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NORSK ENTOMOLOGISK FORENING

ser sin hovedoppgave i å fremme det entomologiske studium i Norge, og danne et bindeledd mellom de interesserte. Søknad om opptagelse i foreningen sendes formannen. Medlemskontingenten er for tiden kr. 20,— pr. år. Medlemmer får tidsskriftet fritt tilsendt.

Laboratory Study on Factors Influencing Pre-imaginal Development in *Hylobius abietis* L. (Col.,Curculionidae)

ERIK CHRISTIANSEN

Christiansen, E. 1971. Laboratory Study on Factors Influencing Pre-maginal Development in *Hylobius abietis* L. (Col., Curculionidae). *Norsk ent. Tidsskr. 18,* 1-8.

Pine weevils, *Hylobius abietis* L. (Col., Curculionidae), were reared in sand-buried pine billets at different constant temperatures. The developmental period from deposition of egg to larval entry of pupal chamber is described by an exponential function of temperature, the shortest period (40 days) occurring at 23° C. Critical temperature for induction of diapause was about 21° C. Diapausing specimens sojourned five months or more in pupal chambers. Within a wide range, the sand moisture did not influence larval growth. Body weights of full-grown larvae were reduced in dense populations.

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The development of immature stages in insects largely depends on climatic conditions, especially the temperature. The larvae of *Hylobius abietis* L. usually feed in the inner bark layer of the roots of recently cut coniferous stumps. They excavate their pupal chambers in the outer part of the wood, or, in case of thick bark, partly in the bark, partly in the wood. This habitat offers good protection against detrimental climatic conditions. The opportunities for the larvae to seek out conditions which promote development are, however, rather restricted. Hence, the growth rate of a larva depends by and large on the soil climatic regime in the very spot where it happens to be located.

Field studies of the developmental time of the species reveal great differences between the various climatic zones in Fennoscandia (Butovitsch & Heqvist 1961, Nordic Forest Entomologists' Research Group 1962) as well as between sites of different exposure within the same macro-climatic zone (Bakke & Lekander 1965). The publications mentioned review relevant literature from other European countries.

In the laboratory, the growth of *H. abietis* larvae has been studied by Eidmann (1963, 1964), who reared the larvae on pine inner-bark in Petri dishes kept at different constant temperatures. Eidmann demonstrated among other things that a facultative diapause is induced when larvae of the last instar are exposed to temperatures below a critical value, which lies between 20 ° and 25 °C.

The purpose of the present study was to examine the pre-imaginal development of *H. abietis* under constant climatic conditions by using a rearing medium as similar as possible to the natural food of the species.

MATERIAL AND METHODS

Slender stems of fresh, unbarked Scots pine *(Pinus sylvestris)* were cut into sections 23 cm long. The diameter (without bark) of the billets ranged from 3 to 5 cm. The ends were dipped in paraffin wax to prevent desiccation of the wood and colonization by microorganisms. All the billets were sorted into groups of ten, so that each group consisted of a representative sample with regard to diameter and bark type. The groups of ten billets were placed in a vertical position in 10 litre plastic buckets, and covered with moist sand.

Ten female and ten male *H. abietis* were introduced into each bucket for deposition of eggs in the billets. The buckets were covered with a screen and kept under outdoor conditions, shaded from direct sunshine, for 10 days. After this period, the ten billets of each group were transferred to a bucket with fresh sand, after ensuring that no weevils were sticking to the billets, and the buckets were once again covered with a screen.

In June 1968, six buckets prepared by this method were placed at each of the constant temperatures 12 °, 15 °, 18 °, 21 °, and 24 °C, immediately after the oviposition. This procedure was repeated in June 1969, and in addition, six buckets were placed at 28 °C this year. The climate chambers operate with an accuracy of ± 0.5 °C.

The first year, the weevils had been collected at Harestua (county of Oppland) and the second year at Åbogen (county of Hedmark). Both places are inland localities, the latitude is about 60 °N, and the altitude 200-250 m. The weevils were caught on sawdust heaps of local sawmills during the swarming period in early June.

The sand in the buckets was watered weekly. The amount given was estimated subjectively from the degree of desiccation. At fixed times, counting from the mean date of egg-laying, buckets were taken into the laboratory, the billets were debarked and all larvae, pupae, imagines, and empty pupal chambers were counted, as was the number of larvae which had entered their pupal chamber. At the two highest temperatures, 24 ° and 28 °C, the hatching progress of the adults could be recorded by this procedure. At the four temperatures 12 °, 15 °, 18 °, and 21 °C, however, the development and hatching progress was highly time-consuming, and, therefore, adult emergence from the billets had to be recorded instead. For this purpose, one bucket was left intact until the presumed majority of weevils had emerged, whereupon the buckets were examined as described above. In 1969, two buckets were transferred from 12 °C to 20 ° and 24 °C respectively six months after egg-laying, to study the effect of a temperature rise on the emergence progress.

At all inspections during the larval growth period, and at some of the later inspections, when larvae were found in pupal chambers, the larvae were fixed in Carl's solution. One litre of this solution contains 340 ml ethyl alcohol, 120 ml formalin, 40 ml acetic acid, and 500 ml destilled water. After two days or more the larvae were decapitated, and the widths of their head capsules were measured by means of a microscope equipped with a measuring ocular. Generally, eggs had been deposited in seven to ten of the billets in one bucket.

At the different inspections, sand samples were taken from the buckets to determine the moisture contents, which fluctuated during the experimental period, because of the means of watering. Moisture contents of 11 to 33 % of capillary saturation were recorded. To examine the influence of the soil moisture on the development of eggs and feeding larvae, 60 pine billets were exposed to oviposition for ten days according to the method described above, and then transferred to 12 plastic bags, five billets in each. In the bags, the billets were covered by sand with moisture contents of 7.5, 15, 30, and 60 % of saturation, three bags at each moisture level. The field capacity of the sand had been measured to 274 ml per kg of dry sand. The bags were weighed and stored in the laboratory at approximately 21 °C. The sand was watered daily, so that the original weights were maintained throughout the experimental period. After 27 days, the moisture contents of sand and billets (i.e. without bark) were determined, and the head capsule widths of the larvae measured.

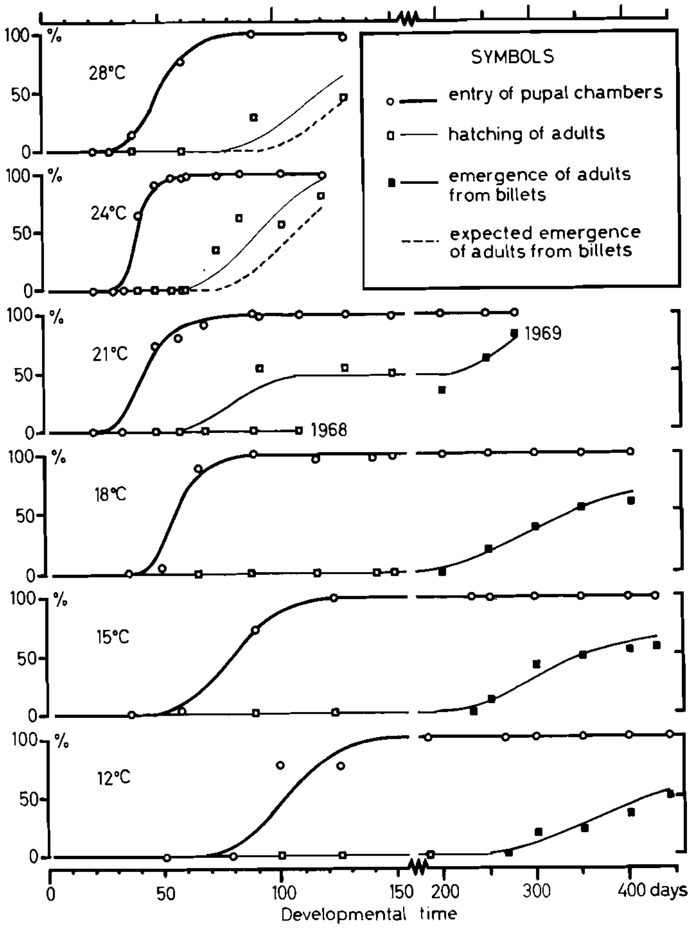
Measurement of head capsule widths and recording of larval numbers per billet permitted a comparison between larval density and head capsules in developing larvas, as well as in larvae found in pupal chambers. In addition, body weights were recorded in samples of larvae found in pupal chambers of billets with varying larval density.

RESULTS

Influence of temperature

The development from deposition of egg to emergence of imago can be divided into two basically different parts: 1) Before the

Fig. 1. Cumulative graphs of development in *Hylobius abietis* at different constant temperatures.



larvae enters the pupal chamber, and 2) after this event.

Developmental data for *H. abietis* bred at different constant temperatures are summarized in Fig. 1. The percentage of specimens which had entered their pupal chambers is plotted against time, as are the percentages of hatching adults at 24 ° and 28 °C, and of adult emergence from the billets at 12 °, 15 °, 18 °, and 21 °C. The total number of specimens found in the billets of each bucket examined varied from 41 to 129, with a mean value of approximately 75. The broken curves of expected adult emergence from the billets at 24 ° and 28 °C (Fig. 1) are derived by adding 16 days to the curves representing the hatching of adults. This time corresponds approximately to the period of adult sojourn in the pupal chambers found under similar temperature conditions (Novák 1965).

In the first part of the developmental period, viz. before the larvae enter the pupal chambers, there is a distinct correlation between the developmental time and the temperature (Fig. 2). The data plotted in Fig. 2 are fitted fairly well by the equation

$$T = 20\,(1.15^{t} + 1.15^{-t})$$

which is given graphically in the figure. This function is a special case of the general equation of growth

$$T = \frac{m}{2}\,(a^{t} + a^{-t})$$

presented by Janisch (1925), where T means duration of development, m is the shortest developmental time (i.e. at the temperature

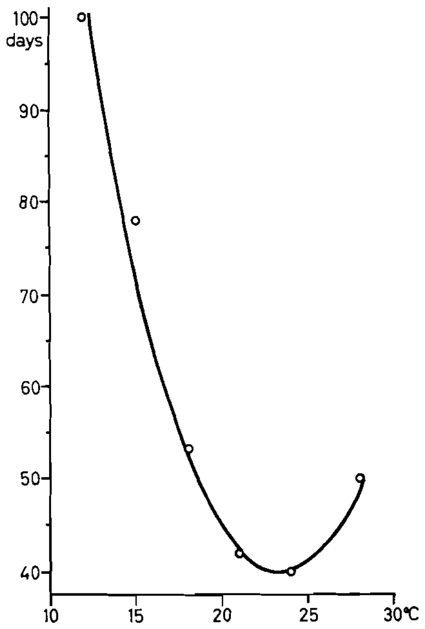


Fig. 2. Duration of developmental period from deposition of egg to larval entry of pupal chamber in *Hylobius abietis.*

optimum), t is temperature measured from the optimum point and a is a constant factor. This implies that the shortest developmental time is 40 days. The optimum temperaure is close to 23 °C.

The frequency distribution of head capsule widths of the whole material measured (2.480 larvae) (Fig. 3) reveals distinct peaks at 0.9, 1.4, 2.1, and 2.7 mm, which represent mean values for the last four instars. An interesting feature in the head capsule material measured is the small size of the final instar of larvae from eggs which were laid in 1968 and developed at 12 °C (Fig. 4). These larvae had peaks in head capsule widths at 0.9, 1.4, and 2.1 mm. Pupae from this temperature proved significantly lighter (t = 5.04***, df = 52) than those developed at 15 °C. The pupae and imagines of these weevils appeared perfectly normal, except for the small dimensions.

Among the larvae reared at temperatures from 15 ° to 28 °C, a variation in the mean size of head capsules could be thought to exist between the different temperatures when considering Fig. 4. Using specimens as replicates, significant differences in the capsule widths were found among the 5th instar larvae of all these temperatures ($p < 0.01$). However, when the mean head capsule width of all larvae in one billet was taken as a replicate, no significant differences were found. This discrepancy is due to the variation between the larvae of different billets. Consequently, no great importance should be attached to these apparent differences between temperatures.

The second developmental period, viz. from the date when 50 % of the specimens have entered the pupal chamber to the day when 50 % have emerged from the chambers as adults, reveals a more complicated relation to temperature (Fig. 1), due to the influence of the facultative diapause occurring in pupal chamber larvae. At 24 °C the period lasted for about 2 months, and presumably somewhat

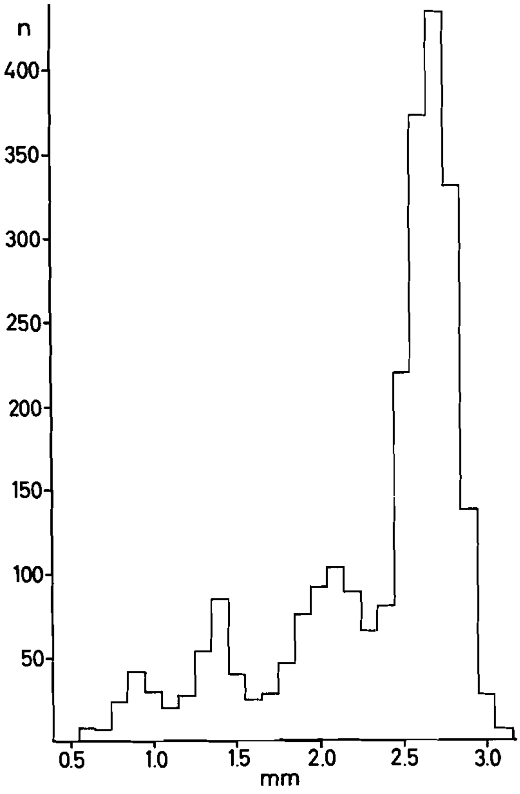


Fig. 3. Distribution of head capsule widths in the total material of *Hylobius abietis* larvae measured, i. e. from all temperatures.

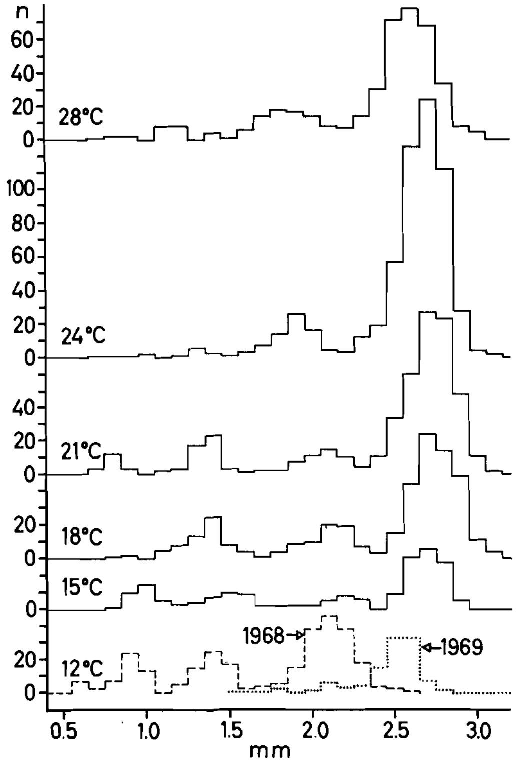


Fig. 4. Distribution of head capsule widths in *Hylobius abietis* larvae developed at different constant temperatures.

longer at 28 °C. At temperatures of 12 ° to 18 °C all specimens remained in the pupal chambers for five months or more before emergence, which then occurred at a very slow pace. In the material transferred from 12 °C to 24 °C six months after oviposition, the first weevils emerged from the sand only 34 days after the transfer, and within 45 days 75 % of the total number (64 specimens) had emerged. Even an increase in temperature from 12 ° to about 20 °C led to an accelerated pupation, although not as much as did the rise to 24 °C.

In 1968, about 2½ months after the entry of the pupal chambers, none of the weevils bred at 21 °C had pupated. In 1969 approximately half of the specimens had emerged after this period, whereas the rest remained larvae for half a year or more.

Influence of soil moisture

Head capsule measurements of feeding larvae reared at four different moisture contents of the soil revealed no significant differences. Consequently, the moulting process went quite similarly within the moisture range in question. During the experimental period of 27 days, the original moisture contents of 7.5, 15, 30, and 60 % of capillary saturation dropped to approximately 4.5, 8, 18, and 31 %, respectively, because of a diffusion of water into the billets.

Influence of population density

When specimens from billets with different larval densities were compared as for a) time when larval moults took place, and b) time when the entry of pupal chamber occurred, no pronounced differences were found. Neither was the head capsule size in populations of full-grown larvae correlated to density. In contrast, the body weights of these larvae revealed a negative correlation (r = — 0.37) to the population density (Fig. 5).

At the highest densities the whole inner bark was consumed. In the billets used, the cambium covered from about 200 to 350 cm^2, which means that when a billet was populated by

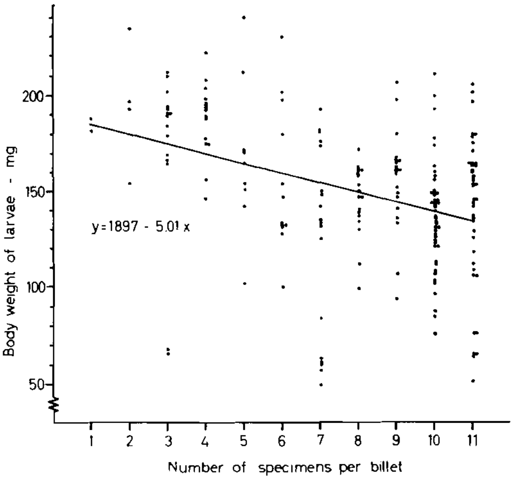


Fig. 5. Body weights of full-grown *Hylobius abietis* larvae in relation to population density.

25 larvae (which was one of the highest densities found) the bark area at disposal per larva was 8-14 cm2.

DISCUSSION

During the present investigation, all weevils were reared in billets cut from pine stems, and not, as under natural conditions, in roots of stumps. Stems and roots may be thought to offer the weevils breeding conditions of unequal quality, but the development of preimaginal stages under these two different conditions has been reported to show a fairly good agreement (Nordic Forest Entomologists' Research Group 1962).

The relation between temperature and development may vary from stage to stage within one species. Examples of this are compiled by Schwerdtfeger (1963). Hence, the mathematical relation established for the period from hatching of egg to entry of pupal chamber can only be regarded as relevant for the total period, and not for the various stages.

At the optimum temperature, 23 °C, the length of this period was approximately 40 days. The developmental zero cannot be derived from the material, as no larvae were bred below 12 °C. Neither can the upper lethal temperature, which is likely to be very close to the upper limit for development (Schwerdtfeger 1963). However, Eidmann (1964) reported that whereas development of eggs failed at 30 °C, full-grown larvae tolerated this temperature.

The length of the period from the time when the larvae enter the pupal chambers until the imagines emerge from the billets depends on whether or not a diapause occurs. In the laboratory, Eidmann (1963, 1964) found that larvae exposed to temperatures between 10 ° and 20 °C during the last instar entered the diapause. Kept at 25 °C during this crucial period, the larvae pupated without diapausing. The present investigation indicates that the critical temperature is close to 21 °C, as in 1969 about half of the larvae diapaused and the rest did not when reared at this temperature. The year before, all larvae at 21 °C diapaused.

It should be noted that both the optimum temperature for larval development, and the critical temperature for the induction of diapause, tally fairly well with the preference temperatures of feeding and oviposition found in the adult weevils (Christiansen & Bakke 1968).

Hatching and emergence of adults took place at all temperatures from 12 ° to 28 °C. Even at 10 °C the larvae have been reported to pupate (Eidmann 1963). The duration and termination of the diapause has not been studied in detail. However, the diapause in larvae developing at 12 °C appeared to be broken six months after oviposition, as a very rapid hatching and emergence occurred at this time, when the larvae were transferred from 12 ° to 24 °C. The period from transfer to emergence in this case corresponded approximately to the duration of the pupal stage plus the adult sojourn in the pupal chambers, established by Novák (1965) under similar temperature conditions. Larvae remaining at 12 °C emerged much later, and at a very slow rate.

The data on development in relation to temperature obtained through the present investigation can be compared with data presented by Novák (1965). Novák reported that the egg stage of *H. abietis* lasts between 12 and 16 days (mean 15 days) under laboratory conditions, with temperatures oscillating between 20 ° and 28 °C, and also recorded a larval developmental period of 58 to 82 days (mean 73 days). Likewise a quiescence stage in the pupae of one to four weeks (mean 18-19 days) was found, whereas the young weevils remained in the pupal chambers from one to four weeks (mean 15-18 days) before emerging. This gives a total developmental period of about 125 days on the average, which is somewhat longer than the total period of about 105 days found in the present material of larvae developing at 24 °C.

It is a well established fact that temperatures which oscillate regularly around a mean value may yield a developmental rate in insects which differs from that produced by the constant temperature of this mean. The experiences are, however, contradictory, in that oscillation may cause a retarded development in some species, and an accelerated development in others (Schwerdtfeger 1963). A study of the effect of oscillating temperatures on the development of *H. abietis* might reveal interesting features.

The breeding of larvae at different moisture contents of the sand reveals that the developmental conditions of *H. abietis* larvae in inner bark of pine are very little influenced by variations in sand moisture between some 5 and 45 % of capillary saturation, at least at temperatures about 21 °C. During the sojourn in the pupal chambers, none of the developmental stages are likely to be influenced by the moisture of the soil, because the air of the chamber will always be saturated with aqueous vapour. In this connection, it should be mentioned that Eidmann (1963) found no differences with regard to induction of diapause between larvae reared on bark diet of different humidities. These considerations indicate that variations in soil moisture can be excluded as a reason for the fact that all larvae bred at 21 °C diapaused in 1968, but only half of them in 1969. Differences in the temperature between the two years can also be excluded. An explanation of this phenomenon can only be hypothetical; differences in the genetical material or in the nutritional value of the bark, or even combinations of different factors, may be suggested.

The population density proved to have very little, if any, influence on the developmental time in the present material, which comprised very dense populations. The body size of full-grown larvae was, however, reduced when the intraspecific competition for food increased. Because small larvae render small imagines, the fecundity of females is likely to be reduced under such circumstances. A positive correlation between body size and ovariole length has been reported in *H. abietis* (Christiansen 1971). The practical consequences of this are difficult to assess because data concerning population densities under field conditions are not available. It might, however, be suggested that the impact on fecundity may act as a regulating factor when the populations become very dense.

Larvae of *H. abietis* generally pass through five instars before pupating, but a sixth instar occurs (Nordic Forest Entomologists' Research Group 1962, Eidmann 1962, Tsankov 1968). The peaks of head capsule widths in the present material tally with the mean values of the different larval stages established by different investigations. These data are summarized by Tsankov (1968). Eidmann (1962) suggested that the occurrence of a sixth instar may be due to a nutritional factor. In the present material a sixth instar is not distinguishable, but the small final dimensions of some weevils developed at 12 °C indicate a four-instar development. The peaks of head capsule widths of these smaller weevils corresponded to those of the total material (i.e. from all temperatures) at 0.9, 1.4, and 2.1 mm, but the 2.7 mm instar was lacking. This indicates that the small specimens had undergone one moult less than normal. In several insects the number of instars varies with temperature (Schwerdtfeger 1963), but the fact that the *H. abietis* reached normal dimensions at 12 °C in the second year of experiment, reveals that some other factors may be involved, possibly in combination with temperature. It should be mentioned that occurrence of extraordinarily small weevils has been observed earlier and explained by shortage of nutrition (Rothe 1910), because they were found to emerge from small root pieces which were left when stumps were removed.

During a field study of development and life cycle in Fennoscandia (Nordic Forest Entomologists' Research Group 1962), *H. abietis* larvae were mostly found to inhabit the soil below 10 cm depth. In Germany, Dingler (1931) stated that about 3/4 of pupal chambers were situated in the zone between 30 and 60 cm depth. Both results were obtained by means of buried billets. Temperature recording during the Nordic field study led to the conclusion that the temperatures in the *Hylobius* zone mostly varied between 10 ° and 15 °C during the warm season, and hardly ever exceeded 17 °C. A comprehensive study of air and soil temperatures of forest stands and clear-felled areas at Elverum (county of Hedmark) revealed that, even at a depth of 5 cm, temperatures above 19 °C hardly occurred in a horizontal, clear-felled area during the years 1961-63 (K. Bjor, pers. comm.).

In south-facing slopes, however, the direct solar radiation will produce higher soil temperatures than on horizontal ground. Studies of this have not, to the author's knowledge, been carried out in the Nordic countries. It must be concluded that the established temperature optimum for the period from deposition of the egg to entry of the pupal chamber (about 23 °C) is generally well above the temperatures occurring in the *Hylobius* zone in the soil of Nordic forests. Because of this, a rise in the soil temperature will in almost all cases favour the development.

The critical temperature for induction of the facultative diapause (about 21 °C), is also unlikely to be reached, except on special occasions, and consequently the larvae diapause in almost all cases. This conclusion has been drawn before by Eidmann (1963, 1964), and is in good agreement with the fact that during the Nordic field study of the development and life cycle (Nordic Forest Entomologists' Research Group 1962) only 6 out of nearly 35,000 weevils were found to pupate the first autumn after egg-laying. None of these 6 weevils, which were found in sites of Denmark and southernmost Sweden, had completed pupation when found in October-November 1955. Nevertheless, a one-year generation was recorded during the extremely warm summer of 1959 on one sun-exposed slope of South Norway (Bakke & Lekander 1965). In this case a minority of the weevils had left their pupal chambers during the first autumn, the majority remaining larvae in the pupal cells. The minority had, however, excavated their chambers in the upper part of the breeding billets used. Temperature measurement revealed that this soil layer had been exposed to temperatures above the critical level.

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Morphology and Life Cycle of *Ampullosiphon stachydis* Heikinheimo (Hom., Aphididae)

CHRISTIAN STENSETH

Stenseth, C. 1971. Morphology and Life Cycle of *Ampullosiphon stachydis* Heikinheimo (Hom., Aphididae). *Norsk ent. Tidsskr. 18,* 9-13.

The present article gives a description of different morphs and the life cycle of *Ampullosiphon stachydis* Heikinheimo. The species is host-alternating, with *Ribes cultorum* as primary host and *Galeopsis bifida* as secondary host.

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During work on *Ribes* inhabiting aphids I found an aphid on *Ribes* × *cultorum* Hort. which was identified by Dr. D. Hille Ris Lambers as *Amphorophora (Ampullosiphon) stachydis* Heikinheimo.

The life cycle of this species is unknown and the only morph described (Heikinheimo 1955) is apterae viviparae taken on *Stachys silvatica.*

The present article gives a description of the different morphs, and information on the life cycle of the species.

MORPHOLOGY

Fundatrix

Very much like apterous viviparous female. Maximum hair lengths: antennal segment III, 0.013-0.018; 3rd abdominal tergite, 0.010-0.013; 6th tergite, 0.018-0.023; 8th tergite, 0.036-0.044; tibia, 0.033-0.052 mm. Antennae 0.9-1.0 × the length of the body, without secondary rhinaria; processus terminalis 5-6 × the base of segment VI. Length of antennal segments: III, 0.63-0.69; IV, 0.35-0.45; V, 0.38-0.48; VI, 0.16-0.18 + 0.87-1.00 mm. Cauda with 4-6 hairs. Other characters as in apterous viviparous female.

Colour in life: yellowish or pale green, with green marginal and spinal spots. The spinal spots are darker than the marginal ones.

Apterous viviparous female

From *Ribes:* Body oval, 2.7-3.0 mm long, with smooth, colourless, tergum. Hairs on head, antennae, legs and dorsum short, stiff, and rather thick, with incrassate or capitate apices, but those on 8th abdominal tergite blunt or with spear-shaped apices like the ventral hairs. Maximum hair lengths: antennal segment III, 0.010-0.016; 3rd abdominal tergite, 0.008-0.010; 6th tergite, 0.013-0.028; 8th tergite, 0.028-0.036, with 6-8 hairs; tibia, 0.034-0.039 mm. Frontal lateral tubercles well developed, divergent, smooth, the median tubercle low with two hairs. Antennae pale, 1.1-1.5 × the length of the body, with 0-2 small, elevated, secondary rhinaria at the base of segment III; antennal segments I-IV smooth, V and VI imbricated; processus terminalis about 9 × the base of segment VI. Length of antennal segments: III, 0.63-0.95; IV, 0.49-0.71; V, 0.40-0.54; VI, 0.14-0.17 + 1.25-1.66 mm. Apical rostral segment 0.135-0.148 mm long, 1.1-1.6 × the length of second tarsal segment of hind legs, with 5-7 secondary hairs. Siphunculi very thin-walled, swollen, 0.54-0.60 mm long, smooth, pale, with 2-3 transverse striae in a marked incision below the flange. Cauda pale, distal half triangular, rather acute, 0.15-0.18 mm long, with 6-7 hairs Subgenital plate with 4-5 anterior and 9-11 posterior hairs. Muscular plates absent. Legs

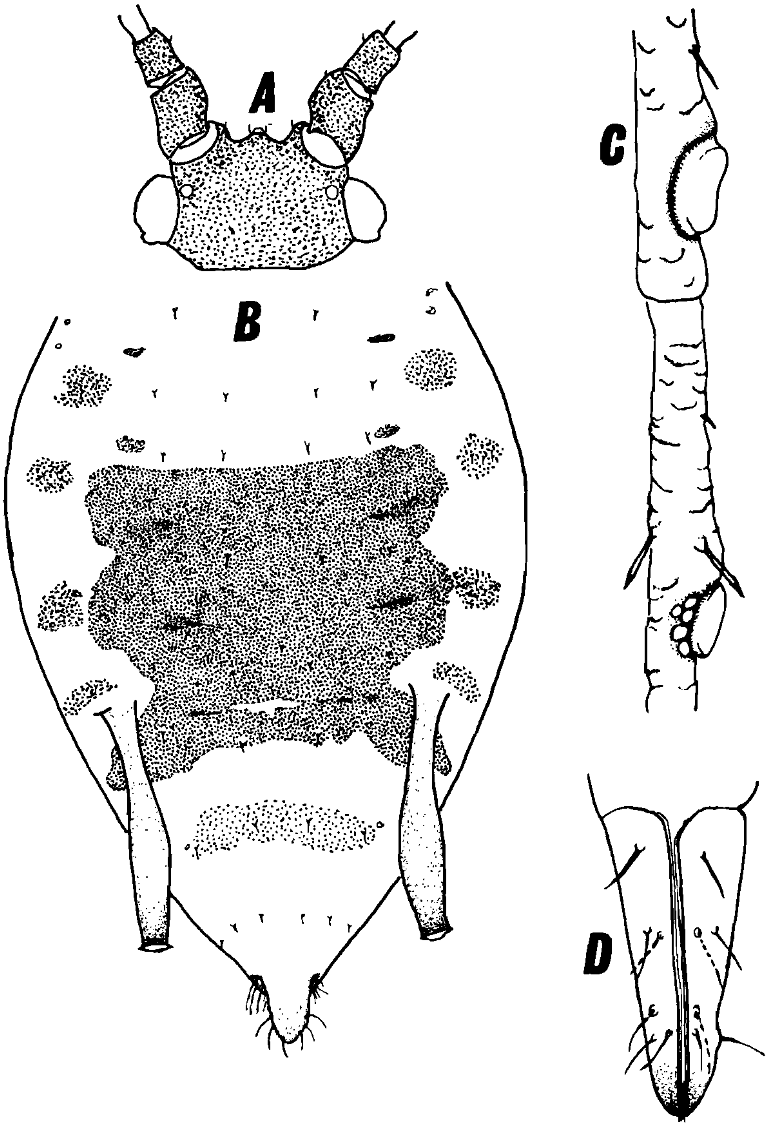

Fig. 1. *Ampullosiphon stachydis* Heikinheimo. Alate viviporous female; A, head; B, dorsal view of abdomen; C, primary rhinaria; D, apical rostral segment.

pale, first tarsal segments with 3 hairs; second tarsal segment of hind legs 0.091-0.111 mm long.

Colour in life: yellowish, whitish or pale green with green spinal spots from the head to 5th abdominal tergite.

From *Galeopsis:* Very much like apterous viviparous female from *Ribes*. Maximum hair lengths: antennal segment III, 0.015-0.024; 3rd abdominal tergite, 0.013-0.026; 6th tergite, 0.020-0.029; 8th tergite 0.041-0.052 mm. Antennae 1.3-1.7 × the length of the body. Length of antennal segments: III, 0.90-1.02; IV, 0.64-0.78; V, 0.50-0.63; VI, 0.17-0.19 + 1.41-1.89 mm. Secondary rhinaria protruding, mostly arranged on one side of antennal segments III and IV, distributed as follows: III, 2-25; IV, 0-12. Apical rostral segment 0.135-0.161 mm long, with 5-8 secondary hairs. Siphunculi

0.51-0.60 mm long. Cauda with 6-8 hairs. Second tarsal segment of hind legs, 0.104-0.117 mm long. Other characters as in apterous viviparous female from *Ribes*.

Alate viviparous female

Body spindle-shaped, 1.85-3.00 mm long. Abdominal dorsum with a solid, very broad, brown, central sclerite from the middle of 3rd tergite to posterior margin of 5th tergite where it is almost completely fused to a cross bar of the same colour on 6th tergite; 7th tergite with a pale brown or uncoloured sclerotic cross bar; marginal and antesiphuncular sclerites present (Fig. 1). Hairs on head, antennae, legs and dorsum with incrassate or capitate apices, those on 8th abdominal tergite pointed. Maximum hairs lengths: antennal segment III, 0.013-0.026; 3rd abdominal tergite, 0.007-0.026; 6th tergite, 0.023-0.36; 8th tergite, 0.021-0.060 with 5-8 hairs; tibia, 0.031-0.041 mm. Frontal tubercles well developed (Fig. 1); the lateral tubercles divergent with rounded inner apices and 1-3 hairs; the median tubercle about ½ as high as the lateral ones with two hairs. Antennae 1.3-1.8 × the length of the body, segment I and II dark like the head, flagellum somewhat paler, with a small paler base; processus terminalis 7-10 times as long as the base of segment VI. Primary rhinaria very large (Fig. 1). Secondary rhinaria slightly protruding, distributed as follows: III, 40-51; IV, 18-32; V, 2-9. Length of antennal segments: III, 0.73-1.07; IV, 0.50-0.74; V, 0.39-0.58; VI, 0.14-0.19 + 1.26-1.66 mm. Apical rostral segment (Fig. 1) 0.130-0.150 mm long, 1.20-1.35 × the length of second tarsal segment on hind legs, with 4-9 hairs. Siphunculi (Fig. 1) swollen, 0.38-0.52 mm long, smooth, gradually brownish toward apices, with 2-3 rows of partly coalescing transverse lines in an incision below the flange. Cauda (Fig. 1) pale, triangular, blunt, 0.10-0.15 mm long with 6-8 hairs. Subgenital plate with 4-6 anterior and 8-14 posterior hairs. Legs pale brown with apices of femora and tibia dark; first tarsal segment of each leg with 3 hairs, but 2 hairs may occur; second tarsal segment of hind legs 0.098-0.119 mm long. The wing venation normal, veins clear-cut, rather dark brown.

Colour in life: head and thorax black. Antennae brown with pale processus terminalis. Abdomen yellowish or pale green, with green spinal spots and dark central sclerite; siphunculi and cauda pale.

Apterous oviparous female

Body oval, distal part pointed, 1.78-1.92 mm long. Tergum smooth, colourless. Maximum hair lengths: antennal segment III, 0.013-0.018; 3rd abdominal tergite, 0.008-0.010; 6th tergite, 0.013-0.20; 8th tergite, 0.033-0.057 mm with 7-9 hairs. Antennae pale, about $1^1/_3$ of the length of body without secondary rhinaria; processus terminalis 7.5-9.0 × the base of segment VI. Length of antennal segments: III, 0.42-0.46; IV, 0.25-0.30; V, 0.29-0.31; VI, 0.12-0.14 + 1.05-1.17 mm. Apical rostral segment 0.109-0.117 mm long, 1.2-1.3 × the length of second tarsal segment of hind legs, with 3-7 secondary hairs. Shape and colour of siphunculi as in apterous viviparous female, but only 0.36-0.40 mm long. Cauda pale, triangular blunt, 0.09-0.1 mm long, with 7-11 hairs. Subgenital plate with 10-18 anterior and 17-22 posterior hairs. Legs pale, second tarsal segment 0.083-0.091 mm long. Hind tibia very slightly increassate, with pseudosensoria. Other characters as in apterous viviparous female.

Colour in life: yellowish green or pale green with spinal green spots on thoracic segments and anterior abdominal segments.

Alate male

Body 2.22-2.40 mm long. The abdominal sclerotic pattern brown, consisting of an intersegmental cross bar between 3rd and 4th tergite, of small intersegmental sclerites on the three anterior tergites only, of a central sclerite covering 4th and 5th tergite and fused to a cross bar on the 6th tergite, of a pale brown cross bar on 7th tergite, and of marginal and

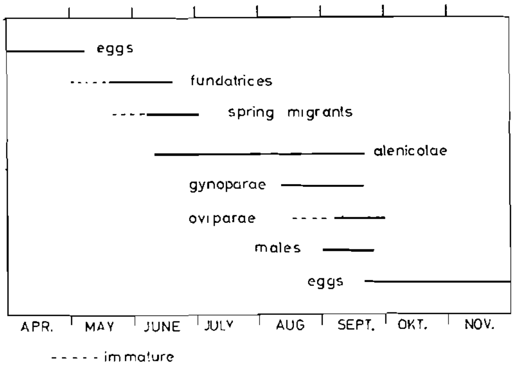

Fig. 2. *Ampullosiphon stachydis* Heikinheimo. Life cycle and occurrence of different morphs.

antesiphuncular sclerites. Secondary rhinaria distributed as follows: III, 47-58; IV, 13-22; V, 6-13. Apical rostral segment 0.132-0.143 mm long, 1.34-1.42 × the length of second tarsal segment on hind legs. Other characters as in alate viviparous female.

LIFE CYCLE

The species was found on both *R.* × *cultorum* and *Galeopsis bifida* Boenn. Spring migrants were transmitted from *R.* × *cultorum* to *G. bifida* and *Stachys silvatica*. The spring migrants colonized *G. bifida*, and also started reproduction on *S. silvatica* but here the offspring died in the first instar. Apterae viviparae transmitted from *G. bifida* did not accept *S. silvatica* as host plant at all.

In the insectary (outdoor conditions) the species completed the life cycle with *R.* × *cultorum* as primary host and *G. bifida* as secondary host. The life cycle and occurrence of the different morphs are shown in Fig. 2.

The eggs hatched at bud burst and the fundatrices were full grown after about 20 days. The fundatrices had a reproduction period of four weeks and produced in this time 87-123 larvae. The offspring, which were all alate spring migrants, were mature after 15-17 days. In the open field, however, apterae viviparae of the second generation could be found, but also here the second generation seemed to be mainly alate viviparae.

Gynoparae occurred in August-September. Mature oviparae females and males were present during September. Oviposition was not recorded before the middle of September. The eggs were mostly laid in crevices of the bark on older branches.

The species produced reddish or yellow vein-banding on *R.* × *cultorum,* see Fig. 3.

DISCUSSION

The apterae viviparae described in this paper are in essential morphological characters like the apterae of *Amphorophora (Ampullosiphon) stachydis* Heikinheimo, described from *Stachys silvatica*. Even if the species in transfer tests did not accept *Stachys silvatica,* the morphological characters establish the identity. Hille Ris Lambers (in litt.) has also pointed out that

Fig. 3. *Ampullosiphon stachydis* Heikinheimo. Leaf damage on *Ribes* × *cultorum.*

many aphid species which live on *Galeopsis* will sometimes live on *Stachys* and that host preference drops to a low level at lower temperatures.

Heikinheimo (1955) used *Ampullosiphon* as a subgenus to *Amphorophora* Buckton. As a result of the present study of all morphs of the species, *Ampullosiphon* is here classified as a genus. As pointed out by Hille Ris Lambers (in litt.), *A. stachydis* is related to *Cryptomyzus* Oestlund rather than to *Amphorophora.*

The long processus terminalis; capitate hairs; thinwalled, smooth, rather slender, swollen, siphunculi; short blunt cauda, well developed frontal tubercles; central abdominal sclerite in alate viviparae and host relationship to *Ribes* and *Galeopsis* all indicate a closer relationship to *Cryptomyzus* than to *Amphorophora.*

A. stachydis does not show the angular first antennal segment which is characteristic of the genus *Cryptomyzus* (Hille Ris Lambers 1953), and also the short body hairs in apterae differ from those found in species of the genus *Cryptomyzus.* The annular incision below the flange of the siphunculi is found again in other genera from *Ribes,* such as *Nasonovia* Mordvilko and *Hyperomyzus* Börner, and in this respect the genus is intermediate between *Cryptomyzus* and *Nasonovia.*

Received 19 October 1970

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Notes on Norwegian Coniopterygidae (Neuroptera) III. *Coniopteryx esbenpeterseni* Tjeder and *Conwentzia psociformis* Curt. in Norway

LITA GREVE

Greve, Lita 1971. Notes on Norwegian Coniopterygidae (Neuroptera) III. *Coniopteryx esbenpeterseni* Tjeder and *Conwentzia psociformis* Curt. in Norway. *Norsk ent. Tidsskr. 18,* 15-16.

Coniopteryx esbenpeterseni Tjeder and *Conwentzia psociformis* Curt. are reported new to Norway, both species from Vestfold.

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During a short stay near Sandefjord, Vestfold, in the summer of 1970, I collected 2 species of Neuroptera not previously recorded from Norway. Both species were collected from one locality situated a few hundred metres from the sea shore. The specimens were caught on oak foliage while using a sweep-net on a cluster of middle-sized oaks. The vegetation surrounding the locality consisted of deciduous trees. The specimens were caught from branches approximately 2 m above the ground. Together with the two mentioned species, I also caught 1 ♂ 4 ♀♀ of *Semidalis aleyrodiformis.*

Coniopteryx esbenpeterseni Tjeder 1930

Norwegian record. VE: Sandar, Nes 8 July 1970, on *Quercus* 1 ♂. *C. esbenpeterseni* was described on material from Jylland, Denmark and Östergötland, Sweden by Tjeder (1930, 1931). The species has been recorded from several places in Europe and has also been found in Turkey, see Aspöck & Aspöck (1964, 1969).

C. esbenpeterseni is confined to deciduous trees with a preference for oak.

Conwentzia psociformis Curt. 1834

Norwegian record. VE: Sandar, Nes 8 July 1970 on *Quercus* 5 ♀♀. *C. psociformis* and *C. pineticola* females are separated on the number of antennal joints. Of the five females caught, four had 39 antennal joints and one had 40 antennal joints (in this specimen one antenna was broken) which determine all five with certainty as *C. psociformis* females, see Zeleny (1961) and Greve (1966).

In Fennoscandia *P. psociformis* is known with certainty from Skåne (Tjeder 1967). It is also recorded from Australia, Germany, Rumania, Jugoslavia and Greece (Aspöck & Aspöck 1964, 1969). Due to earlier confusion between *C. pineticola* and *C. psociformis,* older records of both species cannot be considered as reliable.

ACKNOWLEDGEMENTS

Fil. lic. Martin Meinander, Helsingfors, has kindly verified my identification of *Coniopteryx esbenpeterseni.*

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Spiders New to Norway

P. F. WAALER

Waaler, P. F. 1971. Spiders New to Norway. *Norsk ent. Tidsskr. 18,* 17-24.

Ten species of spiders found in different localities in Southern Norway during 1966-1969 are described. A female of *Antistea elegans* (Blackwall) is the first record of that sex in Norway. All the remaining nine species are reported for the first time in Norway. The species are: *Robertus arundineti* (O. P.-Cambridge), *Abacoproeces saltuum* (L. Koch), *Micrargus subaequalis* (Westring), *Notioscopus sarcinatus* (O. P.-Cambridge), *Erigonella ignobilis* (O. P.-Cambridge), *Diplocephalus permixtus* (O. P.-Cambridge), *D. picinus* (Blackwall), *Taranuncus setosus* (O. P.-Cambridge) and *Lepthyphantes angulipalpis* (Westring).

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Ten species of spiders from the author's collection, which were found during 1966-1969 in different localities in Southern Norway, are described below. Of these species, nine are recorded for the first time from Norway, while the remaining one, *Antistea elegans* (Blackwall) is the first recorded occurrence of a female of that species, Kauri (1966) has found a male at Vatnahalsen.

As knowledge of the Norwegian spider fauna is very limited, the species are described in detail and drawings are made of the genitalia from microscope slides.

The nine newly recorded species are: Theridiidae: *Robertus arundineti* (O. P.-Cambridge); Erigonidae: *Abacoproeces saltuum* (L. Koch), *Micrargus subaequalis* (Westring), *Notioscopus sarcinatus* (O. P.-Cambridge), *Erigonella ignobilis* (O. P.-Cambridge), *Diplocephalus permixtus* (O. P.-Cambridge) and *D. picinus* (Blackwall); Linyphiidae: *Taranuncus setosus* (O. P.-Cambridge) and *Lepthyphantes angulipalpis* (Westring). A map of the localities where the spiders were found is shown in Fig. 1.

Unless otherwise stated, all measurements are in mm. Width of clypeus used as described by Locket & Millidge (1953, p. 175). AM, AL, PM, and PL = anterior median, anterior lateral, posterior median and posterior lateral eyes. D = diameter.

ANTISTEA ELEGANS (BLACKWALL)

One female collected outside the town of Kragerö on Oslofjord, in moss, 100 metres from the sea, 3 July 1967.

Total length 2.88. Carapace length and width 1.38 × 1.05. Yellow-brown, radiating dark streaks faint. 10-12 black hairs along mid-line from fovea to eye-region. Cephalic region obviously narrower. Sternum heart-shaped, broad, yellow. Margins mottled black. Black hairs pointing forwards and against the centre of sternum, where no hairs present. Labium and maxillae coloured as carapace. Ocular area with numerous bristles and suffused with black, especially round the anterior median eyes, which are slightly larger than the posterior medians (AM : PM = 12 : 10). Anterior medians 0.4 D apart and from the anterior laterals. Posterior medians slightly less than their D apart and approximately 0.5 D from the adjacent laterals. Median ocular trapezium 0.25 long, 0.24 broad posteriorly, 0.23 in front. Abdomen length 2.0. General impression greyish-brown. A faint longitudinal bar darker in the fore-half with a rusty brown depression on each side, backwards median bar flanked by five pairs of lighter leaf-like patches. Sides with light dots or lines, bending round ventrally. Abdomen clothed with black hairs up to 0.25

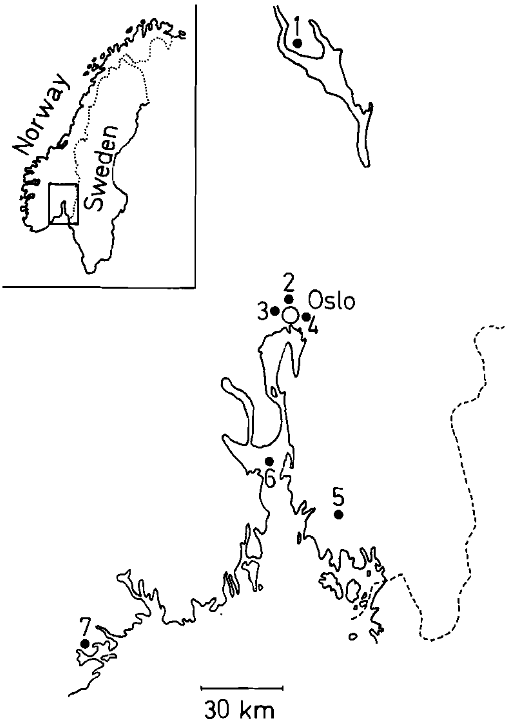

Fig. 1. The localities where the ten species described were collected. 1, Ringsaker, Hedmark. 2, Sognsvann, Oslo. 3. Röa, Oslo. 4, Trasop, Oslo. 5, Vister, Östfold. 6, Mölen, Oslofjord. 7, Kragerö, Telemark.

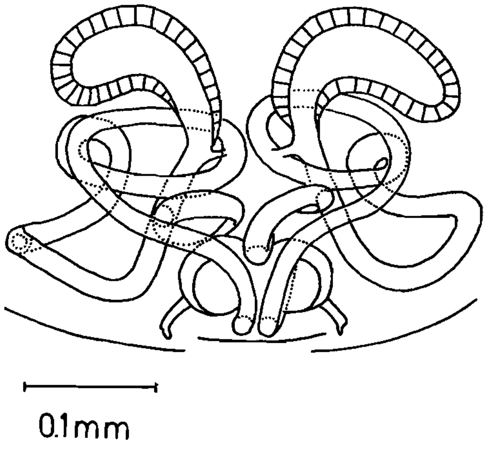

Fig. 2. *Antistea elegans* (Blackwall) ♀, vulva.

long. Legs: 4 1 2 3. Yellow-brown. Length of legs (fem.-pat.-tib.-metat.-ta.):

I (0.88-0.37-0.67-0.63-0.49) = 3.04
II (0.88-0.37-0.66-0.63-0.49) = 3.03
III (0.80-0.35-0.59-0.76-0.50) = 3.0
IV (1.05-0.37-0.84-0.95-0.60) = 3.81

Vulva of *A. elegans* is shown in Fig. 2. *A. elegans* was found together with *Erigonella ignobilis, Minyriolus pusillus* and *Hahnia pusilla.*

ROBERTUS ARUNDINETI (O. P.-CAMBRIDGE)

One female in spruce twigs under 10-20 cm snow in a vegetable garden at Trasop, Oslo, 10 Apr. 1969. One male in spruce twigs just after the snow had melted, same place, 15 Apr. 1969.

Female. Total length 2.30. Carapace length and width 1.03 × 0.83. Yellow-brown with darker striae. Three bristles on a row in the cephalic part, five in the thorax-part. Sternum length and width 0.64 × 0.55. Yellow, reticulated with black, darker margins. Long, black

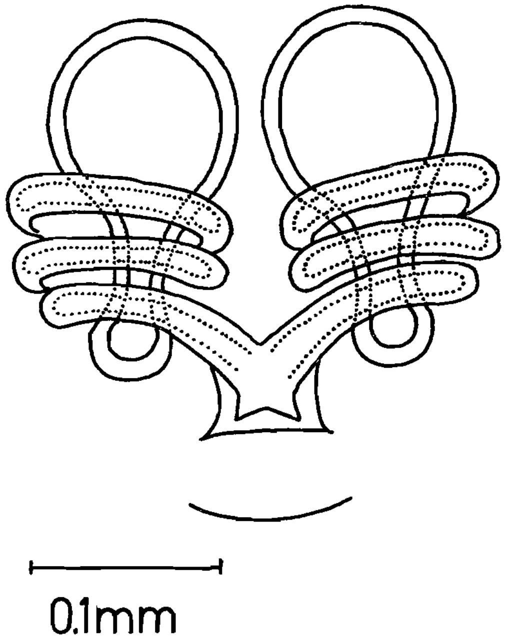

Fig. 3. *Robertus arundineti* (O. P.-Cambridge) ♀, vulva.

hairs except in the centre. Eyes: Seen from in front, anterior row straight, posterior row slightly procurve and slightly longer than anterior row. Width of PM: Width of AM = 11 : 8. The anterior medians slightly smaller than the rest (6 : 7), less than 1 D apart, and slightly less than 1 D from laterals. Posterior eyes all 1 D apart. Width of clypeus = width of AM (approx. 0.12-0.13). Abdomen grey, with four reddish dots. Legs yellow, femora and patellae lighter than the remaining joints, which grade into a yellow-brown colour. Length of legs:

I (0.77-0.37-0.55-0.46-0.38) = 2.53
II (0.65-0.29-0.46-0.38-0.35) = 2.13
III (0.55-0.28-0.35-0.35-0.35) = 1.88
IV (0.78-0.37-0.64-0.50-0.39) = 2.68

Vulva of *R. arundineti* is shown in Fig. 3.

Male. Total length 2.18. Carapace length and width 1.05 × 0.83. Eyes: Anterior medians 0.5 D apart. All laterals slightly greater than in the female, (8 : 7). Length of legs:

I (0.80-0.35-0.66-0.49-0.45) = 2.75
II (0.67-0.30-0.51-0.41-0.39) = 2.28
III (0.57-0.28-0.40-0.35-0.35) = 1.95
IV (0.80-0.32-0.71-0.51-0.42) = 2.76

Embolic division of right palp of *Robertus arundineti* shown in Fig. 4. (The long embolus broken in the author's micr. slide.) *Robertus arundineti* was found together with *Pachygnatha degeeri, Savignia frontata, Erigone dentipalpis E. atra* and *Meioneta rurestris.*

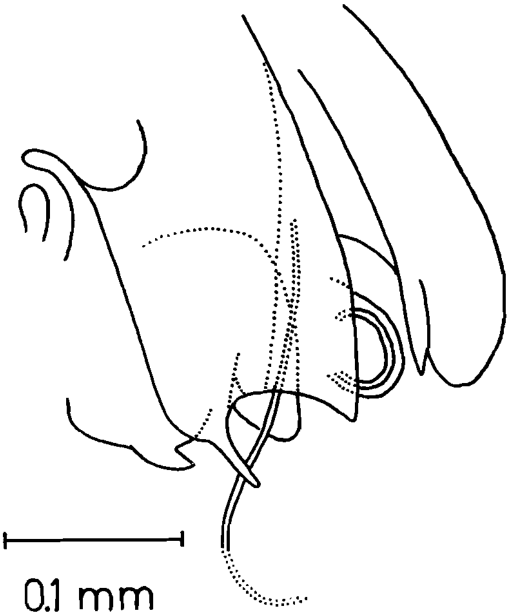

Fig. 4. *Robertus arundineti* (O. P.-Cambridge) ♂, embolic division of right palp.

ABACOPROECES SALTUUM (L. KOCH)

One female in an old heap of straw from the harvest, Ringsaker, Hedmark, 31 Oct. 1969.

Total length 2.55. Carapace length and width 0.92 × 0.77. Greyish-brown, profile 'sway-backed'. Sternum length and width 0.57 × 0.55, heart-shaped. Eyes unequal in size. AM : AL : PM : PL = 4 : 7 : 6 : 5. Anterior eyes equidistant, less than 1 D apart. Posterior medians almost 2 D apart and 1 D from laterals. Width of clypeus sligthly less than 2 × width of AM, (approx. 0.17). Abdomen length 1.75. Grey, with 4 brownish dots, sparsely clothed with short, black hairs. Lighter ventrally. Legs yellow-brown. Fem., tib. and metat. darker, colour becoming lighter to rear. Length of legs:

I (0.76-0.28-0.68-0.57-0.32) = 2.61
II (0.67-0.25-0.64-0.55-0.31) = 2.42
III (0.63-0.25-0.51-0.55-0.29) = 2.23
IV (0.92-0.28-0.84-0.78-0.34) = 3.16

Legs seem to be shorter than in German specimens (Wiehle 1960, p. 102). The trichobotria were measured as follows: I-III: 0.81-0.83; IV: 0.86. These measurements do not accord with those of Wiehle, which are 0.90-0.94.

Cleared epigyn of *A. saltuum* shown in Fig. 5.

A. saltuum is not mentioned from Britain. It has been found in Finland (Huhta 1965) and in Sweden (Tullgren 1955).

The author's specimen was found together with *Hahnia pusilla, Ceratinella brevis, Pocadicnemis pumila, Savignia frontata, Diplocephalus latifrons, Meioneta rurestris, Macrargus rufus, Bathyphantes concolor* and *Lepthyphantes angulipalpis.*

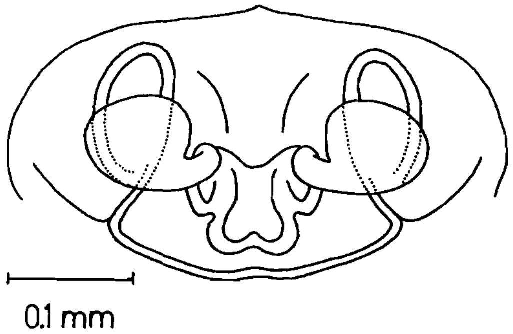

Fig. 5. *Abacoproeces saltuum* (L. Koch) ♀, cleared epigyn.

MICRARGUS SUBAEQUALIS (WESTRING)

Female and male on apple-twigs, Vister, Östfold, 8 June 1967. (R. Ihlebæk leg.)

Female. Total length 1.75. Carapace length and width 0.70 × 0.58. Greyish-yellow, margins blackish. Sternum length and width 0.42 × 0.42, yellow-brown, heartshaped. Eyes: Anterior medians smallest, slightly smaller than posterior medians (4 : 5), 0.75 D apart and 1.25 D from anterior laterals. Posterior eyes equal in size, slightly smaller than anterior laterals (5 : 6). Posterior medians 1 D apart and slightly less than 1 D from laterals. Width of clypeus = width of AM. Abdomen grey. Legs yellow. Length of legs:

I (0.56-0.19-0.50-0.34-0.33) = 1.92
II (0.55-0.20-0.45-0.33-0.32) = 1.85
III (0.48-0.17-0.36-0.31-0.30) = 1.62
IV (0.63-0.20-0.53-0.38-0.30) = 2.04

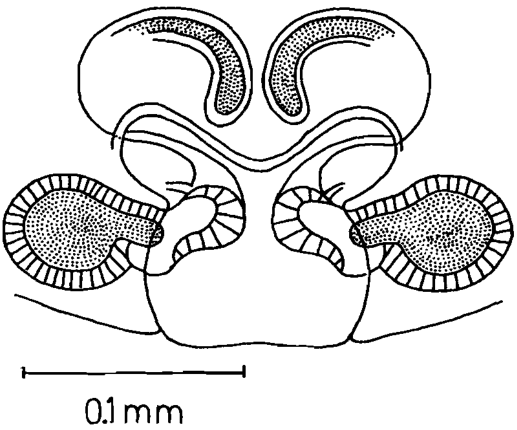

Fig. 6. *Micrargus subaequalis* (Westring) ♀, vulva.

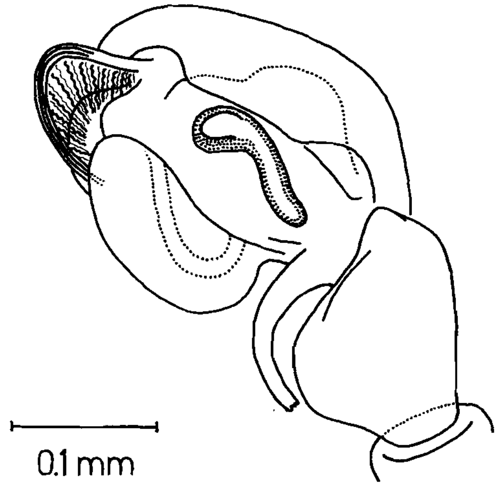

Fig. 7. *Micrargus subaequalis* (Westring) ♂, palp.

TmI = 0.34. Vulva of *M. subaequalis* shown in Fig. 6.

Male. Total length 2.05. Carapace length and width 0.76 × 0.60. Head slightly raised, a 'sulcus' on both sides. Eyes: Posterior medians 1.5 D apart. (Cf. Locket & Millidge 1953, p. 285). Width of clypeus 0.15. Length of legs:

I (0.63-0.18-0.60-0.46-0.35) = 2.22
II (0.59-0.18-0.54-0.39-0.35) = 2.05
III (0.53-0.17-0.39-0.35-0.33) = 1.77
IV (0.70-0.16-0.64-0.50-0.36) = 2.36

TmI = 0.36. Male palp of *M. subaequalis* shown in Fig. 7.

M. subaequalis was found together with *Philodromus aureolus, Araneus cucurbitinus, Theridion pallens, Dictyna pusilla, Hypomma cornutum* and *Erigone atra.*

NOTIOSCOPUS SARCINATUS (O. P.-CAMBRIDGE)

One female at Sognsvann, Oslo, in *Sphagnum,* 15 May 1966. Total length 2.00. Carapace length and width 0.84 × 0.66. Yellow-brown. Sternum yellow-brown. Eyes: Size of anterior medians half of the posterior medians. Anteriors 0.75 D apart, posteriors slightly less than 1 D apart. All laterals equal in size, slightly smaller than posterior median pair. Width of clypeus = 0.08. Abdomen grey. Four faint, lightly depressed spots anteriorly. Three light, narrow bars across posteriorly. Legs yellow. Length of legs:

I (0.71-0.24-0.59-0.50-0.38) = 2.42
II (0.63-0.23-0.55-0.46-0.35) = 2.22
III (0.59-0.20-0.46-0.43-0.33) = 2.01
IV (0.82-0.25-0.76-0.61-0.38) = 2.82

TmI = 0.6. Vulva of *N. sarcinatus* shown in Fig. 8. *N. sarcinatus* was found together with *Ceratinella brevis* and *Dicymbium tibiale.*

ERIGONELLA IGNOBILIS (O. P.-CAMBRIDGE)

One male outside Kragerö on Oslofjord, in moss, 3 July 1967. Total length 1.28. General impression greyish-yellow. Carapace length and width 0.63 × 0.43. Head slightly prominent. Sternum length and width 0.43 × 0.38. Dark brown, with numerous lighter 'craters'. Eyes: Anterior medians half of posterior medians. Anterior pair less than 1 D apart and 2 D from laterals. Posterior medians 1.5 D apart. Lateral eyes equal in size, slightly smaller than posterior medians. Clypeus with a characteristic projection. Abdomen grey. Length of legs:

I (0.47-0.16-0.37-0.32-0.31) = 1.63
II (0.43-0.14-0.33-0.28-0.27) = 1.45
III (0.37-0.12-0.25-0.24-0.25) = 1.23
IV (0.50-0.16-0.38-0.32-0.31) = 1.67

TmI = 0.35. Left male palp of *E. ignobilis* shown in Fig. 9. (Microscopic slide somewhat flattened).

E. ignobilis was found together with *Antistea elegans, Hahnia pusilla* and *Minyriolus pusillus.*

E. ignobilis seems to be widely distributed in Germany (H. Wiehle 1960, p. 557-558), but rare in Britain (Locket & Millidge 1953, p. 289).

DIPLOCEPHALUS PERMIXTUS (O. P.-CAMBRIDGE)

One female, Island of Mölen, Oslofjord, in moss, 12 June 1966. Total length 1.53. Carapace length and width 0.71 × 0.56. Greyish-brown. Sternum 0.42 × 0.39, dark brown, shiny, sparsely clothed with light hairs. Eyes: Anterior medians 0.75 of posterior medians and all laterals, which are equal in size. Anterior medians and posterior medians slightly less

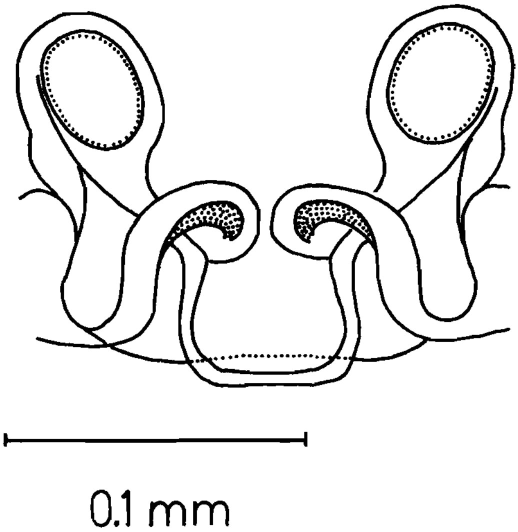

Fig. 8. *Notioscopus sarcinatus* (O. P.-Cambridge) ♀, vulva.

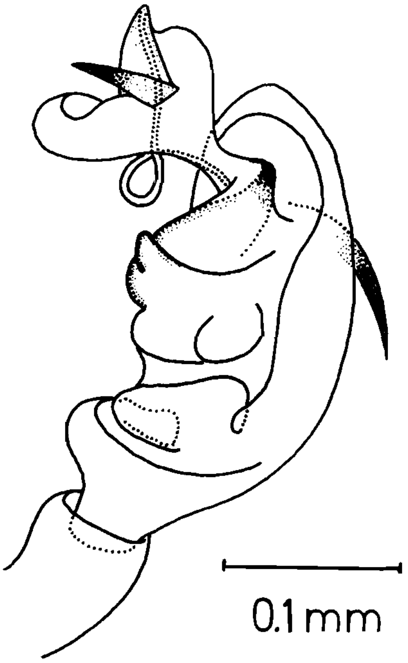

Fig. 9. *Erigonella ignobilis* (O. P.-Cambridge) ♂, left palp.

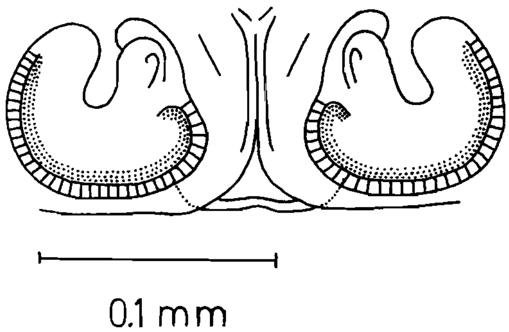

Fig. 10. *Diplocephalus permixtus* (O. P.-Cambridge) ♀, vulva.

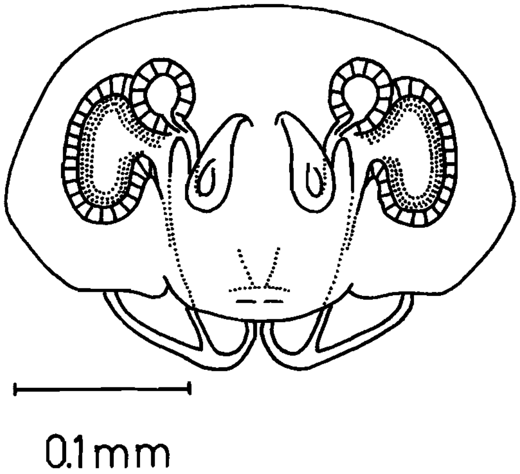

Fig. 11. *Diplocephalus picinus* (Blackwall) ♀, vulva.

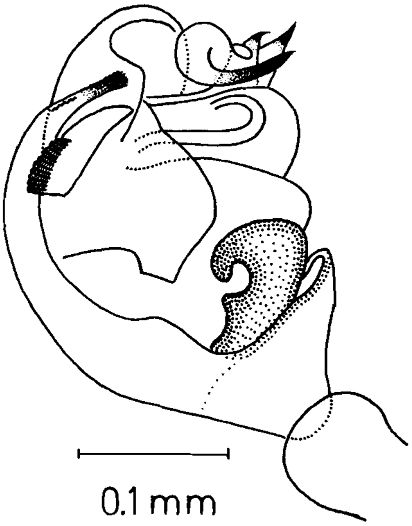

Fig. 12. *Diplocephalus picinus* (Blackwall) ♂, right palp.

than 1 corresponding D apart. Width of clypeus less than width of AM, approx. 0.08. Abdomen grey. Legs light yellow. Length of legs:

I (0.50-0.18-0.40-0.38-0.28) = 1.74
II (0.48-0.18-0.36-0.35-0.27) = 1.64
III (0.44-0.17-0.29-0.31-0.23) = 1.44
IV (0.59-0.19-0.50-0.42-0.28) = 1.98

TmI = 0.4, or slightly less. Vulva of *D. permixtus* shown in Fig. 10.

DIPLOCEPHALUS PICINUS (BLACKWALL)

Female and male in leaves and detritus, mixed forest, Ringsaker, Hedmark, 17 May 1967. Female. Total length 1.58. Carapace length and width 0.63 × 0.54. According to Wiehle (1960, p. 515) L : W = 8 : 7, and to Tullgren (1955, p. 326) 0.7 × 0.56. Dark brown. Chelicerae yellow, darker and reticulated with black. Sternum length and width 0.42 × 0.39, dark brown. Abdomen grey. Eyes: Seen dorsally, anterior eyes slightly recurve, posterior eyes slightly procurve. Eyes almost equal in size; the anterior medians slightly smaller than the rest (4 : 5). Anterior medians 0.5 D apart and from adjacent laterals. Posterior eyes 1 D apart. Regarding the distance between the posterior median pair and the posterior lateral pair of eyes, Wiehle (1960) says greater than D, Locket & Millidge (1953) less than D. Distance between anterior medians and posterior medians also slightly less than 1 D. Width of clypeus 0.10; greater than width of anterior median eyes, which is 0.08-0.09. Legs yellow. Length of legs:

I (0.52-0.15-0.39-0.35-0.27) = 1.68
II (0.47-0.15-0.35-0.33-0.27) = 1.57
III (0.44-0.16-0.31-0.31-0.25) = 1.47
IV (0.54-0.16-0.50-0.40-0.28) = 1.88

TmI = 0.45. Vulva of *D. picinus* shown in Fig. 11 (Dorsal vue). Male: Total length 1.45. Carapace length and width 0.76 × 0.56. Dark brown. The head raised and lighter. Abdomen grey, with four faint brown dots, lighter crossbars; more oblong than in the female. Eyes: The four mid-eyes slightly smaller than the four laterals (4 : 5). Anterior median eyes 0.5 D

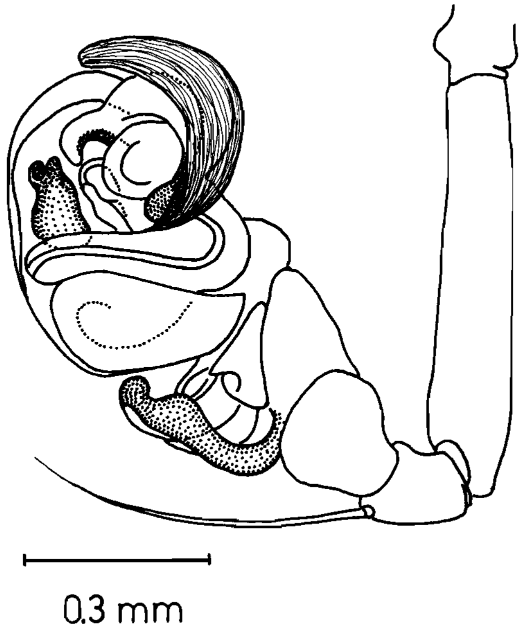

Fig. 13. *Taranuncus setosus* (O. P.-Cambridge) ♂, right palp.

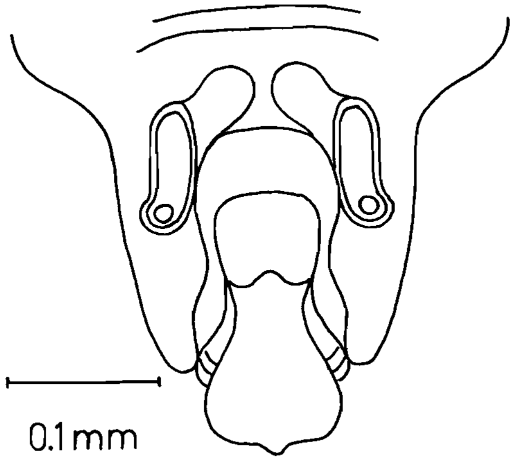

Fig. 14. *Lepthyphantes angulipalpis* (Westring) ♀, vulva.

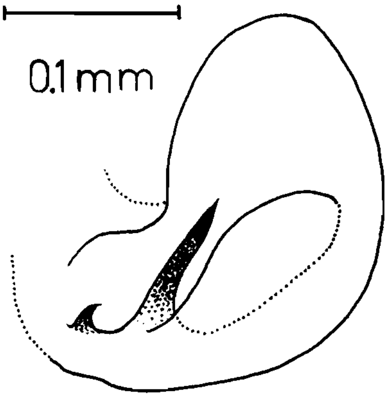

Fig. 15. *Lepthyphantes angulipalpis* (Westring) ♂, paracymbium of palp.

apart and slightly more than 1 D from laterals. Posterior median eyes almost 2.5 D apart. Distance between anterior and posterior median eyes greater than width of posterior medians (0.17 : 0.15).

Legs yellow. Length of legs:

I (0.55-0.16-0.46-0.40-0.30) = 1.87
II (0.47-0.15-0.42-0.39-0.29) = 1.72
III (0.44-0.14-0.37-0.33-0.29) = 1.57
IV (0.59-0.17-0.55-0.43-0.31) = 2.05

TmI = 0.38-0.40. Right male palp of *D. picinus* show in Fig. 12. The characteristic paracymbium mentioned by Wiehle (1960, p. 518) is obvious. The 'bulging' of cymbium (Ausbuchtung) also mentioned by Wiehle (1960) is in the author's specimen ridged and not smooth as in Wiehle's Fig. 957.

TARANUNCUS SETOSUS (O. P.-CAMBRIDGE)

One male in leaves, Röa, Oslo, Apr. 1967 (A. Strand leg.). Total length 2.9. Carapace length and width 1.53 × 1.25. Yellow-brown, margins reticulated with black. Head more yellow. Forward-pointing black hairs, also in ocular area. Sternum length and width 0.78 × 0.78, reticulated with black. A few black hairs present; darker margins. Abdomen oval, 1.55 long. Dorsally, anterior part light grey-yellow, with darker cross-stripes to rear. Ventrally greyish-black. Eyes: Markedly large, close together, on black spots. Median pairs slightly smaller than the laterals. D of median eyes approx. 0.08, of laterals 0.10. Anterior median eyes less than 0.5 D apart, more than 0.75 D from laterals. Posterior medians slightly less than 1 D apart, further from each other than from laterals. Width of clypeus 0.29. Legs: 1 2 4 3.

Long, unicolorous yellow, tibiae somewhat darker. Length of legs:

I (2.35-0.48-2.55-2.63-1.53) = 9.54
II (2.00-0.41-1.98-2.05-1.25) = 7.69
III (1.55-0.34-1.33-1.32-1.10) = 5.64
IV (2.05-0.34-1.95-2.03-1.15) = 7.52

TmI = 0.20-0.23. *T. setosus* was found together with *Bathyphantes concolor, B. nigrinus, Lepthyphantes angulatus, L. angulipalpis* and *Cryphoeca silvicola*. Right palp of *Taranuncus setosus* shown in Fig. 13. Hairs not included, except for the very long patellar-spine.

LEPTHYPHANTES ANGULIPALPIS (WESTRING)

Female and male in old heap of straw, Ringsaker, 31 Oct. 1969. Female total length 2.13. Carapace length and width 0.93 × 0.68. Sternum length and width 0.45 × 0.52, clothed with long hairs. Abdomen grey. Eyes: Anterior median eyes smaller (5 : 6) than the remaning six, which are equal in size. Anterior medians 0.75 D apart and 0.6 D from laterals. Posteriors all 0.6 D apart. Width of clypeus 0.11. Legs yellow. Length of legs:

I (0.85-0.25-0.86-0.82-0.59) = 3.37
II (0.84-0.23-0.77-0.75-0.53) = 3.12
III (0.73-0.19-0.67-0.63-0.38) = 2.60
IV (0.87-0.26-0.88-0.84-0.55) = 3.40

TmI = 0.20. Vulva of *L. angulipalpis* shown in Fig. 14. Male. Total length 2.05. Capapace length and width 0.90 × 0.80. Light brown, black margins. Cheliserae darker. Sternum length and width 0.56 × 0.50, grey, spotted with lighter dots which have black hairs. Abdomen 1.3 long; grey with black hairs, ventrally darker. Eyes: A few forward-directed hairs in the ocular area. Anterior medians slightly greater than in the female and only 0.17 D apart. Legs light yellow, First tibiae somewhat darker. Length of legs:

I (1.02-0.26-1.05-0.98-0.67) = 3.98
II (1.00-0.26-1.05-0.98-0.61) = 3.90
III (0.84-0.24-0.72-1.05-0.60) = 3.45
IV (0.10-0.26-1.02-1.08-0.63) = 4.09

TmI = 0.18. Paracymbium of male palp of *L. angulipalpis* shown in Fig. 15. (Cf. Wiehle 1956, p. 212, Fig. 354). *L. angulipalpis* was found together with *Hahnia pusilla, Ceratinella brevis, Abacoproeces saltuum, Pocadicnemis pumila, Savignia frontata, Diplocephalus latifrons, Meioneta rurestris, Macrargus rufus* and *Bathyphantes concolor*.

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Araneae from Northern Norway

ERLING HAUGE

Hauge, E. 1971. Araneae from Northern Norway. *Norsk ent. Tidsskr. 18,* 25-28.

The present paper gives a list of 33 species of spiders collected at the Lyngen Peninsula and near Tromsö, Troms. The distribution in Norway for most of the species concerned is poorly known, and for some of them this must be considered as the northernmost locality in Norway. For one species, *Hilaira pervicax* Hull, locality records are given for the first time in Norway.

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Last summer Dr. E. Duffey, Monks Wood Experimental Station, England, sent me a small collection of spiders made at the Lyngen Peninsula (69 °25′-45′ N, ca. 20 °E) and near Tromsö, Troms in Northern Norway. The spiders were collected during the summer of 1969 by Mr. D. G. Goddard, University of Leicester.

From a distributional point of view most of the species seem to be very little known to Norway, and I find it correct to make up a complete list containing 33 species. For some of these species the present localities must be considered as the northernmost in Norway.

The dates and habitat descriptions are according to information given to me by Dr. Duffey. One of the collecting methods is described by me as pitfall traps. These traps were sometimes left in the field for considerable time, which means that exact dates for some of the species concerned cannot be given. This is the case with the single male of *Gonatium rubens* (Bl.). For this species the method of collecting, habitat, and collecting period is given. Some specimens of other species were collected together with *G. rubens*, and in order to avoid repetition, these are marked with a (G) in the list below.

LINYPHIIDAE

Cornicularia cuspidata (Bl.). One ♂ in a pitfall trap in July. Previously found up to Svartisen, Nordland (Cooke 1967).

Gonatium rubens (Bl.). One ♂ from a pitfall trap set in the birch woodland, just above sea level, near the landward end of Sörlenangen fiord, Lyngen Peninsula, 27 July-26 August. I have not found any locality record for this species in Northern Norway, but during the summers of 1967 and 1968 in Skjomen fiord, near Narvik, Nordland, I myself collected some specimens of *G. rubens* in the ground cover of birch forest. Here it appears in very small quantities, and seems to be less abundant than *G. rubellum* (Bl.).

Trichopterna mengei (Westr.). One ♂ in pitfall traps (G), and 1 ♂ in July. According to Holm (1951) this species is very common in Northern Sweden, and up to 1000 m above sea level (Holm 1950, Table 2). The northernmost Norwegian record is nearby Sulitjelma in Nordland (Cooke 1967).

Erigone longipalpis (Sundev). From seaweed shore, 29 Aug.: 13 ♀♀ and 28 ♂♂. Hitherto only two records from Norway: Hol, Hallingdal (Strand 1899), and Tysfjord and Lökta in Nordland (Strand 1920b).

E. arctica maritima (White). From seaweed near Tromsö Museum, 14 July: 2 ♀♀. Recorded by Strand (1906) from Tysfjord and Lökta, Nordland.

Eboria fausta (Cambr.). One ♂ in pitfall traps (D). Hitherto only one locality record Northern Norway, the Skjomen Fiord, Nordland (Hauge 1968). In addition it has been taken once in Southern Norway (Sogn) by Kauri (1966) about 1100-1300 m above sea level.

Leptorhoptrum robustum (Westr.). From pitfall traps (G): 9 ♀♀ and 27 ♂♂; from pitfall traps in July: 2 ♀♀ and 2 ♂♂. Recorded from several localities in Nordland (Strand 1906, Cooke 1967), from Vadsö, Finnmark (Strand 1906) and from Kolvik in Porsanger, Finnmark (Cooke 1967).

Drepanotylus uncatus (Cambr.). Bog at tern colony, 25 Aug.: 1 ♂. Reported by Strand (1900b) from Målselvdalen, Troms, and near Svolvær (Strand 1902b). Strand (1902a) also found this species in Suldal, Sogn. From Asköy, north of Bergen, I have identified 1 ♀ taken 12 April 1968.

Hilaira herniosa (Thor.). In pitfall traps (G): 1 ♀; Forholtaksla, 25 Aug.: 1 ♂. A typical arctic species, and as far as I know reported only from the northern part of Norway: Susendal and Tysfjord, Nordland, and from Tromsö (Strand 1906). During my work in the Skjomen fiord, Narvik, from which I hope to bring a more extensive report in a later paper, I have found this species to be very abundant in the ground cover of sub-alpine birch forest. For description and drawings of male and female genitalia see Tullgren (1955).

H. frigida Thor. Under stones in Forholtdalen, 21 Aug.: 2 ♀♀ and 2 ♂♂. An arctic species, but seems to be more restricted to the alpine area than *H. herniosa*. It has been found on many localities in Nordland (Strand 1906) and on high altitudes (Cooke 1967). It has also been recorded from Elvenes, Finnmark (Strand 1906) and from Vadsö (Sörensen 1898), but not previously from Troms.

H. pervicax Hull. From pitfall traps (G): 4 ♀♀ and 3 ♂♂; bog sweep, 28 Aug.: 2 ♀♀; in Aug.: 1 ♀. Mr. P. F. Waaler most kindly informed me (in litt.) that this species was found in Norway (Storå, Tysfjord) by Strand (1902b), who identified it as *H. frigida* Thor. Later on, the specimens were re-identified by H. Tambs-Lyche as *H. pervicax* Hull. As far as I know, Tambs-Lyche's re-identification has not been published. According to Holm (1950), this species is known from Norway, but he gives no further information. Until 1939 the species was not known outside England (Bristowe 1939). Therefore this is probably the first locality record from Norway.

Centromerus sylvaticus (Bl.). In pitfall traps (G): 2 ♀♀. Has been found up to Hamaröy, Nordland (Strand 1906).

Bathyphantes setiger (F. P.-Cambr.) = *B. canadensis* Em. (see Ivie 1969). Bog. sweep, 26 Aug.: 75 ♀♀ and 43 ♂♂; sweeping dwarf willow/dwarf birch, 26 Aug.: 1 ♀; bog sweep, 28 Aug.: 6 ♀♀ and 2 ♂♂. The only previous record from Norway is from Arnöy, Troms (Tambs-Lyche 1967).

Bolyphantes luteolus (Bl.). In pitfall traps (G): 1 ♀; Tverrelvdalen in August: 1 ♀; from dwarf willow near shore, 29 Aug.: 1 ♀. Hitherto reported from Måsöy, Finnmark and Tysfjord, Nordland (Strand 1906). Also found at Molnarodden, Lofoten (Cooke 1967).

B. index (Thor.). Dwarf willow near shore, 29 Aug.: 1 ♀. Seems to be very common in Northern Norway (Strand 1902a and b), and has been found up to Vadsö, Finnmark (Strand 1906).

Lepthyphantes mengei Kulcz. In pitfall traps (G): 1 ♀ and 2 ♂♂. The northernmost locality in Norway is Arnöy, Troms (Tambs-Lyche 1967).

L. expunctus (Cambr.). On moraine in July: 1 ♂. This is probably the northernmost locality in Norway. Previously I found these specimens in the Skjomen Fiord, Nordland: 25 Aug. 1967: 1 ♂ and 18 ♀♀; 1 Sept. 1967: 1♂ and 5 ♀♀. All of them were taken when sweeping *Juniperus communis* L. in a steep south faced slope. Recorded by Strand (1902b) up to Tysfjord, Nordland as *L. lepidus* (Cbr.).

Linyphia pusilla Sundev. Bog sweep, 28 Aug.: 1 ♀. Previously found up to Lofoten, Nordland (Strand 1903).

Mengea scopigera (Grube). In pitfall traps (G): 35 ♀♀ and 22 ♂♂, comprising 49.6 % of all adult spiders taken in these traps. Also found at camp site near Tromsö in August: 1 ♀. Reported up to Vadsö, Finnmark (Strand 1903).

ARGIOPIDAE

Meta merianae (Scop.). Furuflaten, on rock/grass slope, in August: 1 ♀, and perhaps the northernmost locality in Norway. Previously reported from Dönna, Nordland (Strand 1900b).

Araneus cornutus Clerck. Off dwarf willow, 24 Aug.: 1 ♀.

A. diadematus (Clerck). Forholtdalen, 5 Aug.: 1 ♀; 3 Aug.: 1 ♀. The last two species are fairly common throughout the whole country.

Cercidia prominens (Westr.). 30 or 31 Aug.: 1 ♂. Reported from Skarmodal and Susendal in Nordland by Strand (1900a).

LYCOSIDAE

Lycosa amentata (Clerck). In pitfall traps (G): 1 ♂; in Aug.: 1 ♀ with cocoon containing 24 young; from pitfall trap, in July: 1 ♀. Very common, found up to Kolvik, Porsanger (Cooke 1967).

L. prativaga L. Kock. (L. riparia (Koch)). In pitfall traps (G): 1 ♀; in August: 1 ♀; on road, 26 Aug.: 1 ♀ with cocoon containing 33 young. Found up to Alta (Tambs-Lyche 1939).

L. saltuaria hyperborea Thor. On island in a bog pool, in July: 2 ♀♀, each with a cocoon; on moraine, 26 Aug.: 1 ♀ with a cocoon; in August: 1 ♀; from pitfall traps in July: 2 ♀♀ and 2 ♂♂; from wood pitfall traps, 22 July: 2 ♀♀. Found up to Finnmark (Tambs-Lyche 1939).

L. tarsalis Thor. At moraine, 26 Aug.: 1 ♀; 26 Aug.: 1 ♀ with a cocoon; at moraine, 13 Aug.: 2 ♀♀ with cocoons. Found up to northernmost part of Finnmark (Tambs-Lyche 1939).

Pirata piratacus (Clerck). In pitfall traps (G): 1 ♀. Common up to Finnmark (Collett 1875).

Tarentula pulverulenta (Cl.). In pitfall traps in July: 1 ♀ and 1 ♂. Found up to Finnmark (Collett 1875).

THOMISIDAE

Xysticus cristatus (Cl.). 20 July: 1 ♀. Common throughout the whole country; found up to Finnmark (Strand 1906).

Tibellus maritimus (Menge). 26 Aug.: 1 ♀. No other locality record from Northern Norway. Found near Trondheim by Storm (1898) as *Thanatus oblongus* (Menge), see Roewer (1954, p. 1678).

GNAPHOSIDAE

Gnaphosa lapponum L. Koch. In pitfall traps (G): 1 ♀; on moraine, 26 Aug.: 1 ♀; Botnelva island, 28 Aug.: 1 ♀; 27 Aug.: 1 ♀; 20 July: 1 ♂; 30-31 Aug.: 1 ♀ and 1 ♂. Previously found up to Nordland: Klovimoen in Vefsn (Strand 1900a) and near Svartisen in Rana (Cooke 1967).

CLUBIONIDAE

Clubiona reclusa (Cambr.). On dwarf willow near shore, 26 Aug.: 1 ♀. Hitherto found up to Nordland: Skarmodal and Hattfjelldal (Strand 1900a).

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Beetle Fauna on the Borders of Some Scandinavian Glaciers

AXEL FRIDÉN

Fridén, A. 1971. Beetle Fauna on the Borders of Some Scandinavian Glaciers. *Norsk ent. Tidsskr. 18,* 29-32.

Grounds close to some Scandinavian glaciers were investigated. Near low altitude offshoots of the vast glaciers Jostedalsbreen and Folgefonnen, the collected number of species was not large, but sufficient for certain conclusions. Few of the true mountain species were present, and the choice of habitats of several species was in some cases different from that usually found in Scandinavia.

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During my investigations of Scandinavian mountain fauna (Fridén 1956, 1967), I also studied open grounds close to glaciers. After examining the results, I decided to treat these localities separately.

LOCALITIES

The terrain in question is woodless, and has, because of its position, an exposed and barren character. The areas are situated in Western Norway close to the vast glaciers of Folgefonnen in the vicinity of Odda, HOi (Lindroth 1960), 60 °N, and Jostedalsbreen, SFi (Lindroth 1960), 62 °N. Near Jostedalsbreen, I investigated the ends of two glacier offshoots in the Lodalen and Oldedalen valleys quite thoroughly. These areas are highly interesting because of their altitude (about 475, 175 and 300 m a. s. l.). Therefore they have a rich fauna. Investigated localities near the borders of glaciers in Southern Swedish Lapland (Fridén 1956), on the other hand, have an alpine environment and a very poor fauna, occasionally enlarged a little by animals carried by the wind and accidentally landed on snow. The present discussion will not pay regard to these northern areas.

NATURE AND CLIMATE

The nature of the investigated localities varies, of course, according to the altitude. The high localities are barren or have very poor vegetation, whereas the low ones, even quite near the glaciers, sometimes have a quite rich vegetation. The glacier, in fact, has a rather small influence on the mean temperature, even close to the border (Lindroth 1965, Schreckenthal-Schimitschek 1933). Nevertheless the climate is characterized by certain fluctuations of temperature and wind, caused by large and frequent precipitation. At Briksdal (175 m a. s. l.) in the Oldedalen valley, the climate is of a superhumid character, the winter temperature being about 0 °C and the cover of snow usually small, i.e. an oceanic climate (Fægri 1933).

As a consequence of the unstable conditions, all localities investigated were woodless. Fægri (1933) made botanical investigations of similar localities near Jostedalsbreen. The vegetation of the lowest places (175 m a. s. l.) consists to a surprisingly large degree of species of mainly alpine or subalpine character. I recorded *Cerastium alpinum, Erigeron eriocephalum, Juncus trifidus, Phyllodoce coerulea, Rhodiola rosea, Salix herbacea, S. lanata, S. lapponum, S. reticulata, Saxifraga cotyledon, S. groenlandica, Sibbaldia procumbens, Silene acaulis* and *Tofieldia pusilla.* Moreover, in Oldedalen (300 m a. s. l.) I noted the following species: *Alchemilla alpina, Arabis alpina, Saxifraga aizoides* and *S. oppositifolia.* The presence of the alpine and subalpine plants, however, may be secondary. The real mountain species of the fauna proved to be decidedly fewer (see below).

RESULTS AND DISCUSSION

When assessing the validity of the conclusions, the situation of the area (in fjord districts, see above) and dates of excursions (SFi, end of June and earlier part of July; HOi, end of July and beginning of August) must be taken into consideration.

The species recorded from the borders of the glaciers are given in Table I. The results correspond with those of Janetschek (1948). In some valleys, however, the combination of species may fluctuate a little.

The most common species is *Nebria rufescens*. This may seem surprising considering the species' low preference temperature, which is 8 °C according to Krogerus (1960). As on Iceland (Larsson & Gigja 1959), it is found not only by rivers, but practically everywhere. Only a few shore species are of the real mountain type, as opposed to the vegetation, most of which is alpine or sub-alpine (see above). The large supply of water from all directions, through large precipitation and water from the slopes, makes the differences between the various localities less striking. Thus the boundaries between the biotopes are indistinct.

The results may be of interest from three points of view: 1. The small number of species, even on lower levels. 2. The combination of the species with regard to their general distribution. 3. The habitats of several species are not the same as usually in Scandinavia.

Regarding the first point, it is striking that several common Scandinavian species are not found. In Scandinavia, the moist terrain near the borders of glaciers and snowfields does not promote a very rich fauna such as is found at lower and drier latitudes, where the water from the ice and snow makes refuges for many animals. In Scandinavia there is water enough on most grounds. The rather uniform conditions, the limited areas, and not least the unstable conditions of soil and climate, cause a restricted number of species.

Regarding the second point, the domination of southern and Pan-Scandinavian species is not unexpected, because the valleys are open

Table I. Records of Coleoptera collected on woodless grounds on the borders of some glaciers in Scandinavia

Species	Localities*		
	I	II	III
Rivers:			
Nebria rufescens Ström	+	+	+
Notiophilus biguttatus F.		+	+
Bembidion fellmani Mnh.		+	
B. hasti Sahlb.	+	+	
B. nitidulum Mrsh.			+
B. femoratum Sturm	+		+
Trechus secalis Payk.			+
Trichocellus placidus Gyll.		+	
Pterostichus adstrictus Eschz		+	+
P. melanarius Ill.			+
Lesteva longelytrata Gze			+
Geodromicus plagiatus F.	+	+	+
G. longipes Mnh.	+	+	+
Quedius umbrinus Er.			+
Amischa analis Gr.			+
Podabrus alpinus Payk.			+
Rhagonycha limbata Th.			+
Malthodes sp.			+
Hypnoidus riparius F.			+
H. dermestoides Hbst.			+
Byrrhus arietinus Steff.		+	
Phyllodecta vulgatissimus L.			+
Rocky grounds:			
Cychrus caraboides L.		+	
Nebria rufescens Ström		+	+
Notiophilus germinyi Fauv.		+	
N. biguttatus F.		+	+
Trechus secalis Payk.	+		+
T. obtusus Er.			+
Patrobus assimilis Chd.			+
P. atrorufus Ström		+	+
Bradycellus collaris Payk	+	+	+
Trichocellus placidus Gyll.	+	+	+
Pterostichus adstrictus Eschz		+	+
Calathus melanocephalus L.	+	+	
C. micropterus Dft.		+	
Lesteva monticola Kies			+
Geodromicus plagiatus F.		+	
G. longipes Mnh.		+	+
Lathrobium fulvipenne Gr.		+	
Quedius limbatus Heer		+	
Quedius nitipennis Steph.		+	
Q. fulvicollis Steph.		+	+
Q. boops Gr.		+	
Sipalia circellaris Gr.		+	+
Atheta islandica Kr.			+
Rhagonycha limbata Th.		+	
Hypnoidus riparius F.		+	+
H. dermestoides Hbst			+
Byrrhus fasciatus Forst.		+	
Peat-moss ground:			
Trichocellus placidus Gyll.	+		
Pterostichus diligens Sturm	+		

Species	Localities*		
	I	II	III
Lesteva monticola Kies	+		
Stenus carbonarius Gyll.	+		
Philonthus trossulus Nordm.	+		
Quedius umbrinus Er.	+		
Phytonomus plantaginis DeG.	+		
Vegetation:			
Anthobium minutum F.		+	
Geodromicus longipes Mnh.		+	
Anaspis rufilabris Gyll.		+	
Phyllodecta vitellinae L.		+	
Deporaus betulae L.		+	

* I: Folgefonnen, Odda; II: Jostedalsbreen, Lodalen; III: Jotedalsbreen, Oldedalen.

for migration to the very vicinity of the glacier offshoots. The contribution from Regio arctica, however, is perhaps restricted by the glaciers and the steep mountain sides. Thus, the real mountain species may be few. Particularly at the edge of glacier streams, however, there ought to be niches with a suitable microclimate for certain species, as *Bembidion fellmani* and *B. hasti*.

As opposed to the plants, the true mountain species of beetles thus form a rather small part of the fauna, which is surprising. The species listed in Table II should be mentioned.

Nebria rufescens should not be numbered with this group. The two species marked x are only accidental, and thus there remain only three species, mainly adapted to shores *(Bembidion hasti* entirely). Only *Geodromicus longipes* seems to be common. No species, special to any other biotope, was repeatedly found during the present investigation.

The investigated districts are situated in parts of Scandinavia, not really rich in mountain species. But this is not the cause of the small number of such species recorded. A probable reason is that the climate is the normal one for the altitude. The soil seems to be cooled only a few metres from the ise borders, and the influence of frost is reduced by the moisture of the soil (Schreckenthal-Schimitschek 1933). On the other hand, the water of the glacier streams is always cool.

Regarding the third point, in certain cases the choice of habitats differs strikingly from what is normal for Scandinavia. This is a consequence of the local climatic conditions. The species listed in Table III should be particularly noted.

Notiophilus biguttatus and particularly *Trechus secalis* and *Trichocellus placidus* (Fridén 1967) occur extremely frequently. In Scandinavia they normally live in woods or on open grounds with a luxuriant vegetation (Lindroth 1945). However, *Trichocellus placidus* is also found in Western Norway on quite poor open grounds (Lindroth 1945). Besides *Nebria* rufescens, which is the most common species on the moist, rocky grounds, *Patrobus atrorufus,* which is found rather frequently, and *Pterostichus adstrictus* should be particularly noted.

On the other hand, the northern *Patrobus assimilis* is strikingly retiring (Fridén 1967), as are also *Notiophilus germinyi* and *Calathus melanocephalus*. *Notiophilus aquaticus* L. was not found. The three last mentioned species, however, prefer drier grounds than e.g. *Notiophilus biguttatus* (Lindroth 1945).

The number of species collected is not considerable, which is a consequence of the uniformly poor and very limited habitats. It may, however, be sufficient for certain conclusions.

My results apparently show that the vicinity of the glacier has a very small influence on temperature. The fauna of low localities consequently has a rather poor alpine and subalpine character. The large moisture, emanating from the glacier, may, however, be of great importance.

Janetschek (1948), Lindroth (1965), and Schreckenthal-Schimitschek (1933), came to the following conclusions in similar studies to mine. The cooling effect of the ice is con-

Table II. Records of true mountain species collected by the borders of some glaciers of low altitude. Parentheses indicate that the species in question are included with hesitation

Bembidion fellmani Mnh.
B. hasti Sahlb.
(Pterostichus adstrictus Eschz)
Lesteva monticola Kies x
Geodromicus longipes Mnh.
Atheta islandica Kr. x

Table III. Species of beetles, which in Scandinavia ordinarily occur in different habitats, recorded on the border of some low altitude glaciers. For explanation of parentheses see Table II

(Nebria rufescens Ström)
Notiophilus biguttatus F.
Trechus secalis Payk.
(Patrobus atrorufus Ström)
Trichocellus placidus Gyll.
Pterostichus adstrictus Eschz
Calathus micropterus Dft.
(Geodromicus longipes Mnh.)
Hypnoidus dermestoides Hbst

siderably reduced even 3 m outside the ice border (Lindroth 1965, Schreckenthal-Schimitschek 1933). The climatical and biological effect of the ice on the surroundings is small, and particularly the ground temperature is hardly influenced to any extent (Lindroth 1965). The glacier wind blows a short distance over the end of the glacier shoot and thus hardly influences the temperature of the adjacent grounds (Geiger 1950). According to Fægri (1933) the succession series of plants on similar habitats by Jostedalsbreen show no subalpine features.

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Field Observations on the Ecology of a Snow Insect, *Chionea araneoides* Dalm. (Dipt., Tipulidae)

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Hågvar, S. 1971. Field Observations on the Ecology of a Snow Insect, *Chionea araneoides* Dalm. (Dipt., Tiplidae). *Norsk ent. Tidsskr. 18,* 33-37.

The density of *Chionea araneoides* Dalm. on the snow was measured during different weather conditions. Animals were found between –6 and 0° C, which corresponds to the temperature range during the field surveys. Next to temperature, wind seemed to be the most important limiting factor regulating the density. Animals in chill-coma (with no, or very slow movements) were found at temperatures between —5 and –6° C. The maximum density recorded was 8.6 animals per 1000 m². To accomplish pairing, this small density is compensated for in three ways: 1) The animals are constantly moving around. 2) The animals walk near their top speed at the given temperature. 3) They have so narrow preferences for climatic factors that they occur simultaneously on the snow. The ratio between the sexes was always near 1:1. A short comparison between the ecology of *C. araneoides* and *Boreus* sp. (Mecoptera) is given.

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Chionea araneoides Dalm. is a wingless tipulid, adapted to life on the snow. The larva lives in the soil, and the imago hatches in late autumn (Strübing 1958). It can be found on the snow throughout the winter. Wojtusiak (1950) found that *Chionea*-sp. preferred temperatures around —3° C. The low temperature is tolerated by supercooling of the body fluids, and *C. araneoides* may be active in a supercooled state (Sömme & Östbye 1969).

Chionea-sp. is found on the snow only during special weather conditions. When the weather becomes unfavourable, the animals creep down to the subnivean air space along tree trunks etc. Various authors have described findings of *Chionea*-sp., and have given notes on the weather conditions. Regarding temperature, most of the individuals have been found between 0 and —6° C (Chapman 1954, Frey 1913, Marchand 1917, Strübing 1958, Svensson 1966, Sömme & Östbye 1969 and Wojtusiak 1950). Other climatic factors, such as wind, snowfall, and cloud cover are briefly discussed by Chapman (1954), Svensson (1966), and Sömme & Östbye (1969). In the present study, the density of the animals on the snow was measured during different weather conditions, and the relative importance of the various climatic factors for the occurrence of *C. araneoides* was revealed. In addition, notes were made on the behaviour of the animals.

MATERIAL AND METHODS

During the winter of 1967—68 the species *Chionea araneoides* was studied at Kolsåsen, Bærum, near Oslo. The habitat consisted of wood dominated by fir *(Picea abies)*. The number of animals on the snow was counted within a range of three metres to each side along a fixed route of 2.4 km. The route was divided into four parts of 420, 650, 610 and 740 meters, each part covering an area of 2500, 3900, 3700 and 4400 m², respectively. Altogether the route covered 14,500 m².

Since weather conditions could change during the time needed to inspect the entire route, they were noted for each part of the route. The surveys were made during the lightest part of the day, between 1030 and 1630 hrs.

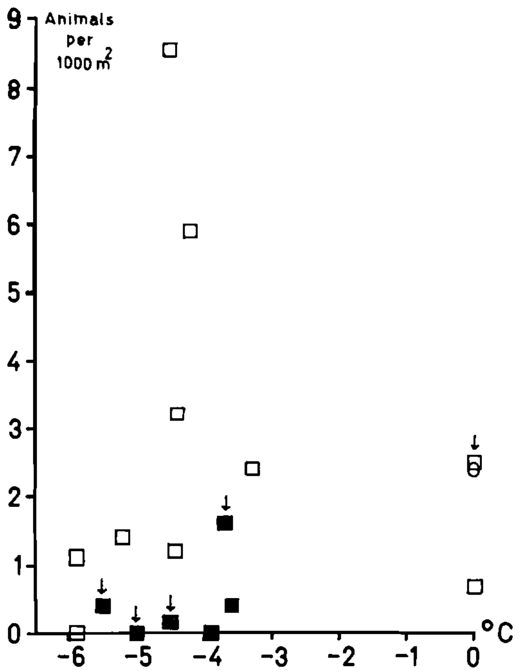

Fig. 1. Density of *Chionea araneoides* on the snow during different weather conditions. The open symbols represent densities when there was no wind, and the solid symbols represent densities during windy days. All of the surveys except for one (circle) were made on newly fallen snow. Arrows indicate that snow was falling during the surveys. The surveys indicated by the two open squares at —6 and the lowest open square at 0° C were made during partly cloudy days. During all the other surveys, the sky was completely overcast.

About three hours were spent covering the study area. In most cases the surveys were made soon after, or during snow falls, because the animals are much more difficult to observe when the snow cover is scattered with needles and particles from the trees. During the field season the depth of the snow varied, from about 40 cm in the last part of December to about 70 cm in the last part of January.

The weather factors noted in the field were temperature, wind, cloud cover, whether or not there was newly-fallen snow, and whether it was snowing at the time. The temperature was measured to the nearest tenth of a degree centigrade at a level of 1.5 m above the snow. These recordings may not always correspond with the air temperature near the snow surface, where the insects occur. Later recordings, however, (during the same weather conditions as in the investigation) never revealed a difference greater than 0.3 ° C between these two levels. In most cases the difference was less than 0.1 ° C. But when the upper snow cover is moist, larger differences may be expected with a temperature close to 0 ° C near the surface. During my field work, the snow cover was moist only twice (28 December and 20 January). For these two dates I set the surface temperature as 0 ° C. (The actual air temperature measured at 1.5 m on these days were —1.1 to + 0.7 and —0.5 to —1.0° C, respectively.)

The entire study area was surveyed on the following dates: 23 December, 28 December, 31 December, and 14 January. On 15 January only the first two parts of the route, and on 16 January, 17 January, and 20 January only the first part of the route were investigated. Altogether 127 *C. araneoides* were observed.

RESULTS AND DISCUSSION

Density and weather conditions

The density of *C. araneoides* on the snow was never high, but it varied markedly during the different weather conditions. Fig. 1 shows the density under different climatic situations. Each symbol represents the density measured for each part of the route. The temperatures given in Fig. 1 are the means of the initial and final temperatures during inspection of each part. In two cases the symbols represent the mean density of the first three parts of the route.

All surveys, except the round symbol, were made on newly fallen snow. The sky was cloudy during all surveys, except in three cases when it was partly cloudy (the lower right symbol in Fig. 1, and the two symbols on the extreme left). If we ignore these four symbols, we can study the effect of the wind alone, when the factors of newly fallen snow and cloud cover are constant. It is seen that the density of animals present on the snow surface is markedly reduced by wind. The density rarely exceeds one animal per 1000 m^2 on windy days. This is the case even if the temperature is favourable.

The wind, which was never very strong, did not exceed roughly 5 m/sec., indicating that these animals are very sensitive to air currents. It is possible that wind leads to a dehydration of the insects; the body temperature will also be lowered, because of increased evaporation and convection. The animals may even be blown away or covered with snow. Furthermore, on windy days snow often falls down from the trees and would kill many of the animals.

The insects are killed at their supercooling point, which for *C. araneoides* has a mean value of –7.5° C (Sömme & Östbye 1969). This fact, together with their very narrow range of temperature preference (Wojtusiak 1950), indicates that temperature is the primary limiting factor regulating the density of animals on the snow.

As for the other climatic factors, Sömme & Östbye (1969) report that the most frequent occurrences of winter-active insects on snow were found on cloudy days, shortly after snow falls. Chapman (1954) also found most of the *Chionea*-sp. individuals on cloudy days with newly fallen snow — although he dealt with other species of the genus. He noted that most animals were found when there was little or no noticeable wind. Svensson (1966) observed a relatively high number of *Chionea*-sp. on an overcast day with no wind.

From Fig. 1 it is apparent that wind, after temperature, is perhaps the most important limiting factor for *C. araneoides*. This suggests that wind is a more important limiting factor than the age of the snow or cloud cover. The density is always small on windy days, even if the snow is fresh, and the sky cloudy. The round symbol in Fig. 1 represents a relatively high density measured on old snow, on a day when the sky was only partly cloudy. This shows that fresh snow and cloudy weather are not absolutely essential for *C. araneoides*. Animals were also observed at –5.9° C in partly cloudy weather. Chapman (1954) found *Chionea*-sp. during sunshine.

The reason why *Chionea*-sp. is reported so often on newly fallen snow may be because the animals are much easier to see when the snow is not covered with needles etc. from the trees. Cloudy weather is not necessarily a significant factor for *Chionea*-sp., but may only be a factor commonly present during or just after a snow fall, when *Chionea*-sp. is most often discovered.

Some of my surveys were taken when it was snowing. But if it was blowing at the same time, then the density of animals was consistently low. Furthermore, when the highest densities were measured, it was not snowing. Thus falling snow does not seem to be among the most important factors.

Air humidity is probably near 100 per cent at the snow surface, at least on windless days.

Activity and behaviour

With the exception of one specimen in chill-coma, all individuals were walking when found. A remarkable feature of *Chionea*-sp. is that the legs are in continuous motion. The front and hind leg on one side of the body are moved forward at the same time as the middle leg on the other side. The speed of any individual seems to be constant at a given temperature.

To find out if it was possible to make the insect move its legs faster than it did normally, two males were irritated repeatedly during their walking. The number of times the insect moved one of its forelegs was counted. One of them was able to increase the number of steps per minute from 52 to 56; the other one increased the rate from 74 to 90. This test indicates that *C. araneoides* constantly walks near its top speed.

The number of steps per minute was measured in the field at different temperatures. Each sex was measured separately (Fig. 2). In this figure most of the temperatures between 0 and –2° C were measured near the snow surface.

The mean frequency of males was 62.3 steps/

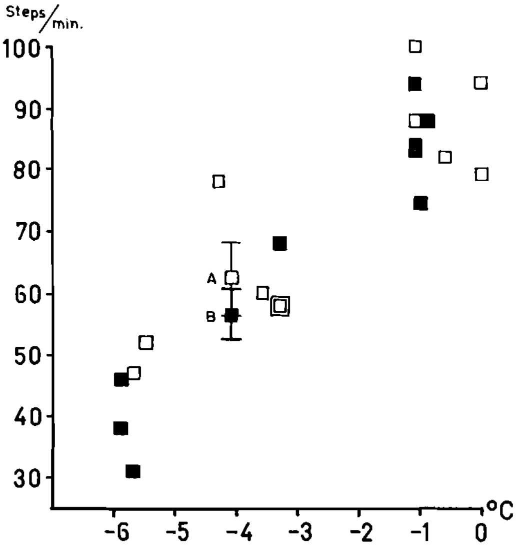

Fig. 2. Walking speed at different temperatures in *Chionea araneoides*, measured by the number of steps made by one of the fore legs per minute. Open squares: males, solid squares: females. A and B represent the mean speed and standard deviation of 17 males and 19 females, respectively. These speeds were measured at temperatures between —3.6 and —4.6° C. All the other symbols represent measurements of single indviduals, except two individuals with the same speed at —3.3° C (marked with two squares). None of the individuals used in this figure showed signs of chill-coma.

min., and of females 56.7 steps/min., measured at temperatures between —3.6 and —4.6° C. The values for the males varied between 48 and 74 (the second lowest value was 56), and for the females between 50 and 64. This difference between males and females is statistically significant (<0.005, t-test). However, it is not known if this difference exists at other temperatures.

The ability to move the legs varied markedly within a range of a few degrees centigrade. The number of steps per minute increased to about double when the temperature changed from —6 to 0° C. This discloses a strong physiological reaction even within small variations in temperature. None of the animals used in Fig. 2 were in chill-coma, and their movements were quite normal.

Sömme & Östbye (1969) noted chill-coma at —5.5° C in the laboratory (one individual). Among my own field observations, the following may be mentioned: Out of 94 individuals, found at temperatures between -3.6 and -4.6° C, all showed quite normal movements. One male at -5.5° C was moving very slowly, being partly in chill-coma. Two legs were held up in the air as he walked. Another male at —5.7° C was standing motionless on the snow, in chill-coma. Later the animal died, even after it was warmed. In conclusion, a temperature of about —6° C appears to be the lower limit for activity.

The ratio between the sexes was about 1:1 at both high and low densities. The highest number of animals counted during any one day was 50 males and 43 females.

Some animals lacked one or more legs. (These animals were, of course, not used in the measurements of walking velocity.) Out of 50 males, 4 had lost one leg, and one two legs. Out of 43 females, 4 lacked one leg. Any leg could be missing. These observations were made 14 January. In captivity, copulating animals sometimes lost one of their legs. This probably happened because the legs are partly used to keep the animals together during copulation.

Copulating animals were never found in the field, but if the two sexes were placed together on the snow, they usually copulated immediately. The male prevents the female from escaping by bowing his long tarsi around the female's legs. Then he grips the dorsal part of the female's abdomen with his claw-like genitalia. This grip slowly slips posteriorly until he makes contact with the female's genitalia. The male's 'genital claw' thus also has a function in the process of locating the female's genitalia.

Besides their function in copulation, the long tarsi also help *Chionea*-sp. to maintain a steady pace on an uneven snow surface.

To enable successful reproduction, the low density of *C. araneoides* is compensated for in three ways: 1) The animals are constantly moving about. 2) They are moving near their to speed at the given temperature. 3) Because of their narrow preferences in temperature, wind speed, and perhaps also other climatic factors, the animals in a given area occur simultaneously on the snow.

Comparison with the ecology of Boreus-sp.

Regarding moving ability, *C. araneoides* differs from another typical snow insect, *Boreus*-sp. (Mecoptera). *Boreus*-sp. specimens are most often found quiet on the snow, and when they do move, they take single jumps or at most a few steps at a time. This limited ability to move is, however, compensated for with a much higher density than in *C. araneoides*. In April. I have found several specimens of *Boreus-sp.* per m^2 snow cover, that is a density which is more than one hundred times higher than the highest recorded for *C. araneoides* (Fig. 1). In conclusion, we can say that *C. araneoides* and *Boreus*-sp. have two different ways of solving the same problem — that of allowing the sexes to meet on the snow surface.

C. araneoides and *Boreus* sp. also differ as to which part of winter they are most common. Throughout the winters 1967—70 I found most specimens of *C. araneoides* during the first part (December—February). During this same period, *Boreus*-sp. has been seen only rarely. In late winter, however, (in March and April) *C. araneoides* is very scarce, but *Boreus*-sp. is very common on the snow. These periodic fluctuations are probably a result of a higher temperature optimum in *Boreus* sp. Wojtusiak (1950) recorded preference temperatures around 0 ° C for *Boreus*-sp. individuals. Herter (1953) found the preference temperatures of *B. westwoodi* (L.) and *B. hyemalis* (Hag.), the two species recorded in Norway, to be 4° and 10° C, respectively.

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I am indebted to Eivind Östbye for help with the literature, and to Richard Wiger for improving the English.

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Notes on the Species *Amischa soror* Kr., *A. simillima* Sharp and *A. sarsi* Munst. (Col., Staphylinidae)

ANDREAS STRAND

Strand, A. 1971. Notes on the Species *Amischa soror* Kr., *A. simillima* Sharp and *A. sarsi* Munst. (Col., Staphylinidae). *Norsk ent. Tidsskr. 18,* 39-40.

The question regarding *Amischa soror* Kr. is discussed, and the view that *A. soror* Kr., *A. simillima* Sharp and *A. sarsi* Munst. are one and the same species is supported.

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There has recently been some discussion as to the status of *Amischa soror, simillima* and *sarsi.* Benick (1967) considers *sarsi* to be the same as *soror,* but at the same time he asserts that the number of the setae on the 6th sternite in the male of *soror* is 8 and not 4 as in *sarsi.*

Relying on Benick that his male of *soror* is the real one, I (Strand 1968) came to the conclusion that *soror* and *sarsi* could not be the same species, as the males of the two are different.

However, further studies of the question have convinced me that the male of *sarsi,* and not that of *soror* sensu Benick, must be the real *soror*. What I have seen up to now determined as the males of *soror* (with 8 setae), *analis, cavifrons* and *vogti* have all the same form of the penis, while the penis of *sarsi,* i.e. in my opinion the real *soror,* is different, as shown in Figs. 1 and 2.

Williams (1969) has examined type material of *simillima* and found the species to be the same as *sarsi* and not, as generally presumed, a form of *cavifrons*. As regards *soror* he points out that the females of *soror* and *simillima* are difficult to separate, *soror* being only slightly larger and the antennae more elongate than in *simillima*. However, these characters seem to vary somewhat.

Hansen (1969) mentions that in Denmark females of *soror,* but no males, have been found. According to Williams (1969) the same is the case in England; 145 specimens which he examined were all females, while males are known from Scotland under the name of *simillima*.

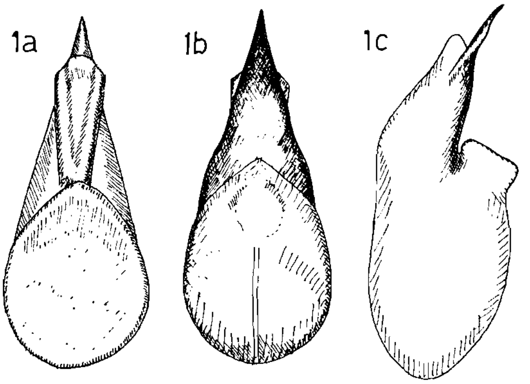

Fig. 1. *Amischa cavifrons* Sharp (Malham, Yorks, North-England, leg. S. A. Williams). a. Penis, dorsal view, b. Penis, ventral view, c. Penis, lateral view. A. Vik del.

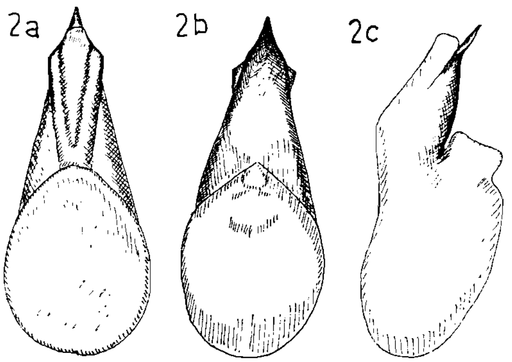

Fig. 2. *Amischa soror* Kr. (*sarsi* Munst.) (AK: Röa, Norway, leg. A. Strand). a. Penis, dorsal view, b. Penis, ventral view, c. Penis, lateral view. A. Vik del.

Palm (1968) has no *soror* from Sweden, nor is it mentioned from Norway and Finland, but from these countries it appears as *sarsi,* and both males and females occur.

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As far as I know, the only finds of the male of *soror* have been from Scotland, Fennoscandia, the Alps, and Hautes Pyrénées.

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Description of the Female *Syrphus pilisquamis* Ringd., and a Comparison with Female *S. ribesii* L. (Dipt., Syrphidae)

TORE RANDULFF NIELSEN

Nielsen, T. R. 1971. Description of the female *Syrphus pilisquamis* Ringd., and a Comparison with the Female *S. ribesii* (L.) (Dipt., Syrphidae). *Norsk ent. Tidsskr. 18,* 41-44.

The hitherto unknown female of *Syrphus pilisquamis* Ringd. is described. The differences from the male are explained, and the female is compared with the female of the nearly allied *S. ribesii* (L.).

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Ringdahl (1928) described his new species *Syrphus pilisquamis* based on male specimens from regio subarctica in Abisko, northern Sweden. The female was unknown to him, and until now the female has remained undescribed.

The following description is based on material (altogether nine specimens) from regio sylvatica of the mountainous areas of Dovre and eastern Hardangervidda, both in central southern Norway.

SYRPHUS PILISQUAMIS RINGD.

Female

Head. Eyes naked. Frons (Fig. 1A) at vertical triangle as broad as about 2/5 width of an eye; upper 1/3 of frons (from behind hind margin of vertical triangle and forwards) shining purplish black. In front of this, two large side dust-spots spread inwards, thus forming a sharply defined, greyish-yellow transverse belt occupying roughly the middle half of frons. The dusting between the two side spots is less dense, thus not quite hiding the black ground colour. Below this belt, frons and lunulae are broadly undusted, clearly shining orange-yellow; the yellow dusting just narrowly skirting the eye-margins. Face clearly yellow, covered all over (except central prominence) by light yellowish dusting. Oral margin often with a little deeper orange-yellow colour. Jowls brightly yellow or orange-yellow. Occiput densely greyish-yellow dusted. Vertical triangle, frons, and face at the level of antennae black-haired; the hairs of face and upper half of occiput golden, yellow or more whitish-yellow on jowls and lower half of occiput. Antennae with third joint roundish oval; all joints usually clearly orange, but sometimes third joint may be darkened as much as on upper half. Arista with microscopic hairs only, orange brown or brown.

Thorax. Mesonotum dull, bluish- or greenish-black and with two faint, more or less visible whitish stripes in the middle (most distinct when viewed from behind); extreme sides, from about transverse suture and backwards, more or less clearly orange-yellow. Pleurae dulled and similarly coloured as mesonotum, but sternopleurae more shining. Mesonotum orange-yellowish haired, the extreme sides more deeply so; pleural hairs often with somewhat lighter yellow colour. Scutellum brightly yellow or orange, yellow-haired in front, but predominantly black-haired on disk. Coxae and trochanters of all legs brownish black, but hind side of trochanters on p_3 yellow. Femorae immaculately yellow, or only extreme base (ca. 1/20 of total length) darkened. They are all yellow-haired, but hind femorae may have short, black hairs clustered around apical 1/3. Tibiae yellow; anterior pairs yellow-haired, hind pair black-haired. Tarsi on p_1 and p_2

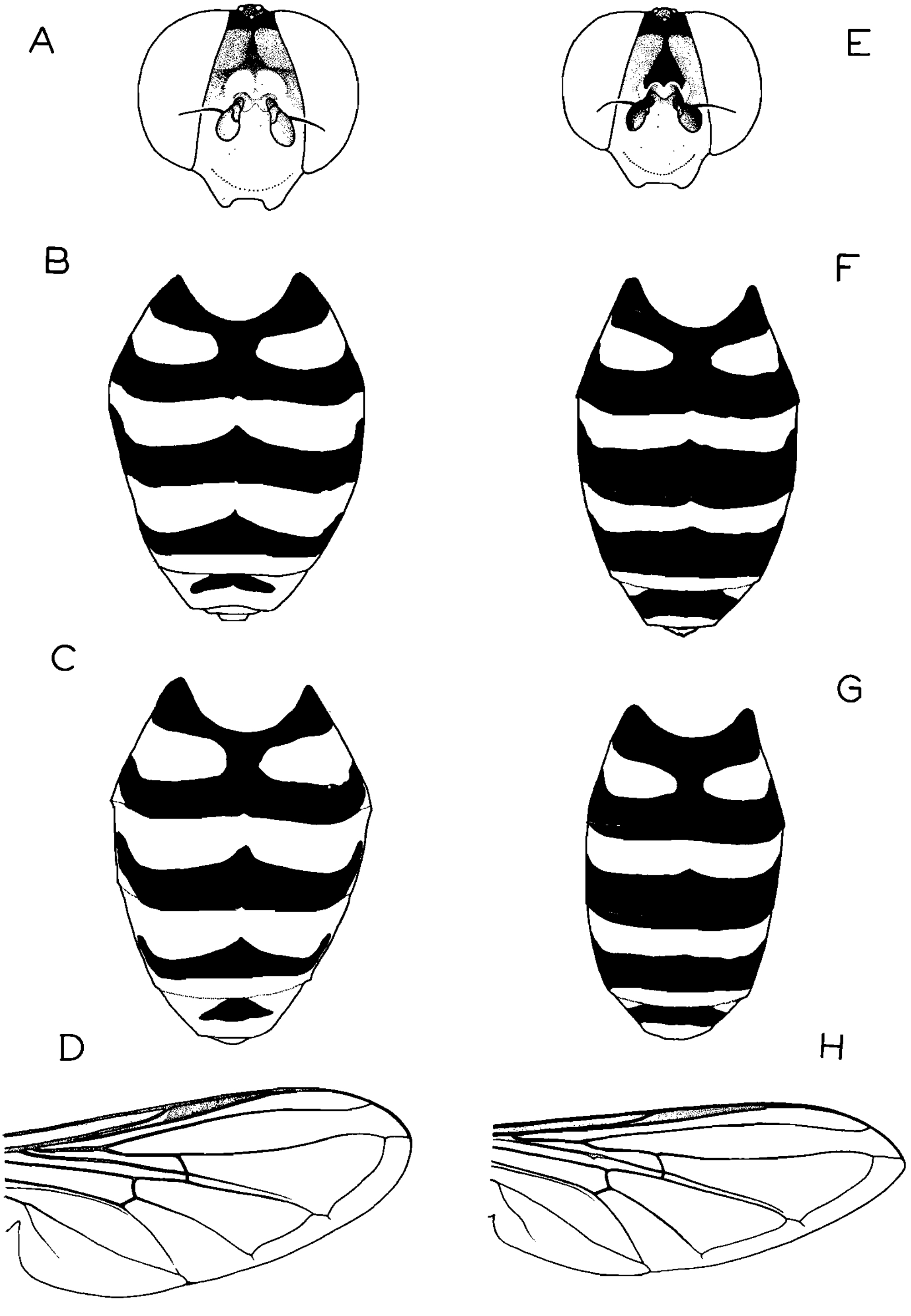

Fig. 1. A-D: *Syrphus pilisquamis* Ringd., female. A. Head from in front. B-C. Abdomen. D. Right wing. – E-H: *Syrphus ribesii* (L.), female. E. Head from in front. F-G. Abdomen. H. Right wing. Orig.

Table I. A comparison between the females of *Syrphus pilisquamis* Ringd. and *S. ribesii* (L.)

S. pilisquamis Ringd. ♀ (Fig. 1A-D)	*S. ribesii* (L.) ♀ (Fig. 1E-H)
Frons immediately above lunulae quite orange-yellow.	Frons immediately above lunulae black.
Antennae usually clear orange, or 3rd joint somewhat darkened above.	Antennae with all joints black above, orange below.
Abdomen rather broad, roundish oval. The yellow bands on tergite 3 and 4 occupying ½ length or more of tergite. Tergite 5 with triangular, black spot not reaching the side-margins of tergite.	Abdomen narrower. The yellow bands on tergite 3 and 4 occupying 1/3-2/5 length of tergite. Tergite 5 with a black band that reaches the side-margins of tergite.
Front tarsi orange.	Front tarsi blackish-brown above.
Hind side of trochanter on p_3 yellow.	Hind side of trochanter on p_3 black.
Wings relatively broad, wing tips more rounded.	Wings narrower, and wing tips more pointed.
Stigma yellow.	Stigma greyish-brown.
A subarctic and boreo-mountainous species.	A widely distributed species, occurring in both the lowland and in the mountains.

yellow, yellow-haired; those on p_3 often more brownish-yellow, black-haired. Wings (Fig. 1D) quite broad and wing tips roundish; stigma yellow, the veins of basal third of wing predominantly orange-yellow. Squamulae and halters orange-yellow.

Abdomen (Fig. 1B-C). Tergites with the yellow bands broad, reaching the side-margins. Tergite 1 all black. Tergite 2 with two widely separated yellow spots, lying near the middle of the segment. The spots are subrectangular, sloping forwards and going broadly over the side-margins of the tergite. Tergite 3 with a broad yellow, undulating band lying near front of the segment, incised behind and at basal corners going over the side-margins in about half its width. Tergite 4 with yellow band lying close to base of segment, and similarly passing over the side-margins; also hind margin of segment rather broadly yellow. On tergites 3 and 4 the yellow colour may sometimes spread from the basal corners of the bands backwards along the side-margins of the segments, and thus on tergite 4 quite surrounding the black parts. Tergite 5 with a longish triangular black spot lying in the middle of the segment. The following segments quite yellow. The hairs of the tergites mainly follow the ground colours. Venter quite yellow, or sternites in the middle with a more or less faint brownish, longitudinal stripe. The pubescence all yellow.

Differences from the male

The female is much like the male, but differs in the following respects:

a) The yellow bands on tergite 3 and 4 are not as broad as in the male, and less deeply incised behind. In the male this incision may separate the bands into spots.

b) f_1 and f_2 quite yellow (or only extreme base darkened) in the female. Basal ca. 1/4 of f_1 and f_2 black in the male.

Comparison with related species

Altogether, *S. pilisquamis* with its restricted black patterns is a strikingly yellow-orange species, and much more so than its related species *S. torvus* Ost.-Sack., *S. vitripennis* Meig. and *S. ribesii* (L.).

The females of *S. pilisquamis* and *S. ribesii* are most alike, but some differences may be noted, as shown in Table I.

Distribution

S. pilisquamis seems to be a northwestern subarctic and boreo-mountainous Palaearctic species. It has been reported from NW-Siberia, Finland, northern Sweden and also Norway, where Ringdahl (1955) reports it (1 specimen) from Hjerkinn, Dovre (62 ° 13′ N, 9 ° 34′ E Greenwich). My own finds are partly from Kongsvoll, Dovre, 10 km north of Hjerkinn, and from the Geilo district on Hardangervidda, further south (60 ° 32′ N, 8 ° 14′ E Greenwich). In Norway the species has been taken in subalpine woods and shrubs (mainly birch) at altitudes of 750-950 m above sea level.

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I wish to thank Professor Hans Kauri, Zoological Museum, University of Bergen, for reading and criticizing the manuscript of this paper.

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Cold-Hardiness in Eggs of *Neodiprion sertifer* (Geoffroy) (Hym., Diprionidae) under Natural Conditions

ÖYSTEIN AUSTARÅ

Austarå, Ö. 1971. Cold-Hardiness in Eggs of *Neodiprion sertifer* (Geoffroy) (Hym., Diprionidae) under Natural Conditions. *Norsk ent. Tidsskr. 18,* 45-48.

Cold-hardiness in eggs of *Neodiprion sertifer* exposed to natural conditions was studied by measuring the supercooling points at intervals during the winter. The lowest mean supercooling point recorded was —36.1° C. Near the completion of the postdormancy ebryogenesis —29.8° C was measured; the eggs, however, remained sufficiently cold-hardy to avoid freezing during the embryogenesis period. Changes in supercooling points during a cold spell indicate that *N. sertifer*-eggs are capable of a rapid thermal acclimation. The eggs were killed by freezing. Outdoor egg mortality of 51.9 % was recorded at the end of the winter.

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Neodiprion sertifer overwinters in the egg stage, the eggs being deposited during September/October in slits cut in the pine needles. On tall trees, therefore, the eggs are usually directly exposed to low winter-temperatures, mortality from which being an important natural control factor of many insects (Green 1962). Sullivan (1965) and Juutinen (1967) found that in *N. sertifer*-eggs also, significant mortality may occur due to freezing. However, in laboratory experiments, Sullivan also demonstrated cold-hardiness in the eggs by a depression of the supercooling points following acclimation at various low temperatures, down to —23 °C, and suggested that thermal acclimation might have a considerable effect on survival of overwintering eggs.

The experiment described in this paper aimed at elucidating the pattern of cold-hardiness in *N. sertifer*-eggs under natural conditions, expressed by the measured supercooling points at intervals throughout the winter.

MATERIAL AND METHODS

Cocoons were collected in September 1965 near Prestebakke in Idd county and brought to Ås, where they were placed in muslin cloth tents covering small pine trees. Successful swarming and egg-deposition were obtained on four trees, resulting in 9 egg batches with a total of 417 eggs. When swarming and egg-laying were completed, the tents were removed from the trees, the eggs thereby being exposed to the natural climate. The air temperature was recorded at 2 m above the ground by a thermograph placed in a temperature screen (Linke model). During the period 1 November 1965 to 27 May 1966 pine needles containing eggs were collected, usually at one to two weeks intervals, and brought to the laboratory in a cool thermos flask for immediate testing of the supercooling point. Each egg batch supplied eggs for the tests at successive intervals. To keep the eggs exposed to air temperature, the shoots were kept free from snow.

The tests were carried out according to the method described by Robinson (1928) and, with certain modifications, used by Green (1962), Sömme (1964) and Bakke (1969).

At each test, the determination of the average supercooling points was usually based on ten eggs. The cooling rate was approximately 2 °C per minute.

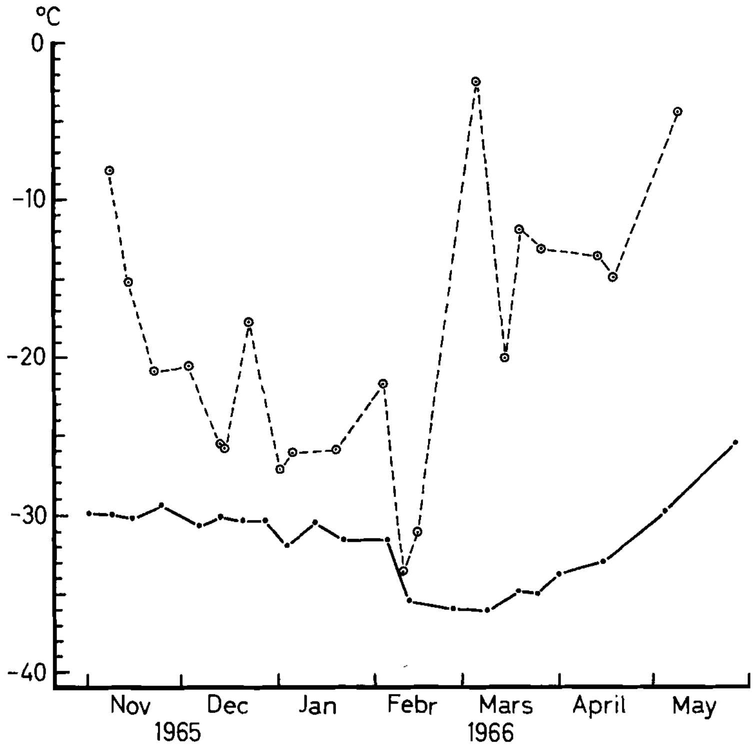

Fig. 1. Mean supercooling points in eggs of *Neodiprion sertifer,* measured at intervals throughout the winter 1965-66 (•—•—•—•) The circles, connected with the broken line, show the absolute minimum air temperature at the site where the eggs were collected between the dates of the supercooling point determinations.

RESULTS

The graph in Fig. 1 shows the average supercooling points at successive intervals throughout the winter. For each interval are also plotted the absolute minimum air temperatures recorded at the site where the eggs were collected.

The results indicate that there was a slow increase in cold-hardiness during the period 1 November-4 February, when the mean supercooling points dropped from —30.0 to —31.6 °C. During the later half of this period minimum air temperatures down to —27.2 °C were recorded.

Between 4 and 11 February the mean supercooling points fell from —31.6 to —35.5 °C; during this period the air temperature also dropped drastically (Table I).

The low supercooling point was maintained for about one month, the daily temperatures during the last 12 days of the period rising to and fluctuating around 0 °C. Around the middle of March the air temperature again dropped, but without any effect on the cold-hardiness of the eggs. The supercooling points from now on rose steadily. On 4 May evidence of embryogenesis was clear, the eggs swelling and the egg-pockets of the needles opening. At this time the mean supercooling point was —29.8 °C. About three weeks later, on 27 May, the eyes and mouth-parts of the embryo were clearly visible through the egg chorion, and the

Table I. Minimum air temperature at the site where eggs were collected during the period 1 to 12 February 1966

Date	1	2	3	4	5	6	7	8	9	10	11	12
°C	-17.1	-21.8	-16.4	-17.2	-17.0	-13.9	-30.4	-32.2	-33.6	-29.2	-28.1	-30.0

supercooling point had risen to —25.2 °C. On 9 June, the supercooling points of five one-day old larvae were measured to be —16.0, —15.0, —17.0, —16.0 and—16.0°C respectively. All eggs used in determination of supercooling points were killed by freezing.

Egg mortality was first recorded in the material collected from the trees on 8 March, and in all the following collections dead eggs were found. The percentage egg mortality was 51.9% of the total remaining number of eggs on 4 February, which was 297.

DISCUSSION

The minimum air temperatures during the period before 4 February were well above the mean supercooling points of the eggs (Fig. 1), and the eggs were therefore not exposed to freezing. Part of the egg mortality recorded on and after 8 March is most likely caused by the drastic drop in air temperature between 6 and 7 February, when the minimum temperature fell from —13.9 to —30.4 °C. A further portion of eggs was probably killed at the low temperatures (Table 1) on the following two days, when the minimum air temperatures were below the mean supercooling points of the eggs on 4 February. But since approximately 48% of the egg population remaining on 4 February survived, these eggs must have increased their cold-hardiness considerably during the three extremely cold days by lowering the mean supercooling point by approximately 4 °C, from —31.6 to —35.5 °C. As mentioned in the introduction, Sullivan (1965) found changes in supercooling points after acclimation at temperatures down to —23 °C. In his experiment the acclimation period was one week, but no conclusions can be drawn as to how quickly the eggs acclimated within the week. The present study indicates, however, that the eggs may undergo a considerable cold-hardening during one day at low acclimation temperatures.

The present study also indicates that under natural conditions the cold hardening can be maintained throughout a period with relatively high minimum temperatures, the daily temperatures fluctuating around 0 °C for 12 days without having any immediate effect on the cold-hardiness of the eggs. Sullivan (1965) found that exposed to a constant temperature at +21 °C for one day, the supercooling points of *N. sertifer* eggs rose more than 3 °C, from —32 to —28 °C.

From Fig. 1. will also be seen that the eggs lost some of their cold-hardiness during post-dormancy embryogenesis, but remained sufficiently cold-hardy to avoid freezing. A similar development has been demonstrated by Sullivan (1965) in laboratory experiments.

N. sertifer is distributed in the pine forests throughout southern Norway, and has occurred in mass-outbreaks in western, southern and eastern parts of the country. From several localities in Österdalen, where very low winter temperatures may occur, Schöyen (1906) reports considerable damage by *N. sertifer*-larvae in 1904. In one of these localities, Tynset, the minimum air temperature recorded for the five year period 1901-05 was —42.8 °C (Meteorologisk Institutt 1957). For the remaining five-year periods between the years 1881 and 1925 the minimum temperatures varied between —40.3 and —46.6 °C.

In Finland, Juutinen (1967) found hatching larvae of *N. sertifer* in a locality where air temperatures down to —43.1 °C had been recorded the preceding winter; the eggs from which the larvae hatched were located fairly high up in the trees. Juutinen (1967) also measured supercooling points in *N. sertifer*-eggs down to —41.1 °C, but found that the supercooling points in 98.3% of the eggs were above —40 °C. His supercooling point determinations were done during December and first half of January, i.e. relatively early in the winter. It is, therefore, not impossible that lower supercooling points, due to a further cold-hardening, could have been measured later in the winter. The findings of Juutinen (1967), the results described in this paper with regard to the cold-hardening at low temperatures, and the distribution of *N. sertifer* in Norwaw, make it reasonable to assume that eggs of *N. sertifer* under natural conditions in Norway are capable of obtaining a cold-hardiness corresponding to a far lower supercooling point than has been demonstrated in the present study.

ACKNOWLEDGEMENT

I am grateful to Dr. A. Bakke for reading the manuscript and making valuable comments.

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Notes on *Olibrus norvegicus* Munst. and *O. flavicornis* Sturm (Col., Phalacridae)

ANDREAS STRAND

Strand, A. 1971. Notes on *Olibrus norvegicus* Munst. and *O. flavicornis* Sturm (Col., Phalacridae). *Norsk ent. Tidsskr. 18*, 49-50.

Olibrus norvegicus Munst. is considered as a separate species, and not as a synonym of *O. flavicornis* Sturm.

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When describing *Olibrus norvegicus,* Munster (1901) compared the species with *bicolor, affinis, aenescens, baudii* and *demaisoni,* but not for some unknown reason with the nearly related *flavicornis.* I (Strand, 1946) used to consider *norvegicus* as a synonym of *flavicornis,* but a comparison of specimens of *norvegicus* from Norway with specimens of *flavicornis* from Central Europe, covering also the genitalia, has shown that the two species must be separated.

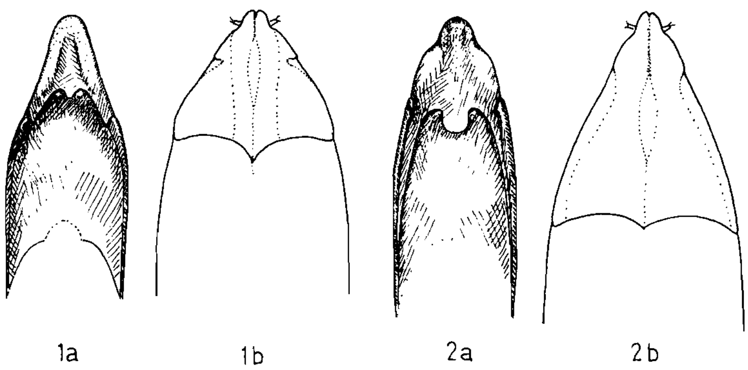
Deville (1935-1938), in his catalogue of the coleoptera of France, lists *norvegicus* from Ambleteuse in the vicinity of Boulogne, while he mentions *flavicornis* as distributed all over the country. Deville used to correspond with Munster, and he certainly would have contacted him if he had any doubt as to the identification of *norvegicus.* Moreover he has placed a ! , which he explains as a 'signe de certitude', after the species.

Norvegicus is on average smaller and lighter-coloured than *flavicornis,* with stronger and closer puncturation on metasternum. The punctures on the sides are more stretched out in length, and the sutural line of the elytra is unabridged (in *flavicornis* abridged). The form of the aedeagus (Figs. 1a and 2a) and, as pointed out by Kerstens (i. l.), also of the ovipositor (Figs. 1b and 2b) is different in the two species.

The drawings published by Thompson (1958) and Vogt (1967) show that in *flavicornis* the sides of the apical part of the parameres are rounded and contracted before the apex, while in *norvegicus* the sides are rectilinear or slightly concave. In the penis the notch at the apex is stronger in *flavicornis* than in *norvegicus* (Figs. 1a and 2a).

In the ovipositor the apical part is broader and the sides more strongly tapering towards the apex in *norvegicus* than in *flavicornis* (Figs. 1b and 2b).

In Norway, *norvegicus* has been found in



1a 1b 2a 2b

Fig. 1-2. Aedeagus seen from above (a) and ovipositor (b) of 1. *Olibrus norvegicus* Munst. and 2. *Olibrus flavicornis* Sturm. Anders Vik del.

several localities in the south-eastern part of the country and once in a locality in the western part, viz. SFi: Lærdal in Sogn.

Munster (1901) mentions that he has found *norvegicus* at the roots of pines early in the spring.

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I am most grateful to Stud.-Direktor K. Ermisch, Leipzig, Dr. Victor Hansen, Köbenhavn, J. Jarrige, Chatenay-Malabry, G. Ruter, Savigny-sur-Orge, G. Kerstens, Aldrup, Curator A. Lillehammer, Oslo and Dr. H. Vogt, Darmstadt for gifts of specimens and for information, and to Anders Vik, Sandefjord for the drawings.

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Remarks on *Trigonophora meticulosa* L. and Some Other Lepidoptera in Norway

C. F. LÜHR

Lühr, C. F. 1971. Remarks on *Trigonophora meticulosa* L. and Some Other Lepidoptera in Norway. *Norsk ent. Tidsskr. 18,* 51.

Trigonophora meticulosa L. (Lep., Noctuidae) was captured by the author at On: Lom on 30 Sept. 1959 and 29 Sept. 1968. These finds indicate that the distribution of the species in Norway is not restricted to coastal areas, as claimed by Nordström et al. (1969). New information on the distribution of some other Lepidoptera in Norway is presented.

C. F. Lühr, N-2680 Lom, Norway

One specimen of *Trigonophora meticulosa* L. (Lep., Noctuidae) (leg. C. F. Lühr, det. N. Knaben) was captured in a mercury-light trap 406 m above sea level at On: Lom on 30 Sept. 1959. Another specimen (leg. et det. C. F. Lühr) was captured at the same locality on 29 Sept. 1968.

The first specimen was published by Opheim (1962, No. 379), who states: 'One specimen of this typical coast species was found in a mercury-light trap at On: Lom September 30th 1959 (C. F. Lühr). The summer of 1959 was warm and dry in Norway.'

According to Nordström et al. (1969), a work edited by P. Douwes, *T. meticulosa* is restricted to coastal areas, and the occurrence at Lom is considered as doubtful. These authors claim that the eastern border of *T. meticulosa* runs from SFy: Randaberg, Nord-Vågsöy in the northwest to HOi: Voss, and on to Ry: Usken, Hetland in the south. From there on the border of distribution it turns eastward to AAy: Nes Verk and Oslo.

Since *T. meticulosa* has so far been captured twice at Lom by the author, there can be no doubt about the occurrence of this species in this area. This indicates that the distribution is not restricted to coastal areas, as claimed by Nordström et al. (1969).

Contributions to the distribution of Lepidoptera in Norway have previously been published by the author (for list of references see Lühr (1970)). Further additions to the *Catalogue of the Lepidoptera of Norway* (Opheim 1958, 1962) are reported in the present paper. None of the species have previously been described from the districts from which they are reported below. District abbreviations are according to Strand (1943) and nomenclature according to Nordström et al. (1941).

VE: *Acronycta leporina* L., Narveröd, Sem, 8 June 1970. *Rhizedra lutosa* Hb., Narveröd, Sem, 19 Sept. 1970.

VAy: *Monima gracilis* F., Repstad, Sögne, 18 May 1970.

STi: *Pachnobia tecta* Hb., Kongsvoll, Oppdal, 15 Aug. 1968. *Stygiostola umbratica* Goeze. Malvik, 27 June 1970.

Fi: *Hepialus fusconebulosus* De Geer, Gargia, Alta, 11 July 1970.

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Syrphidae (Dipt.) from Jæren, Norway, I. With Description of Two New Species

TORE RANDULFF NIELSEN

Nielsen, T. R. 1971. Syrphidae (Dipt.) from Jæren, Norway, I. With Description of Two New Species. *Norsk ent. Tidsskr. 18,* 53–73.

The Syrphidae fauna of Jæren in SW Norway was investigated during the period 1963–66. The present article gives information on the distribution, flight period, and flowers visited by 68 species of the subfamilies Syrphinae and Chrysotoxinae. Two new species, *Platychirus jaerensis* nov. sp. and *Melangyna coei* nov. sp. are described, and 15 species are reported as new to Norway.

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Hitherto, slightly less than two hundred species are known to be represented in the Norwegian Syrphid fauna. The first species were published in the eighteenth century by Ström, but most species have been reported by research workers from the nineteenth century, e.g. Bidenkap, Schöyen, Siebke, Storm, Zetterstedt, and others, who travelled through large parts of south-eastern and northern Norway. In the twentieth century, faunistic and systematic subjects have been treated mainly by Ringdahl, Soot-Ryen, and Strand. Soot-Ryen (1943) gives a good survey of the literature concerned up to the year 1940.

In contrast to this abundance of reported material, little is known about the fauna of western and south-western parts of the country. From Jæren only three Syrphid species (Ardö 1957) have previously been reported.

The author's investigation was carried out during 1963–66, but material from earlier and later years has also been incorporated. Some faunistic and ecologic subjects of the investigation have already been published (Nielsen 1966a and b, Nielsen 1968); the rest will be presented in this and a following paper.

DESCRIPTION OF THE AREA

Jæren occupies about 800 km² of the coastal area in Rogaland county, SW Norway (58° 31′–59° 03′ N; 5° 29′–5° 48′ E Greenwich) (Fig 1 A). It is an exception to the general landscape of that part of the country, being very flat and only slowly rising inwards from the coast. The mountain chain, bordering Jæren towards the east, is also rather low, reaching 250–350 m a.s.l.

The vegetation of the landscape is quite young. Until the nineteenth century Jæren was dominated by heaths and swampy bogs, and along the coast the sand kept drifting with the winds. During the last hundred years, however, intensive draining and cultivating processes have been carried out, and today cultivated fields dominate the landscape. Few bogs and heaths are left, and along the coast the sand is tied into *Ammophila* and *Elymus* dunes.

The area is very open in the western parts, with only a few small planted pine or spruce forests (Fig. 2). Inland, in the eastern, more hilly parts, the woods may be larger and comprise either native birch, oak or hazel populations, or plantations of spruce or pine. But still the whole landscape is rather bare and open.

A few slow-running rivers drain the area, in a direction east to west. The climate is rather atlantic, mild and quite humid.

MATERIAL

Forty-two localities, including different biotopes, were visited (Fig. 1 B, Table I). Collection was carried out during the annual period (April)

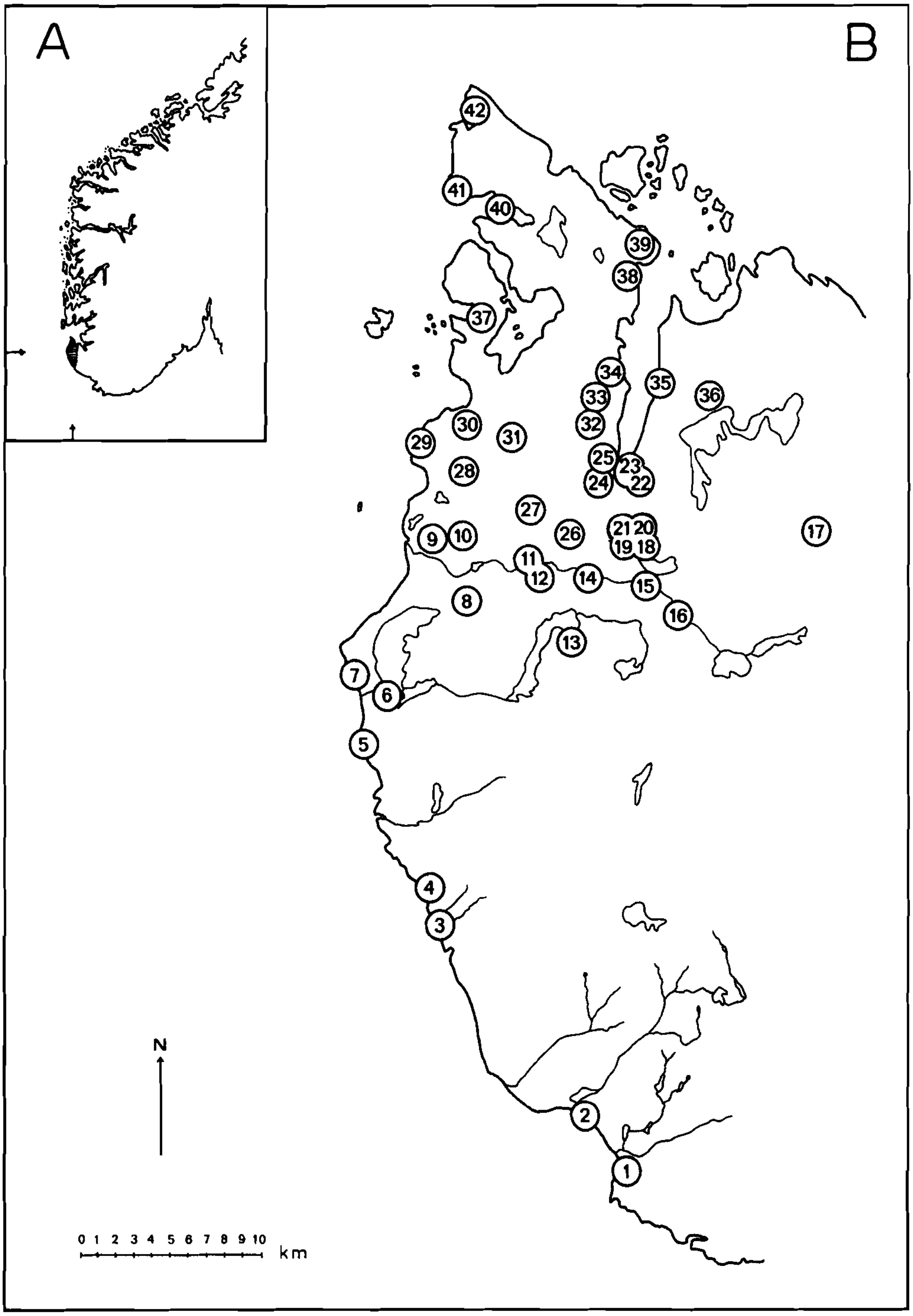

Fig. 1. A: Location of Jæren in southern Norway. B: The Jæren area with localities investigated (locality names: see Table I).

Table I. Names of localities investigated, as shown in Fig. 1B

Loc. No.	Locality	Canton
1	Ogna	Ogna
2	Brusand	Ogna
3	Rognbekken	Varhaug
4	Grödaland	Nærbö
5	Vik	Klepp
6	Erga	Klepp
7	Orre	Klepp
8	Kleppe	Klepp
9	Alvevatn, Sele	Klepp
10	Skasheim	Klepp
11	Skjæveland	Klepp
12	Öksnevad	Klepp
13	Kverneland	Time
14	Fosseikeland	Klepp
15	Bråstein	Höyland
16	Figgjo	Höyland
17	Röynli	Höle
18	Osli	Höyland
19	Helgeland	Höyland
20	Myrland	Höyland
21	Brattebö	Höyland
22	Austrått	Höyland
23	Gravaren	Sandnes
24	Skogsbakken	Sandnes
25	Lura	Sandnes
26	Ganddal	Höyland
27	Malmin	Höyland
28	Tjelta	Sola
29	Vigdel	Sola
30	Reke	Sola
31	Gimra	Sola
32	Stokka	Höyland
33	Forus	Höyland
34	Gausel	Hetland
35	Dale	Hetland
36	Hogstad	Hetland
37	Sletthei	Sola
38	Hillevåg	Stavanger
39	Stavanger	Stavanger
40	Randaberg	Randaberg
41	Viste	Randaberg
42	Sande	Randaberg

May–September, but the number of collecting days in spring are proportionally fewer, and further details about the spring aspects are therefore needed to get a more complete view of the fauna.

The total material of the investigation, deposited in the collections of Zoological Museum, University of Bergen, comprises slightly less than 12,000 specimens. This paper deals with the subfamilies Syrphinae and Chrysotoxinae, including 68 species. Two new species, *Platychirus jaerensis* nov. sp. and *Melangyna coei* nov. sp. are described, and the following 15 species are reported as new to the Norwegian fauna:

Fig. 2. Unlike most parts of western Norway, Jæren is a very flat and open cultivated coastland. The landscape is, however, more hilly and rich in forest areas inland, where a low mountain chain makes a rather indistinct border towards east. Photo above is taken at Gimra (loc. No. 31). The roundish top to the left is mountain Dalsnuten (324 m a. s. l.) at Dale (loc. No. 35).

Platychirus fulviventris (Macq.) 1829
Platychirus perpallidus Verr. 1901
Epistrophe euchroma (Kow.) 1885
Metasyrphus latilunulatus (Coll.) 1931
Metasyrphus punctifer (Frey in Kanervo) 1934
Dasysyrphus postclaviger (Stys & Moucha) 1962
Ischyrosyrphus laternarius (O. F. Muell.) 1776
Melangyna compositarum (Verr.) 1873
Melangyna quadrimaculata (Verr.) 1873
Phalacrodira malinella (Coll.) 1952
Phalacrodira punctulata (Verr.) 1873
Didea intermedia Loew 1854
Sphaerophoria dubia (Zett.) 1849
Sphaerophoria picta (Meig.) 1822
Sphaerophoria sarmatica Bank. 1964

Some abbreviations and terms used in the following list should be explained. *Flight period* expresses the time period in which the species has been found in the area. *NF* means nourishing flowers (flowers providing nourishment: nectar or pollen). *Norway* signifies finding-places previously reported from Norway by various authors, as mentioned above. Furthermore, Strand's abbreviations (Strand 1943) for the counties are used (e.g. *Ry* = outer part of county Rogaland; *Ri* = inner part of Rogaland). To point out the part of Norway in which the counties are located, I have used the terms W (western parts of South Norway), SE (eastern parts of South Norway) and N (North Norway: north of county Nord-Tröndelag).

Under *NF*, *Picea* sp. (secreted sugar) is mentioned as a source of nourishment for some Syrphid species. To me, this source was unknown, until it was observed that the insects sucked the secretion from young shoots of spruce in early summer. This secretion, in the morning probably often diluted by the dew, is found on the developing fresh shoots from the twigs, and is eagerly sucked by both sexes of many species.

SUBFAMILY SYRPHINAE

Genus *PARAGUS* Latreille

P. tibialis (Fall.) 1817

9 specimens from 4 localities; single specimens in dry biotopes (heather, dry forest meadows and cultivated land): Öksnevad 17. July 1963 (1♀), 24. June 1964 (1 ♀), 2. Aug. 1964 (1 ♂), 10. Aug. 1965 (1 ♂); Osli 30. aug. 1963 (1 ♀); Gimra 5 July 1965 (1 ♂), 3. July 1969 (1 ♂); Dale 19. Aug. 1965 (1 ♂), 6. July 1969 (1 ♀). Flight period: 24. June–30. Aug.

NF: *Calluna vulgaris* (L.) Hull.

Norway: SE (AK, VE).

Genus *BACCHA* Fabricius

B. obscuripennis (Meig.) 1822

In wooded areas, at the edge of forests: Myrland 1. July 1964 (1♀); Dale 2. June 1967 (1 ♂).

Norway: SE (Ö, AK, HEn).

Genus *PYROPHAENA* Schiner

P. granditarsa (Forst.) 1781

99 specimens from 17 localities. Rather frequent in humid biotopes (humid bogs and shrubs, edges of canals). Flight period: 14. June–2. Sept.

NF: *Ranunculus acris* L., *Potentilla erecta* (L.) Räusch., *Sanguisorba officinalis* L.

Norway: SE (AK, STi).

Genus *PLATYCHIRUS* St. Farg. et Serv.

P. albimanus (Fabr.) 1781

329 specimens from 30 localities. Eurytope and common. As with some other *Platychirus* species, two marked peaks in the number of specimens have been found, one in June and one at the end of July/beginning of August. Between these peaks the species has been found far less abundant. Flight period: 9. May–17. Sept.

NF: *Ranunculus acris*, *Potentilla fruticosa* L., *P. erecta*, *Sanguisorba officinalis*, *Acer platanoides* L. (Aphid honey-dew), *Calluna vulgaris*, *Plantago lanceolata L*, *Taraxacum* sp., *Hieracium* sp.

Norway: SE (VE); W (SFi).

P. angustatus (Zett.) 1843

208 specimens from 24 localities. Eurytope and locally common (most abundant in second half of July till beginning of August). Flight period: 1. June–2. Sept.

Norway: SE (AK, HEn, Bö).

P. clypeatus (Meig.) 1822

812 specimens from 31 localities. Eurytope and common, but most abundant on meadows and cultivated land. Two peaks in the numbers have been registered; one smaller in June and one large in the period middle of July until middle of August, the latter with large numbers of individuals. Flight period: 15. May–2. Sept.

NF: *Potentilla fruticosa*, *Sanguisorba officinalis*, *Calluna vulgaris*, *Plantago lanceolata*, *Taraxacum* sp.

Norway: SE (Ö, AK, VE, Bö, AAy, Os, On, STi, STg NTi); W (Orre, Ry: Klepp (Ardö 1957)); N (Nnv, TRi).

P. fulviventris (Macq.) 1829

New to Norway. 12 specimens from 2 localities: Öksnevad 24. June 1963 (4♂♂, 4♀♀), 21. June 1964 (1 ♀), 23. July 1965 (1 ♂), 24. July 1965 (1 ♀); Sande 29. July 1963 (1♀). Rare and local, found only in humid bogs or close to them. Flight period: 21.June–29. July.

P. immarginatus (Zett.) 1849

12 specimens from 3 localities: Öksnevad 24. June 1963 (4♂♂, 5 ♀♀), 17. July 1963 (1 ♀); Gimra 16. Aug. 1963 (1 ♀); Sande 29. July 1963 (1 ♀).

Rare; most abundant in humid *Comarum-Phragmites* bogs, otherwise in single specimens on meadows. Flight period: 24. June–16. Aug.

Norway: N (Nnö).

P. manicatus (Meig.) 1822

239 specimens from 24 localities. Eurytope and common species. Like some of the other species of the genus, it seems to occur in at least two annual generations. Marked hatching with sudden increase in the numbers of flying insects have been observed at end of May/beginning of June, and in second half of July. Flight period: 26. May–4. Sept.

NF: *Ranunculus acris*, *Cakile maritima* Scop., *Sedum acre* L., *Comarum palustre* L., *Sanguisorba officinalis*, *Rosa cinnamomea* L., *Galium verum* L., *Valeriana officinalis* L., *Taraxacum* sp., *Hieracium* sp.

Norway: All over the country, according to Siebke (1877) and Bidenkap (1900).

P. peltatus (Meig.) 1822

185 specimens from 23 localities. Eurytope and common, but most abundant in first part of summer (June–July). Flight period: 30. May–27. Aug.

NF: *Ranunculus acris*, *Cakile maritima*, *Rubus idaeus* L., *Comarum palustre*, *Potentilla fruticosa*, *Calluna vulgaris*, *Taraxacum* sp.

Norway: SE (VE, HEn, HEs, On, Os, STi, STy, NTi); W (Nsi, TRi).

P. perpallidus Verr. 1901

New to Norway. 5 specimens from 3 localities: Kleppe 15. Aug. 1965 (2♂♂); Skjæveland 3. Aug. 1968 (1♂); Brattebö 4. June 1965 (1♂, 1♀). Rare; in humid biotopes (bogs, riverbanks). Flight period: 4. June–15. Aug.

P. podagratus (Zett.) 1838

83 specimens from 5 localities. A distinctly early summer species; flight period 1. June–6. July.

NF: *Ranunculus acris.*

Norway: SE (AK); W (Orre, Ry: Klepp (Ardö 1957)); N (Nnö).

P. scambus (Staeg.) 1845

74 specimens from 18 localities. Frequent; most abundant in humid biotopes (on humid meadows, in bogs, along ditches and brooks). Flight period: 13. June–13. Aug.

Norway: SE (AK, HEn, On, STi).

P. scutatus (Meig.) 1822

26 specimens from 8 localities. Rare in the open western part of the area, more frequently in the inland forest region. Flight period: 1. June–12. Sept.

NF: *Potentilla fruticosa*, *P. erecta*, *Taraxacum* sp.

Norway: SE (Ö, AK); W (MRy).

P. transfugus (Zett.) 1838

A female specimen in spruce forest: Brattebö 5. June 1965.

Norway: According to Siebke (1877) caught in eastern parts of the country: SE (AK, Os, STi).

Platychirus jaerensis nov. sp.

A rather large species with large yellow abdominal spots, resembling *P. ovalis* Becker and *P. peltatus* (Meigen).

Male

Head. Fig. 3A. Frons black with rather light grey or greyish-yellow dusting, the hairs black. Lunulae black, somewhat shining. Mouth-edge only slightly more produced than face tubercle; face shining bronzy-black with even greyish-yellow or yellowish dusting, leaving only tubercle and mouth-edge undusted. The hairs brownish-black on upper half of face, more yellow-haired around tubercle and mouth-edge. Jowls shining black with light whitish dusting; yellow and black-haired. Occiput yellow-dusted, dorsal area less so; the hairs yellow and black dorsally, otherwise yellow. Vertical triangle black, mainly black-haired. Antennal joints orange, 3rd joint somewhat darkened dorsally; arista slightly thickened at base, orange brown and with numerous microscopic black hairs.

Thorax. Mesonotum and scutellum shining bronzy-black, yellow-haired (a few black hairs mediolaterally on mesonotum). Pubescence yellow, rather dense, erect and longest on hind part. Pleurae shining bronzy-black; pubescence yellow, but pteropleurae and hind part of mesopleurae

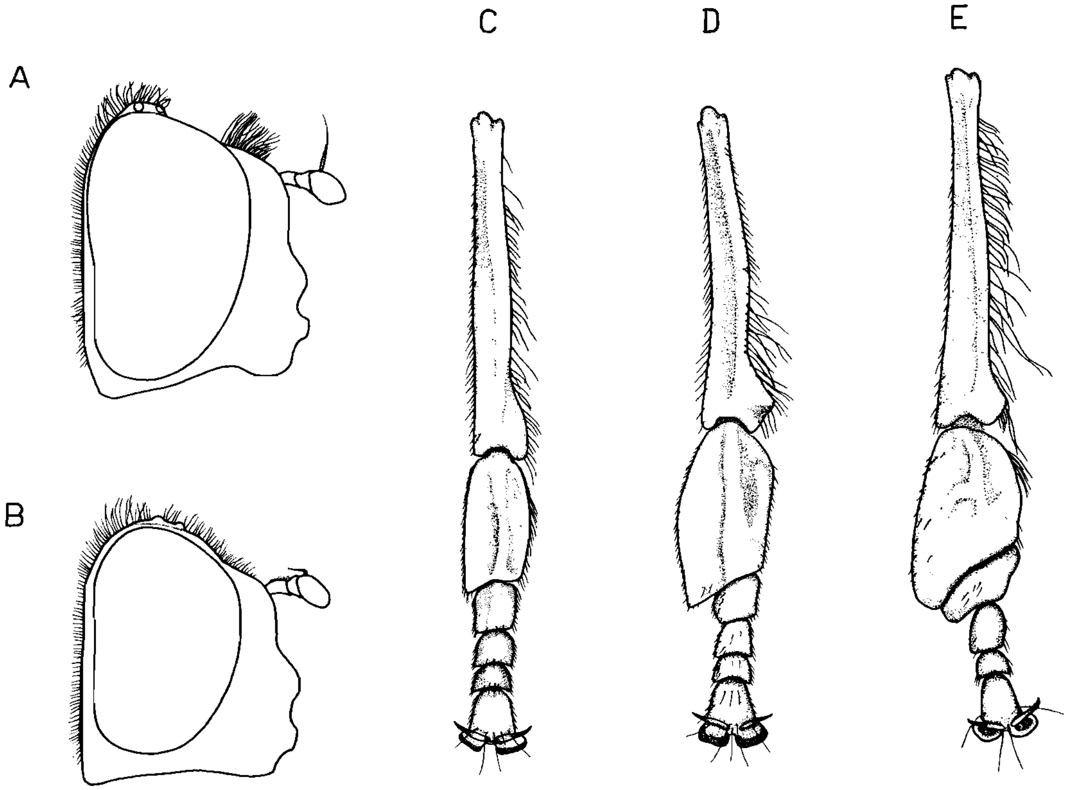

Fig. 3. A–C: *Platychirus jaerensis* nov. sp. A: Head of male. B: Head of female. C: Front tarsus of male. D: Front tarsus of male *P. peltatus* (Meig.). E: Front tarsus of male *P. ovalis* Beck.

often with some black hairs. Legs yellow and black. f_1 with basal $^1/_4$–$^1/_3$ black, and underside often somewhat darkened; t_1 brownish laterally in the middle, f_1 and t_1 otherwise yellow. Tarsus$_1$ yellow; metatarsus (Fig. 3C) slender, only a little broader than tibiae at tip, length about twice its breadth. Metatarsus obliquely cut at tip. Second tarsal joint a little longer than broad; it is a little narrower than metatarsus and about as broad as the following joints. f_2 black on basal $^1/_3$ (and often on the entire length of the underside). t_2 often darkened on apical $^1/_3$; f_2 and t_2 otherwise yellow. Metatarsus$_2$ brown or brownish-black, extreme base and tip yellow; the tarsal joints otherwise yellow (in one specimen also the second joint somewhat darkened). f_3 black, yellow on apical $^1/_6$; t_3 black, yellow only at extreme base and tip. Tarsus$_3$ black, but ventral side often more yellow. f_1 with bristly black hairs behind on almost entire length, t_1 laterally on basal $^2/_3$–$^3/_4$ with brownish-black hairs; f_1 and t_1 otherwise yellow-haired. Hind side of f_2 with yellow and black hairs, front side mainly yellow-haired, but with some stout and short black bristles below in the middle. t_2 laterally on basal $^3/_4$ predominantly black-haired, hind side with some crowded brownish-black hairs on apical half. f_2 and t_2 otherwise mostly yellow-haired. Tarsus$_2$ mainly yellow-haired, the last two joints sometimes with some scattered black hairs. Hind legs more purely yellow-haired; black hairs laterally and dorsally on tarsi. Wings slightly greyish tinged; veins brown to dark brown, stigma yellow. Wing length 7.9-8.3 mm; mean length 8.1 mm. Squamulae greyish-yellow to whitish-yellow, fringe yellow. Halters light brown to greyish-yellow, the knob darkened.

Abdomen. Fig. 4A. Black with four pairs of yellow-orange spots which do not reach the side-

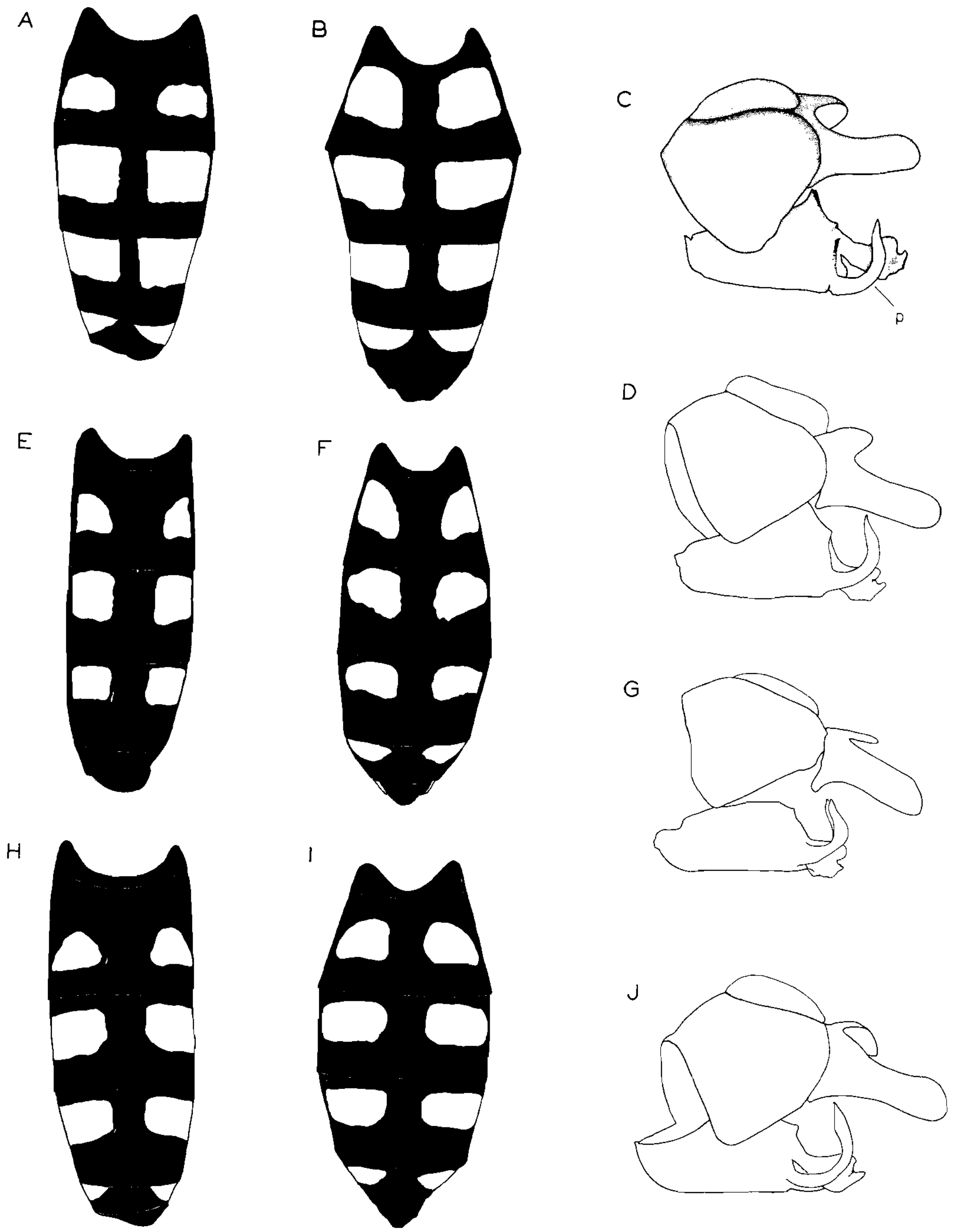

Fig. 4. A–D: *Platychirus jaerensis* nov. sp. A: Abdomen of male (holotype). B: Abdomen of female (allotype). C: Male genitalia (holotype). D: Male genitalia (paratype). E–G: *P. peltatus* (Meig.). E: Abdomen of male. F: Abdomen of female. G: Male genitalia. H–J: *P. ovalis* Beck. H: Abdomen of male. I: Abdomen of female. J: Male genitalia. p = paramere of male genitalia.

margin of the tergites. Tergite 1 shining bronzy-black; the black areas of following tergites (except base of tergite 2) dulled. Tergite 2 with not large, roundish-rectangular spots lying in the middle of the segment. The spots on tergite 3 and 4 squarish, lying at base and occupying about $^2/_3$ of the segments. Tergite 5 with triangular spots. The segments following, including the genitalia, black. The sternites pellucid; sternite 1 greyish-black with some faint whitish dusting; sternites 2–4 yellow. Abdomen mainly yellow-haired, the black hairs being restricted to the black areas of the tergites. Genitalia yellow-haired. Sternites yellow-haired; the hairs are long on sternites 1–3, short on 4. Body length 9.6–10.1 mm; mean length 9.8 mm.

Female

Head. Fig. 3B. Frons at vertical triangle as broad as about $^3/_4$ the breadth of an eye; shining bronzy-black, faintly greyish-yellow dusted and with two rather broad, triangular and somewhat ill-defined dust-spots which occupy about $^2/_3$ of frons. Frons mainly black-haired, but sometimes with a few yellow hairs in the middle. Lunulae shining black. Face bronzy-black, shining, but evenly and faintly yellowish dusted, except on tubercle and mouth-edge; it is mainly yellow-haired. Jowls, occiput and antennae as in the male.

Thorax. Mesonotum and scutellum glittering bronzy-black, often with light bluish lustre; mesonotum lightly greyish-yellow dusted in front of transverse suture. Pubescence yellow (an area with black hairs may be seen above base of wing), erect and short (half the length of the hairs of male). Pleurae shining bluish-black or bronzy-black, faintly whitish dusted; pubescence yellow. Legs more yellow than in the male. p_1 and p_2 yellow, or with a more or less visible brownish shadow on apical half of t. p_3 somewhat darker; f_3 yellow on apical $^1/_6$ and basal $^1/_3$, the middle part more or less dark brown (in one specimen this area is restricted to a narrow ring). t_3 orange-brown, yellow at base and tip (sometimes also in the middle). Tarsus$_3$ brownish-black, ventrally more or less yellow. Wings as in the male. Wing length 7.9–9.1 mm; mean length 8.5 mm. Squamulae yellowish-white, fringe yellow. Halters yellow to deep orange.

Abdomen. Fig. 4B. Shining black with rather large yellow spots, which do not go over the side-margins. Tergite 1 black (in one specimen orange-brown at base). Tergite 2 with the spots larger than in the male; they are squarish, lying close to base of segment and occupying about $^2/_3$ of its length. Tergites 3–5 with rectangular or subrectangular spots, sloping off towards side-margins and occupying $^1/_2$–$^2/_3$ of length of the segments. Tergite 6 shining black or with small, rather indistinct reddish side-spots. The following segments black. Sternite 1 usually a little darkened at base, apical half of it and the following sternites translucent yellowish. As in the male, the colour of the hairs mainly following the abdominal ground colours. The hairs are short, however somewhat longer at side-margins of tergite 1 and 2. The hairs on sternites short and yellow. Body length 9.7–10.9 mm; mean length 10.3 mm.

Material

The material totals 13 specimens: 5 ♂♂ and 8 ♀♀. There are two females from the Bergen district (Åstveit and Paradis, about 170 kms north of Jæren) included in the series, and also a male specimen from Sweden, kindly sent me from the collections of Zoologiska Institutionen, University of Lund, by Mr. Hugo Andersson.

Holotype: Brattebö, Ry: Höyland, 1.June 1967 (♂), Tore Nielsen leg. *Allotype:* Brattebö, Ry: Höyland, 1. June 1967 (♀), Tore Nielsen leg. *Paratypes:* Gimra, Ry: Sola, 31. May 1965 (2 ♀♀); Brattebö, Ry: Höyland, 4. June 1965 (1♂); 1. June 1967 (2♂♂ (one ex. dichoptic), 3 ♀♀); Åstveit, HOy: Åsane, 28. May 1967 (1 ♀); Paradis, HOy: Fana, 31. May 1968 (1 ♀); all paratypes above collected by the author. The Swedish paratype, a male specimen, is labelled: Gstr, Hille, Forsby 14. June 51, Kj. Fahlander. The locality is situated near Gävle, some 170 kms NNW of Stockholm.

Type locality: The holotype (and allotype) was collected on a meadow (*Taraxacum*, *Ranunculus*, *Gramineae*) at the edge of a spruce and pine forest near the farm at Brattebö, Höyland.

All Norwegian localities are in the lowland by the coast, where the material has been collected on *Taraxacum* meadows. The finds of the whole type series are from the period 28. May–14. June; there are no finds later in the summer in spite of

Table II. Comparison between *Platychirus jaerensis* nov. sp. and the allied species *P. peltatus* (Meigen) and *P. ovalis* Becker

P. jarensis nov. sp. (Figs. 3A–C, 4A–D)	*P. peltatus* (Meig.) (Figs. 3D, 4E–G)	*P. ovalis* Beck. (Figs. 3E, 4H–J)
♂	♂	♂
Antennal joints orange; 3rd joint darkened above.	Antennal joints brownish-black; 3rd joint reddish below.	Antennal joints brownish-black; 3rd joint usually reddish below.
Metatarsus$_1$ rather narrow and straight, only a little (1.2 ×) broader than t$_1$ at tip. Second tarsal joint slightly narrower than metatarsus$_1$, and about as broad as the following joints.	Metatarsus$_1$ rather broad and straight, somewhat (1.4 ×) broader than t$_1$ at tip. Second tarsal joint much narrower than metatarsus$_1$, but about as broad as the following joints.	Metatarsus$_1$ rather broad and roundish, and somewhat (1.6 ×) broader than t$_1$ at tip. Second tarsal joint a little narrower than metatarsus$_1$, but much broader than the following joints.
t$_1$ laterally mainly short-haired.	t$_1$ laterally with short and long hairs.	t$_1$ laterally with short and long hairs.
f$_1$ black on basal $^1/_4$–$^1/_3$ (and often along entire underside).	f$_1$ with basal $^1/_2$ black.	f$_1$ black, only apical ca. $^1/_5$ yellow.
Abdomen with 4 pairs of spots. The spots on tergite 3 and 4 lying close to base of segment.	Abdomen with 3 pairs of spots. The spots on tergite 3 and 4 lying close to base of segment.	Abdomen with 4 pairs of spots. The spots on tergites 3 and 4 somewhat removed from base of segment.
Genitalia: parameres rather long, and as in *P. ovalis* with terminal third part elongated.	Genitalia: parameres shorter, terminal third part more abruptly ending.	Genitalia: parameres rather long and slender, and as in *P. jaerensis* with terminal part elongated.
♀	♀	♀
Antennal joints orange; 3rd joint darkened above.	Antennal joints brownish-black; 3rd joint usually reddish below.	Antennal joints brownish-black; 3rd joint usually reddish below.
Frontal dust-spots rather faint or ill-defined, not so readily seen towards frons.	Frontal dust-spots well-defined, readily seen towards frons.	Frontal dust-spots well-defined, readily seen towards frons.
Pleurae shining, only faintly dusted.	Pleurae rather dull, heavily dusted.	Pleurae shining, only faintly dusted.
f$_3$ yellow and brown; yellow on apical $^1/_6$ and basal $^1/_3$, otherwise brown.	f$_3$ predominantly black; yellow on basal $^1/_4$ and apical $^1/_6$.	f$_3$ predominantly black; yellow on basal $^1/_9$ and apical $^1/_9$.
t$_3$ orange-brown, yellow at base and tip (sometimes also in the middle).	t$_3$ quite yellow.	t$_3$ black, only innermost base yellow.
Abdomen usually with 5 pairs of squarish or short-rectangular spots, all but the first pair lying quite up to base of segments.	Abdomen with 4 pairs of kidney-shaped spots, all lying close to base of segments.	Abdomen with 4 pairs of rectangular spots, well removed from base of segments. The spots on tergite 2 lying in the middle of segment.

several collecting seasons in both Jæren and Bergen area, which may indicate that *P. jaerensis* is an early, univoltine species.

The species is given its name after the landscape Jæren, where first found by the author.

Comparison with related species

P. jaerensis nov. sp. seems to be nearly related to *P. peltatus* (Meigen) and *P. ovalis* Becker, and a comparison between the species is given below (Table II). *P. ovalis* Beck., here for the first time reported from Norway, has been collected in the Bergen district.

Genus *XANTHANDRUS* Verrall

X. comtus (Harr.) 1782

Lura 16. Aug. 1966 (1♂), on *Potentilla fruticosa.*

Norway: According to Bidenkap (1900) found at Balsfjord, Troms 28. June 1895.

Genus *MELANOSTOMA* Schiner

M. mellinum (L.) 1758

800 specimens from 36 localities. Eurytope and common; most abundant in August. Flight period 15. May–5. Sept.

NF: *Parnassia palustris* L., *Potentilla erecta*, *Sanguisorba officinalis*, *Calluna vulgaris*, *Taraxacum* sp.

Norway: SE (Ö, AK, VE, HEs, HEn, On, Os, STi, STy); W (MRi, MRy); N (Nsi, Nnv, Nnö, TRy, TRi).

M. scalare (Fabr.) 1794

182 specimens from 18 localities. Common, but less so than the previous species. Flight period: 15. May–17. Sept.

NF: *Salix repens* L., *Rumex acetosa* L., *Potentilla fruticosa*, *P. erecta*, *Calluna vulgaris*, *Taraxacum* sp., *Acer platanoides* (Aphid honey-dew).

Norway: According to Siebke (1877) common all over southern and central parts of the country. Otherwise recorded from SE (Bv, STi) and W (SFi).

Genus *SYRPHUS* Fabricius

S. ribesii (L.) 1758

493 specimens from 28 localities. Eurytope and common; however, in contrast to *S. torvus*, it seems to be most numerous in late summer. Flight period: 9. May–17. Sept.

NF: *Picea* sp. (secreted sugar), *Salix caprea*, *Ranunculus acris*, *Brassica campestris* L. *Sedum acre*, *Comarum palustre*, *Potentilla fruticosa*, *P. erecta*, *Sanguisorba officinalis*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Valeriana officinalis*, *Sonchus arvensis* L. *Taraxacum* sp., *Hieracium* sp.

Norway: SE (Ö, Bv, STi, STy, NTi); W (SFi) and N (Nsi), but also in Spitsbergen (Elton 1925).

S. torvus Ost.-Sack. 1875

420 specimens from 21 localities. Eurytope and common, but seems to be most numerous in early summer. This also fits well with Danish experiences (Torp Pedersen 1964). Flight period: 9. May–19. Oct.

NF: *Picea* sp. (secreted sugar), *Ranunculus acris*, *Cakile maritima*, *Brassica campestris*, *Parnassia palustris*, *Rubus ideaus*, *Comarum palustre*, *Potentilla fruticosa*, *P. erecta*, *Sanguisorba officinalis*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Valeriana officinalis*, *Sonchus arvensis*, *Taraxacum* sp., *Hieracium* sp.

Norway: W (SFi).

S. vitripennis Meig. 1822

400 specimens from 22 localities. Eurytope and common, and together with *S. torvus* and *S. ribesii* amongst the most numerous and widespread Syrphinae species. Flight period: 15. May–19. Oct.

NF: *Ranunculus acris*, *Brassica campestris*, *Parnassia palustris*, *Rubus ideaus*, *Potentilla fruticosa*, *P. erecta*, *Sanguisorba officinalis*, *Acer platanoides* (Aphid honey-dew), *Angelica silvestris* L., *Calluna vulgaris*, *Sonchus arvensis*, *Taraxacum* sp., *Hieracium* sp.

Norway: SE (AK, VE, HEs, HEn, Bö, On, Os, STi, STy); W (SFi, MRy) and N (TRi, TRy).

Genus *EPISTROPHE* Walker

E. eligans (Harr.) 1782

Dale 30. May 1965 (2♂♂).

Norway: SE (Ö, AK, VE).

E. euchroma (Kowarz) 1885

New to Norway. Myrland 1. June 1965 (1♂), in pine forest.

E. nitidicollis (Meig.) 1822

Myrland 1. June 1965 (1 ♀), 23. June 1965 (1 ♂), on forest meadows.

Norway: SE (Ö, AK, HEn); N (Nnö).

Genus *METASYRPHUS* Matsumura

M. corollae (Fabr.) 1794

463 specimens from 29 localities. Eurytope and common. Especially abundant in late summer (after middle of July), occurring everywhere in numbers. Flight period: 15. May–19. Oct. Caught in copula 7. Sept.

NF: *Ranunculus acris, Cakile maritima, Brassica campestris, Parnassia palustris, Potentilla fruticosa, P. erecta, P. anserina* L., *Trifolium hybridum* L, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris, Matricaria inodora* L., *Senecio jacobaea, Sonchus arvensis, Taraxacum* sp., *Hieracium* sp.

Norway: SE (Ö, AK, VE, HEn); W (SFi, MRi); N (TRi).

M. lapponicus (Zett.) 1838

12 specimens from 3 localities: Öksnevad 27. July 1965 (1 ♂, 1 ♀), 28. July 1965 (2 ♀♀); Myrland 29. May 1965 (1 ♀), 1. June 1965 (1 ♀), 23. June 1965 (1 ♀); Brattebö 4. June 1965 (2 ♀♀), 8. July 1965 (2 ♂♂), 16. Aug. 1965 (1 ♂). In forests or at the edge of forest. Flight period: 29. May–16. Aug.

NF: *Picea* sp. (secreted sugar), *Ranunculus acris, Calluna vulgaris, Taraxacum* sp.

Norway: SE (HEs, HEn, STi).

M. latifasciatus (Macq.) 1829

13 specimens from 6 localities: Öksnevad 29. July 1965 (1 ♀); Figgjo 15. July 1960 (1 ♂); Skogsbakken, Sandnes 28. June 1963 (1 ♂); Lura 16. Aug. 1966 (1 ♂, 2 ♀♀); Gimra 21. July 1963 (2 ♂♂), 16. Aug. 1963 (1 ♀), 29. Aug. 1963 (2 ♀♀); Dale 30. May 1966 (2 ♀♀). Flight period: 30. May–29 Aug.

NF: *Potentilla fruticosa, Taraxacum* sp.

Norway: SE (HEn, Os).

M. latilunulatus (Collin) 1931

New to Norway. 2 specimens from 2 localities: Öksnevad 27. July 1965 (1 ♂); Gravaren 16. Aug. 1963 (1 ♂).

M. lundbecki (Soot-Ryen) 1946

21 specimens from 10 localities. Flight period: 15. May–5. Sept.

NF: *Ranunculus acris, Sanguisorba officinalis, Taraxacum* sp.

Norway SE (Ö, AK, HEs, HEn, Os, On); W (HOy).

M. luniger (Meig.) 1822

37 specimens from 11 localities. Flight period: 6. April–19. Oct. The earliest collected specimens (6. Apr. (1 ♂) and 21. Apr. (1 ♀)) were well sclerotinized and pigmented, and had most possibly hibernated. Cold weather before these April dates would also make hatching less probable.

NF: *Salix caprea, Calluna vulgaris, Senecio jacobaea, Taraxacum* sp.

Norway: SE (Ö, AK, VE, AAy, HEs, On, STi, STy); N (Nsi, TRi).

M. nitens (Zett.) 1843

13 specimens from 2 localities: Öksnevad 23. July 1965 (1 ♀), 28. July 1965 (1 ♀), 31. July 1965 (2 ♀♀), 3. Aug. 1965 (1 ♂, 1 ♀), 11. Aug. 1965 (1 ♀); Dale 7. Sept. 1965 (1 ♀), 15. May 1966 (1 ♀), 30. May 1966 (1 ♀), 30. May 1967 (1 ♂), 6. July 1969 (1 ♀), 29. July 1969 (1 ♀). Flight period: 15. May–7. Sept.

NF: *Potentilla fruticosa, Taraxacum* sp.

Norway: SE (HEn).

M. punctifer Frey in Kanervo 1934

New to Norway. 3 specimens from 2 localities (pine/spruce forest biotopes): Myrland 29. May 1965 (1 ♂); Öksnevad 29. May 1965 (1 ♂), 3. Aug 1965 (1 ♂).

Genus *SCAEVA* Fabricius

S. pyrastri (L.) 1758. - Fig. 5.

86 specimens from 14 localities. Rare in early summer, frequent and locally abundant in late summer (August). The material apportions as follows: June (1 ex.), July (20 ex.), August (61 ex.), September (4 ex.). Flight period: 23. June–13. Sept.

The variant *S. pyrastri* var. *unicolor* Curtis 1838, with quite black abdomen, has been taken once: Orre 13. Aug. 1965 (1 ♀).

NF: *Comarum palustre, Trifolium hybridum.*

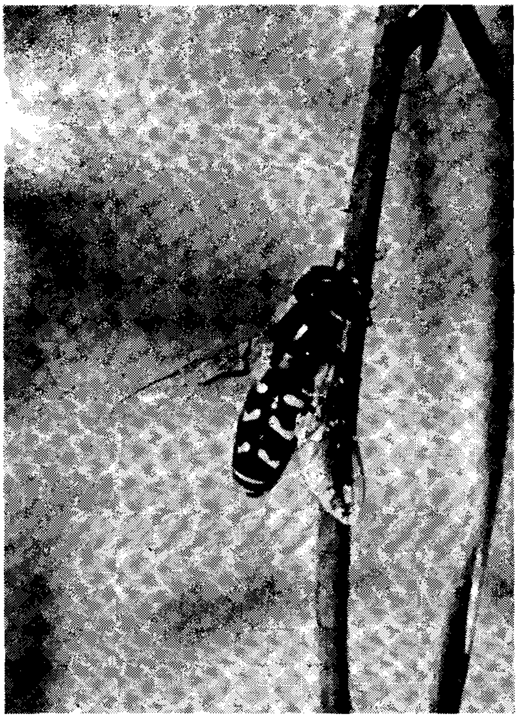

Fig. 5. *Scaeva pyrastri* (L.), male sunning on plant stem.

Calluna vulgaris, *Senecio jacobaea*, *Sonchus arvensis*, *Hieracium* sp.

Norway: SE (Ö, AK, Os, HEs).

S. selenitica (Meig.) 1822

13 specimens from 7 localities: Orre 23. June 1964 (1 ♀); Kleppe 16. July 1965 (1 ♀); Øksnevad 21. June 1964 (1 ♀), 24. June 1964 (1 ♀), 13 Aug. 1964 (1 ♀), 15. Aug. 1964 (1 ♂, 1 ♀), 16. Aug. 1964 (1 ♀) 28. July 1965 (1 ♀); Myrland 22. June 1965 (1 ♀); Brattebö 16. Aug. 1965 (1 ♂); Gimra 12. July 1964 (1 ♀); Dale 6. Apr. 1969 (1♀) Flight period: 4. Apr.–16. Aug.

NF: *Calluna vulgaris*.

Norway: SE (AK, VE, On).

Genus *DASYSYRPHUS* Enderlein

D. albostriatus (Fall.) 1817

50 specimens from 12 localities. Flight period: 15. May–21. Sept.

NF: *Ranunculus acris*, *Brassica campestris*, *Potentilla fruticosa*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Taraxacum* sp.

Norway: SE (Ö, AK, VE, STi); W (SFi, MRi, MRy) and N (TRy).

D. arcuatus

D. lunulatus (Meig.) 1822

80 specimens from 7 localities. As with *D. tricinctus* and *D. arcuatus* frequent in early summer, more rare in late summer: May (24 ex.), June (43 ex.), July (9 ex.) and August (4 ex.). Flight period: 15. May–19. Aug.

NF: *Ranunculus acris*, *Malus silvestris*, *Sanguisorba officinalis*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Taraxacum* sp.

Norway: According to Siebke (1877) distributed all over the country, as far north as Alta, Finnmark (Fi).

D. postclaviger (Stys & Moucha) 1962

New to Norway. Dale 30. May 1966 (1 ♂), on *Taraxacum* sp.

D. tricinctus (Fall) 1817, Fig 6

81 specimens from 9 localities. Frequent (local-

Fig. 6. Male of *Dasysyrphus tricinctus* (Fall.) feeding on flower of *Potentilla fructiosa*.

ly abundant) in late May and June on *Taraxacum* meadows, more rare in late summer. Flight period: 15. May–4. Sept.

NF: *Comarum palustre*, *Potentilla fruticosa*, *Acer platanoides* (Aphid honey-dew), *Valeriana officinalis*, *Taraxacum* sp.

Norway: SE (AK, HEs, HEn, On, STi); W (SFi) and N (Nnö, TRi).

D. arcuatus (Fall.) 1817

41 specimens from 6 localities. Frequent in early summer (May–June), otherwise rare. The material apportions as follows: May (9 ex.), June (27 ex.), July (4 ex.), August (2 ex.). Flight period: 29. May–10. Aug.

NF: *Ranunculus acris*, *Malus silvestris*, *Comarum palustre*, *Valeriana officinalis*, *Taraxacum* sp.

Norway: SE (AK, VE, Os, On, STi).

Genus *ISCHYROSYRPHUS* Bigot

I. glaucius (L.) 1758

5 specimens from 3 localities: Ogna 29. July 1962 (1 ♂); Fosseikeland 28. July 1962 (1 ♂), 16. Aug. 1964 (1 ♀); Dale 24. July 1970 (1 ♀), 28. July 1970 (1 ♂). Flight period: 24. July–16. Aug.

NF: *Potentilla fruticosa*.

Norway: SE (Ö, AK, VE, AAy).

I. laternarius (O. F. Mueller) 1776

New to Norway. 5 specimens from 3 localities: Ogna 29. July 1962 (1 ♂, 1 ♀), 21. July 1963 (1 ♀); Fosseikeland 30. July 1964 (1 ♂); Gimra 2. Sept. 1965 (1 ♀). Flight period: 21. July–2. Sept.

NF: *Filipendula ulmaria* (L.)

Genus *LEUCOZONA* Schiner

L. lucorum (L.) 1758

7 specimens from 5 localities: Öksnevad 3. Aug. 1965 (1 ♀); Myrland 1. June 1965 (1 ♂); Brattebö 4. June 1965 (3 ♀♀); Gimra 13. Aug. 1965 (1 ♀); Hogstad 14. June 1963 (1 ♀). Flight period: 1. June–13. Aug.

NF: *Ranunculus acris*, *Sanguisorba officinalis*, *Taraxacum* sp.

Norway: SE (Ö, AK, VE, On, HEn, STi); N (NSi, TRy, TRi).

Genus *MELANGYNA* Verrall

M. cincta (Fall.) 1817

62 specimens from 4 localities; in forests. Flight period: 30. May–3. Aug.

NF: *Malus silvestris*.

Norway: SE (Ö, AK, NTi).

Anomality: A male specimen from Osli, Ry: Höyland, 12. July 1965, shows a left simple and a right triple arista (Nielsen 1966a).

M. compositarum (Verr.) 1873

New to Norway. Dale 29. July 1969 (1 ♂, 3 ♀♀) on *Potentilla fruticosa*.

M. lasiophthalma (Zett.) 1843

Myrland 1. June 1965 (1 ♂), in pine forest.

Norway: SE (AK, HEs, STi); N (Nnv).

M. quadrimaculata (Verr.) 1873

New to Norway. Bråstein 3. May 1970 (4 ♀♀); Dale 4. May 1970 (1 ♀), on both localities in forests on flowering *Salix caprea*.

M. umbellatarum (Fabr.) 1794

Ogna 4. Aug. 1960 (1 ♀), on dry meadow.

Norway: According to Siebke (1877) occurring in southern and central parts of the country. Otherwise reported from SE (STi, STy); N (Fi).

Melangyna coei nov. sp.

Male

Head. Figs. 7A–B. A little more broad than tall. Vertical triangle a little longer than broad, black, black-haired. Eyes naked towards face, otherwise densely greyish or greyish-yellow haired all over, the hairs almost as long as 2nd antennal joint. Eyes touching for a distance slightly longer than vertical triangle. Frons and lunulae bronzy black; slightly brownish-yellow dusted, more so along eye-margins; the hairs black. Face orange-yellow (sometimes rather dull) with a black medial stripe that reaches base of antennae, and that on the broadest covers about $^1/_3$–$^2/_5$ of face. Face whitish to greyish-yellow dusted, leaving only central prominence and a short, narrow stripe above this shining black; the facial hairs long and black. Mouth-edge and jowls broadly black, somewhat hidden by the dusting. The hairs black along mouth-edge, on jowls yellow and black. Occiput densely greyish-(whitish-)yellow dusted, this dusting almost absent on the narrow upper third. The latter part with long black and short

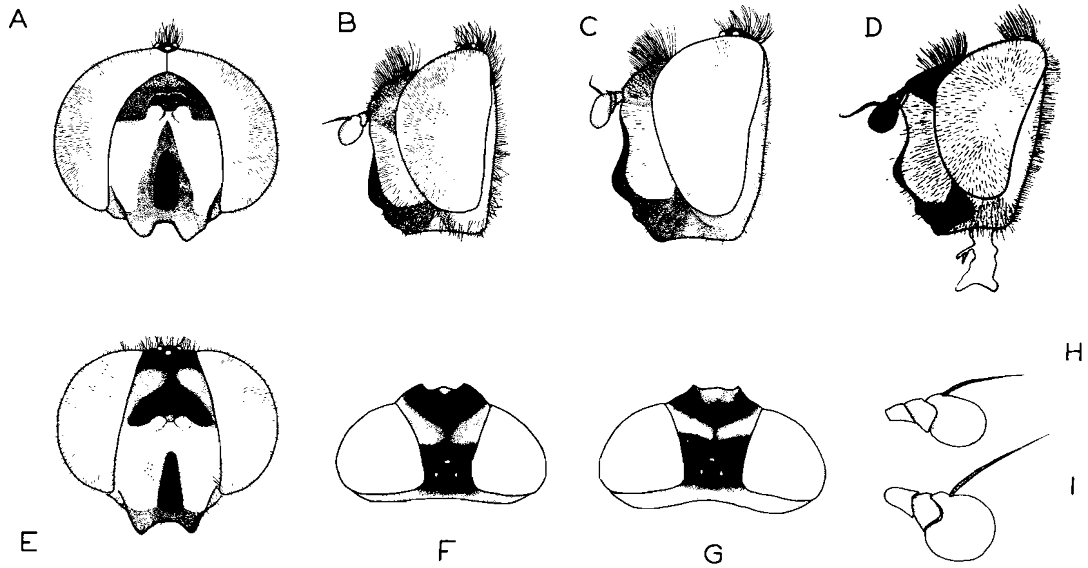

Fig. 7. A: Head in front view of male *Melangyna coei* nov. sp. (holotype). B: Do., head in profile. C: Male *M. lasiophthalma* (Zett.), head in profile. D: Male *M. olsufjevi* (Viol.) (after Violovich 1956), head in profile. E: Female *M. coei* nov. sp. (allotype), head in front view. F: Do., head seen from above. G: Female *M. lasiophthalma*, head seen from above. H: Antenna of female *M. coei*. I: Antenna of female *M. lasiophthalma*.

brownish-yellow hairs; the lower two-thirds of occiput with yellow to whitish hairs. Antennae with all joints quite black; 3rd joint roundish-oval, a little longer than broad. Arista black, somewhat thickened at base.

Thorax. Mesonotum shining black with some brownish-greenish lustre, and with light, almost invisible dusting. The pubescence erect and rather long, yellow to brownish-yellow in the middle, black behind and along the sides. Scutellum dark yellow, with a somewhat bluish shine; it is bluish-black at the corners and at base, towards mesonotum. The pubescence long and black. Most pleurae bronzy-coloured, dusted (but not densely) greyish-yellow; however, medial parts of hypo- and sternopleurae more bluish shining, lightly greyish-whitish dusted. Pubescence long, mainly brownish-yellow, but sometimes with numerous black hairs intermingled. Legs predominantly black; apical $^1/_6$–$^1/_8$ of f_1 and f_2 yellow, that of f_3 usually more obscurely so or quite black. t_1 and t_2 obscurely brownish-yellow on basal $^2/_5$ and extreme tips, or (in one specimen) nearly black; t_3 darker than the previous ones, quite black or dark brown at extreme tip and base. Tarsi black. The pubescence long and mainly yellow on hind side of f_1 and f_2 and on front side of f_3; otherwise short, yellow and black. Wings slightly greyish or greyish-yellow tinged, veins brownish-black, stigma greyish-brown. Wing length 7.3–8.3 mm; mean length 8.0 mm. Squamulae varying from yellow to very light brown, fringes yellow. Halters brown, the knob yellowish.

Abdomen. Fig. 8A. Tergites black, tergite 2–4 with yellow spots not reaching the side margins. Tergite 1 shining black. Tergite 2 dullish black with squarish spots lying in the middle of tergite. Tergite 3 dullish black with rectangular spots lying towards base of tergite. Tergite 4 black on basal half, shining on distal half; the spots rectangular and lying near base of tergite: hind margin of tergite narrowly yellow. Tergite 5 shining black with narrow, yellow hind margin. Pubescence of the tergites longest on the sides of tergite 2 and 3; mainly following the ground-colours of the tergites. Sternites brownish-black with broad yellow bands at base and tip; pubescence yellowish. Body length 7.7-9.3 mm; mean length 8.3 mm.

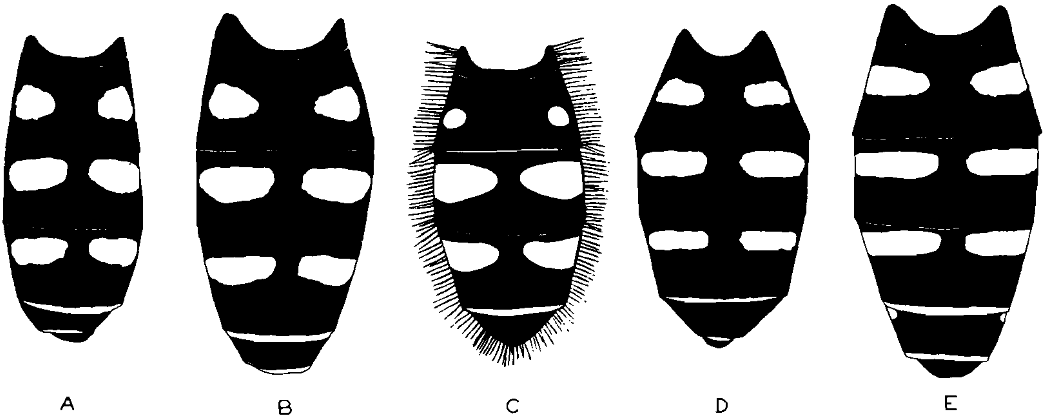

Fig. 8. Abdomen. A: Male *Melangyna coei* nov. sp. (holotype). B: Male *M. lasiophthalma* (Zett.). C: Male *M. olsufjevi* (Viol.) (after Violovich 1956). D: Female *M. coei* (allotype). E: Female *M. lasiophthalma*.

Genitalia. Black, black-haired. Notice shape of lingula and posterior margin of theca. Fig. 9A.

Female

Head. Fig. 7E–F, H. As in the male, a little broader than high. Eyes rather densely greyish or greyish-yellow haired, but not as densely as in the male. Vertical triangle and frons glittering black, black-haired. Lunulae mainly black. Frontal dust-spots somewhat semicircular, and at point of approximation covering slightly more than $^1/_4$ of frontal length; they are greyish or greyish-yellow, but often brownish at the margins and at point of approximation. This darker dusting makes the spots less clearly defined towards the black ground colour, and at the point of approximation somewhat contiguous. Face as in the male, but median black stripe usually a little narrower (covering from about $^1/_5$ to $^1/_4$ of width of face) and not quite reaching base of antennae. Occiput greyish or greyish-yellow dusted; on upper $^1/_3$ also with a few black hairs, otherwise yellow or whitish-yellow haired. Antennae with all joints quite black; 3rd joint a little larger than in the male.

Thorax. Mesonotum vaguely greyish-dusted along the sides in front of transverse suture. Mesonotal pubescence shorter than in the male; more pronouncedly yellowish, but often with a few black hairs intermingled. Pleurae rather densely greyish dusted, leaving only median parts of hypo- and sternopleurae shining bluish-black or black; pubescence white or whitish-yellow. Legs usually more clearly yellow than in the male; femorae and tarsi as in male, but t_1 and t_2 yellow with a distinct black ring near middle (in a few specimens t_1 also darkened at tip, thus leaving only basal parts yellow). t_3 black or brownish black. Wings a little paler than in the male; veins brownish to brownish-yellow, stigma greyish-yellow. Wing length 6.8–8.7 mm, mean length 7.9 mm. Squamulae and halters as in the male.

Abdomen. Fig. 8D. Tergites black; dullish or slightly shining on tergite 2 and basal half of tergite 3, otherwise more shining. Tergites 2–4 with yellow pairs of spots, none of which usually reaching the side margins. Tergite 2 with squarish spots lying in the middle of segment, tergites 3 and 4 with rectangular spots, being narrower than in male, and lying towards base of the segments; tergite 4 also with a yellow hind margin. Tergite 5 usually with a yellow spot at the basal corners, and also with a narrow, yellow hind margin. Pubescence whitish or whitish yellow and rather long at side-margins of tergites 1 anp 2 and at base of tergite 3; otherwise short and following the ground colours of the tergites. Sternites as in the male; dark in the middle and with yellow bands at base and tip. The last sternites are darker than the first ones, the yellow bands at tip of sternites being narrower. Pubescence yellowish. Body length 7.8–9.5 mm; mean length 8.2 mm.

Material

The type material totals 19 specimens: 4 ♂♂, 15 ♀♀. *Holotype:* Myrland, Ry: Höyland, 1. June 1965 (♂), Tore Nielsen leg. *Allotype:* Dale, Ry: Hetland, 5. Sept. 1965 (♀), Tore Nielsen leg. *Paratypes:* Forus, Ry: Hetland, 15. Aug. 1963 (1 ♀); Myrland, Ry: Höyland, 1. June 1965 (2 ♂♂); 4. June 1965 (1 ♂, on *Taraxacum* sp.); Brattebö, Ry: Höyland, 8. July 1965 (1 ♀, on *Ranunculus acris*); Dale, Ry: Hetland, 18. Aug. 1965 (1 ♀); 27. Aug. 1965 (1 ♀); 2. Sept. 1965 (4 ♀♀); 6. Sept. 1965 (1 ♀, on *Potentilla fruticosa*); 7. Sept. 1965 (2 ♀♀, on *Potentilla fruticosa*); 11. Sept. 1965 (1 ♀); 17. Sept. 1965 (1 ♀, on *Potentilla fruticosa*); 15. May 1966 (1 ♀). All paratypes collected by the author.

Type locality. Holotype collected on meadow (Gramineae, *Vaccinium* spp., *Potentilla erecta*) in spruce and pine forest area at Myrland, on the inner, hilly part of Jæren. (loc. No. 20, Fig. 1). The allotype is collected on meadow (Gramineae, *Calluna*) in birch forest at Dale, on the slope of mountain Dalsnuten.

Melangyna coei nov. sp. is named after the late Mr. Ralph L. Coe at British Museum (Natural History), London, who contributed so much to the understanding of the Syrphidae, and who most kindly gave his aid and encouragement to the author's work of determination. He also determined this species as a new one.

Ecology

Some of the specimens collected at Dale in 1965 (all females) were taken on flowers of *Potentilla fruticosa*, while eating pollen. As seen above, the species has also been taken on *Taraxacum* sp. and *Ranunculus acris*.

M. coei has been collected on meadows in cultivated land, in and at the borders of spruce/pine forests of the area investigated.

In contrast to the allied and sympatrically distributed species *M. lasiophthalma* (Zett.), which has an early flight period (April–June) and thus only one annual generation, *M. coei* has been taken over the much wider period of time of

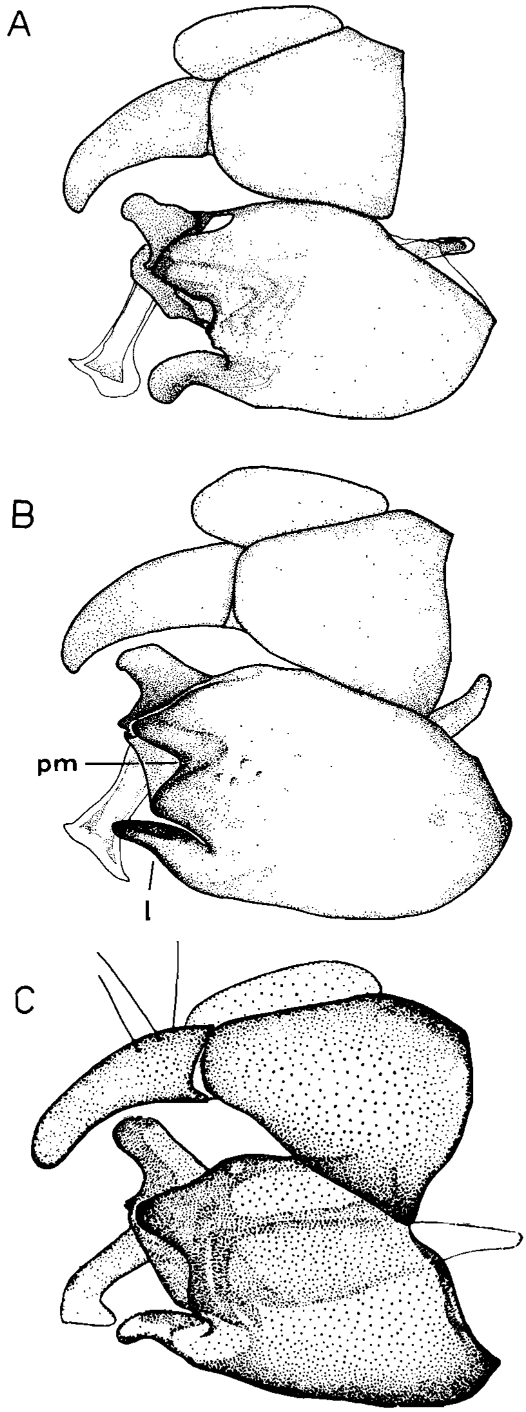

Fig. 9. Male genitalia. A: *Melangyna coei* nov. sp. (holotype). B: *M. lasiophthalma* (Zett.). C: *M. olsufjevi* (Viol.) (after Hippa 1968). pm = posterior margin of theca. l = lingula.

Table III. Comparison between *Melangyna coei* nov. sp. and the related species *M. lasiophthalma* (Zett.) and *M. olsufjevi* (Viol.).

M. coei nov. sp. (Figs. 7A, B, E, F, H; 8A, D; 9A)	*M. lasiophthalma* (Zett.) (Figs. 7C, G, I; 8B, E; 9B)	*M. olsufjevi* (Viol.) (Figs. 7D; 8C; 9C)
♂	♂	♂
Frons bronzy-black, slightly brownish-yellow dusted. Lunulae black.	Frons greyish-black, slightly whitish dusted. Lunulae yellow.	Frons whitish-dusted. Lunulae brownish.
Eyes densely haired.	Eyes less densely haired.	Eyes densely haired.
Scutellum black-haired.	Scutellum with pale hairs on disk towards base, black hairs behind.	Scutellum mainly yellow-haired, but black hairs along hind margin.
Legs mainly black; f_1 and f_2 narrowly yellow at tip, f_3 equally coloured or quite black. t_1 and t_2 obscurely yellow at base and tip.	Legs mainly black; as in *M. coei.*	Legs mainly yellow; f_1 and f_2 with about apical half yellow, f_3 yellow on slightly less (about $^2/_5$). Tibiae yellow, only with black ring after middle.
Abdominal patterns, Fig. 8A.	Abdominal patterns, Fig. 8B.	Abdominal patterns, Fig. 8C.
Genitalia, Fig. 9A. Compare lingula and posterior margin of theca.	Genitalia, Fig. 9B. Compare lingula and posterior margin of theca.	Genitalia, Fig. 9C. Compare lingula and posterior margin of theca.
♀	♀	♀
Frontal dust-spots greyish-yellow; rather broad, somewhat ill-defined, and contiguous at point of approximation. Lunulae mainly black.	Frontal dust-spots more purely whitish or yellowish; narrow, well-defined and usually well separated at point of approximation. Lunulae yellow.	The female of *M. olsufjevi* is still unknown.
3rd antennal joint of normal size and proportion.	3rd antennal joint distinctly deeper and larger than in *M. coei.*	
Eyes rather densely haired.	Eyes less densely haired, the hairs more scattered.	
Scutellum usually quite black-haired, more rarely with some yellow hairs on disk.	Scutellum yellow-haired on disk, and usually black-haired behind.	
Legs mainly black; f_1 and f_2 with only apical $^1/_8$–$^1/_6$ yellow.	Legs more yellow; f_1 and f_2 with apical $^1/_5$–$^2/_5$ yellow.	
Abdominal spots shorter than in *M. lasiophthalma*, and usually well isolated from side-margins. The spots of tergite 2 never reaching side-margins. Abdomen otherwise slightly dullish, less shining than in *M. lasiophthalma.*	Abdominal spots narrower, more longish rectangular, including those on tergite 2, and almost or quite reaching side-margins. Abdomen otherwise brightly shining, the black parts glittering.	

May–September. Therefore it most probably has two or more generations a year.

Comparison with related species

A comparison is given between *Melangyna coei* nov. sp. and the two related species *M. lasiophthalma* (Zett.) and *M. olsufjevi* (Viol.), all of which have distinctly hairy eyes and three pairs of abdominal spots (Table III). It is partly based on examination of type material and material from Norwegian localities (*M. lasiophthalma*, *M. coei*), and partly on original and later description (*M. olsufjevi* (Violovich 1956, Hippa 1968)). The figures of head, abdomen and male genitalia (Figs. 7D, 8C, 9C) of *M. olsufjevi* are copies from the latter papers.

Genus *PHALACRODIRA* Enderlein

P. annulata (Zett.) 1838

Brattebö 4. June 1965 (1 ♀), 16. Aug. 1965 (1 ♀); in or close to forest.

NF: *Potentilla erecta*, *Taraxacum* sp.

Norway: SE (AK).

P. lineola (Zett.) 1843, Fig. 10

84 specimens from 6 localities; in or close to forests, rarely on cultivated land. As *P. vittiger* most abundant in early summer. Flight period: 17. May–26. Aug.

NF: *Picea* sp. (secreted sugar), *Salix caprea*, *Rumex acetosa*, *Brassica campestris*, *Potentilla erecta*, *Calluna vulgaris*, *Valeriana officinalis*, *Taraxacum* sp.

Norway: SE (AK, VE, HEn, Os, Bv, STi, STy).

P. malinella (Collin) 1952

New to Norway. Öksnevad 29. May 1965 (1 ♂, 4 ♀♀); Myrland 1. June 1965 (1 ♀); Brattebö 1. June 1967 (1 ♂), all forest biotopes. An early species (May–June).

NF: *Salix caprea*, *Taraxacum* sp.

P. nigritarsis (Zett.) 1843

Myrland 4. July 1965 (1 ♀), in pine forest on *Rubus idaeus* flower.

Norway: Turtagrö (SFi), 1 ex. found by Ringdahl (1953).

Fig. 10. Male of *Phalacrodira lineola* (Zett.) feeding.

P. punctulata (Verr.) 1873

New to Norway. 31 specimens from 4 localities (Öksnevad, Myrland, Brattebö, Kverneviken), in or close to forests. An early species, flight period: 29. May–5. June (and one single find on 30. July).

NF: *Picea* sp. (secreted sugar), *Taraxacum* sp.

P. vittiger (Zett.) 1843

85 specimens from 7 localities; in or close to forests. Most abundant in early summer (June). Flight period: 29. May–17. Aug.

NF: *Picea* sp. (secreted sugar), *Salix caprea*, *Ranunculus acris*, *Brassica campestris*, *Malus silvestris*, *Calluna vulgaris*, *Vaccinium myrtillus*, *Taraxacum* sp.

Norway: SE (HEn, Os, STi).

Genus *DIDEA* Macquart

D. alneti (Fall.) 1817

1 female on forest meadow: Öksnevad 31. July 1965 (*Valeriana officinalis*).

Norway: SE (AK, HEn, STi).

D. intermedia Loew 1854

New to Norway. 4 specimens from 4 localities: Orre 4. Sept. 1965 (1 ♀); Öksnevad 27. July 1965

(1 ♀); Bråstein 7. Aug. 1960 (1 ♀); Helgeland 13. July 1965 (1 ♀). Flight period: 13. July–4. Sept.

NF: *Hieracium* sp.

Genus *MEGASYRPHUS* Dušek and Láska
M. annulipes (Zett.) 1838

5 specimens from 2 localities: Öksnevad 29. May 1965 (1♂, 2♀♀), 23. July 1965 (1♀); Brattebö 4. June 1965 (1♂), both places on forest meadows.

NF: *Valeriana officinalis*, *Taraxacum* sp.

Norway: SE (AK, VE, HEs, HEn, NTi); N (Nsi).

Genus *MELISCAEVA* Frey
M. auricollis (Meig.) 1822

20 specimens from 4 localities; in forests (meadows) and gardens. As *repisyrphus balteatus* a late species with greatest abundance in late summer; May (1 ex.), June and July (0 ex), Aug. (9 ex.), Sept. (6 ex.), Oct. (4 ex.). Flight period: 30. May–19. Oct.

NF: *Potentilla fruticosa*, *Calluna vulgaris*, *Taraxacum* sp.

Norway: SE (AK).

M. cinctella (Zett.) 1843

50 specimens from 7 localities. Most frequently met with in forest areas. Flight period: 1. June–27. Aug.

NF: *Ranunculus acris*, *Rubus ideaus*, *Comarum palustre*, *Potentilla fruticosa*, *P. erecta*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Valeriana officinalis*.

Norway: According to Siebke (1877) all over southern Norway. Localities mentioned by him and others: SE (AK, VE, STi, NTi); N (Nsi).

Genus *EPISYRPHUS* Matsumura and Adachi
E. balteatus (De Geer) 1776, Fig. 11

140 specimens from 19 localities. A late species with few individuals in early summer, however numerous in August and September: June (3 ex.), July (35 ex.; 34 in second half of the month), Aug. (76 ex.), Sept. (26 ex.), Oct. (1 ex.). Flight period: 18. June–19. Oct.

NF: *Cakile maritima*, *Brassica campestris*, *Potentilla fruticosa*, *P. erecta*, *Sanguisorba officinalis*, *Filipendula ulmaria*, *Acer platanoides* (Aphid honey-dew), *Calluna vulgaris*, *Matricaria indora*, *Sonchus arvensis*, *Hieracium* sp.

Fig. 11. *Episyrphus balteatus* (De Geer) is a late species, being most abundant in late summer and autumn.

Norway: SE (Ö, AK, Bö, STi); W (HOy).

Genus *SPHAEROPHORIA* St. Farg. et Serv. Females of some species of the genus are still difficult to determine with certainty. The material therefore mainly refers to male specimens. Nomenclature after Bańkowska (1964).

S. dubia (Zett.) 1849

New to Norway. 9 specimens from 3 localities: Myrland 26. June 1964 (2♂♂), 22. June 1965 (1♂); Brattebö 3. July 1963 (1 ♂), 4. June 1965 (1 ♂), 5. June 1965 (1 ♂), 16. Aug. 1965 (1 ♂); Dale 21. June 1966 (2♂♂). Flight period: 4. June–16. Aug.

S. picta (Meig.) 1822, Fig. 12

New to Norway. 147 specimens from 16 localities. Undoubtedly the commonest *Sphaerophoria* species in the area, and occurring in all biotopes investigated. Flight period: 31. May–30. Aug.

NF: *Hieracium* sp., *Taraxacum* sp.

S. sarmatica Bank. 1964

New to Norway. 48 specimens from 16 locali-

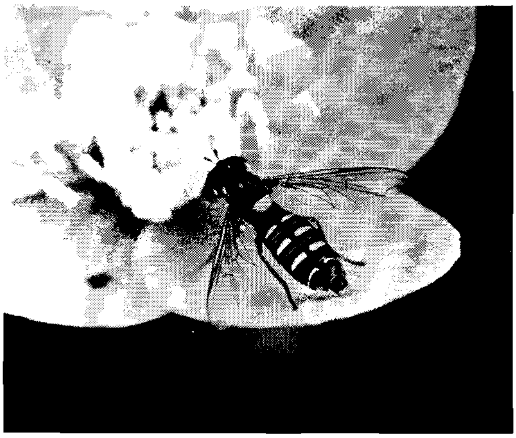

Fig. 12. Female *Sphaerophoria picta* (Meig.) feeding on flower of *Caltha palustre*. It is the most common *Sphaerophoria* species in the area.

ties; eurytope and rather frequent. Flight period: 30. May–27. Aug. One pair in copula 3. Aug. 1965.

NF: *Calluna vulgaris*, *Taraxacum* sp.

S. scripta (L.) 1758

91 specimens (♂♂ and ♀♀) from 17 localities. Eurytope and frequent, however most abundant in late summer: May (1 ex.), June (9 ex.), July (40 ex.), Aug. (38 ex.), Sept. (3 ex.). Flight period: 30. May–12. Sept.

NF: *Potentilla fruticosa*, *Senecio jacobaea* L., *Taraxacum* sp., *Hieracium* sp.

Norway: SE (Ö, AK, VE, TEy, Bö, Os, HEs, HEn, STi, STy) and N (TRi).

SUBFAMILY CHRYSOTOXINAE

Genus *CHRYSOTOXUM* Meigen

C. arcuatum (L.) 1758

20 specimens from 5 localities; in forests or on meadows neighbouring forests. Found most abundant in the period second half of June–beginning of July. Flight period: 4. June–24. Aug.

NF: *Ranunculus acris*, *Potentilla erecta*, *Taraxacum* sp.

Norway: According to Siebke (1877) all over the country, in the north to Alta, Finnmark. Later recorded from SE (VE, STi); N (Nsi, Nnö).

C. bicinctum (L.) 1758, Fig. 13

34 specimens from 4 localities; in or at border of forests, often frequenting flowers of *Potentilla erecta*. Flight period: 23. June–3. Aug.

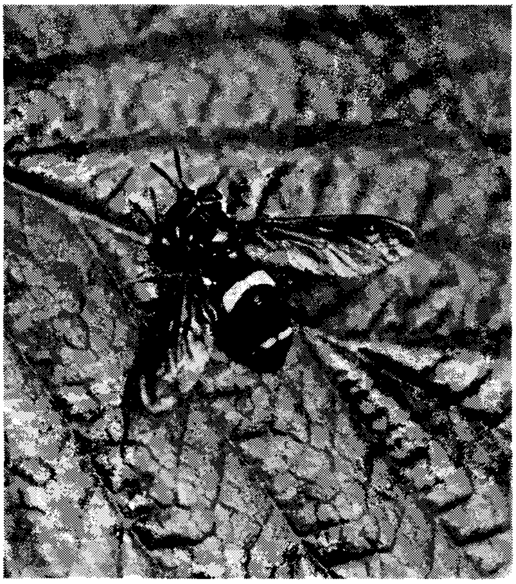

Fig. 13. Female *Chrysotoxum bicinctum* (L.) sunning on a *Rubus* leaf.

NF: *Ranunculus acris*, *Rubus ideaus*, *Potentilla erecta*.

Norway: SE (Ö, AK, VE, HEs, Os, VAi, Ri, STi, STy).

C. festivum (L.) 1758

16 specimens from 5 localities; in or at the border of forests (one specimen in sand-dunes some distance from forest). Flight period: 29. June–4. Aug.

Norway: According to Schöyen (1889) commonly distributed in southern Norway.

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Bokanmeldelser

Palm, T. 1970. Skalbaggar. Coleoptera. Kortvingar: Staphylinidae. Underfam. Aleocharinae (Atheta). *Svensk Insektfauna 52,* h. 6, p. 113-296. Almquist & Wicksellls, Uppsala.

I serien «Svensk Insektfauna» er nå 6. hefte av Palms bearbeidelse av staphylinidene kommet. Heftet behandler utelukkende slekten *Atheta,* den største av de nordiske billeslekter, med 205 arter. Slekten har vært regnet for den vanskeligste blant billene, som vel forholdsvs få har våget seg på.

Grunnlaget for den moderne oppfatning av slekten har Brundin lagt i flere avhandlinger i årene 1940—1954. Her er først og fremst genitaliene, men også andre ikke, eller lite, påaktede karakterer som mikroskulptur og behåring behandlet.

I 1954 kom så Victor Hansens grundige behandling av slekten i serien «Danmarks Fauna», men dette arbeid er begrenset til Danmark og nærmeste områder og omfatter således ikke de typisk nordlige arter, som i denne slekt er mange.

I det foreliggende arbeid har Palm tatt med ikke bare de svenske, men også de øvrige nordiske artene. Det er gitt bestemmelsestabeller og inngående beskrivelse av artene, og arbeidet er rikt illustrert med Victor Hansens naturtro tegninger av en rekke arter, med genitaltegninger for samtlige arter og med en rekke detaljtegninger bl. a. av de sekundære kjønnskarakterer, som er til stor hjelp ved bestemmelsen. Arbeidet omfatter også meget utførlige og verdifulle opplysninger om funnforhold for de enkelte artene på grunnlag av Palms egne omfattende notater.

Med dette arbeid har de som vil gi seg i kast med denne interessante slekten, fått et så godt utgangspunkt som de kan ønske seg.

Andreas Strand

Beier, M. (ed.) 1968—1969. Insecta. *Handbuch der Zoologie IV,* 2. Hälfte (2. Auflage). Lieferung 1—10. Walter de Gruyter, Berlin.

Bind IV av Handbuch der Zoologie omfatter Arthropodene, og insektene utgjør 2nen halvpart av bindet. Utgivelsen av 2nen halvpart ble påbegynt i 1968, og vil strekke seg over flere år. 2nen halvpart er igjen delt opp i en generell og en spesiell del. En rekke hefter har allerede kommet ut, og flere er under bearbeidelse. Hvert hefte inneholder ett eller flere bidrag. Ved referanse til verket benyttes f. eks. tallene 4 (2) 2/5, som betyr bind IV, 2. halvpart, del 2, bidrag 5.

Max Beier er hovedredaktør for Insecta, og innleder den generelle delen med en kort karakteristikk (4 (2) 1/1, 3 pp.). Beier har også skrevet om entomologiens historie (4 (2) 1/2, 9 pp.), hvor han gir en oversikt om kjennskapet til insekter fra urtiden og frem til vår egen tid. De eldste beretninger og illustrasjoner av insekter har ofte forbindelse med skadelige arter, eller med nyttige arter, som f. eks. silkesommerfugl og bier. Fra nyere tid gjennomgår forfatteren utviklingen av de forskjellige disipliner innen entomologien. Meier's bidrag etterfølges av to bidrag av B. B. Rohdendorf om paleontologi (4 (2) 1/3, 27 pp.) og fylogeni (4 (2) 1/4, 28 pp.). Tilsammen gir de et uttømmende bilde av vår tids kunnskap om insektenes opprinnelse og innbyrdes slektskap. Mens de tidligste funn omfatter Collemboler og det første vingete insekt fra Devon, er de fleste av de nålevende formers stamfedre kjent fra Karbon og Perm. Beskrivelsen av et fylogenetisk system byr på mange vanskeligheter, bl. a. på grunn av ufullstendig og manglende paleontologisk materiale. Nålevende insekters systematikk, og vanskelighetene med inndeling i et naturlig system, er beskrevet i et bidrag av M. Beier om klassifikasjon (4 (2) 1/5, 17 pp.). Forfatteren deler insektene i tre underklasser — Entognatha, Ectognatha og Pterygota — hvorav den første omfatter Collembola, Protura og Diplura, og den andre bare ordenen Thysanura. Bidraget inneholder bestemmelsestabell til orden.

I den generelle delen foreligger også et bidrag om human- og veterinærmedisinsk entomologi (4 (2) 1/9, 49 pp.) av F. Zumpt. Her gis en systematisk oversikt over de aktuelle insektarter, og såvel giftige og parasitterende, som smitteoverførende insekter blir omtalt. Interessant og underholdende lesning er E. Schimitschek's bidrag om insekter som næring og nyttedyr, og i overtro og kunst (4 (2) 1/10, 62 pp.). Illustrasjonene omfatter bl. a. insekter i malerkunst og på porselen fra forskjellige tider. Eksempler på lyrikk går så langt tilbake som kineseren Dschuang Dsi (350 f. Kr.), som drømte han var en sommerfugl. Insektenes forvandling er beskrevet av M. Fischer (4 (2) 1/16, 68 pp.). Metamorfose og utviklingsstadienes morfologi er detaljert behandlet for de forskjellige insektsgrupper.

Av den spesielle delen foreligger Ephemeroptera av J. Illies (4 (2) 2/5, 63 pp.), Odonata av D. St. Quentin & M. Beier (4 (2) 2/6, 39 pp.), Embiodea av A. Kaltenbach (4(2) 2/8, 29 pp.) Phasmida av M. Beier (4 (2) 2/10, 56 pp.), Mantodea av M. Beier (4 (2) 2/12, 47 pp.), Mallophaga av St. von Kéler (4 (2) 2/17, 72 pp.) og Thysanoptera av H. Priesner (4 (2) 2/19, 32 pp.). Beskrivelsen av de forskjellige ordnene følge et bestemt mønster med innledende kapitler om karakteristiske kjennetegn, paleontologi og fylogeni. Derpå følger den systematiske inndeling med bl. a. bestemmelsestabeller til underorden, familie og underfamilie. Disse gruppenes kjennetegn er nærmere beskrevet, og de viktigste slekter er nevnt. Utbredelse, økologi og eventuell økonomisk betydning er behandlet i egne kapitler, som etterfølges av utførlige beskrivelser av morfologi, fysiologi, forplantning og utvikling. På denne måten får man en bred oversikt om de forskjellige ordners biologi. Selv om det er en grense for hvor detaljert man kan gå til verks, rommer hvert bidrag et hav av detaljer. For den som ønsker ytterligere opplysninger fins utførlige litteraturlister.

Det er ikke mulig for en enkelt anmelder å gi en kritisk vurdering av et så omfattende verk som dette. Etter å ha lest og bladd igjennom det, sitter man igjen med et inntrykk av at dette er en meget velskrevet og velredigert håndbok. Når den er avsluttet vil man ha en nær komplett fremstilling av entomologiens stilling idag, iallfall når man inkluderer de utallige kildehenvisninger, som gjør det mulig å gå videre på de forskjellige områder. Verket er rikt illustrert, for det meste med tydelige strektegninger. Prisen for de 10 hefter som er omtalt her varierer endel, og utgjør tilsammen ca. D.M. 320,–.

Lauritz Sømme

Kristensen, N. P. 1970. *Systematisk entomologi.* 173 pp. Munksgaard, København. Pris d. kr. 45.–.

N. P. Kristensens bok er beregnet som lærebok i entomologi ved danske universiteter. Som forfatteren selv skriver i sitt forord kan den bare tjene som en første introduksjon for de som skal spesialisere seg i faget. Som en introduksjon har boken både mangler og fordeler. Manglene er ikke dominerende, men det virker som om forfatteren har presset for meget stoff inn på minst mulig plass. For en som for første gang får kontakt med entomologien, ville det kanskje vært mer inspirerende om formen hadde vært mindre kompakt.

Men når dette er sagt må forfatteren ha ros for hva han har klart å få med. Boken gir på mange måter en utmerket oversikt over overklassen Hexapoda, klassene Entognatha og Insecta, og de ordner som hører med til disse grupper. De viktigste familiene i hver orden blir kort beskrevet.

Så langt det er mulig søker forfatteren å følge en fylogenetisk inndeling. I innledningen forklares de forskjellige typer av likheter som legges til grunn for vurdering av slektskapet mellom de forskjellige grupper.

Morfologien, som gir grunnlag for insektenes systematikk, er utførlig behandlet. De enkelte organenes bygning og funksjon er kort omtalt i et generelt kapitel, og de mer spesielle morfologiske kjennetegn er nærmest beskrevet under hver enkelt orden. Beskrivelsene omfatter karakteristiske trekk ved larver, pupper og imagines. Man finner forklaring på en rekke ord som benyttes i den entomologiske terminologi. Spesielt utmerker boken seg med klare og tydelige illustrasjoner, som gjør det lettere å oppfatte de forskjellige organenes bygning og ordnenes morfologiske kjennetegn. Illustrasjonene er omtegnet for boken i enhetlig form av fru Grete Lyneborg.

Ialt har N. P. Kristensen gitt et verdifullt bidrag til entomologisk litteratur på de skandinaviske sprog. Foruten anvendelse som lærebok ved universiteter og høyskoler, vil den være til nytte som håndbok og oppslagsbok for alle som er interessert i faget.

Lauritz Sømme

Gustafsson, M. 1970. *Människan, insekterna och miljön. En bok om biologisk kontroll.* 117 s. Raben & Sjögren, Stockholm. Pris sv. kr. 22,50.

Som forfatteren selv uttrykker det, er hensikten med denne boken å gi biologisk underholdning, som kunne vekke til ettertanke. Fremstillingen er populær og lettleselig, og forfatteren har klart å gi en grei fremstilling av mange kompliserte økologiske forhold. Betydningen av økologi, som bakgrunn for utnyttelsen av mikroorganismer, parasitter og predatorer til insektbekjempelse, er et hovedtema i boken.

Denne bakrunnen er viktig for forståelsen av de vanskeligheter biologisk og mikrobiologisk bekjempelse støter på. Det moderne landbruk gir økede livsvilkår for mange skadelige organismer. Det naturlige, økologiske system er bragt ut av balanse, og er vanskelig å rette opp bare ved introduksjon av nyttige organismer.

Liksom forfatteren peker på vanskelighetene, og på behovet for videre økologisk forskning, gir han flere eksempler på de muligheter som ligger i biologisk og mikrobiologisk bekjempelse. Denne delen av boken kunne med fordel vært mer utførlig. Det velkjente eksemplet fra California med marihøner mot skjoldlus er detaljert behandlet, men man savner en bredere omtale av konkrete tilfelle på bruk av parasitter og rovinsekter fra senere tid.

Forfatteren er selv spesialist på insektpatogene sopper, og de deler av boken som omhandler disse organismer er spesielt interessante. I sopp av slekten *Entomophtora* ser forfatteren flere muligheter til mikrobiologisk bekjempelse av skadeinsekter.

Læren om insektenes sykdommer, forårsaket av forskjellige mikroorganismer, er belyst i historisk sammenheng med en rekke eksempler. Disse er sett i relasjon til gamle tiders insektproblemer, og bl. a. vanskeligheter med birøkt og dyrking av silkesommerfugl.

Boken mangler et sidestykke på norsk og burde interessere alle som vil ha en kortfattet, populær introduksjon på området insektenes sykdommer, biologisk og mikrobiologisk bekjempelse.

Lauritz Sømme

Wigglesworth, V. B. 1970. *Insect hormones.* 159 p. University Reviews in Biology 12. Oliver & Boyd, Edinburgh. Pris 50 sh.

Sir Vincent B. Wigglesworth's bok om insekt hormoner er ikke en «text book», og heller ingen fullstendig monografi. Det forfatteren har ønsket er å fremstille kunnskapene om insektenes hormoner på en lettleselig måte, slik at stoffet kan være tilgjengelig for alle med biologiske interesser. Boken forutsetter allikevel en viss bakgrunn i entomologi og fysiologi.

Forfatteren er selv en av de ledende forskere på det feltet han omtaler. Hans behandling av stoffet omfatter en historisk innføring i den forskning som har ført frem til våre dagers resultater. En rekke viktige oppdagelser ble gjort i 30-årene, og i tiden etter siste verdenskrig har kunnskapene på dette området øket sterkt.

Den hormonale regulering av hudskiftet hos insektene hører til et av de mest fascinerende områder innen fysiologien. Gjennom en serie elegante forsøk har Wigglesworth og en rekke andre ved implantasjoner og parabiose demonstrert betydningen neurosekretoriske celler og thoraxkjertelen. De første utskiller et aktiverende hormon, som induserer dannelsen av hudskiftehormonet (ecdyson) i thoraxkjertelen. Like spennende er oppdagelsen av «ungdomshormonet» (det juvenile hormon) fra corpora allatum, og dets innflytelse på hvilket stadium hvert hudskifte skal resultere i.

Hormoner spiller en avgjørende rolle i en rekke andre forhold. Hos larver og pupper kan diapuse forklares ut fra mangel på de hormoner som induserer vekst og hudskifte. Når ovariene hos silkesommerfuglen blir utsatt for et spesielt hormon fra hjernen, legger hunnene egg som er i diapause. Modning av egg i ovariene har også en hormonal regulering, og finner sted sammen med en kraftig svelling av corpora allatum, f. eks. hos tegen *Oncopeltus.* Neurosekretoriske celler og neurosekresjon har også vært inngående studert hos insekter. Hormoner fra disse cellene har antagelig innflytelse på en rekke biokjemiske prosesser, men mange forhold venter sin oppklaring.

Forfatteren tøyer begrepet hormoner noe lengere enn vanlig, og kommer også inn på en del beslektede emner. Bl. a. har han et kapittel om insektenes pheromoner og deres betydning som signalstoffer. Disse stoffene, såvel som ecdyson og det juvenile hormon, har spesiell aktualitet i utforskningen av nye metoder til insekt bekjempelse. C. M. Williams har kalt det juvenile hormon «tredje generasjons insektmidler», men en anvendt entomolog vil savne at Wigglesworth ikke går nærmere inn på disse forhold.

Forfatteren har gitt oss en velskreven og utførlig oversikt om oppdagelsen av insektenes hormoner, og deres betydning for en rekke vitale funksjoner. Boken inneholder et stort antall referanser til sentrale arbeider, og er illustrert med strektegninger og fotografier.

Lauritz Sømme

Sundby, Ragnhild. 1970. Insekter. Scandinavian University Books. Universitetsforlaget, Oslo, 121 s. Tegninger av Thore Bihaug. Pris kr. 29,50.

Det er blitt ganske livlig på det nordiske bokmarkedet når det gjelder insektböker av vitenskapelig innhold og av allmenn interesse. Sundbys bok er ment, som undertittelen angir, som oversikt over norske insektgrupper. Samtlige i Norge representerte ordener er med, men blant familiene er det gjort et utvalg, slik at bare de viktigste er blitt behandlet. Av artene nevnes et fåtall som eksempler.

Etter kapitlet om bygningen og utviklingen, gis bestemmelsestabell over ordener og for noen lavere grupper. I den spesielle delen gjennomgås ordener og de familiene som er tatt med. Teksten er knapp og konsis, og boken er heller ikke ment som lærebok i entomologi. Den gir imidlertid en innledende orientering om norske insekter. Boken kan med fordel anvendes ved praktiske övelser ved skoler og universitet. Når det gjelder utvalget av familier og eksempler, har forfatteren holdt seg til det aller vesentligste. En og annen utvidelse eller et bytte kunne diskuteres, men forfatteren har gardert seg med den begrensede störrelsen som boken var predestinert for.

Det var kanskje ikke nödvendig at underordenen fluer *(Brachycera)* ble oppdelt i to, hvorved de laverestående fluer fikk samme navn *Brachycera.* Det er ikke å anbefale at man bytter taksonenes omfang og benevnelser på en slik måte, tross slikt kan forekomme i litteraturen. Årsaken til en oppdeling er heller ikke lett å forstå, ettersom mygg, *Nematocera,* som virkelig er en heterogen gruppe, har fått stå uendret. Sammenliknet med *Nematocera* er fluer mer enhetlige. Også blant de laverestående fluer fins grupper som divergerer, men for å rette på systemet skulle en helt ny oppdeling vært foretatt.

Noen feil har sneket seg inn på tegningene. På fig. 7 er underkjevens *galea* blitt kalt maxillarpalp (mxp) og på fig. 8 er *labrum* blitt *labium* (lb). Billedtekstene kunne i visse tilfeller ha vært noe mere informative. Ved fig. 11 sies intet om hjertet, selv om symbolet c peker på det. Tuben hos spretthalen (fig. 22) synes å være noe feilplassert. Det er heller ikke bra at vannskorpionens ånderör er blitt tegnet i form av divergerende halvdeler (fig. 38) uten at forholdet kommenteres. Slike detaljer tyder på at tegneren har avbildet museumsobjekter og ikke har hatt tilgang til levende dyr, eller at han har brukt forbilder fra litteraturen uten selv å kunne ta stilling til detaljene. Omslagsbildet behövde kanskje heller ikke forblitt anonymt i en bok om insekter.

De få skjönhetsfeil er ikke så vesentlige og kan lett rettes.

Hans Kauri

C. F. Lühr 70 år

Utforskningen av norsk insektfauna i vårt århundre er i første rekke utført av personer som ikke har hatt entomologien som yrke. Sivilingeniør C. F. Lühr er en av disse. Den 16. januar 1971 fylte han 70 år.

I sine tidlige ungdomsår kom Lühr i kontakt med den aktive gruppen av insektsamlere som hadde tatt initiativet til stiftelsen av Norsk Entomologisk Forening. Han fikk der den første innføring i entomologiens innsamlingsteknikk og arbeidsmetode. Interessen for entomologi måtte så vike plassen for andre oppgaver i en lengre periode. Etter avsluttet eksamen ved Norges Tekniske Høgskole som maskiningeniør i 1926, ble bilen hans arbeidsfelt. I flere år hadde han stillinger ved rutebilselskapene i Oslo og Troms. Siden 1948 har han vært disponent for Ottadalen Kommunale Billag og bodd i Lom.

Da Norsk Entomologisk Forening i 1952 skulle leie rutebiler for en ekskursjon til Vågåmo i forbindelse med det 9. Nordiske Entomologmøtet, kom Lühr påny i kontakt med sin ungdoms kjærlighet, og interessen for insekter våknet for alvor. Siden den gang har NEF hatt et aktivt og alltid tjenestevillig medlem. Han fungerte som foreningens kasserer i en årrekke, og deltar ofte på møter i Oslo på tross av at avstanden fra hans hjem i Lom er 370 km.

Det er lepidopterene som er Lühr's insektgruppe. Takket være hans iherdige innsamlingsarbeide er sommerfugl-faunaen i nordre delen av Oppland nå godt kartlagt. Verdifulle innsamlinger har Lühr også foretatt i andre landsdeler, i første rekke Vest-Agder. Norsk Entomologisk Tidsskrift inneholder flere artikler hvor han har publisert sine funn.

Man treffer sjelden en mer vital 70-åring enn Lühr. Det flyr mange ukjente og sjeldne sommerfugler i vårt land som vi derfor i årene fremover må regne med vil måtte gi opp overfor Lühr's hov.

Alf Bakke

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