for the first time from Norway. Our specimens of *H. aterrima* may be var. *auripila* Meigen, which Leclercq (1966) raised to a full species.

The seasonal change in tabanid abundance for the years 1967 and 1968 is shown to be related to the maximum and average air temperature, a little more to the former (Figs. 1, 2). In 1967 *H. lurida* was the common early species with *H. lundbecki* becoming more numerous in mid-July, but thereafter *H. kaurii* predominated (Table II, Fig. 1).

In 1968 the first few days of July were unusually hot (Fig. 2) followed by a cool period until mid-month. This early warm period resulted in a short, but much smaller, burst of activity of *H. lurida* on July 1, followed by a much larger peak in the population of *H.*

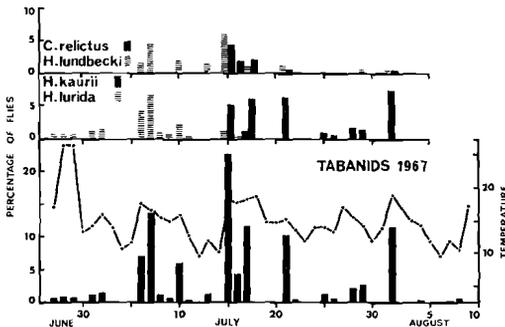


Fig. 1. Abundance of tabanid females and maximum daily air temperature during the 1967 summer in Renådal, Norway. The bottom histogram includes all tabanid species collected.

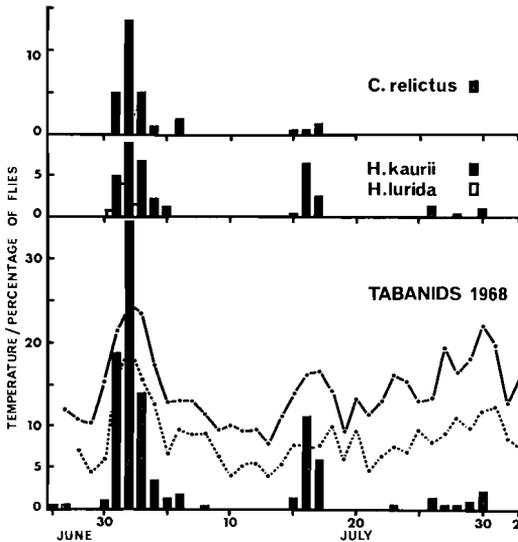


Fig. 2. Abundance of tabanid females, and maximum (—) and mean (---) daily air temperatures during the 1958 summer in Renådalen, Norway. The bottom histogram includes all tabanid species collected.

*kaurii* and also in that of *C. relictus*. Another sharp peak of *H. kaurii* abundance occurred on July 16 after the cool spell.

More flies were attracted to two black cows than to two brown cows but no quantitative

comparison was made. *Hybomitra* spp. generally attacked the extremities of the cow's legs or its muzzle when it was close to the ground while grazing. *Chrysops* spp. were more common on the top of the head, around the ears, eyes and base of the horns. *Haematopota pluvialis* landed singly often on the flank of the cow.

Many flies were collected from outside the sunny leese of the cabin or after they had flown into the cabin or Renåvängen Motell through open windows and doors. A few collections were netted from humans, mostly *Chrysops* spp., as was found also by Smith et al. (1970).

Other female tabanids were collected by us in southern Norway, Sweden and Finland, that is, south of 60° N latitude. At Bö, Telemark on 5 July 1968, *H. pluvialis* and *Tabanus bromius* L. were collected. At Årjang, near the Norwegian border in southern Sweden, the following were collected on 7 Aug. 1964: *Chrysops relictus* 1, *H. pluvialis* 8, *T. bromius* 1 and *T. maculicornis* 2. At the Tvärminne Zoological Station near sea level in southwest Finland the following were collected inside buildings or netted around humans on 27 and 28 July 1968: *Chrysops viduatus* (F.) 2, *C. relictus* 4, *H. pluvialis* 48, *T. bromius* 6 and *T. maculicornis* 1.

Table II. Period of occurrence of females of various tabanid species in the Rendalen region of Norway from 28 June to 8 Aug. 1967 and 25 June to 6 Aug. 1968 (with date(s) of peak abundance in parentheses)

Species	1967	1968
<i>Hyb. lurida</i>	28 June–4 Aug. (7 July)	30 June–2 July (1 July)
<i>H. conformis</i>	1 July–16 July (7 July)	27 June–1 July (1 July)
<i>H. lundbecki</i>	6 July–1 Aug. (15 July)	1 July–2 July (1 July)
<i>H. aterrima</i>	6 July–7 Aug. (15 July)	1 July–16 July (2 July)
<i>C. nigripes</i>	10 July–21 July (15 July)	1 July–17 July (2 July)
<i>H. arpadi</i>	10 July–1 Aug. (1 Aug.)	2 July
<i>C. relictus</i>	15 July–1 Aug. (15 July)	1 July–17 July (2 July)
<i>H. kaurii</i>	15 July–1 Aug. (21 July, 1 Aug.)	1 July–30 July (2 July, 16 July)
<i>H. m. flaviceps</i>	15 July–1 Aug. (1 Aug.)	1 July–30 July (3 July, 30 July)
<i>H. tarandina</i>	15 July	2 July
<i>H. tropica</i>	—	15 July
<i>Haem. pluvialis</i>	16 July–1 Aug. (22 July)	3 July–29 July (17 July)
<i>Chrysops</i> spp	10 July–8 Aug. (15 July)	1 July–17 July (2 July)
<i>Hybomitra</i> spp	28 June–8 Aug. (15 July)	26 June–30 July (2 July)

## DISCUSSION

There are few previous records of Tabanids from the middle region of Norway between 60°-64° N latitude (Leclercq 1960, 1966; Kauri 1968), and all of these except *Hybomitra borealis*, *H. lundbecki*, and *H. tropica*, differ from those found on the Renådalen plateau in the Rendalen region. This probably indicates a lack of collecting rather than an absence of species that are found at the same latitude in Sweden. The low number of *Haematopota pluvialis* and complete absence of the genus *Tabanus* at the cabin should be noted, because one of us (D.M.D.) in a previous trip through Norway and Sweden (6 July to 12 Aug. 1964) and later in Finland, mainly at lower altitudes, found this species to be the commonest tabanid (about 80%) followed by *Tabanus* spp. with no *Hybomitra*. Other species occurring in middle Norway, some at a lower altitude than the cabin, are *Chrysops sepulcralis* Fab., *Tabanus maculicornis* Zett., and *Atylotus rusticus* (L.) (Leclercq 1960, 1966), and *T. sudeticus* Zeller, *H. nigricornis* (Zett.), and *A. sublunaticornis* (Zett.) (Kauri 1968). Also one each of *T. maculicornis*, *H. aterrima*, *H. kaurii*, and *C. relictus*, and two of *C. nigripes* were taken by us at a lower level (425 m) beside lake Kjemsjöen near Koppang, Norway on 1 Juli 1968.

Leclercq (1966) records *Haematopota crassicornis* Wahl. and *H. pluvialis*, but not *T. bromius*, from southern Norway, and Kauri (1968) mentions these additional species: *T. glaucopsis* Meigen, *T. maculicornis*, *T. sudeticus*, *H. bimaculata* (Macq.), *H. conformis*, *H. distinguenda* (Verral), *H. lundbecki*, *H. m. montana* (Mg.), *H. tropica*, *A. plebejus* (Fallen), and *Hexatoma pellucens* (Fab.). Kauri (1967) lists the following species with aquatic immature stages as occurring in Norway (Boreales Hochland): *Chrysops caecutiens* (L.), *C. nigripes*, *C. relictus*, *C. sepulcralis*, *Hexatoma pellucens*, *Haematopota crassicornis*, *H. pluvialis*, *Tabanus bromius*, *T. maculicornis*, *T. sudeticus*, *Hybomitra conformis*, *H. lundbecki*, *H. bimaculata*, *H. tarandina*, *Atylotus plebejus* and *A. sublunaticornis*. In addition Kauri (1968) mentions *H. sexfasciata* (Hine) from

northern Norway. Furthermore, Surcouf (1924) records *H. aterrima* from Norway and says that several species, listed by Kauri (1967), are distributed over the whole of Europe, with the addition of *T. bovinus* Loew.

Certain species taken in the Rendalen region of Norway are considered to be holarctic. *Chrysops nigripes* occurs from Alaska across Canada and the northern United States, and from northern Europe across Siberia to Japan (Philip 1956). *Hybomitra arpadi*, with which the nearctic *H. gracilipalpis* (Hine) was synonymised (Philip 1960), has almost the same North American distribution as *C. nigripes*. *H. lurida* was formerly known in North America as *H. metabola* (McDunnough) (Pechuman & Stone 1968), where it had a similar distribution to the two previous species. Recently, Chvála & Lyneborg (1970) showed that *H. lapponica* (Wahlberg 1848) should be synonymised with *H. borealis* (Fabricius 1781). This meant that *H. borealis* (Loew 1858) (= *borealis* Fabr. of Meigen 1820) had to be given the new name of *H. kaurii* Chvála & Lyneborg. Previously *H. sexfasciata* was synonymised with *H. borealis* (auct., nec F.) (Leclercq 1966), although Kauri (1968) considered the latter as a separate entity. Moreover, if we retain the species *H. sexfasciata*, which was originally considered in Scandinavia as a subspecies of *H. borealis* (Mg., nec F.), i.e., *H. borealis anderi* Kauri 1951, then it is also holarctic (Philip 1956, Kauri 1958), but it has been found only in northwest Norway (Kauri 1951) and northern Sweden (Kauri 1954, 1964). Kauri (1958) synonymised the nearctic *H. typhus* (Whitney) with *H. lapponica*, although this is not accepted in North America (Stone et al. 1965, Pechuman 1970 in litt.).

Further collecting in Norway will provide better information on what species are present and an indication of the limits of their distribution.

## ACKNOWLEDGEMENTS

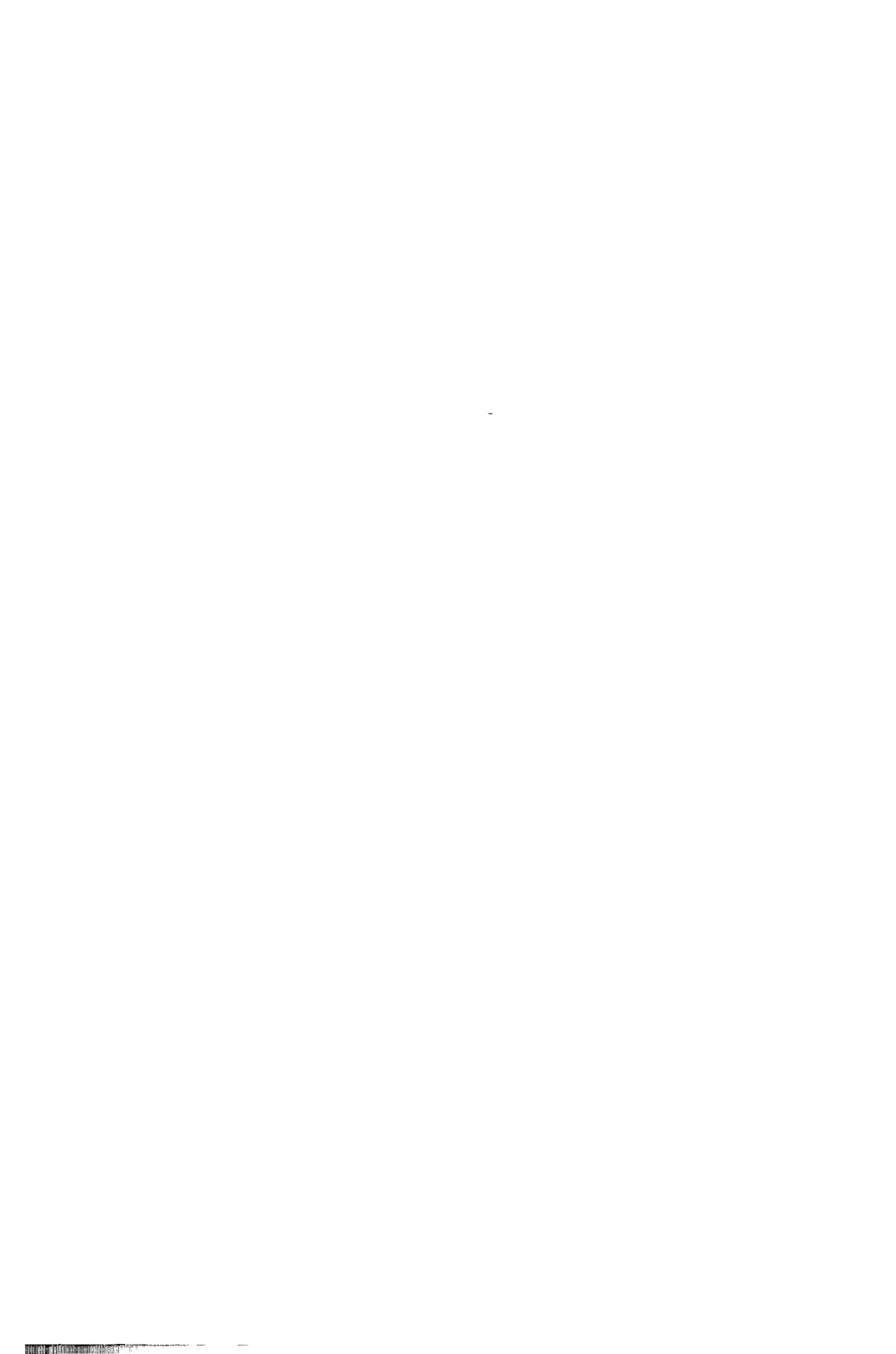
This was part of a cooperative research project in 1967 and 1968 between the Zoological Laboratory, University of Bergen, and the Depart-

ment of Parasitology, University of Toronto, made possible by a NATO grant to Professor A. M. Fallis of the latter Department. We appreciate being invited to share in the project. One of us (D.M.D.) gratefully acknowledges a Senior Research Fellowship from the National Research Council of Canada for travel in Scandinavia in 1964 and a grant from the Council for travel to Finland in 1968. We wish to thank Professor H. Kauri, Director of the Zoological Museum, Bergen, for determining the tabanids and for his interest and advice. We appreciate the help of Professor Fallis, Arne Eide, Torill Raastad and Dwight Eligh in the field and of Mrs. H. Gyorkos in the laboratory. Mr. Ajas Kiær helped us, amongst other things, to obtain the weather screen, Mr. Odd Kværnes, Manager, Renåvängen Motell, made the cabin available to us, and Dr. Ernst Palmén arranged facilities in Finland.

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# The Malacophagous Flies of Norway (Diptera, Sciomyzidae)

L. V. KNUTSON & C. O. BERG

Knutson, L. V., & Berg, C. O. 1971. The Malacophagous Flies of Norway (Diptera, Sciomyzidae). *Norsk ent. Tidsskr.* 18, 119-134.

The sciomyzid fauna of Norway consists of 43 species in 18 genera, as determined from published records and examination of museum specimens. Three genera (*Colobaea*, *Dichetophora*, and *Sciomyza*) and 16 species listed here have not been recorded from Norway previously. In addition to detailed Norwegian records, references to publications on the biology and morphology of the immature stages and notes on habitats, food snails, and general distribution are included. Distribution maps of *Tetanocera elata* Fabricius, *Dictya umbrarum* L., and *Trypetoptera punctulata* Scopoli are presented.

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Snail-borne diseases and the destruction of agricultural crops by snails and slugs have stimulated a vigorous search for better methods of controlling these molluscs and have resulted in increased interest in natural enemies of molluscs. This interest has involved the dipterous family Sciomyzidae, since Berg (1953) suggested that 'the snail eating habit is very widespread among larvae of this family' and that they 'might prove efficient in the biological control of undesirable snails.' Subsequent study of the Sciomyzidae or 'marsh flies' has included the rearing of about 200 species through complete life cycles and observations of their habits and ecological relationships. Larvae of all except a few species in the 36 genera now reared have attacked and killed snails; those few were reared on snail eggs, slugs, and fingernail clams.

The Sciomyzidae are well known inhabitants of marshes and other wet-lands in climates ranging from polar to tropical. The world fauna probably includes 600 species. Although found on all continents, they are best represented in the Palearctic and Nearctic Regions, with 150 species in 26 genera in the Palearctic.

The adult flies, ranging from about half to more than twice the size of a housefly and usually brown to grey in color, are characterized by porrect antennae and well-developed bristles on the femora, tibiae, thorax, and head (Fig. 1). Discussions of their morphology, taxonomy, and geographical distribution and biology, focused on the Scandinavian region, were published by Knutson & Lyneborg (1965).

Just as the data obtained from laboratory rearings are prerequisite for choosing an effective natural enemy for each molluscan pest, reliable data on natural distribution patterns are prerequisite for informed decisions concerning the areas where a candidate species for biological control can be used. If the Sciomyzidae prove effective in the control of slugs, for example, the distributional data presented here will have considerable practical value. The fact that a slug-killing species, *Tetanocera elata* Fabr., is the most widely distributed and perhaps the most abundant marsh fly in Norway indicates a broad tolerance that would enable it to survive in areas having very diverse ecological conditions.

No comprehensive study of the Sciomyzidae

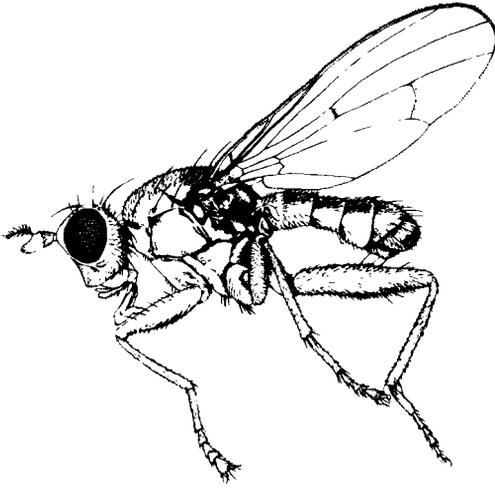


Fig. 1. *Tetanocera ferruginea* Fallén, male, a common species of the most widespread sciomyzid genus in Norway.

of Norway has ever been published. Fifteen genera and 27 species have been recorded from Norway by Zetterstedt (1838, 1846), Siebke (1877), and a few other authors cited below. On the basis of our study of 700 specimens from 8 museums and from C. O. Berg's collection in 1970, we here add 3 genera (*Colobaea*, *Dichetophora*, and *Sciomyza*) and 16 species to the known sciomyzid fauna of Norway. Taxa newly recorded from Norway are marked with an asterisk.

To facilitate further study of the biology and immature stages of Norwegian Sciomyzidae and to provide essential information needed in other investigations that may include Sciomyzidae, we give the following data for each species: 1) citations of publications on the biology and morphology of the immature stages with notations of which immature stages have been described (E = egg; L<sub>1,2,3</sub> = first, second and third instar larva; P = puparium); 2) characterization of the macro-habitat of the adults; 3) the genera of molluscs killed and eaten during laboratory rearings in Europe and North America, followed by the species known to be fed upon in nature in parentheses; 4) the general distribution with citation of published maps.

Under 'Published records' and 'Examined material' the localities listed after the county names are spelled as they appear on the labels or as published; any information that we have added in addition to the county name is placed in brackets. Curators Albert Lillehammer and Astrid Löken have kindly supplied the modern spellings (on the right) of some of the older place names listed on the left.

Aamodt = Åmot

Dyrön = Dyrøy

Evenäs = Evenes

Frhld and Fr.hald = Fredrikshald = Halden

Garnäs = Garnaes = Garnes

He'göen = Helgöy

Hovind = Hovin

Kjolhaugen = Kälähög

Kr.ania = Oslo

Krydsh. = Krydsherred = Krödsherad

Kvaerner = Kverner

Laurvik = Larvik

Näs = Nes

Nordsäter = Nordseter

Öier = Öyer

Östensö = Östensjövanet

Thynäs = Thynaes = Tynes

Töien = Tøyen

Veblungsnaes = Veblungsnes

The following data are given under 'Examined material' if known: county, locality, and date of collection, initials of collector, and (in parentheses) initials of museum where specimens are deposited. Collectors are indicated as follows: A.L. = A. Lillehammer; C.O.B. = C. O. Berg; J. Ö. = J. Ökland; S. = H. Siebke; T.E. = T. Edland; T.N. = T. Nielsen; T.S. = T. Solhøy. The museum designations are: BM = British Museum (NH), London; CU = Cornell University, Ithaca, New York; NRM = Naturhistorisk Riksmuseum, Stockholm; RD = collection of R. Dahl; TM = Tromsø Museum; USNM = United States National Museum, Washington, D. C.; ZIL = Zoological Institute, Lund; ZMB = Zoological Museum, Bergen; ZMO = Zoological Museum, Oslo.

In addition to the specimens listed under 'Examined material', we have also seen the collection of Hans Ström (1726-1797) in the Royal

Norwegian Society of Sciences, Trondheim. Soot-Ryen (1943) notes: 'Being a vicar in Sunnmøre most of his collecting was surely done there and northwards to Trøndelag. All his finds, however, lack localities'. The 23 specimens of Sciomyzidae that we examined were without labels or bore only a number label. The following species were represented: *Dictya umbrarum* L., *Limnia unguicornis* (Scopoli), *Pherbellia schoenherri schoenherri* Fallén, *Pherbina coryleti* (Scopoli), *Tetanocera elata* (Fabricius), *T. ferruginea* Fallén, and *T. hyalipennis* von Roser.

All Sciomyzidae known from Norway, except *Tetanocera lapponica* Frey and *Limnia paludicola* Elberg, can be identified with the keys of Knutson & Lyneborg (1965). *Tetanocera lapponica* is distinguished from all other *Tetanocera* by the characteristic surstyli. These are straight, triangular, narrowed apically, and have a triangular process posterobasally. *Limnia paludicola* is not included in the discussion of *Limnia* (pp. 83-84), but can be distinguished from *L. unguicornis* (Scopoli) mainly on characters of the male genitalia as shown by Elberg (1965). The following corrections should be noted in the 1965 key:

- p. 72, couplet 5: for *lichtwardti* Hendel 1902, read *knutsoni* Verbeke 1967.
- p. 73, couplet 9: for *mixta* Elberg 1965, read *obtusa* Fallén 1820.
- p. 74, couplet 14: for *pallidicarpa* Rondani 1868, read *scutellaris* von Roser 1840.
- p. 74, couplet 15: for *obtusa* Fallén 1820, read *argyra* Verbeke 1967.
- p. 75, couplet 2: for *glabricula* Fallén 1820, read *angustipennis* Staeger 1845.
- p. 75, couplet 3: for *nigrimana* Meigen 1830, read *glabricula* Fallén 1820.
- p. 77, couplet 10: change second part to, 'Scutellum with four setae. Mesopleuron with or without hairs; sometimes a single seta present'.
- p. 78, couplet 16: change second part to read, 'Second antennal joint less than . . . '.
- p. 86, couplet 2: add 'prosternum bare' to first part and 'prosternum with hairs' to second part.

## \*I. COLOBAEA ZETTERSTEDT

*Ctenulus* Rondani

### \*1. *Colobaea bifasciella* (Fallén)

*Biology, immature stages.* Lundbeck (1923) (P); Knutson & Bratt (in manuscript) (E. L., P).

*Habitat.* Swamp woods, margins of ponds and rivers, and other habitats where small *Lymnaea* snails forage or become stranded.

*Food snails.* *Lymnaea* (*Lymnaea palustris* (Müller) and *L. truncatula* (Müller)).

*Distribution.* Palearctic. Vuollerim, Sweden and Kantalahti, U.S.S.R. across northern and central Europe to Hungary and Moscow.

*Examined material.* Opland: [Lom] Nordsäter, 12 July 1953 [Ringdahl] (ZMO).

## II. PHERBELLIA ROBINEAU-DESVOIDY

*Sciomyza* auctt.

### 2. *Pherbellia albocostata* (Fallén).

*Biology, immature stages.* Bratt et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat.* Mesic woods, often with *P. dubia*.

*Food snails.* *Balea*, *Cochlicopa*, *Discus*, *Eucornulus*, *Retinella*, *Zonitoides* (*Discus rotundatus* (Müller)).

*Distribution.* Holarctic. In the Palearctic Region: from Scotland to Russian Lapland (Petsamo) southward through France, central Yugoslavia, and the Crimean Peninsula (map: Bratt et al. 1969, Fig. 179).

*Published record* (Zetterstedt 1846, p. 2098). Nordland: Evenäs.

*Examined material.* Buskerud: Gol, Hallingdal, 29 June 1944, N. Knaben (ZMB) (pair *in copula*). Hedmark: Rendal, S. (ZMO); [Elverum] Grundset, S. (ZMO). Hordaland: Eidfjord, Hjömodalen, 4 July 1967, K. Bjørklund (ZMB); Eidfjord, Hjömodalen, bjerkeskog 480 m.a.s.l., 8 July 1967, T.N. (ZMB); Eidfjord, Måbödalen, 450 m.a.s.l., 24 July 1967, A. Löken (ZMB). Nordland: Røsvik, 3 July 1923, Soot-Ryen (TM). Oslo: Hovind, 27 June 1850, S. (TM, ZMO); Töien, 9 Aug. 1851, S. (ZMO). Sogn og Fjordane: Aurland, Fretheim, 11 June 1939, N. Knaben (ZMB).

3. *Pherbellia annulipes* (Zetterstedt)

*Biology, immature stages.* Bratt et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat.* Open beech woods.

*Food snails.* *Discus*.

*Distribution.* Palearctic. Southern England, Norway, and Sweden to Corsica, Italy (Rome), and Yugoslavia (Vlasic) (map: Bratt, et al. 1969, Fig. 183).

*Published record* (Siebke 1877, p. 142). Vestfold: Mærem ad Jarlsberg prope Tönsberg, 28 July 1865.

*Examined material.* Vestfold: Tönsberg, S. (ZMO).

4. *Pherbellia brunnipes* (Meigen)

*pusilla* Zetterstedt (*Sciomyza*)

*Biology, immature stages.* Bratt et al. (1969) (L<sub>3</sub>, P).

*Habitat.* Exposed marshes and vernal ponds.

*Food snails.* Unknown.

*Distribution.* Palearctic. Finnish Lapland, southward to England, Germany, Czechoslovakia, and Kiev Province, U.S.S.R.

*Published record* (Siebke 1877, p. 142). Oslo: Christianiam in horto botanico, August-September, Daehlenengen ad Christianiam, 19 August 1846.

*Examined material.* Finnmark: Kåfjord, 4 July 1956, H. Andersson (ZIL). Troms: Bardu, 1 July 1956, H. Andersson (ZIL). Vestfold: Borre, Falkenstein Möllerdam., 9 Sept. 1970, C.O.B. — J.Ö. (CU).

5. *Pherbellia cinerella* (Fallén)

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>1-3</sub>,); Bratt, et al. (1969) (E, L<sub>1-3</sub> P); Beaver (1970).

*Habitat.* Eurytopic in a wide variety of freshwater and terrestrial habitats.

*Food snails.* *Australorbis*, *Gyraulus*, *Helicella*, *Helisoma*, *Helix*, *Hygromia*, *Lymnaea*, *Physa*, *Succinea*.

*Distribution.* Palearctic, Oriental. Across central and southern Europe through Asia Minor to Afghanistan (map: Bratt, et al. 1969, Fig. 183).

*Published record* (Ardö 1957, p. 120). Rogaland: Orre, 11 August 1953, P. Ardö.

*Examined material.* Akershus: Bærum, Tjernsmyr, 7 Sept. 1970, C.O.B. — A.L. (CU, ZMB, ZMO). Rogaland: Jaeren, Orre, 15 August 1955, P. Ardö (ZIL).

6. *Pherbellia dubia* (Fallén)

*Biology, immature stages.* Bratt et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat.* Mesic woods and old fields.

*Food snails.* *Clausilia*, *Cochlicopa*, *Discus*, *Euconulus*, *Oxychilus*, *Retinella*, *Vitrina*, (*Cochlicopa lubrica* (Müller), *Discus rotundatus*, *D. ruderatus* (Studer), *Hygromia hispida* (L.), *Oxychilus cellarius* (Müller), *O. helveticus* (Blum), *Retinella nitidula* (Draparnaud)).

*Distribution.* Palearctic. Finnish Lapland (Utsjoki) southward throughout northern and central Europe to France (Paris) and Rumania (Mehadia); Kamchatka (map: Bratt et al. 1969, Fig. 179).

*Published records.* Akershus: Røken (Siebke 1877, p. 142). Hedmark: Tyldal Österdaliae (Siebke 1877, p. 142). Nord-Trøndelag: Thynäs (Zetterstedt 1846 p. 2118; Dahl 1965, p. 157); Levanger, Tynes (Dahl 1965, p. 157). Oppland: Öier Gudbrandsdaliae (Siebke 1877, p. 142). Oslo: Töien, Hovind, Ladegaard Sö (Siebke 1877, p. 142). 'Norwegen' (Soós 1958, p. 110).

*Examined material.* Finnmark: Langfjord, 4 July 1956, H. Andersson (ZIL). Hedmark: [Tynset] Tyldalen, 22 July 1848, S. (ZMO). Hordaland: Eidfjord, Hjömodalen, 1 July 1967, K. Björklund; 6 July 1967, F. Rönhovde; 8 July 1967, 450 m a.s.l. T.N., 4 July 1969, 430 m a.s.l., T.N. (ZMB); Kinsarvik, Stavali omr., 950 m a.s.l., 25 July 1968, A. Fjellberg (ZMB); Eidfjord, Isdalen, 880 m a.s.l., 25 June 1969, K. E. Jörstad (ZMB). Oppland: Öier, S. (ZMO). Oslo: Töien, S. (TM); 14, 15 June 1850, S. (ZMO); Hovind, 27 July 1850, 16 July 1851, S. (ZMO).

7. *Pherbellia griseola* (Fallén)

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>1-3</sub>,P); Bratt, et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat.* Temporary and permanent marshes, ponds, and swamps.

*Food snails.* *Aplexa*, *Australorbis*, *Helisoma*,

*Lymnaea*, *Oxyloma*, *Physa*, *Succinea*, (*Lymnaea palustris*).

*Distribution*. Holarctic. Palearctic range: northernmost Finnish Lapland southward throughout Britain and most of Europe to Spain, Italy, Rumania, and Kiev Province, U.S.S.R. (map: Bratt et al. 1969, fig. 178).

*Published records*. Opland: Öier Gudbrandsdaliae ad Moshus (Siebke 1877, p. 142). Nordland: Björkvik (Zetterstedt 1846, p. 2101).

*Examined material*. Akershus: Bærum, Tjernsmyr, 7 Sept. 1970, C.O.B.-A.L. (CU). Opland: Öier, S. (ZMO); Nordsäter, 12 July 1953 (ZMO). Oslo: Töien, 11 August 1851, 8 Sept. 1847, S. (ZMO). Sogn og Fjordane: Aurland, Vassbygda, 16 Aug. 1941, N. Knaben (ZMB). Vestfold: Borre, Falkenstein Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU).

8. *Pherbellia grisescens* (Meigen)

*Biology, immature stages*. Rozkosny (1967) (E, P); Bratt, et al. (1969) (L<sub>1-3</sub>, P).

*Habitat*. Damp to wet habitats, shaded or exposed.

*Food snails*. *Australorbis*, *Cochlicella*, *Haplotrema*, *Helicella*, *Helisoma*, *Lymnaea*, *Mesodon*, *Physa*, *Planorbis*, *Succinea*, *Theba*, *Triodopsis*, *Zonitoides*.

*Distribution*. Palearctic, Oriental. Iceland, Franz Joseph Land, northern Finland and U.S.S.R. southward to Spain, Egypt, and Afghanistan (map: Bratt et al. 1969, Fig. 182).

*Published record* (Ardö 1957, p. 120). Rogaland: Orre, 11 July 1953, P. Ardö.

\*9. *Pherbellia nana* (Fallén)

*Biology, immature stages*. Bratt et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat*. Margins of lakes; open, sunlit marshes; deeply shaded forest pools.

*Food snails*. *Aplexa*, *Australorbis*, *Eulota*, *Helicella*, *Helisoma*, *Hygromia*, *Lymnaea*, *Physa*, *Planorbis*, *Segmentina*, *Succinea* (*Gyraulus parvus*, *Lymnaea humilis*, *L. palustris*, *Physa* sp.).

*Distribution*. Holarctic. In the Palearctic Region: from Swedish Lapland southward throughout Europe to southern Spain, Algeria, Greece,

and eastward to Siberia (map: Bratt et al. 1969, Fig. 182).

*Examined material*. Akershus: Bærum, Tjernsmyr, 7 Sept. 1970, C.O.B.-A.L. (CU, USNM, ZMB, ZMO).

*Note*. Two of the 4 holarctic species of *Pherbellia* known to occur in Norway, *P. albocostata* and *P. schoenherri*, are appreciably more abundant and widespread in Europe than in North America. In contrast, *P. griseola* is fairly common on both continents, and *P. nana* is far more abundant in North America than in Europe.

10. *Pherbellia pallidiventris* (Fallén)

*Biology, immature stages*. Unknown.

*Habitat*. Mesic woods.

*Food snails*. Unknown.

*Distribution*. Palearctic. Southern Fennoscandia to France and Germany.

*Published records*. Akershus: Röken (Siebke 1877, p. 142). Hedmark: Tyldal Österdaliae (Siebke 1877, p. 142). Nord-Trøndelag: Thy-naes (Zetterstedt 1846, p. 2112; Dahl 1965, p. 156); Levanger (Dahl 1965, p. 156). Oslo: Töien (Siebke 1877, p. 142). Vestfold: Laurvik prope Fritsövand (Siebke 1877, p. 142).

*Examined material*. Akershus: [Asker] Röken, S. (ZMO). Hedmark: [Tynset] Tyldal, 22 July 1848 (ZMO). Vestfold: Laurvik, S. (ZMO).

11. *Pherbellia schoenherri schoenherri* Fallén

*Biology, immature stages*. Verbeke (1960) (E); Rozkosny (1967) (E, P); Beaver (1970).

*Habitat*. Sunlit marshes and margins of ponds, lakes and streams.

*Food snails*. *Succinea* (*Succinea putris* (L.)).

*Distribution*. Holarctic. The Palearctic subspecies occurs from northern Fennoscandia throughout Europe to Spain and the Ukraine.

*Published records*. Nordland: Evenäs juxta sinum Osoden Fjord (Zetterstedt 1846, p. 2107). Oslo: Töien, Rynbjerg (Siebke 1877, p. 142).

*Examined material*. Akershus: Bærum, Överland, 7 Sept. 1970, C.O.B.-A.L. (CU, ZMO); Ås, Lake Årungen, 11 Sept. 1970, C.O.B.-T.E. (CU, ZMO). Oslo: Østensjøvannet, 15 Sept. 1970, C.O.B. (CU); Kr.ania, Esmark (TM,

ZMO); Rynbjerg, 4 June 1846, 29 June 1848, S. (ZMO); Tøien, 28 May 1846, S. (ZMO). Sör-Tröndelag: Oppdal, Grönbakken, 940 m, 25 July 1966, T.N. (ZMB). Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU, USNM, ZMB, ZMO).

*Note.* *P. s. schoenherri* was found in more of the collecting sites visited by C.O. Berg in southern Norway than any other species of Sciomyzidae. It was also the most abundant species taken at Överland and was second only to *Sepedon s. spinipes* at 3 other localities.

\*12. *Pherbellia scutellaris* (von Roser)  
*bezzii* Hendel (*Sciomyza*)

*Biology, immature stages.* Bratt et al. (1969) (E, L<sub>1-3</sub>, P).

*Habitat.* Coniferous and deciduous woods.

*Food snails.* *Balea*, *Clausilia*, *Cochlicopa*, *Discus*, *Eulota*, *Helix*, *Hygromia*, *Monacha*, *Vitirina* (*Clausilia bidentata* (Strom), *C. dubia* Draparnaud).

*Distribution.* Palearctic. Southern Fennoscandinavia and northern Scotland across central Europe to Albania (map: Bratt et al. 1969, Fig. 180).

*Examined material.* Hordaland: Granvin, Seim, 1 June 1936, N. Knaben (ZMB); Eidfjord, Måbødalen, 340 m a.s.l., 6 July 1968, T.N. (ZMB). Oslo: Tøien, July 1845, S. (ZMO).

\*13. *Pherbellia ventralis* (Fallén)

*Biology, immature stages.* Bratt et al. (1969) (E, L<sub>1,2</sub>, P); Beaver (1970).

*Habitat.* Various aquatic and damp situations.

*Food snails.* *Australorbis*, *Physa*, *Succinea* (*Lymnaea palustris*).

*Distribution.* Palearctic. Iceland; central Scandinavia to southern Spain, Greece, and Turkey (map: Bratt et al. 1969, Fig. 181).

*Examined material.* Opland: [Vågå] Vågåmo, 13 July 1953 (ZMO). Oslo: Kristiania, 15 June 1922, A.H. Sturtevant (USNM).

### III. PTEROMICRA LIOY

*Dichrochira* Hendel

14. *Pteromicra glabricula* (Fallén)  
*nigrimana* Meigen (*Sciomyza*)

*piliseta* Roser (*Piophila*)

*sororcula* Meigen (*Opomyza*)

*ventralis* Meigen (*Opomyza*)

*Biology, immature stages.* Rozkosny & Knutson (1970) (L<sub>1-3</sub>, P).

*Habitat.* Ponds, swamps, and marshes where some shade is available.

*Food snails.* *Discus*, *Lymnaea*, *Physa*, *Planorbis*, *Succinea*.

*Distribution.* Palearctic. Iceland and Finnish Lapland southward to Hungary (map: Rozkosny & Knutson 1970, fig. 78).

*Published record.* Opland: Dovre (Zetterstedt 1838, p. 738; Zetterstedt 1846, p. 2093 as *S. albitarsis* Zetterstedt; Rozkosny & Knutson 1970, p. 1435 female lectotype and paralectotype of *Sciomyza nigrimana* Meigen, in Staatliches Museum für Naturkunde, Ludwigsberg, Germany).

*Examined material.* Nordland: Fauske, 27 June 1956, R. Dahl (RD). Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970. C.O.B.-J.Ö. (CU, USNM, ZMB, ZMO).

### IV. \*SCIOMYZA FALLÉN

*Bischofia* Hendel

\*15. *Sciomyza simplex* Fallén

*Biology, immature stages.* Foote (1959) (E, L<sub>3</sub>, P).

*Habitat.* Open marshes, margins of ponds.

*Food snails.* *Bathymphalus*, *Helix*, *Lymnaea*, *Oxyloma*, *Physa*, *Retinella* (*Lymnaea palustris*).

*Distribution.* Holarctic. In Palearctic Region: middle latitudes of Fennoscandinavia to Czechoslovakia.

*Examined material.* Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU).

### V. COREMACERA RONDANI

*Statinia* Meigen

16. *Coremacera marginata* (Fabricius)

*Biology, immature stages.* Unpublished data, L. V. Knutson.

*Habitat.* Amongst herbaceous vegetation in

exposed, scrubby woods; old fields at wood margins.

*Food snails.* *Cochlicopa*, *Discus*, *Eulota*, *Helicella*, *Hygromia*, *Monacha*.

*Distribution.* Palearctic. Southern Sweden and Norway to Spain and Turkey.

*Published records.* Nord-Trøndelag: Thynäs (Zetterstedt 1846, p. 2129; Dahl 1965, p. 158); Levanger, Tynes (Dahl 1965, p. 158). Oslo: Christiania (Zetterstedt 1846, p. 2129).

*Examined material.* Rogaland: Oгна, R. y., 27 June 1962, T.N. (ZMB).

#### \*VI. *DICHETOPHORA* RONDANI

\*17. *Dichetophora finlandica* Verbeke  
*obliterata* Sack, *nec* Fabricius

*Biology, immature stages.* Unknown.

*Habitat.* Amongst grass and herbaceous vegetation at exposed margins of woods.

*Food snails.* Unknown.

*Distribution.* Palearctic. Southern Finland, Sweden, Norway, Poland, and England (map: Rozkosny & Zuska 1965, Map 3).

*Examined material.* Oslo: Östensö, Aug. 1872, S. (ZMO).

#### VII. *DICTYA* MEIGEN

18. *Dictya umbrarum* L.

*Biology, immature stages.* Unpublished data, S. E. Neff.

*Habitat.* On herbaceous vegetation in ponds, marshes, bogs, and margins of lakes.

*Food snails.* *Helisoma*, *Lymnaea*, *Planorbis*, *Succinea* (*Lymnaea* sp.).

*Distribution.* Palearctic. Iceland and northernmost Fennoscandia to France and Bulgaria. (Known range in Norway shown in Fig. 2.)

*Published records.* Nord-Trøndelag: Näs (Zetterstedt 1846, p. 2136). Opland: Gausdal Gudbrandsdaliae ad Toft (Siebke 1877, p. 143). Oslo: Kvaerner, Linderud (Siebke 1877, p. 143).

*Examined material.* Finnmark: [Alta], Kåfjord, 4 July 1956, H. Andersson (ZIL); [Tana],

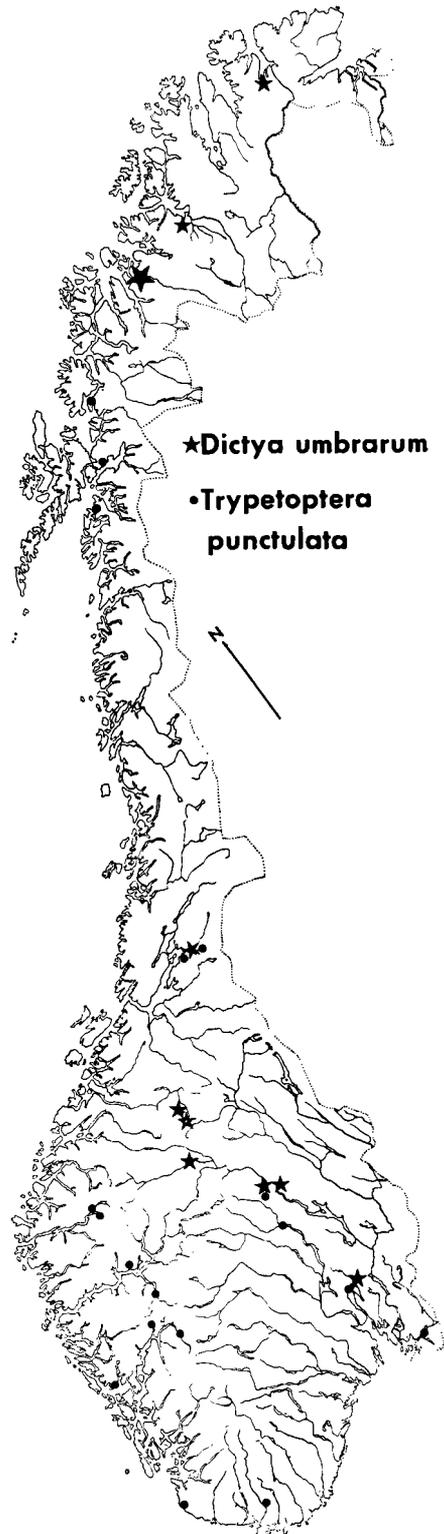


Fig. 2. The distribution of *Dictya umbrarum* and *Trypetoptera punctulata* in Norway.

Vestertana, 6 July 1956, H. Andersson (ZIL). Opland: Nordsäter, 12 July 1953 (ZMO); [Vågå], Vågåmo, 11 July 1953 (ZMO). Oslo: Linderud, 13 June 1846, S. (ZMO); Kr.ania, S. (ZMO); Kvaerner, 22 Aug. 1846, S. (ZMO). Sör-Tröndelag: Oppdal, Grönbakken, 940 m. 25 July 1966, T.N. (ZMB); Högsnydde, Kongsvoll, 890 m, 29 July 1966, T.N. (ZMB). Troms: Sørkjøs, 3 July 1957, R. Dahl (RD).

*Note.* The records from Finnmark extend the known range considerably northward. In 1959, one of us (C.O.B., unpublished) collected specimens at Abisko, Sweden, well above the Arctic Circle and north of all published records, but south of the Finnmark localities.

### VIII. ECTINOCERA ZETTERSTEDT

#### 19. *Ectinocera borealis* Zetterstedt

*sciomyzina* Zetterstedt (*Tetanocera*)

*Biology, immature stages.* Unknown.

*Habitat.* Densely shaded coniferous forests.

*Food snails.* Unknown.

*Distribution.* Palearctic. Northernmost Fennoscandia to northern Germany and Poland.

*Published records.* Sör-Tröndelag: Drivstuen in alpe Dovre (Zetterstedt 1838, p. 743 and 1846, p. 2148; Dahl 1965, p. 160, female lectotype in ZIL). Nord-Tröndelag: Garnaes Vaerdaliae (Zetterstedt 1846, p. 2145, as *Tetanocera sciomyzina* Zetterstedt; Dahl 1965, p. 160).

### IX. ELGIVA MEIGEN

*Ilione* Hendel

*Hedroneura* Hendel

#### 20. *Elgiva cucularia* L.

*Biology, immature stages.* Knutson & Berg (1964) (E, L<sub>1-3</sub>,P); Rozkosny (1967) (P).

*Habitat.* Eurytopic in freshwater situations.

*Food snails.* *Lymnaea*, *Physa*, *Planorbis*.

*Distribution.* Palearctic. Scotland and southernmost Scandinavia to North Africa and Greece (map: Knutson & Berg 1964, Pl. 2).

*Published record* (Siebke 1877, p. 144). Oslo: Hovind, 27 June-16 July 1851.

*Examined material.* Oslo: Østensjøvannet, 15

Sept. 1970, C.O.B. (CU); Hovind, 27 June 1850, 16 July 1851, S. (ZMO). Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU).

#### \*21. *Elgiva rufa* Panzer

*sundewalli* Kloet and Hincks (*Elgiva*)

*Biology, immature stages.* Henning (1952) (L); Smith (1959) (P); Knutson & Berg (1964) (E, L<sub>1-3</sub>,P); Rozkosny (1967) (E, L<sub>1-3</sub>,P).

*Habitat.* Eurytopic in freshwater situations.

*Food snails.* *Australorbis*, *Gyraulus*, *Heliosoma*, *Lymnaea*, *Physa*, *Planorbis*.

*Distribution.* Holarctic. In Palearctic Region: northernmost Fennoscandia to Spain and Greece (map: Knutson & Berg 1964, Pl. 2).

*Examined material.* Akershus: Ås, Lake Årungen, 11 Sept. 1970, C.O.B. - T.E. (CU, USNM, ZMB, ZMO).

### X. EUTHYCERA LATREILLE

*Lunigera* Hendel

#### 22. *Euthycera chaerophylli* Fabricius

*Biology, immature stages.* Rozkosny (1967) (P). Several attempts to rear this species have been made by L. V. Knutson and J. W. Stephenson. Of the great variety of terrestrial and aquatic molluscs offered, newly hatched larvae attacked only *Agriolimax reticulatus* (Müller), a slug. All larvae died shortly after their first larval molt.

*Habitat.* Damp woods, densely shaded swamps to open marshes.

*Food slugs.* *Agriolimax*(?).

*Distribution.* Palearctic. Southern Fennoscandia to the Alps, northern Greece, and Turkey.

*Published records* (Siebke 1877, p. 143). Akershus: Enebak. Opland: Öier. Östfold: Sarpsborg (Grimsgaard), Eskeviggen ad Fredrikshald. Vestfold: Laurvik.

*Examined material.* Akershus: Bærum, Tjernsmyr, 7 Sept. 1970, C.O.B.-A.L. (CU); Bærum, Schøyen (ZMO); Enebakk, S. (ZMO). Opland: Öier, S. (ZMO). Oslo: Frogner, 14 June 1846, 27 June 1845, Esmark (ZMO); Kr.ania, S. (ZMO); Hovind, 27 June 1850, 16 July 1851, S. (ZMO). Östfold: Frhld, July 1852,

S. (ZMO). Vestfold: Stavaern, S. (ZMO, TM).

(1967) (E, L<sub>1-3</sub>, P); Rozkosny (1967) (E, L<sub>1-3</sub> P); Beaver (1970).

## XI. HYDROMYA ROBINEAU-DESVOIDY

### 23. *Hydromya dorsalis* (Fabricius)

*Biology, immature stages.* Knutson & Berg (1963) (E, L<sub>1-3</sub>, P); Beaver (1970).

*Habitat.* Eurytopic in freshwater situations (see note below).

*Food snails.* *Anisus, Helisoma, Lymnaea, Physa, Planorbis.*

*Distribution.* Palearctic. Northernmost Fennoscandinavia to North Africa, Asia Minor, and Afghanistan (map: Knutson & Berg 1963, fig. 1).

*Published records.* Oslo: Töien, Hovind, Baekkelaget, June-August (Siebke 1877, p. 144). Rogaland: Orre, 11 July 1953, P. Ardö (Ardö 1957, p. 120).

*Examined material.* Finnmark: Tanafjord, 6 July 1956, R. Dahl (RD). Oslo: Töien, July 1845, 12 Aug. 1851, S. (ZMO); Kr.ania, Esmark (ZMO). Rogaland: Jæren, Orre, 15 Aug. 1955, P. Ardö (ZIL); Sola, Gimra, 10 Aug. 1967, T.N. (ZMB); Klepp, Kleppe, 27 Aug. 1967, T.N. (ZMB). Troms: Tromsö, 20 July 1947, P. Ardö (ZIL).

*Note.* We must retract the statement (Knutson & Berg 1963) that *H. dorsalis* is difficult to rear and the suggestion that larvae may develop only in flowing water. Collections and rearings that we have made in Denmark, Spain, and Afghanistan since 1963 show that the larvae are not restricted to flowing water habitats and are no harder to care for than other aquatic Tetanocerini. Beaver (1970) collected adult flies in dune slacks having no appreciable water movement in Wales and reared larvae successfully in petri dishes in which water stood for 2 to 3 days between changes.

## XII. KNUTSONIA VERBEKE

### *Elgiva auctt*

### 24. *Knutsonia albiseta* (Scopoli) *aratoria* Fabricius (*Musca*)

*Biology, immature stages.* Knutson & Berg

*Habitat.* Temporary and permanent freshwater habitats.

*Food snails.* *Helisoma, Lymnaea, Physa.*

*Distribution.* Palearctic. Scotland and lower Fennoscandinavia to North Africa and Turkey (map: Knutson & Berg 1967, fig. 51).

*Published records.* Oslo: Kvaerner, 22 August 1846 (Siebke 1877, p. 144). Östfold: Lundestad as Fredrikshald, 3 August 1865 (Siebke 1877, p. 144). Rogaland: Orre, 11 July 1953. P. Ardö (Ardö 1957, p. 120).

*Examined material.* Oslo: Kvaerner, 22 Aug. 1846, S. (ZMO). Rogaland: Ryfylke, 15 July 1941, Holgersen (BM).

## XIII. LIMNIA ROBINEAU-DESVOIDY

### \*25. *Limnia paludicola* (Elberg)

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>1</sub>). A few specimens of this species have been reared from eclosion to pupation on dead and living *Succinea* by the senior author.

*Habitat.* Widespread at margins of ponds, swamps, damp woods; found with *L. unguicornis*.

*Food snails.* *Succinea.*

*Distribution.* Palearctic. Northern and central Europe (map: Elberg 1965, fig. 20).

*Examined material.* Hordaland: Bremnes, Tollaksvatn, 27 June 1966, T.N., 1 male (ZMB); Meland, Brakstad, 7 July 1968, L. Greve, 1 male (ZMB).

### 26. *Limnia unguicornis* (Scopoli)

*Biology, immature stages.* Beaver (1970) (*L. unguicornis*, s. lat.).

*Food snails.* Unknown.

*Habitat.* Widespread at margins of ponds, swamps, damp woods; found with *L. paludicola*.

*Distribution.* Palearctic. Widespread throughout most of Europe; known from Turkey, but not from Lapland (map, Elberg 1965, fig. 20).

*Examined material.* Hordaland: Eidfjord, Ö. Eidfjord, 21 July 1967, A. Löken, 1 male (ZMB). Opland: Öier, S., 1 male (ZMO). Oslo: Töien, July 1843, S. 1 male (ZMO).

25 and 26. *Limnia paludicola* or *L. unguicornis*, females.

*Published records.* Hedmark: Aaset in par. Aamodt (Siebke 1877, p. 143). Oslo: Töien, Hasle (Siebke 1877, p. 143).

*Examined material* (females). Oslo: Töien, 20 July 1847, S. (ZMO); Kr.ania, Esmark (ZMO); Frogner, 27 July 1845, Esmark (ZMO).

*Note.* In distinguishing his new species, *L. paludicola*, from the sympatric *L. unguicornis* (Scopoli), Elberg (1965) noted that females of the 2 species could be separated only by the color of the longitudinal, median thoracic stripe. He states that female *L. unguicornis* have a coat of golden pruinosity over the brown base color of the median stripe, whereas this pruinosity is absent or hardly discernable in females of *L. paludicola*. We cannot recognize such a sharp distinction in specimens we have seen. Many specimens lack pruinosity, many have a heavy median covering but with bare brown lateral margins, a few have a slight but extensive covering, and others have a dense, complete covering that obscures all of the brown base color. The brown median thoracic stripe of males of both species is densely covered with golden pruinosity. (LVK).

#### XIV. *PHORBINA* ROBINEAU-DESVOIDY

27. *Pherbina coryleti* (Scopoli)

*obsoleta* Fallén (*Tetanocera*)

*reticulata* Fabricius (*Musca*)

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>3</sub>, P); Knutson, et al. (in manuscript) (E, L<sub>1-3</sub>, P); Beaver (1970).

*Habitat.* Most freshwater habitats.

*Food snails.* *Anisus*, *Bathymophalus*, *Cochlicopa*, *Discus*, *Hippeutis*, *Lymnaea*, *Oxychilus*, *Physa*, *Planorbis*, *Segmentina*, *Succinea*.

*Distribution.* Palearctic. Southern Fennoscandinavia and around the Gulf of Bothnia, throughout Europe, and across Asia Minor to Afghanistan (map: Verbeke 1960, Fig. 14).

*Published records.* Oslo: June-August (Siebke 1877, p. 143). Rogaland: Orre, 11 August 1953, P. Ardö (Ardö 1957, p. 120).

*Examined material.* Akershus: Ås, Årungen,

11 Sept. 1970, C.O.B.-T.E. (CU). Oslo: Kr.ania, Esmark (TM); Kr.ania, S. (ZMO). Rogaland: Klepp, 27 July 1960, T.N. (ZMB); Ryfylke, 15 July 1941, Holgerson (BM). Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU).

#### XV. *RENOCERA* HENDEL

\*28. *Renocera fuscinervis* (Zetterstedt)  
*strobli* Hendel (*Renocera*)

*Biology, immature stages.* Unknown.

*Habitat.* Ponds, backwaters of rivers.

*Food snails.* Unknown.

*Distribution.* Palearctic. Northern Fennoscandinavia to France, Italy, and Austria; also Kamchatka.

*Examined material.* Finnmark: [Porsanger], Lakselv, 9 July 1956, H. Andersson (ZIL); [Tana], Vestertana, 6 July 1956, H. Andersson (ZIL). Opland: [Søndre-Land], Land, S. (ZMO). Oslo: Kr.ania, S. (ZMO).

29. *Renocera pallida* (Fallén)

*Biology, immature stages.* Beaver (1970). The senior author has reared a few adults from field-collected puparia and has obtained mating, oviposition, and hatching of eggs in the laboratory.

*Habitat.* Densely shaded ponds, marshy areas, swamps.

*Food snails.* Unknown.

*Distribution.* Palearctic. Northern Fennoscandinavia to France, Italy, and Czechoslovakia.

*Published records* (Siebke 1877, p. 141). Akershus: Lillestrømmen in Romerike. Oslo: Töien.

*Examined material.* Oslo: Töien, 20 June 1851, S. (ZMO).

30. *Renocera striata* (Meigen)

*affinis* Zetterstedt (*Sciomyza*)

*Biology, immature stages.* Nothing has been published on the biology and immature stages of this species. The senior author has reared larvae to the second stadium on fingernail clams (Sphaeriidae).

*Habitat.* Boreal ponds, marshes, and bogs.

*Food molluscs.* *Pisidium*.

*Distribution.* Palearctic. Northern Fennoscandia to France and Czechoslovakia.

*Published record* (Dahl 1968, p. 24). Norway, no precise locality.

*Examined material.* Finnmark: [Tana] Vestertana, 6 July 1956, H. Andersson (ZIL); Alta, 4 July 1956, R. Dahl (RD); Börselv, 5 July 1956, R. Dahl (RD); Tanafjord, 6 July 1956, R. Dahl (RD). Nordland: Sörkil, 27 June 1956, R. Dahl (RD).

#### XVI. *SEPEDON* LATREILLE

##### 31. *Sepedon sphaega* (Fabricius)

*Biology, immature stages.* Nagatomi & Kushigemachi (1965) (E, L, P); Neff & Berg (1966) (E, L<sub>1-3</sub>, P); Rozkosny (1967) (E, L<sub>1</sub>); Nagatomi & Tanaka (1967) (E).

*Habitat.* More or less exposed, sunlit ponds, canals, lake margins, and marshlands.

*Food snails.* *Australorbis*, *Gyraulus*, *Helisoma*, *Physa*.

*Distribution.* Palearctic, Oriental. Widely distributed from Ireland to Japan (map: Neff & Berg 1966, Map D).

*Published record* (Siebke 1877, p. 143). Oslo: Christianiam.

*Examined material.* Hedmark: [Ringsaker] Helgöen, Esmark (ZMO). Oslo: Kr.ania, S. (ZMO); Östensjövanne, 15 Sept. 1970, C.O.B. (CU). Vestfold: Borre, Falkenstein Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU, ZMB).

##### \*32. *Sepedon spinipes spinipes* (Scopoli) *haeffneri* Fallén (*Sepedon*)

*Biology, immature stages.* Neff & Berg (1966) (E, L<sub>1-3</sub>, P); Beaver (1970).

*Habitat.* Generally occurring with *S. sphaega*, but evidently far more abundant in breeding sites in Norway (see note below).

*Food snails.* *Australorbis*, *Helisoma*, *Physa*, *Planorbis*.

*Distribution.* Holarctic. The Palearctic subspecies occurs from southern Fennoscandia to southern Spain, Italy, Crete, and Turkey (map: Neff & Berg 1966, Map D).

*Examined material.* Akershus: Ås, Lake Årungen, 11 Sept. 1970, C.O.B.-T.E. (CU, ZMB,

ZMO.) Oslo: Östensjövanne, 15 Sept. 1970, C.O.B. (CU, ZMB, ZMO). Vestfold: Borre, Falkenstein Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU, USNM, ZMB, ZMO).

*Note.* Although never recorded from Norway before, this distinctive species occurred in greater numbers than the total for all other species of Sciomyzidae at all 3 of the sites listed.

#### XVII. *TETANOCERA* DUMERIL

##### 33. *Tetanocera arrogans* Meigen

*foveolata* Rondani (*Tetanocera*)

*Biology, immature stages.* Rozkosny (1965, 1967) (P); Beaver (1970). We have reared this and the following species of *Tetanocera* (except *T. lapponica*) in several European countries (unpublished data); the Holarctic species have been reared also in North America by Foote (1961).

*Habitat.* Amongst dense vegetation at margins of a wide variety of aquatic habitats.

*Food snails.* *Succinea*.

*Distribution.* Palearctic. Northern Fennoscandia and Siberia to Spain, Greece, and Turkey.

*Published records* (Siebke 1877, p. 144). Hedmark: Aaset in par. Aamodt Österdaliae. Möre og Romsdal: insula Smölen in Nordmöre. Opland: Toft in par. Gaudsal, Jerkin in alpe Dowre. Oslo: Christianiam.

*Examined material.* Akershus: Ås, Lake Årungen, 17 July 1970, T.N. (ZMB). Östfold: Fr.hald, S. (ZMO).

##### 34. *Tetanocera elata* (Fabricius)

*nigricosta* Rondani (*Tetanocera*)

*Biology, immature stages.* Knutson et al. (1965) (E, L); Rozkosny (1965, 1967) (P).

*Habitat.* Very broadly distributed and common amongst herbaceous vegetation in wet to mesic terrestrial situations.

*Food slugs.* *Arion*, *Agriolimax*, *Limax*, *Milax*.

*Distribution.* Palearctic. Widely distributed from northernmost Fennoscandia and Siberia to Spain, Italy, and Turkey; northern Manchuria. (Distribution in Norway shown in Fig. 3).



*Published records.* Akershus: Enebak (Siebke 1877, p. 144). Buskerud: Parochiis Krydsherred (Siebke 1877, p. 144). Hedmark: Grue in Solør (Siebke 1877, p. 144); Aamodt (Siebke 1877, p. 144); Rendal and Store Elvedal Österdaliae (Siebke 1877, p. 144). Møre og Romsdal: Romsdalia ad Veblungsnaes (Siebke 1877, p. 144). Nordland: Evenäs Nordlandiae (Zetterstedt 1846, p. 2139). Nord-Trøndelag: Thynäs (Zetterstedt 1846, p. 2139; Dahl 1965, p. 159); Levanger (Zetterstedt 1846, p. 2139, Dahl 1965, p. 159). Oppland: Lillehammer (Siebke 1877, p. 144); alpe Dowre (Siebke 1877, p. 144). Oslo: Christianiam (Siebke 1877, p. 144).

*Examined material.* Akershus: As, Holstad, 13 June 1965, R. Mehl (CU). Bergen: Eidsvåg, 7 July 1935, N. Knaben (ZMO). Buskerud: Krydsherred, S. (ZMO). Finnmark: Adamsfjord, 5 July, 1956, R. Dahl (RD); [Alta], Altidet, 16 July 1947, Ardö (ZIL); [Porsanger], Kistrand, 13 July 1947, Ardö (ZIL); [Porsanger], Börselv, 11 July 1947, Ardö (ZIL); Langfjord, 4 July 1956, H. Andersson (ZIL). Hedmark: Grue, S. (ZMO); Aamodt, 28 July 1848, S. (ZMO). Hordaland: Fana, Stend, 19 June 1957, J. Gullaksen (ZMB); Meland, Brakstad, 2 Aug. 1964, J. Greve (ZMB); Ulvik, Hard., 28 May 1937 (ZMB); Böyum, Fjærland, 30 June 1939, N. Knaben (ZMB); Måiset, Vik, Högill, 19 July 1940, N. Knaben (ZMB); Fana, Fjell-tveitvann, 13 June 1937 (ZMB); Fana, 2 Sept. 1970, C.O.B.-T.S. (CU); Herdla, 22 June 1936 (ZMB); Eidfjord, Måbødalen, 340 m a.s.l., 6 July 1968, T.N. (ZMB); Eidfjord, Hjölmø, 400 m a.s.l., 6 July 1967, Rönhovde (ZMB); Eidfjord, Hjölmø, 450 m a.s.l., 8 July 1967, T.N. (ZMB). Møre og Romsdal: Romsdal, S. (ZMO). Nordland: [Fauske], Sulitjelma, 16° 4' E., 67° 8' N., 14 May 1961 (BM); Rösvik, 3 July, 5 Aug. 1923, Soot-Ryen (TM); [Rana] Mo i Rana, 26 June 1956, H. Andersson (ZIL). Oppland: Dovre, Schøyen, (ZMO); [Vågå], Jotunheimen, Gjendesheim, 7 July 1966, Benson (BM). Oslo: Kr.ania, Esmark (TM, ZMO); Tøien, July 1845, S. (ZMO); Enebakk, S. (ZMO). Rogaland: Sandnes, Skeiane, 28 June 1963, T.N. (ZMB). Sogn og Fjordane: [Aur-

Fig. 3. The distribution of *Tetanocera elata* in Norway.

land], Fretheim, 11, 13 June 1939, N. Knaben (ZMB); [Aurland], Otternes, 14 Aug. 1941, N. Knaben (ZMB); [Aurland], Flåm, 7 July 1965, A. Löken (ZMB). Troms: Tromsø, 2-5 July 1947, Ardö (ZIL); Gratangen, 25 July 1947, Ardö (ZIL); Sandbukt, 3 July 1956, H. Andersson (ZIL). Vestfold: Sandefjord, July 1846, S. (ZMO).

35. *Tetanocera ferruginea* Fallén (Fig. 1).

*Biology, immature stages.* Disney (1964); Rozkosny (1965, 1967) (L<sub>3</sub>, P); Beaver (1970).

*Habitat.* A wide variety of ponds, marshes, swamps, and other freshwater situations.

*Food snails.* *Helisoma*, *Lymnaea*, *Physa*, *Planorbis*, *Succinea*, (*Planorbis* sp. and *Lymnaea palustris*).

*Distribution.* Holarctic. Throughout the Palearctic Region from northernmost Fennoscandinavia, Siberia, and Sakhalin, to Spain, Greece, Turkey, Mongolia, and Tsinkhai, China.

*Published records.* Nord-Trøndelag: Levanger, Tynes (Dahl 1965, p. 159). Opland: alpe Dowre ad Jerkin & Kongsvold (Siebke 1877, p. 143). Oslo: Hovind (Siebke 1877, p. 143). Rogaland: Orre, 11 July 1953, P. Ardö (Ardö 1957, p. 120). Vestfold: Fyldpaa prope Tönsberg (Siebke 1877, p. 143).

*Examined material.* Hordaland: Fana, 2 Sept. 1970, C.O.B.-T.S. (CU). Opland: Dovre, S. (ZMO). Oslo: Östensjøvannet, 15 Sept. 1970, C.O.B. (CU); Kvaerner, 22 Aug. 1846, S. (ZMO). Sör-Trøndelag: Oppdal, Grönbakken, 940 m, 25 July 1966, T.N. (ZMB); Raavand, 6 July 1922, Soot-Ryen (TM); Bjerking, 13 June 1897 (TM). Vestfold: Borre, Falkensten Möllerdam., 9 Sept. 1970, C.O.B.-J.Ö. (CU, USNM).

\*36. *Tetanocera hyalipennis* von Roser  
*laevifrons* Loew (*Tetanocera*)

*Biology, immature stages.* L. V. Knutson, unpublished data.

*Habitat.* Margins of ponds, lakes, in exposed marshes, margins of small streams.

*Food snails.* *Lymnaea*, *Physa*, *Planorbis*.

*Distribution.* Palearctic. Faeroe Islands and northern Fennoscandinavia to Spain, Italy, and Czechoslovakia.

*Examined material.* Akershus: Ås, Vassum, 9 Aug. 1966, T.N. (ZMB). Buskerud: [Hol], Ustaoset, 4 July 1928, Quelprud (ZMO). Hedmark: [Tynset], Tyllidal, S. (ZMO). Sör-Trøndelag: Oppdal, Knutshö, 1130-1300 m, 16-23 June 1967, A. Löken (ZMB). Vestfold: Tönsberg, S. (ZMO).

\*37. *Tetanocera lapponica* Frey

*Biology, immature stages.* Unknown.

*Habitat.* Freshwater lakes and sedge marshes.

*Food snails.* Unknown.

*Distribution.* Palearctic. Boreal Norway, Sweden, and Finland.

*Examined material.* Sör-Trøndelag: Oppdal, Grönbakken, 940 m, 25 July 1966, T.N. (ZMB); Carasj-jaure [‘some small fresh-water lakes on the high lying plain between Frihetsi in Dividal and the Store Ruosta Lake’, Soot-Ryen, *in litt.*], 21 July, Soot-Ryen (TM).

\*38. *Tetanocera montana* Day

*borealis* Frey (*Tetanocera*)

*Biology, immature stages.* L. V. Knutson, unpublished data.

*Habitat.* Swamps, marshes, ponds.

*Food snails.* *Lymnaea*, *Physa*, *Planorbis*.

*Distribution.* Holarctic. In the Palearctic Region: from northern Fennoscandinavia to Belgium, Czechoslovakia, Hungary, and Turkey (map: Rozkosny & Zuska 1965, Map 2).

*Examined material.* Opland: Dovre, S. (TM, ZMO); Z. E. E., Jotkajaure, 1, 19 July 1924, Soot-Ryen (TM); Z. E. E., Faestingst., 30 July 1924, Soot-Ryen (TM); Vannö, 3 July 1925, Soot-Ryen (TM). Oslo: Kr.ania, S. (ZMO). Sör-Trøndelag: Oppdal, Varstigen, 780 m, 16 July 1966, T.N. (ZMB); Oppdal, Grönbakken, 940 m, 25 July 1966, T.N. (ZMB).

\*39. *Tetanocera phyllophora* Melander  
*nigricosta* auctt., nec Rondani

*Biology, immature stages.* Bhatia & Keilin (1937) (L); Knutson, unpublished data.

*Habitat.* Mesic woods.

*Food snails.* *Clausilia*, *Cochlicopa*, *Discus*, *Helix*, *Hygromia*, *Lymnaea*, *Succinea*, *Zonitoides* (*Euconulus fulvus* (Müller), *Vertigo genesii* Gredler).

*Distribution.* Holarctic. In the Palearctic Region: throughout the northern parts of Europe to Belgium, France, and Czechoslovakia; also Kamchatka (map: Rozkosny & Zuska 1965, Map 1).

*Examined material.* Hedmark: Aamot, S. (ZMO). Hordaland: Bremnes, Våge, 26 June 1966, T.N. (ZMB); Hjälmsberg, 21 June 1952, Rydén (ZIL).

\*40. *Tetanocera robusta* Loew

*Biology, immature stages.* Beaver (1970); L. V. Knutson, unpublished data.

*Habitat.* Marshes, ponds, lake margins.

*Food snails.* *Lymnaea*, *Physa*, *Planorbis*.

*Distribution.* Holarctic. In the Palearctic Region: Iceland, Faeroe Islands, and northernmost Fennoscandinavia, throughout central Europe, Siberia, and Kamchatka.

*Examined material.* Buskerud: Uvdal, Bruvoll, 7 July 1970, T.N. (ZMB). Hedmark: Aamot, S. (ZMO). Hordaland: Fana, 2 Sept. 1970, C.O.B.-T.S. (CU, USNM). Opland: Nordsåter, 12 July 1953 (ZMO). Oslo: Hovind, 27 June 1850, S. (ZMO). Rogaland: Höylund, Austrått, 20 June 1963; Figgjo, 13 June 1963, T.N. (ZMB); Sola, Gimra, 12 July 1964, T.N. (ZMB); Hetland, Gausel, 15 June, 1963, T.N. (ZMB.)

41. *Tetanocera silvatica* Meigen

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>1-3</sub>, P).

*Habitat.* Marshes; ponds; damp situations in mesic, shaded woods.

*Food snails.* *Discus*, *Lymnaea*, *Physa*, *Planorbis*, *Succinea* (*Discus rotundatus*).

*Distribution.* Holarctic. In the Palearctic Region: northernmost Fennoscandinavia and western Siberia throughout central Europe (map: Rozkosny & Zuska 1965, Map 1).

*Published records* (determinations questionable). Buskerud: Hönefoss (Siebke 1877, p. 144), in par. Land & Krydsherred (Siebke 1877, p. 144). Hedmark: Tyldal Österdaliae (Siebke 1877, p. 144); Kälähög (Zetterstedt 1846, p. 2140). Nordland: Björkvik, (Zetterstedt 1846, p. 2140); Evenäs (Zetterstedt 1846, p. 2140). Nord-Trøndelag: Thynäs (Zetterstedt 1846, p.

2140; Näs (Zetterstedt 1846, p. 2140); Levanger (Zetterstedt 1846, p. 2140); Suul (Zetterstedt 1846, p. 2140). Opland: Dovre ad Jerkin (Siebke 1877, p. 144). Oslo: Christiania (Siebke 1877, p. 144). Östfold: Fredrikshald (Siebke 1877, p. 144). Troms: Giebostad (Zetterstedt 1846, p. 2140); Dyrön Norlandiae (Zetterstedt 1846, p. 2140).

*Examined material.* Hordaland: Fana, Myrvatn, 11 June 1968, T.N. (ZMB); Ullensvang, Veivann omr., 1150 m a.s.l., 13 July 1968, A. Fjellberg (ZMB). Nordland: Mo i Rana, 25 June 1956, R. Dahl (RD). Opland: Dovre, S. (ZMO). Sör-Trøndelag: Oppdal, Gåvåli, 24 June 1967, A. Löken (ZMB). Troms: Gratangen, 30 June 1956, R. Dahl, (RD). Vestfold: Tjøme, N. f. sentrum, 3 June 1967, J. Greve, pair in copula (ZMB).

\*42. *Tetanocera unicolor* Loew

*Biology, immature stages.* Rozkosny (1967) (E, L<sub>1-3</sub>, P).

*Habitat.* Most freshwater situations.

*Food snails.* *Anisus*, *Bathymphalus*, *Cochlicopa*, *Discus*, *Eulota*, *Helix*, *Hygromia*, *Lymnaea*, *Physa*, *Planorbis*, *Succinea*.

*Distribution.* Holarctic. In the Palearctic Region: northernmost Fennoscandinavia throughout central Europe to northern Italy and Hungary; Kamchatka.

*Examined material.* Buskerud: Krydsh., S. (ZMO). Nordland: Fauske, 27 June 1956, R. Dahl (RD). Opland: Dovre, S. (ZMO). Oslo: Hovind, 27 June 1850. S. (ZMO). Sör-Trøndelag: Oppdal, Grönbakken, 940 m, 25 July 1966, T.N. (ZMB). Troms: Tromsø, 20 July 1947, P. Ardö (ZIL).

XVIII. *TRYPETOPTERA* HENDEL

43. *Trypetoptera punctulata* Scopoli  
*nemorum* Fallén

*Biology, immature stages.* Berg (1961) listed this species among those known to have terrestrial larvae, because newly hatched larvae have reduced to obsolescent body tubercles, float hairs, and spiracular disc lobes and other morphological features characteristic of that group. The larvae did not feed on the land snails pro-

vided for them, and no report of this abortive rearing effort was published.

*Habitat.* Mesic woods, grassy margins of wooded situations.

*Food snails.* Unknown.

*Distribution.* Palearctic. Northern Fennoscandia to central Spain, Italy and Turkey. (Distribution in Norway shown in Fig. 2.)

*Published records.* Nordland: Evenäs (Zetterstedt 1846, p. 2135). Nord-Trøndelag: Thynäs (Zetterstedt 1846, p. 2135); Levanger (Zetterstedt 1846, p. 2135); Garnäs (Zetterstedt 1846, p. 2135); Levanger, Tynes (Dahl 1965, p. 158). Opland: Gausdal Gudbrandsdaliae ad Toft (Siebke 1877, p. 43). Oslo: Christianiam (Siebke 1877, p. 43). Östfold: Fredrikshald (Siebke 1877, p. 43). Rogaland: Orre, 11 July 1953, P. Ardö, (Ardö 1957, p. 120). Sogn og Fjordane: in parochia Aurdal in Valdres (Siebke 1877, p. 43). Troms: Dyrön (Zetterstedt 1846, p. 2135).

*Examined material:* Hordaland: Eidfjord, Måbødalen, Tveito, 24 July 1967, A. Löken (ZMB); Hagavik, 11 Aug. 1945, S. Johnsen (ZMB); Seim, Granvin, 30 May 1936, N. Knaben (ZMB). Nordland: Sörkil, 27 June 1956, R. Dahl (RD). Opland: Gausdal, S. (ZMO) [Nord-Aurdal], Aurdal, S. (ZMO). Oslo: Kr.ania, S. (TM); Esmark (ZMO); Hovind, 27 June 1850, S. (ZMO); Linderud, 2 June 1873, S. (ZMO). Östfold: Fr.hald, S. (ZMO). Sogn og Fjordane: Fretheim, Aurland, 11, 13 June 1939, N. Knaben (ZMB); Visnes, Stryn, 14 July 1942, N. Knaben (ZMB); Loen, Stryn, 2 Aug. 1942, N. Knaben (ZMB); Fosse, Leikanger, 2 July 1939, N. Knaben (ZMB). Vest-Agder: [Kvinesdal], Gjemlestad, 6-7, 1945, N. Knaben (ZMB); July, 1935, N. Knaben (ZMO).

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## Short Communications

### On the Occurrence of *Apatania zonella* Zetterstedt (Trichoptera, Limnophilidae) in Svalbard

H. DÉCAMPS & J.-F. VOISIN

One female of *Apatania zonella* Zett. (Trichoptera, Limnophilidae) was caught on 21 July 1969 at the bottom of the Woodfjord, Svalbard. The species, which has a circumpolar distribution, is previously reported several times from Bear Island and only once from the rest of Svalbard, at the Wijdefjord.

H. Décamps, Université Paul Sabatier, Laboratoire d'Hydrobiologie, 31-Toulouse-04, France

J.-F. Voisin, 57 rue Cuvier, Paris 5°, France

On 21 July 1969 the French Paleontological Expedition stayed at the bottom of the Woodfjord. One of us (J. F. V.) captured a small Trichoptera flying above a rivulet, at the foot of the eastern slope of Sigurdfjellet. This specimen was a female *Apatania zonella* Zett.

This species was first described from Lapland by Zetterstedt in 1840 (*Phryganea stigmella* var. *zonella*). Boheman (1866) reported it from Svalbard (Dirkses Bay, Wijdefjorden) as *Goniotaulus arcticus*. It was also reported, as *Apatania arctica*, from Bear Island by J. Kiefer and W. Lundbeck (Thor 1930), by Lack (1933) and by Bertram & Lack (1938). Ulmer (1932) mentioned it as *Apatelia arctica* from Svalbard.

Schmid (1954) regards *Apatania zonella* as one of the Northernmost Trichoptera: it inhabits many islands and shores of the Arctic Ocean: Scandinavia, Northern USSR and Siberia, Svalbard, Novaya Zemlya, Kamtchatka, Iceland, Canada and Greenland.

The variety *A. zonella dalearlica* was described by Forsslund & Tjeder (1942) from specimens found in Scandinavia.

The occurrence of *A. zonella* at the bottom of the Woodfjord is not unexpected. This region is very isolated and seldom visited. *A. zonella* seems to be rather uncommon in Svalbard, but it is

probably not restricted to the regions where it was captured. It may be present in other regions too, mainly where the climate is a little less harsh than in the rest of the archipelago, for instance in the Isfjord area.

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## The Food Plant of *Parnassius apollo* L. ssp. *jotunensis* Opheim (Lep., Papilionidae)

TOR B. LUND

A larva of *Parnassius apollo* L. ssp. *jotunensis* Opheim was collected on *Sedum rosea* in Jotunheimen in 1967. As far as is known, this is the first record of larvae of ssp. *jotunensis*.

Tor B. Lund, 9301 Finnsnes, Norway

On 15 July 1967 I came across a larva of *Parnassius apollo* L. in the vicinity of Gjendebu, Lom (On) at 1170 m above sea level. The larva was found on *Sedum rosea*, and was fed on this plant until pupation. On 5 August 1967 a ♀ of *P. apollo* L. ssp. *jotunensis* Oph. hatched from the pupa.

Opheim (1945) was not able to find the larva of ssp. *jotunensis*, but suggested that *S. rosea* might be a host plant. As far as I know, the present observation, which confirms Opheim's (1945) suggestion regarding host plant, is the first record of larvae of ssp. *jotunensis*.

The larva of *P. apollo* has been found on *Sedum telephium* and *S. album* (Nordström, Wahlgren & Tullgren 1941). Neither of these could possibly be the food plant of ssp. *jotunensis*, since *S. telephium* has not been found in the area and *S. album* occurs in scarce amounts only. However, three species of *Sedum*, namely *S. rosea*, *S. annuum*, and *S. villosum* have been found near lake

Gjende. *S. villosum* is isolated and scarce, while *S. rosea* is abundant (Hultén 1950, Jörgensen 1933). The few records of *S. annuum* make it unlikely that this species serves as a food plant.

*P. apollo* has been receding in Norway for the last 30-40 years. Since 1960 only a few specimens have been recorded, of which only one ♂ from Heimdalsvann, Øystre Slidre (On), and some specimens from Bygdin (On) belong to ssp. *jotunensis* (Opheim 1969).

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## Spinneren *Selenephora lunigera* funnet i Norge

ALF BAKKE

Five males were collected in a light trap at Åmli, Aust-Agder, in August 1970, and three males at Sør-Odal, Hedmark, in June 1971. The records from Aust-Agder are about 250 km west of the present known distribution in Scandinavia and represent the first records from Norway.

Alf Bakke, Det norske Skogforsøksvesen, 1432 Vollebekk, Norway

Flere av de insektartene som blir registrert sporadisk i Skandinavia har sin hovedutbredelse i de store skog- og steppemrådene i Øst-Europa og Asia. Østgrensen for mange av disse artene går gjennom Finland eller Sverige, slik at innslaget av østlige arter er større der enn i Norge. I løpet av de siste dekadene har flere østlige arter økt sin utbredelse mot vest, og den norske fauna er blitt beriket ved disse artene. Av slike sommerfugler

kan nevnes noctuidaen *Plusia bactea* Schiff. og spinneren *Odontotia sieversi* Mén.

I august 1970 ble en ny østlig art for første gang registrert i Norge. *Selenephora lunigera* Esp. ble tatt i en lysfelle (HP 125) i Åmli i Aust-Agder. Fem individer, alle hanner, ble tatt i perioden 8.-11. august. Dette kan antyde at arten må være etablert i området. I 1971, 8., 25. og 27. juni ble tre hanner fanget i lysfelle i Maarud skog, Sør-

Odal i Hedmark. Et eksemplar av disse er vist i Fig. 1.

Arten er ansett for meget sjelden i Sverige, hvor den er funnet spredt i flere landskap fra Småland til Lappland. I Finland forekommer den også sporadisk, men den er ukjent i Danmark (Nordström et al. 1951).

*Selenephora lunigera* er knyttet til barskogen. Fra Sibir er den kjent som skadedyr på en rekke forskjellige bartrær, arter av gran, furu, edelgran og lerk. Sabunovic og Kulagin (1954) har beskrevet angrep som strakk seg over flere hundre hektar med barskog.

De to lokalitetene hvor arten er funnet, ligger i hver sin ytterkant av det store sammenhengende barskogområdet i Sør-Norge. Individtallet fra begge steder antyder at det ikke dreier seg om enkelte streifyr. Det er derfor grunn til å tro at arten også finnes i barskogene i de mellomliggende distrikter. Fangst med lysfeller har nå funnet sted i Norge i snart 20 år, også i barskoger. Det er derfor naturlig å trekke den konklusjon at *Selenephora lunigera* er en østlig art som har utvidet sin utbredelse mot vest i Skandinavia de siste årene.

Received 22 July 1971



*Selenephora lunigera* ♂. Sør-Odal 8. juni 1971.

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## Notes on Norwegian Spiders (Araneae), I

ERLING HAUGE

In the present paper, four species of spiders collected in Hardanger, Western Norway are reported. For *Hyptiotes paradoxus* (C. L. Koch) (Uloboridae), this is the second Norwegian record and the first from Western Norway. *Theonoe minutissima* (O. P.-Cambr.) (Theridiidae) and the Erigoninae species *Cornicularia unicornis* (O. P.-Cambr.) and *Monocephalus castaneipes* (Sim.) are new to Norway.

E. Hauge, Zoological Museum, University of Bergen, 5000 Bergen, Norway

During a two week stay in May 1971 at Rosendal, Hardanger in Western Norway, I collected four species of spiders which seem to be of immediate interest from a distributional point of view. The species are:

*Hyptiotes paradoxus* (C. L. Koch)

HOi: Tysnes, Ånuglo, 21 May 1971, not a fully developed female, caught when beating the lower branches in a spruce forest.

This Uloborid spider has hitherto been found only once in Norway, in the eastern part of our country, at Son near Oslo (Waalder 1970).

*Theonoe minutissima* (O. P.-Cambr.)

HOi: Varaldsøy, in mixed deciduous forest, 12 May 1971, 3 ♀♀; HOy: Tysnes, Ånuglo, 21 May

1971, 1 ♀ and 2 ♂♂ in mixed forest, pine and deciduous trees. All specimens were obtained by sieving moss on the ground cover.

Dr. Hans Kauri, Zoological Museum, Bergen, has most kindly let me know that he caught 5 ♀♀ and 7 juvenile specimens at HOy: Bömlo, Espevær. Nautøy, 19 May 1968, when sieving in *Vaccinium* spp. and *Juniperus communis*.

The species must be considered as new to the Norwegian fauna. It is previously known from The British Isles, Germany, France, Switzerland, Belgium, Spain, Sweden and Finland.

*Cornicularia unicornis* (O. P.-Cambr.)

HOi: Kvinnherad, Lio, 13 May 1971, 2 ♀♀, from moss in mixed deciduous forest.

According to Wichle (1960), this species is known from Europe ('mit Ausnahme des Südens'), but until now there have not been any records from Norway. In Sweden it is known up to Lappland.

*Monocephalus castaneipes* (Simon)

HOi: Kvinnherad, Rosendal, Murabotn, 19 May 1971, 9 ♀♀. The specimens were found in moss on and between large stones in a deciduous forest

Received 28 June 1971

## Notes on Norwegian Spiders, II

ERLING HAUGE

Zoological Museum, University of Bergen,  
5000 Bergen, Norway

An excursion in the vicinity of Finse (HOi: Ulvik) 20 August 1971 has resulted in the discovery of the Clubionid spider *Micaria alpina* Sim. Holm (1951) mentions the occurrence of this species in Norway, but gives no further information, so this is probably the first exact locality record from Norway published.

The single adult male specimen was found at approximately 1330 m above sea level, under a stone on the very steep southern slope of the

Received 20 September 1971

## *Atheta (Microdota) sundti* n. sp.

ANDREAS STRAND

Melumveien 38, Oslo 7

In Brønnøya some 10 km south-west of Oslo I found an *Atheta* specimens having, in general appearance, a striking resemblance to *glabricula* Thoms. The only difference I have been able to find consisting in the pronotum and clytra being a little broader, and the pubescence, though somewhat disturbed in the specimen, no doubt slightly less outward directed. The spermatheca, however, was clearly different and, as shown in Fig. 1, very characteristic.

Although I have not succeeded in finding further specimens, there seems to be no doubt that it is question of a separate species, which I am glad to name after my friend the *Acrotichis* specialist, Eivind Sundt.

The holotype is in my collection.

I am indebted to Dr. Victor Hansen, who kindly gave his opinion on the specimen submitted to him, and to Anders Vik for the drawing.

Received 11 October 1971

(mainly *Alnus*) at the base of a steep slope facing south. The species is new to Norway.

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- Waalder, P. F. 1970. *Hyptiotes paradoxus* (C. L. Koch) (Araneae) in Norway. *Norsk ent. Tidsskr.* 17, 103–104.
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Nordnut mountain. The vegetation here is very rich and luxurious.

The specimen has a total length 2.81 mm; carapace is 1.35 mm long and 0.92 mm broad.

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Fig. 1. Spermatheca of *Atheta sundti* A. Strand. Anders Vik del.

## Bokanmeldelser

Karg, W. 1971. Acari (Acarina), Milben. Die freilebenden Gamasina (Gamasides), Raubmilben. *Tierwelt Dtl.*, 59 Teil. 475 pp. 516 Abb. VEB Gustav Fischer, Jena. Pris DM 102,60.

Ovenfor nevnte bok kommer som 59. bind i serien «Die Tierwelt Deutschlands». Som bokens tittel forteller, omhandler den de frittlevende rovmidder. Boken er delt i en generell og en spesiell del. Den generelle del behandler morfologi, anatomi, utviklingsforløp, fangstmetodikk og prepareringsteknikk. Det er videre gitt en verdifull oversikt over denne sterkt spesialiserte middgruppens økologi.

Den spesielle del inneholder bestemmelsesnøkler for 650 mellom-europeiske arter. For hver art er det gitt opplysninger om levesteder og geografisk utbredelse. Boken er rikt illustrert, spesielt med tanke på identifisering av artene.

Ordnen *Acarina* er systematisk lite bearbeidet og derav mangel på omfattende bestemmelseslitteratur. Det arbeid som her er utført er derfor verdifullt. Innen anvendt entomologi og akarologi har det i de senere år vært økende interesse for rovmidder. Dette vil utvilsomt føre til stor utvidelse av vår kunnskap om denne middgruppen. Boken vil være et godt grunnlag og nyttig hjelpemiddel for de som arbeider med rovmidder.

Chr. Stenseth

Freude, H., Harde, K. W. og Lohse, G. A. 1971. *Die Käfer Mitteleuropas*. Bind 3. (365 p.). Goecke & Evers Verlag, Krefeld.

Av dette verk, som er planlagt å skulle omfatte 11 bind, er tidligere kommet 5 (1., 4., 7., 8. og 9.), I bind 3 som nå er kommet, er behandlet Adephaga (unntatt Carabidae), Palpicornia, Histeroidea og 1. del av Staphylinoidea: Silphidae — Scaphidiidae fordelt på en rekke bearbeidere, mest spesialister.

Boken er meget rikt illustrert, bl. a. med et stort antall genitaltegninger, dels på grunnlag av tidligere publiserte spesialarbeider, men i stor utstrekning er tegningene originale.

En av de vanskeligste og mest forsømte familier er Ptiliidae, som er forholdsvis sterkt representert i Norden. Slekten *Acrotrichis* har Rosskothén, og nylig Sundt, bearbeidet, og nå har Besuchet i det foreliggende bind publisert resultatet av en grundig revisjon av resten av familien. Også her har det vist seg at genitaliene, særlig spermathecaen, er til god hjelp ved bestemmelsen, og for en rekke arter er de tegnet.

Dytisciden *Oreodytes borealis* Gyll. er oppgitt fra høyere fjelltrakter i M.-Europa og fra Skandinavia, men som Brinck (Norsk ent. Tidsskr. 6:157-158) har gjort oppmerksom på, er den mellom-europeiske arten som går under dette navn ikke kjent fra Fennoskandia.

For *Agabus tarsatus* Zett. oppgis at den sannsynligvis er den samme som *solieri* Aubé, men Falkenström (Zool. Anzeiger 84:52) har ved undersøkelse av Zetterstedts materiale funnet at den er identisk med *melanarius* Aubé.

Andreas Strand

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