On the rearing of *Nesoselandria morio* (Fabricius) and *Birka cinereipes* (Klug) (Hymenoptera, Tenthredinidae), with descriptions of their larvae

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The larva of a Holarctic selandrine sawfly *Nesoselandria morio* (Fabricius) from southern Finland which feeds on mosses is described. Compared with the larva of *Birka cinereipes* (Klug), which feeds on forget-me-nots (*Myosotis scorpioides*), it shows some apomorphic characters: fusion of four apical antennal segments and reduction of sixth dorsal annulet on the third abdominal segment. It is the first sawfly larva known to feed on mosses (Bryopsida). The cocoon has a special structure. The larvae of the tribe Aneugmenini have an extra moult after the feeding period and differ in that respect from known larvae of Strongylogasterini and Dolerini.

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1. Introduction

The genus *Nesoselandria* Rohwer is concentrated in SE-Asia with more than 15 species (Malaise 1944, Smith 1969, 1982). The only Holarctic species, *N. morio* (Fabricius), also occurs in Finland and is distributed in the north up to Inari in Lapland, ca. 69°N. In South Finland the species is common, e.g. in Vuohiniemi, Hattula, it is sixth in the rank order of frequency among the 328 species of sawflies recorded there (Nuorteva 1971). The flight period in Hattula is rather long, lasting from 12 June to 9 August; the earliest capture in the author VV's collection in South Finland is 5 June (in Joensuu, 1963) and the latest on 29 August (in Helsinki, 1964). The biology of this widely distributed species was unknown until T. Naito (1988a) in Japan observed the adult behaviour, following the advice of Dr. Ryoichi Inomata, and found that the species is actually associated with a moss species. This was the first sawfly known to feed on moss. A photograph of the larva was presented, but no further details on the biology and larva were mentioned.

The purpose of this paper is to describe the larva of *N. morio* and other observations on the biology of the species in Finland and to compare them with those of *Birka cinereipes* (Klug), its closest relative in Finland which feeds on the forget-me-not. During a symposium on Holarctic sawflies arranged in Finland in 1989, Dr. H. Goulet, Ottawa, informed us of Naito's observation of the food plant of *N. morio*. This decisively helped our attempts to characterise the sawfly. The observations of the authors were made independently of each other. Author VV started with *N. morio* as early as 1973 but feeding of larvae only succeeded in 1989, 1990 and 1993. The confirmation of Naito's host plant observation by VV

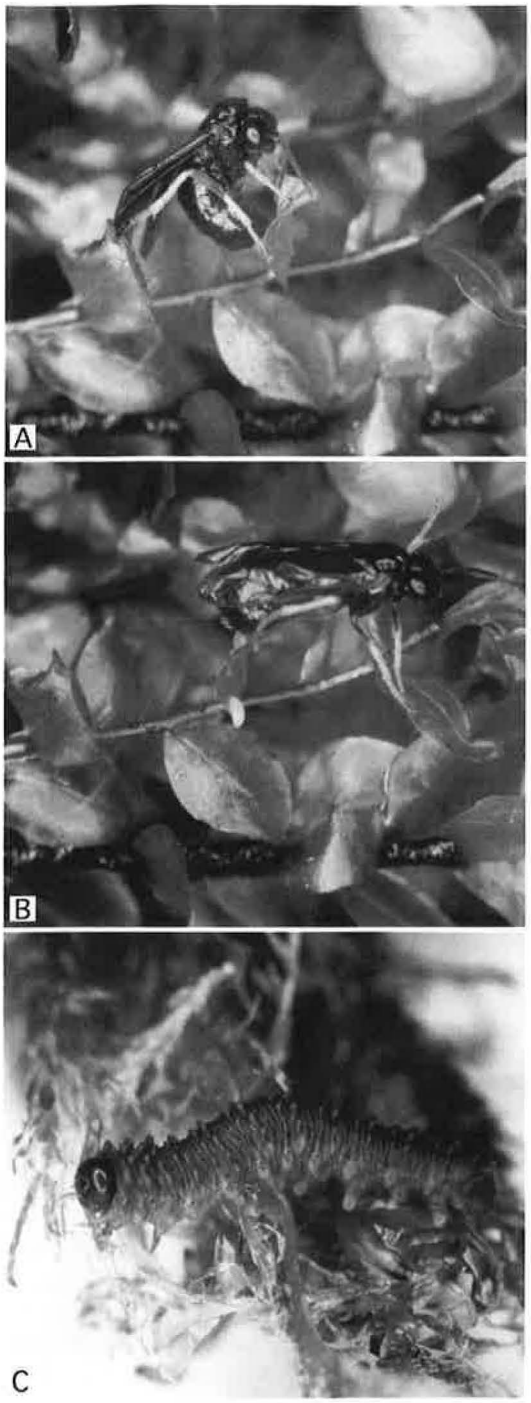

Fig. 1. *Nesoselandria morio* (Fabricius). A: Female ovipositing on a leaf of the moss *Pseudobryum cinclidioides* (Hub.) T. Kop. B: After oviposition an egg is visible on the opposite side of the same leaf. C: Full-grown larva.

was published by Goulet (1992). Author MN reared the larvae of *N. morio* in 1994.

2. Material and methods

The rearing of larvae: the females of *N. morio* and *B. cinereipes* were captured in a net and ovipositing experiments were carried out indoors at room temperature (20–25°C), direct sunlight was avoided.

For vascular plants, author VV used plastic tubes (height 76 mm, diameter 45 mm), the lid of the tube served as a bottom. Small parts of plants (leaves mostly) were fastened to a tightly-coiled porous paper towel strip which was moistened with water. The female was then put into the tube together with plants. Observations were made with the naked eye, a magnifying glass or low-power stereomicroscope.

Mosses were spread on moistened paper toweling on a saucer; this was then covered with a cheese-dish glass lid. Author MN used large (diameter 14 cm, height 2.1 cm) petri dishes, which had moistened filter paper at the bottom. Different species of mosses were then spread on the paper.

During larval feeding the mosses were kept moist all the time. The animals' faeces were removed daily and the head capsules of the larvae were counted and kept in small petri dishes for later study. Prepupae were put in small glass jars with fine sand and peat moss (*Sphagnum*). The colours and other characteristics of living larvae were observed under low magnification. Author MN also took some photographs of ovipositing females, eggs, larvae and cocoons (Fig. 1A–C). Some of the larvae and prepupae were killed in boiling water and kept in 70–80 percent ethanol.

The larvae were studied under a stereomicroscope. Some of the larvae were treated in hot 10 percent KOH, dissected and studied under a compound microscope using objectives of 4–40 ×, figures were made using a drawtube. Because the setae and tubercles on the abdomen of *N. morio* are very small, they were studied with a compound microscope: first, the abdomen was cut lengthwise on the right side and the cuticula on the left side was spread and studied. Figs. 2 and 3 were drawn by author MN, the rest of the figures are by VV.

3. Results

3.1. *Nesoselandria morio* (Fabricius)

3.1.1. Ovipositing and eggs

Between 1973 and 1989 VV offered the animals different vascular plants. The females laid eggs on the leaves of the following dicotyledons representing six different families: *Stellaria media*

(L.) Vill., *Chenopodium album* L., *Polygonum aviculare* L., *Fragaria vesca* L., *Veronica chamaedrys* L., *V. officinalis* L. and *Myosotis scorpioides* L. The names of vascular plants are in accordance with Hämet-Ahti *et al.* 1986. The eggs were laid usually near the leaf margin, sometimes near a vein in the leaf blade. The ovipositing was very fast, it took only 6–8 seconds, the saw pierced the leaf margin and the egg was placed on the opposite side of the leaf to the female. One end of the egg was fastened to the ovipositing site but otherwise the egg was free. The colour of the egg is yellowish or reddish yellow. Forsius (1920) established the dimensions of newly-laid eggs as follows: length 0.77–0.79 mm, width 0.30–0.34 mm, he did not name the plant they were attached to.

In 1989 and later, different mosses (class Bryopsida) were offered. No species of the class Hepaticopsida were tested. VV offered several small mosses growing on earth near a path and on stones in deciduous wood: *Sanionia uncinata* (Hedw.) Loeske, *Brachythecium reflexum* (Starke) Schimp. (order Hypnobryales), *Hedwigia ciliata* (Hedw.) P. Beauv. (order Orthotrichales), *Ceratodon purpureus* (Hedw.) Brid., *Dicranum scoparium* Hedw. (order Dicranales) and *Plagiomnium cuspidatum* (Hedw.) T. Kop. (syn. *Mnium cuspidatum*, order Bryales). The females laid their eggs mostly on mosses with broader leaves: *Hedwigia, Ceratodon* and *Plagiomnium,* but to a lesser extent even *Dicranum* with narrow leaves was accepted. The ovipositing lasted only 5–8 seconds. The eggs were mostly outside or between the leaves.

MN offered several different mosses growing near the place the females were captured (a moist ditch). All females in five separate rearings laid eggs only on the leaves of *Pseudobryum cinclidioides* (Hub.) T. Kop. (syn. *Mnium cinclioides*, order Bryales) on both the green upper leaves and the brown lower leaves. Eggs were layed very quickly, they were clearly visible both on the upper and lower sides of the leaves. At least some eggs were laid through the broad leaf, Fig. 1A and B (photos) show such a case.

3.1.2. Food plants

The hatching of the larvae began after (6)–7 days, most larvae hatched after 8–10 days. When only vascular plants were available, the larvae did not eat, but crawled in the tube and died in 1–2 days. Some 30 different plants, also monocotyledons were offered without success.

When mosses were available, several different mosses with green leaves were eaten. In rearings conducted by VV, *C. purpureus, P. cuspidatum* and *H. ciliata* were eaten willingly, but other green mosses were at least partially eaten. One peat moss species (*Sphagnum* sp.) was offered but was not eaten at all.

In MN's rearing experiments the larvae did not eat the moss *P. cinclidioides* on which the eggs were laid, but crawled to the leaves of *Plagiothecium denticulatum* (Hedw.) Schimp. (order Hypnobryales), which was their favourite food plant. Also some other mosses were eaten, e.g. the soft apical parts of *Polytrichum commune* Hedw. (order Polytrichales).

All the mosses were identified by Dr. H. Vasander (University of Helsinki) and their orders and synonyms were taken from Hallingbäck and Holmåsen (1991).

3.1.3. Larval instars

One of the best-documented rearings (VV) is taken as an example of how larvae moulted and grew.

Two females of *N. morio* were captured on 26 June 1989 in Janakkala, Muurainsuo. On the same day, they laid eggs on the leaves of *Chenopodium, Fragaria* and *Veronica officinalis*. On the next day, they laid eggs on mosses (*C. purpureus* etc.). Mosses were not offered the day before. The females were killed in the evening on 27 June. The first larvae hatched on 2–3 July, some larvae did not hatch until 8–9 July. The first instar had a greyish body and shining black head. The larvae ate only mosses.

The first moult began on 8 July, the 2nd moult on 9 July, the 3rd on 11 July, the 4th on 14 July, the 5th on 16 July and the 6th on 18 July. On 20 July, ten prepupae went to earth for pupating, the rest of the larvae and prepupae were killed. After the moult, the larvae eat their old larval skin, only the head capsules are left. The prepupae did not eat anything.

The cocoons were made in sand near the surface. On 3–4 August 1989, six males emerged and

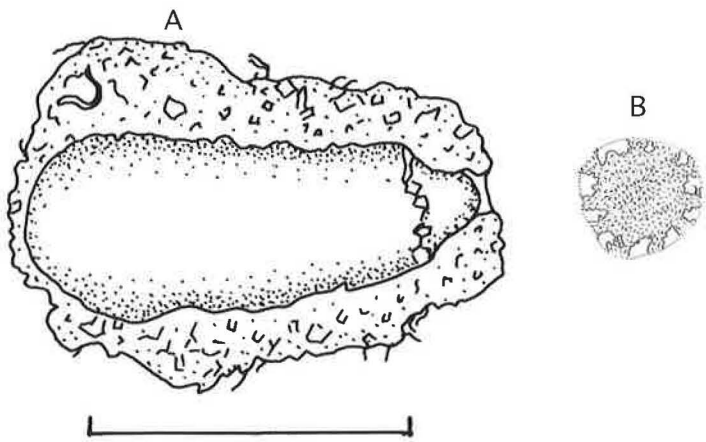

Fig. 2. *Nesoselandria morio*. A: Cocoon, lateral view (opened laterally). Scale line 5 mm. B: Partition wall of the cocoon (inner view).

later in August three more males emerged; one cocoon contained a dead prepupa.

In this rearing, the male larvae had six feeding instars and after an extra moult they entered the prepupa stage; they belong thus to type A of Kontuniemi (1965). The increase in size is best seen by how the width of the head (n = 3–5) and frons change:

1. instar: width of head 0.35–0.38 mm, width of frons ca. 0.20 mm
2. instar: width of head 0.46–0.48 mm, width of frons ca. 0.25 mm
3. instar: width of head 0.59–0.64 mm, width of frons ca. 0.31 mm
4. instar: width of head 0.76–0.78 mm, width of frons ca. 0.39 mm
5. instar: width of head 0.88–0.95 mm, width of frons ca. 0.46 mm
6. instar: width of head 1.01–1.04 mm, width of frons ca. 0.50 mm.

The female larva in another rearing (VV in 1990) had one feeding instar more:

7. instar: width of head 1.20–1.24 mm, width of frons ca. 0.56 mm.

The prepupa is dark greyish, slightly greasy, head pale brown, and setae are shorter than in the feeding instar.

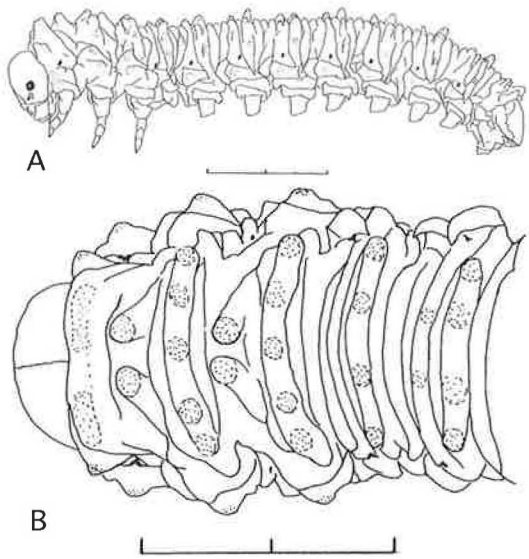

Fig. 3. Full grown larva of *Nesoselandria morio*. A: Lateral view. Scale line 2 mm. B: Head, thorax and two anterior abdominal segments, dorsal view. Scale line 2 mm.

3.1.4. Cocoon

The cocoon has some peculiar structures that were noticed by MN. The prepupae made a pupation chamber inside rotten moss or sand, the inside of the chamber is covered with a dark brown, shining secretion. Particles of soil and plants are fastened to the outer surface of a delicate and weak cocoon, no thread is spun. On one end of the cocoon is a round hole (Fig. 2A), which leads to an empty space separated by a partition wall, separating the rest of the cocoon and prepupa or pupa. This wall has several holes which form a ring-like structure near the outer margin (Fig. 2B), these obviously help the imago to emerge from the cocoon.

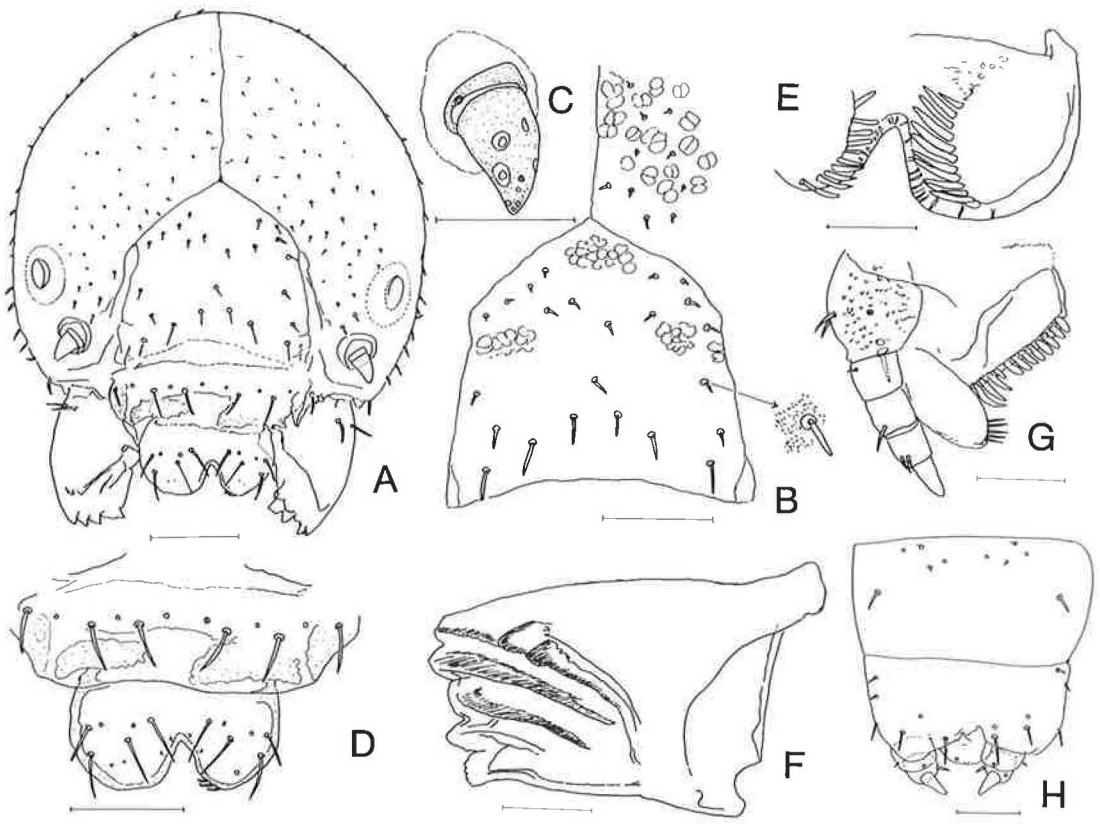

Fig. 4. Head of the larva of *Nesoselandria morio*. A: frontal view. Scale line 0.2 mm. B: Frons and part of epicranium. Scale line 0.2 mm., details 0.1 mm. C: Antenna. Scale line 0.1 mm. D: Clypeus and labrum. Scale line 0.2 mm. E: Epipharynx. Scale line 0.1 mm. F: Left mandible, inner view. Scale line 0.1 mm. G: Maxilla. Scale line 0.1 mm. H: Labium. Scale line 0.1 mm.

3.1.5. Description of the fully-grown feeding larva

Length 8–10.5 mm, the female larva is larger than the male. The colour of the body is a greenish–greyish, matte, and on the abdomen the dorsal vessel is slightly darker. The head is shining, black, the mouth parts are paler. The general habitus (Fig. 3A) is typically sawfly-like, the body being cylindrical, with protuberances bearing short setae, especially on the dorsum of the thorax and laterally.

The head (Fig. 4A) is globose, vertex and temples with short setae. Near the epicranial suture (Fig. 4B) the surface sculpture has structures resembling pale diplococci. Frons with ca. 23 setae, the setae are apically sharp, narrowing, the surface structure is finely spinulose. Antenna (Fig. 4C) two-segmented, with basal ring-like segment and apical conical segment which has several pale porous structures. Clypeus (Fig. 4D) has 3 setae on each half, the setae are distributed evenly. The labrum (Fig. 4D) is symmetrical, each lobe with 4 strong setae. Epipharynx (Fig. 4E) with a row of 10–11 strong spines. The left mandible (Fig. 4F) with 5 apical teeth and two mesal ridges. The malar process is absent from the floor of the mouth. Maxilla (Fig. 4G): cardo with 1 seta, stipes 2, palpifer with 2 lateral setae and 1 posterior seta, maxillar palpus: 1st segment with 1 short seta, 2nd with 1 seta, 3rd with 3 setae and 4th without setae. Galea with 6 apical setae, lacinia with 12 spines, most of them rather short. Labium (Fig. 4H): submentum with 2 short basal and one lateral seta on each half, praementum with 2 short setae near the basal lateral corner and apically with 3 setae.

Thorax (Fig. 3B): prothorax with anterior dorsolateral lobes strongly developed, posterior dorsomesal lobes prominent on each side of the midline. Mesothorax anterodorsally with 5 setiferous small protuberances, one in the midline, two posterior dorsomesal lobes on each side of the midline. Metathorax with 5 protuberances anterodorsally as in mesothorax, posterior dorsomesal lobes wanting. Subspiracular lobes on the thorax prominent. Legs five-segmented. Mesotibia (Fig. 5A) with 12 setae and 2 small setae apically.

Abdomen with prolegs on segments 2–8 and 10. Third abdominal segment (Fig. 6) with 6 dorsal annulets, spiracle on 3rd annulet. Annulet 1 dorsolaterally with a group of 3 small setae. Annulet 3 with 2 protuberances bearing setae, dorsal one with 2 short setae, dorsolateral one with 3 short setae. Annulet 5 with 3 setiferous protuberances, dorsal one with 2 short setae and 1 small tubercle, dorsolateral one with 4 small setae and 1 tubercle and postspiracular protuberance with 3 small setae. Subspiracular lobe with 10 small setae and 1 small tubercle. Surface sculpture composed of small spinulose patches. Surpedal lobes with 6 small setae and 1 tubercle. Proleg: outer side near the apex with 1 small tubercle, inner side with 6 small setae. First anteroventral fold with 1 small tubercle on each side, 2nd anteroventral fold with 5 small tubercles on each side.

Ninth abdominal segment (Fig. 5B) with 5 dorsal annulets, annulet 4 with prominent tubercles bearing small setae. Tenth tergum apically rounded, without protuberances, covered with ca. 45 small, rounded setae and 2 small tubercles, anal margin with ca. 75 longer hairs. Subanal margin with ca. 70 hairs.

3.2. *Birka cinereipes* (Klug)

3.2.1. Rearing larvae

The closest relative of *N. morio* in Finland is *B. cinereipes* which is known to feed on *Myosotis scorpioides* (syn. *M. palustris*) (Von Stein 1885 as *Selandria aperta*, Kontuniemi 1951, Lorenz & Kraus 1957). Benson (1952) treated them as belonging to the same genus. In order to get larvae of *B. cinereipes* for comparison, a female was captured on 13 July 1990 in Janakkala and put into a plastic tube, together with leaves of *Myosotis scorpioides* by VV. On 13–14 July, the female laid ca. 15 eggs. Ovipositing was through the leaf, white tapering eggs stick out of the opposite side, and a small scar can be seen on the other side.

The larvae hatched on 18–19 July and small larvae sceletonized the underside of the leaf, while the larger larvae ate holes in it. On 30 July, small prepupae were seen, and all larvae and prepupae were killed. The species has an extra moult after feeding and belongs to type A of Kontuniemi (1965).

3.2.2. Description of the fully-grown larva

The larva was described by Lorenz (Lorenz & Kraus 1957, as *Melisandra cinereipes*) and further characteristics are added here, especially the characteristics which are different from those of *N. morio*.

Head (Fig. 7A) with distinctly longer setae on vertex and temples. Frons (Fig. 7B) with ca. 22 setae, setae longer and slightly dilated apically, spinulose surface sculpture missing, surface structure consists of small irregular plates. Antenna (Fig. 7C) five-segmented as usually in free-living Selandriinae larvae. Clypeus (Fig. 7D) with 3 setae in each lateral third, the middle third without setae. Labrum (Fig. 7D) with 3–4 setae, some setae small, others strong. Epipharynx (Fig. 7E) with a row of spines shorter, consisting of 7–8 smaller spines. Left mandible (Fig. 7F) of similar type as in *N. morio*. Maxilla (Fig. 7G): palpifer with stronger microsculpture, galea without apical setae, lacinia with 10 strong, equal spines. Labium (Fig. 7H): submentum with 3–4 short setae, praementum with 2 short setae laterobasally and 2 setae apically.

Thorax (see figure in Lorenz & Kraus 1957) with distinctly longer setae.

Third abdominal segment (Fig. 8) with 7 dorsal annulets, with spiracle on 3rd annulet. Annulet 1 with a group of 3 short setae dorsolaterally, annulet 3 with 2 setiferous protuberances, annulet 5 with 2 protuberances and 2nd postspiracular lobe. Surface structure not spinulose but composed of irregular puzzle-like plates. Setae much longer than in *N. morio*. By accident, also the dorsal longitudinal muscles below the cuticula were stud-

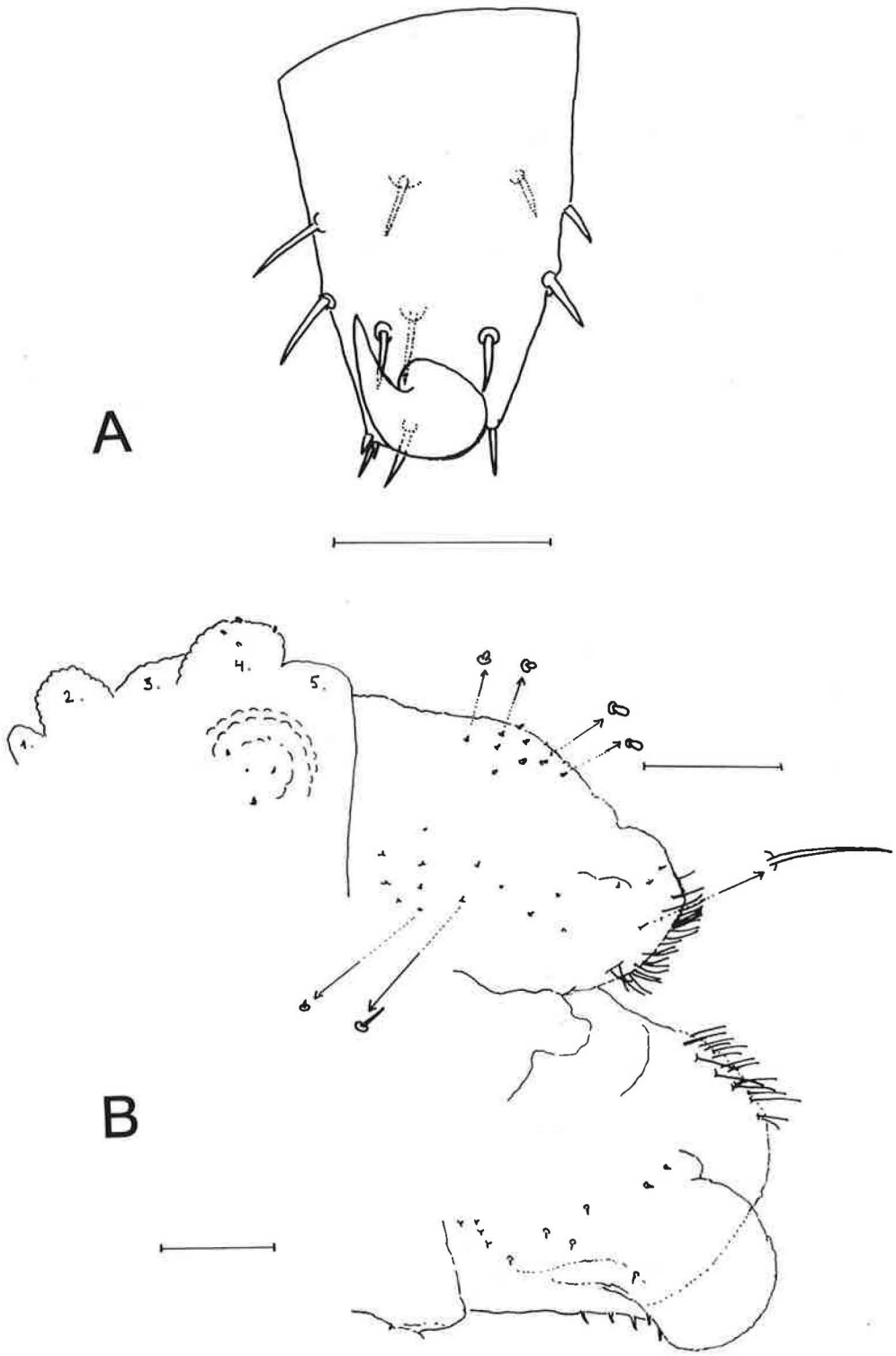

Fig. 5. Larva of *Nesoselandria morio*. A: Left mesotibia and tarsus, ventral view. Scale line 0.1 mm. B: Caudal end of abdomen. Scale line 0.2 mm., details 0.1 mm.

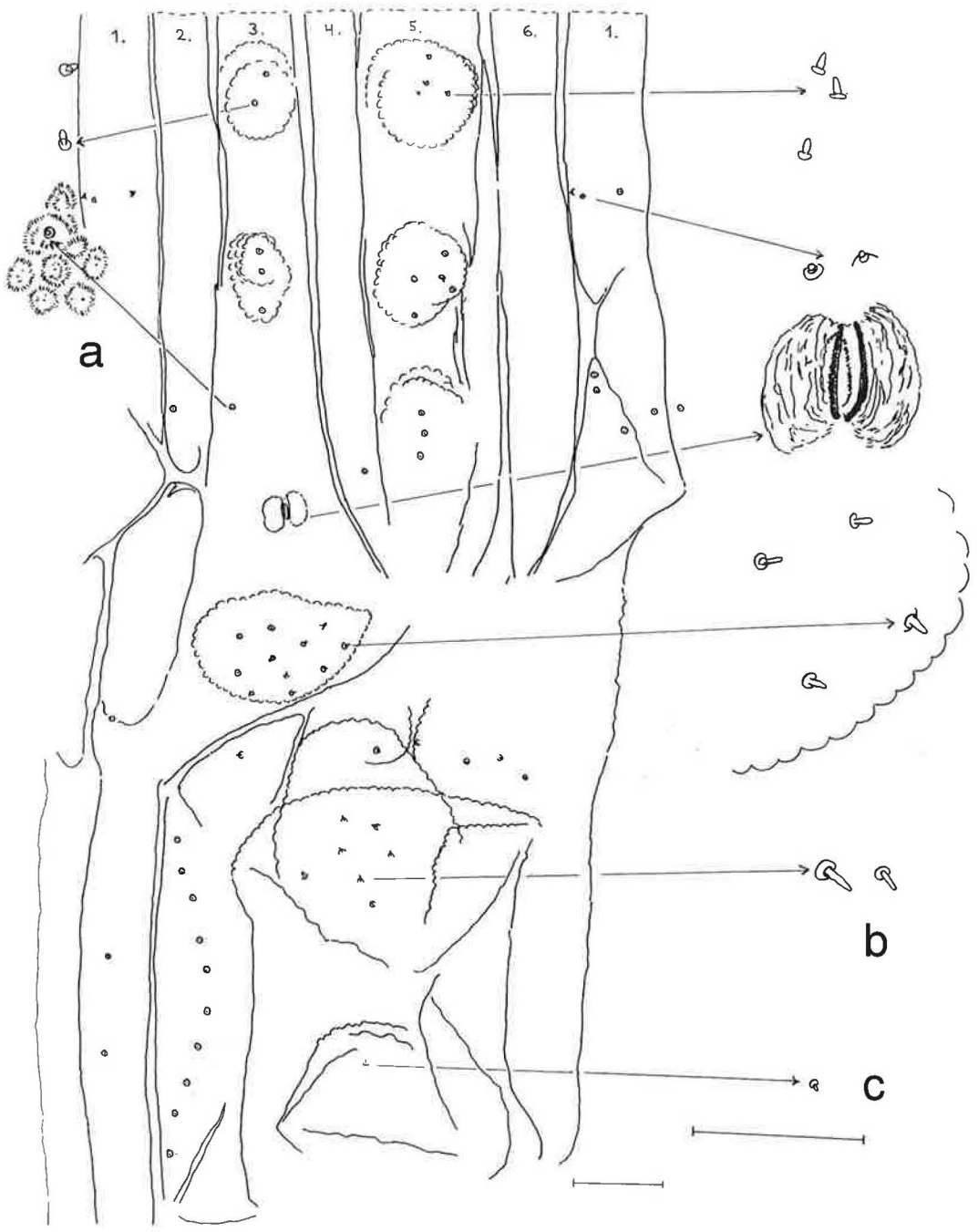

Fig. 6. Third abdominal segment of the larva of *Nesoselandria morio*, sinistrolateral view. Scale line 0.2 mm. Details: a: spinulose surface sculpture around supraspiracular tubercle. b: setae on inner side of proleg. c: small seta on outer side of proleg. Scale line of details 0.1 mm.

ied, their anterior insertion point is the anterior end of annulet 1 of abdominal segment. No muscle cross the cuticular folds or coria between the abdominal segments.

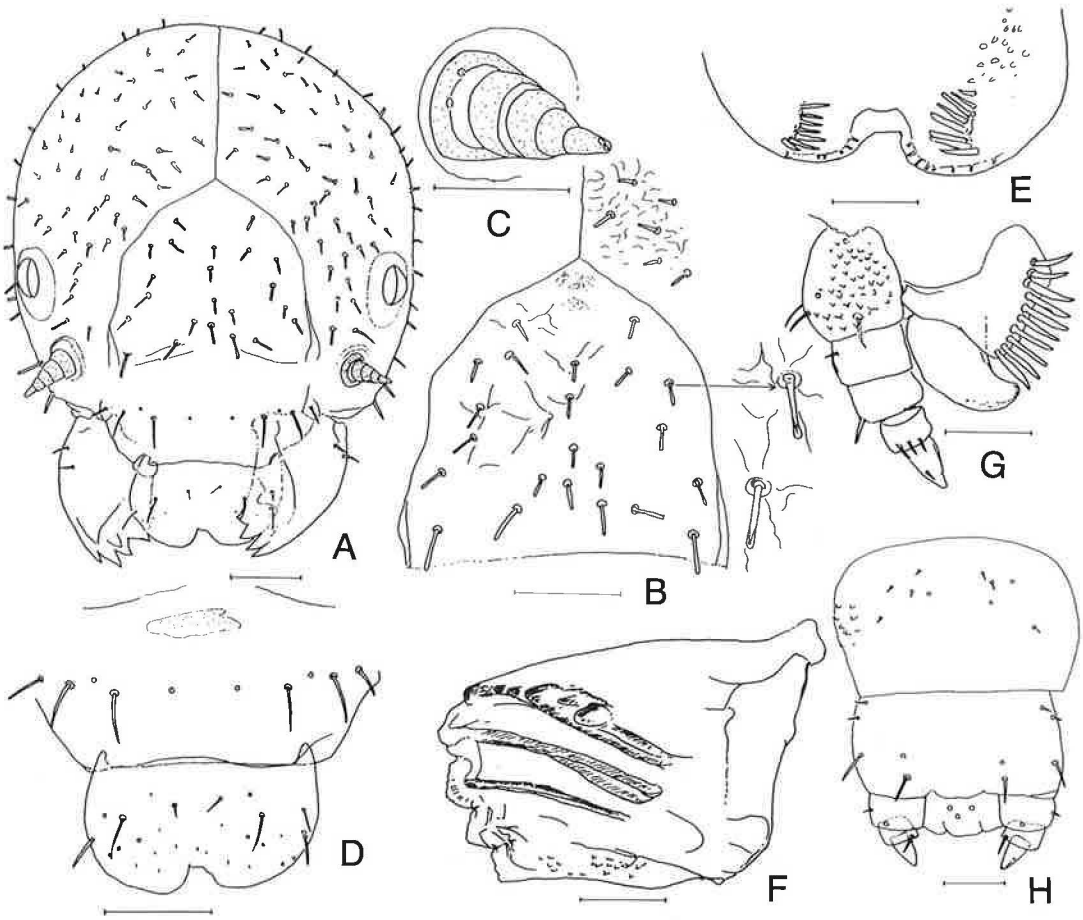

Fig. 7 . Head of the larva of *Birka cinereipes* (Klug). A: Frontal view. Scale line 0.2 mm. B: Frons and part of epicranium. Scale line 0.2 mm., details 0.1 mm. C: Antenna. Scale line 0.1 mm. D: Clypeus and labrum. Scale line 0.2 mm. E: Epipharynx. Scale line 0.1 mm. F: Left mandible, inner view. Scale line 0.1 mm. G: Maxilla. Scale line 0.1 mm. H: Labium. Scale line 0.1 mm.

4. Discussion

N. morio is a member of the family Tenthredinidae, of the subfamily Selandriinae, which is rather poorly represented in the Holarctic region, but it is one of the dominant sawfly groups in the Tropics, especially in Central and South America and SE Asia (Malaise 1944, 1963, Smith 1969). In Finland, 5 tribes of Selandriinae were known (Viitasaari & Vikberg 1985): Strongylogasterini, Aneugmenini, Selandriini, Heptamelini and Dolerini, and later a sixth, the tribe Rocaliini, was added (Naito 1988b). The Strongylogasterini contains some of the most primitive members of Tenthredinidae (Smith 1969). The food plant list of our tribes is varied and includes both primitive vascular plants and monocotyledons: Strongylogasterini larvae feed freely on ferns, Aneugmenini feed freely on ferns (*Aneugmenus* spp.), on a dicotyledon (*B. cinereipes*), on mosses (*N. morio*), Selandriini on monocotyledons (Juncaceae, Cyperaceae and Poaceae), Heptamelini larvae are internal borers of the stems and midribs of ferns, Rocaliini feed on fern spores and Dolerini on horsetails (Equisetaceae) or on monocotyledons. The food plants and larvae of most tropical Selandriinae are unknown.

The food plant (mosses) of *N. morio* is unique among all sawflies. In our rearings, the larvae ate several different mosses of the class Bryopsida

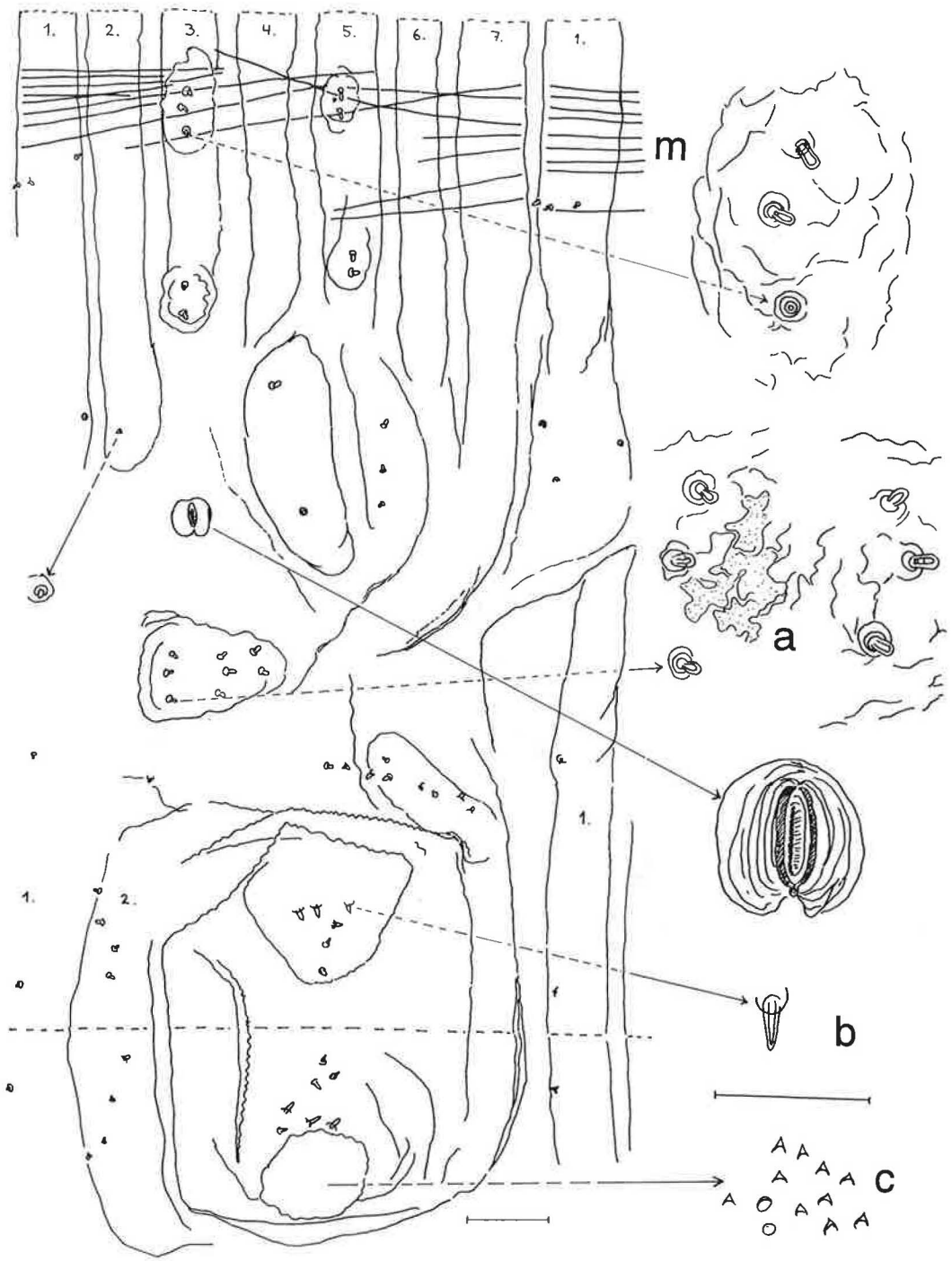

Fig. 8. Third abdominal segment of the larva of *Birka cinereipes*, lateral view. m = dorsal longitudinal muscles shown as lines. Scale line 0.2 mm. Details, a: puzzle like surface sculpture on subspiracular lobe, b: seta on inner side of proleg, c: surface sculpture on outer side of proleg. Scale line of details 0.1 mm.

but we have not made any observations in the wild. The saw of *N. morio* is adapted for quick piercing of the delicate leaves of mosses: the lancet is thin, apically sharply pointed, the lower margin is with-

out teeth (in a figure by Zhelokhovtsev 1951, Scobiola-Palade 1978, the figure in Smith 1969 is different, perhaps the apex is broken). Most species of *Nesoselandria* today live in the rain forest area of SE Asia, the saws of tropical species are of a similar type (figures in Malaise 1944, Smith 1982), so it is possible that their foodplants are also mosses.

The two-segmented antenna of the larva of *N. morio* is unique among Selandriinae. Usually the antenna in Selandriinae is five-segmented, only in internal borers (Heptamelus) is it three-segmented. During the feeding period the larvae hide below mosses, except when feeding. Perhaps this behaviour has led to the fusion of apical antennal segments. The fusion of four apical segments is regarded as an apomorphic character state.

Another derived character of the larva of *N. morio* is the reduction of one annulet on abdominal segments 1–8. When compared with the chaetotaxy of *B. cinereipes,* it is clear that annulet 6 is reduced and does not reach the dorsomesal line. *Strongylogaster macula* (Klug) also has 6 annulets but annulets 1, 2 and 4 have setae and the outer side of the proleg bears setae (Lorenz & Kraus 1957). The key to subfamilies of Tenthredinidae in Smith and Middlekauff (1987) is deficient because not all species of Selandriinae have 7 annulets.

The exact limit of the somite in a sawfly larva is not easy to determine. Yuasa (1923) studied the muscles and found that a majority of longitudinal muscles, including the dorsal, lateral and ventral retractor muscles originate on the cuticular fold or coria. He used the cuticular fold as the cephalic limit of the somite. According to Yuasa, the 3rd abdominal segment in both Selandriinae and Tenthredininae has seven annulets and annulet 1, 3 and 5 are setiferous, the spiracle is on the third annulet. Our observation of dorsal longitudinal muscles and chetotaxy of *B. cinereipes* (Fig. 8) is in line with the observations of Yasa (1923). Our annulet numbers are also consistant with the view of Middleton (1921), according to him the dorsum of both the thoracic and abdominal segment had four transverse divisions which have been secondarily divided in some sawfly groups, the first three of these primary annulets may bear setae, the fourth never. A different conclusion is presented by Lorenz and Kraus (1957) who state that the spiracular annulet is the 2nd annulet and, according to Lorenz, Selandriinae and Tenthredininae larvae with seven annulets have annulet 2 and 4 and often 7 with setae. According to Lorenz, *Melisandra cinereipes* has 7 annulets, annulet 2 with 3 and annulet 4 usually with 2 fleshy setiferous warts. His description differs from ours in two points: the number of protuberances on the 2nd annulet is different and the 1st annulet has a group of small setae.

The structure of left mandible: 5 lateral teeth and 2 mesal ridges (Smith & Middlekauff 1987) is obviously a good larval character for Selandriinae (prepupae lose this character). Both *N. morio* and *B. cinereipes* have typical mandibles of Selandriinae. Naito (1988b) described the interesting biology of *Rocalia longipennis* Takeuchi and that of a new species, and transferred the genus from Heterarthrinae to Selandriinae although the vein Rs+M in its forewing is nearly straight. It would be very interesting to study the morphology of the larva and especially the structure of the left mandible of the larva of *Rocalia.*

The number of setae on mesotibia of *N. morio* is higher than recorded earlier in Selandriinae (Lorenz & Kraus 1957, Smith & Middlekauff 1987). It is technically rather difficult to count all the setae on the tibia.

The last larval moult was used as a taxonomic character in sawflies by Kontuniemi (1965). He included three species of Selandriinae: *Strongylogaster macula* (Klug) and *S. mixta* (Klug), both wrongly as *Eriocampidea*, and *Dolerus gonager* (Fabricius), all these lack an extra moult after feeding and belong to type B of Kontuniemi. *N. morio* and *B. cinereipes* have an extra moult after feeding and so belong to type A of Kontuniemi. *Aneugmenus fuerstenbergensis* (Konow) also has an extra moult, author VV studied two prepupae of it (Mäntyharju, 1.7.1964, rearing of E. O. Peltonen). So all three species of Aneugmenini studied have an extra moult and differ in that respect from the studied species of Strongylogasterini and Dolerini. An extra moult is considered as an apomorphic character state in Selandriinae.

The different biology (quite remote food plants) and different larval morphology of *N. morio* and *B. cinereipes* raise the question of if there are clear differences also in adult morphology. Takeuchi (1941) was the first to place *morio* into the right genus *Nesoselandria* Rohwer, Benson (1952)

treated both in the genus *Melisandra* Benson which is a younger synonym of *Birka* Malaise. There are distinct differences in adults as one could expect: in the structure of claws (*Nesoselandria* has an acute basal lobe and strong subapical tooth, the short basal lobe is easily overlooked (Malaise 1944) and most later authors do not mention it), in the separation of prepectus, in the pubescence of mesepimeron, in the length of malar space, in the length and direction of sawsheath, in the structure of lancet and in coloration of hind femora and tibiae.

Species of Selandriinae do not spin a cocoon (Smith & Middlekauff 1987). Many make a cocoon chamber, as *Dolerus gonager* Fabricius (Kontuniemi 1951). The structure of the cocoon of *Periclista lineolata* (Klug) (Blennocampinae, Nägeli 1931) is rather similar to that of *N. morio*. The cocoon of *Birka cinereipes* also has a peculiar narrow structure at one end (Von Stein 1885) but when the adult emerges it cuts the cocoon below this apical narrow part.

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References

Benson, R. B. 1952: Hymenoptera: 2. Symphyta Section (b). — Handbooks for the identification of British insects 7, part 2 (b): 51–138.

Forsius, R. 1920: Kleinere Beiträge zur Kenntnis der Tenthredinoiden. Eier I. — Medd. Soc. Fauna Flora Fennica 45: 169–184.

Goulet, H. 1992: The genera and subgenera of the sawflies of Canada and Alaska. Hymenoptera: Symphyta. — The insects and arachnids of Canada 20: 1–235.

Hallingbäck, T. & Holmåsen, I. 1991: Mossor. En fälthandbok, 2nd edition. — Interpublishing AB, Stockholm. 288 pp.

Hämet-Ahti, L., Suominen, J., Ulvinen, T., Uotila, P. & Vuokko, S. (eds.) 1986: Retkeilykasvio, 3rd edition. [The field flora of Finland]. — Suomen Luonnonsuojelun Tuki Oy, Helsinki. 598 pp. (In Finnish with English summary.)

Kontuniemi, T. 1951: Zur Kenntnis des Lebenszyklus der Sägewespen (Hymenoptera, Symphyta) in Finnland. — Acta Entomol. Fennica 9: 1–92.

Kontuniemi, T. 1965: Die letzte larvale Häutung bei den Sägewespen (Hym., Symphyta) als taxonomisches Kriterium. — Ann. Entomol. Fennici 31: 115–117.

Lorenz, H. & Kraus, M. 1957: Die Larvalsystematik der Blattwespen (Tenthredinoidea und Megalodontoidea). — Abhandlungen zur Larvalsystematik der Insecten 1: 1–339.

Malaise, R. 1944: Entomological results from the Swedish expedition 1934 to Burma and British India. Hymenoptera: Tenthredinoidea. — Ark. Zool. 35A (10): 1–58.

Malaise, R. 1963: Hymenoptera Tenthredinoidea Subfamily Selandriinae. Key to the genera of the world. — Entomol. Tidskr. 84: 159–215.

Middleton, W. M. 1921: Some suggested homologies between larvae and adults in sawflies. — Proc. Entomol. Soc. Wash. 23: 173–192.

Nägeli, W. 1931: Periclista lineolata Kl. eine Eichenblattwespe als Forstschädling. — Mitt. schweiz. Centralanst. forstl. Versuchswesen. 17: 75–91.

Naito, T. 1988a: Feeding habits and speciation in sawflies (1). — Insectarium 25: 124–131. (In Japanese.)

Naito, T. 1988b: Systematic position of the genus Rocalia (Hymenoptera, Tenthredinidae) feeding on fern spores, with description of a new species from Japan. — Kontyû, Tokyo 56: 798–804.

Nuorteva, M. 1971: Die Sägewespenfauna (Hym., Symphyta) von Vuohiniemi. — Ann. Entomol. Fennici 37: 179–189.

Scobiola-Palade, X. G. 1978: Hymenoptera Symphyta, Tenthredinoidea Fam. Tenthredinidae – Subfam. Selandriinae, Tenthredininae, Heterarthrinae. — Fauna republicii socialiste România Insecta 9(8): 1–248.

Smith, D. R. 1969: Nearctic sawflies II. Selandriinae: Adults (Hymenoptera: Tenthredinidae). — U. S. Dep. Agric. Tech. Bull. no. 1398: 1–48, 10 pls.

Smith, D. R. 1982: Symphyta (Hymenoptera) of Sri Lanka. — Proc. Entomol. Soc. Wash. 85: 117–127.

Smith, D. R. & Middlekauff, W. W. 1987: Tenthredinidae (Tenthredinoidea). — In: Stehr, F. W. (ed.), Immature insects. Kenndal/Hunt Publ. Company, Dubuque, Illinois: 631–643.

Takeuchi, K. 1941: A systematic study on the suborder Symphyta (Hymenoptera) of the Japanese Empire IV. — Tenthredo 3: 230–274.

Viitasaari, M. & Vikberg, V. 1985: A checklist of the sawflies (Hymenoptera, Symphyta) of Finland. — Not. Entomol. 65: 1–17.

Von Stein, R. R. 1885: Neue Afterraupen. — Wiener Entomol. Zeitung 4: 245–250.

Zhelokhovtsev, A. N. (Желоховцев, А. Н.) 1951: (Survey of the palaearctic sawflies of the subfamily Selandriinae (Hym., Tenthr.).) — Moscow Gosud. Univ. Zool. Muz. Sborn. Trudy 7: 123–153. (In Russian.)

Yuasa, H. 1923(1922): A classification of the larvae of the Tenthredinoidea. — Ill. Biol. Monogr. 7(4): 1–172.