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On the biology of Nematinae with hiding larvae

(Hymenoptera, Symphyta, Tenthredinidae)

With 10 figures

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Zusammenfassung

Die Larven der Nematinae (Hymenoptera, Tenthredinidae) sind gewöhnlich freilebend. Ausnahmen stellen die Triben Hoplocampini, Pseudodineurini, Pristolini und die folgenden Nematini dar: *Decanematus* (= *Amauronematus-viduatus*-Gruppe), *Pontopristia*, *Amauronematus-longiserra*-Gruppe, *Polynematus* der Subtribus Nematina, die gesamte Subtribus Euurina (*Euura* und *Pontania* einschließlich der Subgenera *Phyllocolpa* und *Eupontania*), *Micronematus*, und *Sharliphora* der Subtribus Pristiphorina, sowie das nearktische Genus *Neopareophora* mit einer unsicheren taxonomischen Stellung. Deren Larven sind zumindest im ersten Larvalstadium entweder endophytisch oder auf andere Weise nicht typisch freilebend. Die Biologie der aufgeführten Blattwespen wird kurz diskutiert. Es wird vermutet, daß auch *Nepionema*, die wahrscheinlich mit *Rhododendron* assoziiert ist, zumindest im frühen Stadium versteckt lebt. Das Eiablageverhalten und die Gallerregung der blattrollenden *Pontania* wird beschrieben.

Summary

The larvae of Nematinae (Hymenoptera, Tenthredinidae) are usually free-feeding, except for the tribes Hoplocampini, Pseudodineurini, Pristolini, and the following Nematini: *Decanematus* (= *Amauronematus viduatus*-group), *Pontopristia*, the *Amauronematus longiserra*-group, *Polynematus* of the subtribe Nematina, the whole subtribe Euurina (*Euura* and *Pontania* including the subgenera *Phyllocolpa* and *Eupontania*), *Micronematus* and *Sharliphora* of the subtribe Pristiphorina, and also the Nearctic genus *Neopareophora* with an uncertain taxonomic position. Their larvae are either endophytous or otherwise not typically free-living, at least in the earliest stage. The biology of all these sawflies is briefly discussed. It is assumed that *Nepionema*, which is possibly associated with *Rhododendron*, also might have hiding larvae at least in early instars. The ovipositing behaviour and gall incitation is described for the leaf-rolling *Pontania*.

Keywords: sawflies, Tenthredinidae, Nematinae, biology, larvae, galls.

Introduction

The family Tenthredinidae is the largest and most derived one within the sawflies (Hymenoptera, Tenthredinidae). In this family the larvae are mostly free-feeding on different plants (Angiospermae or Coniferae), but some of the subfamilies (Nematinae and others) include sawflies with endophytous larvae. The subfamily Nematinae can be divided into 8 tribes. All known species of the tribes Cladiini, Mesoneurini, Dineurini, and Pristicampini are free-living in the larval stage. Those of Hoplocampini, Pseudodineurini, and Pristolini include only endophytous forms. The larvae of the largest tribe Nematini can be either endophytous or free-feeding.

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ZINOVJEV (1982) assumed that Nematinae could not originate from the forms with exophytous larvae. This assumption was based on the similarity between the shape of the medial pseudocerci of the free-feeding larvae of *Paranematus* ZINOVJEV (see VIKBERG 1972, ZINOVJEV 1978) and various caudal appendages of typically endophytous larvae or "moveable" pupae in Hymenoptera and other orders (ZINOVJEV 1982). Nematinae larvae are also characterized by very short antennae. Considering these features, one would suppose that although the ancestors of Nematinae were not highly specialized, they might have been endophytous or at least had larvae with cryptic habits. This seems to be the best explanation for the reduction of antennae. The hypothesis assuming that hiding habits are plesiomorphic within the subfamily also agrees well with the existence of species with habits intermediate between free-living and typically hiding ones (e.g. *Decanematus*, *Pontania piliserra*).

The idea that this is an evolutionary tendency of the Nematinae biology does not contradict with the currently accepted phylogeny and classification of the subfamily. There is also a correlation between the biology of larvae and the structure of the female ovipositor. A rather long ovipositor with the radix of the lances not enlarged can be considered to be a plesiomorphic state, and is typical for most primitive groups and also for species with endophytous larvae (ZINOVJEV 1991). The structure of the saws suggests that species, such as *Amauronematus longiserra* (THOMSON) or *Nematus proteus* BENSON, should be endophytous, at least having "habit of ovipositing deep in tissues" (BENSON 1963). The larvae of the *longiserra*-group of *Amauronematus* are really endophytous in the earlier stage and free-feeding later (ZINOVJEV 1991). The larvae of *N. proteus* from N. E. Myanmar (Burma) are still unknown but this species is to be included in the gall-making genus *Pontania* according to the morphology of adults (ZINOVJEV 1996).

The same or closely related species of *longiserra*-group as well as many other Nematinae have been studied independently by AZ and VV. Therefore, we decided to prepare this paper jointly. We do not treat the species with typically free-living larvae and do not discuss questions concerning evolution and phylogeny of the Nematinae. The observations and experiments made by AZ refer to the material collected in St. Petersburg and Yekaterinburg Provinces as well as in the expeditions to Yakutia, Russian Far East and during the joint Finnish-Russian expeditions to Magadan (together with M. VIITASAARI, Helsinki).

The Nematinae with hiding habit larvae

1. Tribe Hoplocampini

This tribe consists of the two genera: *Hoplocampa* and *Caulocampus*. The larvae of *Hoplocampa* species bore inside the fruits of Rosaceae (Pomoidea and Prunoidea); they are typically endophytous, but can migrate from one fruit to another. The larvae of the Nearctic *Caulocampus acericaulis* MACGILLIVRAY mine in the leaf-petioles of *Acer*. The biology of the Palaearctic *C. necopinus* ZHELOCHOVTSEV is not yet known. This species may prove to belong to another genus of the same tribe, not yet described.

2. Tribe Pseudodineurini

All the genera of this tribe (*Pseudodineura*, *Endophytus*, and *Kerita*) are miners in leaves of Ranunculaceae and also of Boraginaceae (in North America). The larvae are more specialized morphologically than those of *Hoplocampa* but they still can move from one leaf to another in the laboratory and sometimes even in nature, as was observed by AZ.

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3. Tribe Pristolini

This tribe includes two Nearctic genera (*Pristola* and *Melastola*). The larvae of *P. macnabi* ROSS were reared from berries of *Vaccinium membranaceum* (WONG 1968). The Palaearctic genus *Bacconematus* with type-species *Pachynematus pumilio* KONOW should also belong to this tribe (ZINOVJEV in ZHELOCHOVTSEV 1988). The larvae of this species lives in berries of *Ribes nigrum* and sometimes probably of *Ribes uva*-crispa. They do not move from one berry to another, and the attacked berries are slightly enlarged. This species should be considered to be a gall-maker, and other species of this tribe might have the similar biology (ZINOVJEV 1991).

4. Tribe Nematini

This is the largest tribe and the most specialized one within the subfamily. It is subdivided into the three subtribes: Pristiphorina, Nematina, and Euurina (VIKBERG 1982). The last two subtribes are obviously more closely related.

4.1. Subtribe Nematina

Most species of this subtribe are free-feeding, including all species of *Nematus* (= *Pteronidea*), *Pikonema*, *Eitelius*, and *Pachynematus* (in restricted sense). Some small groups of Nematina occupy an intermediate position between the exo- and typically endophytous forms (*Decanematus*, *Pontopristia*, *longiserra*-group of *Amauronematus* and perhaps even *Polynematus* (= *Pachynematus rumicis*-group).

Decanematus MALAISE

Mature larvae of *Decanematus* (= *viduatus*-group of *Amauronematus*) can be found free-feeding on willow leaves, and some *Decanematus* species were reared just from these large, free-living larvae of the last instar. On early stages the sawflies live inside the developing buds of different *Salix* species (and closely related *Chosenia*) (Fig. 1) (ZINOVJEV 1982, 1991). Sometimes, for example in *Salix aurita*, the infected shoots are very similar to normal ones, but slightly smaller (because of retarded growth). The most common species of this genus, *D. viduatus* (ZETTERSTEDT), is possibly oligophagous but in N. Europe it is found mostly on *Salix myrsinifolia* (= *nigricans*). Infected shoots are very conspicuous, resembling those damaged by some Tortricidae larvae. However, the distortion of the shoot damaged by a sawfly is not caused by fastening leaves with silk, as caterpillars do it. The abnormal shape of the shoots is induced by females. Sometimes one can find such shoots even without larvae or with dead ones inside. The leaves of these shoots become thicker and firmer, therefore, these sawflies should be considered as gall-makers. The shoots damaged by *Decanematus* can be recognized even after the larvae finish their development: the leaves of infected shoots are usually somewhat folded up (Fig. 2). These observations were made by VV and AZ for many species, however, the first report was probably of an undetermined *Amauronematus* (LORENZ & KRAUS 1957: 202). The description of the larvae of "*Euura saliceti* (FALLÉN) var. *sibirica* Strog." (STROGANOVA 1985) might also be partly based on *Decanematus* larvae, though other features correspond to leaf-rolling *Pontania*. The photo of the *Decanematus* gall (assigned to *Phyllocolpa*) was also published by NAITO (1988: fig 13c).

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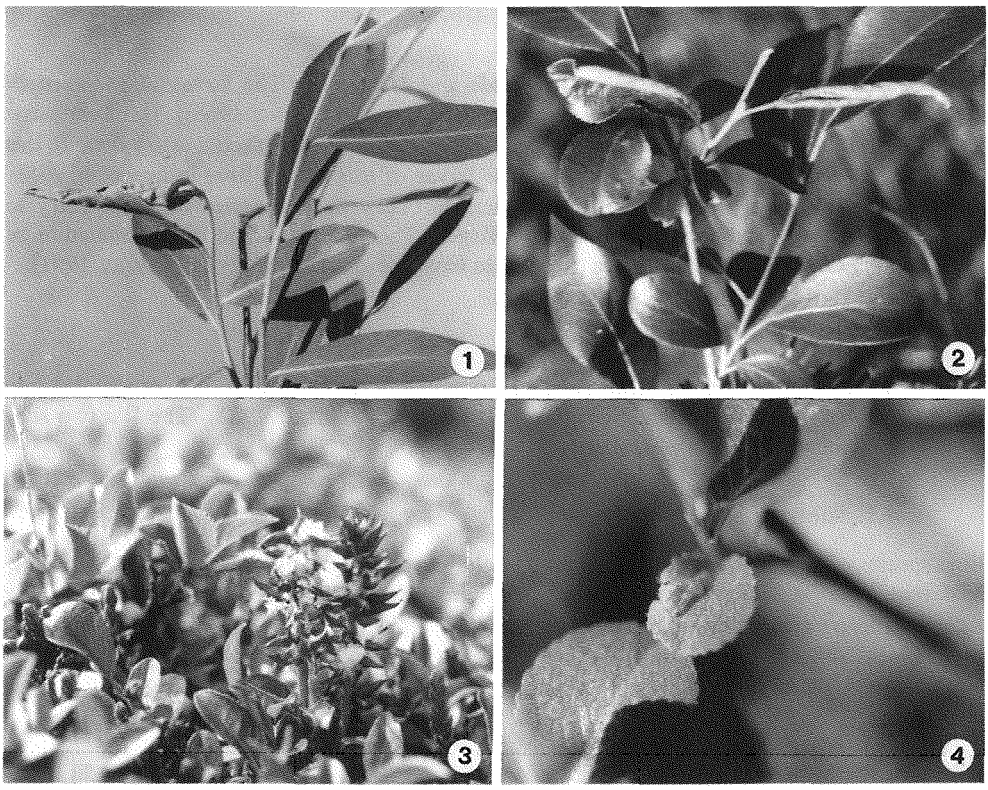

Fig. 1. The gall of *Decanematus* sp. on *Chosenia arbutifolia* (Middle Anadyr River). - **Fig. 2.** The rest of gall of *Decanematus* sp. on *Salix pseudopentandra*. (Yakutsk). - **Fig. 3.** *Salix tschuktschorum* with catkins damaged by larvae of *Pontopristia* sp. (Upper Kolyma River). - **Fig. 4.** The procecidium of *Amauronematus abnormis* HOLMGREN on *Salix herbacea* (egg laying in the laboratory).

Pontopristia MALAISE

This small genus is associated with willow catkins. The larvae have two different feeding habits. First, some larvae bore inside catkin stems, as was observed by VV for *P. analis* LINDQVIST on *S. lanata* in Finnish Lapland and later by AZ for an unidentified species on the far-eastern *Salix abscondita*, and also on some willows in Magadan Province (Upper Kolyma River) by A. ZINOVJEV and M. VIITASAARI. Second, in other species, larvae eat the inside of ovaries, crawling between ovaries and hiding under the wadding of the eaten seeds (Fig. 3). The similar feeding habit is known for species of *Egle* (Diptera, Anthomyiidae), although catkins infected by Diptera larvae can be distinguished by lack of excrements.

Polynematus ZHELOCHOVTSEV

Females of *Polynematus* (*Pachynematus rumicis*-group) are distinguished by shape of their ovipositor which resembles that of Pristolini. The larvae are associated with Polygonaceae (*Rumex* and *Polygonum*). Usually larvae crawl in the inflorescences, eating flowers or their buds, but sometimes they can be found free-feeding on the leaves. In contrast to the situation for *Pontopristia*, there is no wadding or any other cover for larvae, hence, they can be treated as almost typical free-living ones.

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Amauronematus longiserra-group

These rather large sawflies, with larvae living free on different *Salix* species are well known. Females are easily distinguished by long ovipositor resembling that of endophytous Nematinae such as Pseudodineurini and some *Pontania*. ZINOVJEV (1991) briefly discussed the biology of the group. The development was traced from the egg-laying stage of *A. eiteli* Saarinen on *Salix pentandra* in Finland (by VV, mostly in 1987 and afterwards) and also of a species on *Salix boganidensis* by AZ in the Upper Kolyma River (in 1987-1988). The biology of other species (*A. longiserra* (THOMSON) on *Salix aurita* and *S. caprea*, *A. neglectus* (KIRBY) on *Salix phylicifolia*, *A. abnormis* (HOLMGREN) on some arctic dwarf willows, and *A. longicauda* HELLÉN ovipositing in leaves of *Salix glauca* and *S. lanata*) was also examined. The eggs are laid into a large egg-pocket made by female under the epidermis of a young leaflet in a developing bud. There are usually several eggs (up to 4-5 or even 7 eggs in *A. neglectus*), but sometimes only one in a pocket. A few days after the egg-laying, a distinct swelling can be seen on the upper side of the leaf (Fig. 4). The structure of the upper layers of the leaf is changed. At the same time on the lower surface there is only a thin epidermis left. The procecidium[1] grows after the egg-laying and can be up to 7 mm long in *A. eiteli*.

When coming out of the egg, the larva makes a small round hole in the lower epidermis and moves to other young leaves. Through the semi-transparent lower epidermis of the egg pocket one can notice a few small excrements indicating that larva was feeding for a short time inside a mine-like procecidium (in the case of *A. eiteli* maybe 1 or even 2 days). The lower epidermis can break quite quickly (apparently because of the leaf growth), but the egg-laying trace on the upper surface of the leaf (which turns brownish while drying) is usually conspicuous even later on, when only large free-feeding larvae occur.

4.2. Subtribe Euurina

This subtribe includes two genera, *Euura* and *Pontania*, producing different galls on Salicaceae. Species of *Pontania* make galls on leaves (Figs 7b and c, 8 and 9) and those of *Euura* induce galls in central axial organs (Figs 5-6, 7a).

Euura NEWMAN

This genus appears to be much more diverse in N. America than in Eurasia; it was subdivided by E. L. SMITH (1968) into two subgenera: *Euura* s. str., making galls in stems, leaf-petioles or midrib of the leaves, and subgenus *Gemmura*, with species living in enlarged buds (Figs 5-6, 7a). The stem-galling species always pupate inside the galls (either with or without exit hole made by the larvae). Almost all other species leave galls before pupation. However, we found larvae overwintering inside the buds on *Salix lapponum*. Similar observations were done by HEIKKI ROININEN (personal communication). These larvae probably belong to *Euura lappo* MALAISE, a species distinct from the common *Euura mucronata* (HARTIG). Another northern species, *E. lanatae* MALAISE, also overwinters inside the galls (MALAISE 1920; rearings of E. O. PELTONEN and V. VIKBERG). In laboratory, the studied species of the subgenus *Gemmura* (*E. mucronata* and *E. laeta* (ZADDACH)) and petiole-galling *Euura* bore for the pupation into the soft wood. In nature cocoons of *Euura mucronata* were sometimes found in old dry galls of Cecidomyiidae.

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[1] Procecidia associated with the egg-pockets of the sawflies are known for other saw flies with free-living larvae (see e.g. BUHR 1964-1965).

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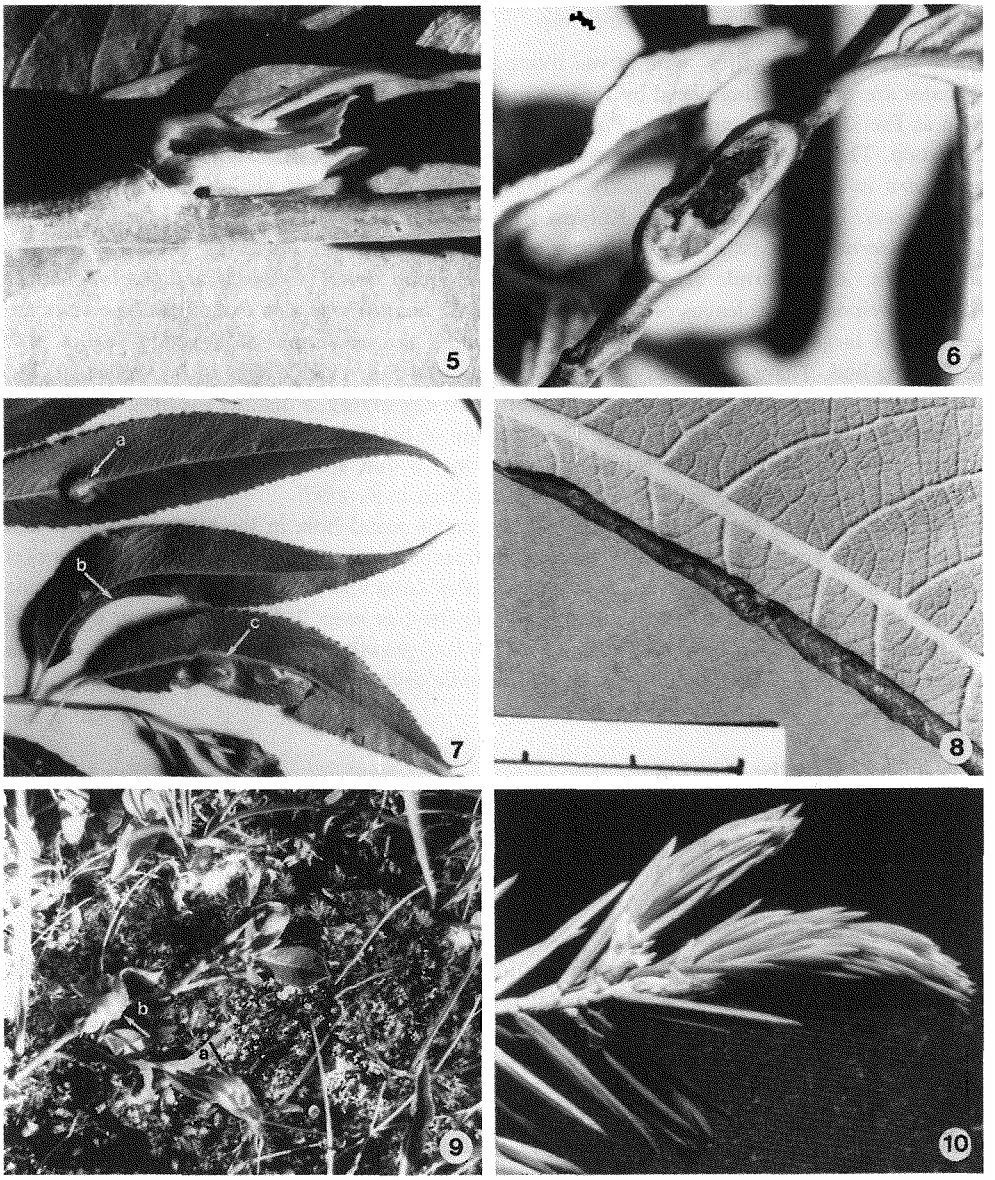

Fig. 5. The gall with exit hole of *Euura* (*Gemmura*) *mucronata* (HARTIG) in bud of *Salix daphnoides* (St. Petersburg Prov.). - **Fig. 6.** The dissected gall of *Euura* (s. str.) *atra* coll. on stem of *Salix lapponum* (River Volkhov in St. Petersburg Prov.). - **Fig. 7.** The gall of *Euura* (s. str.) *testaceipes* (ZADDACH) (on a midrib) (a), leaf roll of *Pontania* (*Phyllocolpa*) *leucapsis* (TISCHBEIN) (b) and gall of *Pontania* (s. str.) *proxima* (LEPELETIER) (c) on leaf of *Salix alba* x *S. fragilis* (St. Petersburg). - **Fig. 8.** The galls of *Pontania* (s. str.) *joergenseni* ENSLIN on *Salix caprea* (St. Petersburg Prov.). - **Fig. 9.** The elongated galls of *Pontania* (s. str.) *dolichura* coll. (a) and gall of *Pontania* (*Eupontania*) *polaris* coll. (b) *Salix fuscescens* (Arctic Yakutia, Tiksi). - **Fig. 10.** The buds of *Picea* damaged by the larva of *Sharliphora* (St. Petersburg Prov.).

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Pontania COSTA

The genus *Pontania* includes the so-called leaf-rollers (making open galls) and gall-makers (living in closed galls). BENSON (1960c) described a separate genus *Phyllocolpa* for the leaf-rolling *Pontania*, although he included in *Pontania* some species, that later proved to be leaf-rollers. In this paper the genus *Pontania* is divided into the three subgenera: *Phyllocolpa* (all the species are leaf-rollers), *Eupontania* ZINOVJEV (all the species are gall-makers), and the subgenus *Pontania* s.str. with one leaf-rolling group and two gall-maker groups (ZINOVJEV in ZHELOCHOVTSEV 1988, ZINOVJEV 1993b).

Subgenus *Phyllocolpa* BENSON

This subgenus is easily distinguished in females by acute shape of the sawsheath, that is probably related to their mode of gall formation. The biology of *P. acutiserra* LINDQVIST on *Salix lapponum* was traced by VV in N. Finland in 1968. *P. puella* (THOMSON) laying eggs on *Salix fragilis* (and once, under laboratory conditions, on *S. babylonica*) was examined by AZ in 1985. A few other species were studied by AZ. Gall incitation of the isolated *P. piliserra* (THOMSON) unfortunately is not yet examined. The egg-laying behavior of two undescribed species from North America and Japan were studied by FRITZ & NOBEL (1989), PRICE & OHGUSHI (1995), and their results were similar to ours.

In all the species of the *leucapsis*-group of *Phyllocolpa*, the process of laying an egg can be divided into three phases. 1. There is a period of initial examination of the bud using antennae and sawsheath with cerci. 2. Having chosen a suitable young leaflet of the slightly opened bud the female positions itself at one side of the leaflet midrib facing the bottom of the bud. It strains its abdomen and begins touching the surface of the leaf with the sharp apex of the sawsheath, making about 4-8 pricks in a row from near the midrib towards the edge of the leaf. Having made a few rows the female comes down the leaf making more pricks. Moving gradually that way it usually comes close to the base of the leaflet. As a result, a large section of the leaflet surface on one side of the midrib is affected. It takes 2-5 or even more than 10 minutes (as in *P. acutiserra*) to complete the whole procedure. 3. The female then lays one egg rather rapidly, sometimes moving towards the apex of the leaf (in examined species the egg is usually situated in the lower third of the leaf).
The affected surface of the leaf begins to fold down, sometimes by the next day. The larva comes out of the egg a few days later, after the gall (leaf-roll) has fully developed. Such galls can develop even without any egg-laying, and empty leaf-rolls are not uncommon in nature. Therefore, the inciting of leaf-rolls by *Phyllocolpa* is caused by females, and such rolls can be treated as true galls.

Subgenus *Pontania* s. str.

This subgenus includes 3 species-groups. The *crassispina*-group is leaf-rolling (Fig. 8), but morphologically these species are very similar to the gall-making species of the *dolichura*-group. BENSON (1960a) did not include most of them into *Phyllocolpa*. Instead he placed them into the *joergenseni*-group of *Pontania*.
We studied galls of all the described European species of the leaf-rolling *Pontania* s.str.: *P. purpureae* (CAMERON), *P. joergenseni* Enslin (not *joergenseni* sensu KOPELKE) (Fig. 8), *P. nudipectus* VIKBERG, *P. crassispina* (THOMSON), and *P. tuberculata* (BENSON). Some other species from the Far East were also examined by AZ. It was observed that at the place of egg-

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laying a small swelling was incited, very similar to that made by the *Amauronematus longiserra*-group. (Sometimes these vestigial procecidia are either inconspicuous or missing on a rolled leaf when larva is mature). In the more thoroughly examined *P. purpureae* and *P. nudipectus* a few excrements were also found inside these mine-like vestigial galls.

Egg-laying was observed only in a few cases. Just after the period of initial examination, the female begins to lay an egg, but, in comparison with *Phyllocolpa*, the ovipositing time is much longer (up to 5-8 minutes). There is no doubt that procecidia at the place of egg-laying are induced by female; it is not clear, however, what is the cause of leaflet rolling. One can assume that it is either incited by female or maybe also by the activity of larva (or else by a stimulus from the egg).

The rest of the *Pontania* species (*dolichura*- and *proxima*-groups) make closed galls. The biology of these groups as well as of the other gall-making *Pontania* is well-known (CARLETON 1939, CALTAGIRONE 1964, BENEŠ 1968, SMITH 1970, KOPELKE 1985a, 1985b, ZINOVJEV 1993a, etc.). As for egg-laying, one can mention that in the *dolichura*-group and sometimes in the *proxima*-group, the female inserts its ovipositor through the midrib of the leaflet, although the galls do not normally involve the midrib. (In the leaf-rolling *Pontania* the eggs are always situated on the leaf-surface away from the midrib). The elongated gall form in most of the *dolichura*-group species (Fig. 9a) is accounted for the behaviour of female. It inserts its ovipositor into the leaf parenchyme a few times, although it always lays only one egg.

Subgenus *Eupontania* ZINOVJEV

All of the species from this subgenus are gall-makers (Fig. 9b). Their galls differ histologically from those of *Pontania* s. str. by missing the inner green layer; they are associated with the midrib, occasionally with the largest veins (ZINOVJEV 1985, 1993b). The larvae of *Eupontania* always come out of the eggs at the time when galls are still small and not fully developed. Parasitized galls or those with dead larvae are usually smaller than normal ones (probably excluding those of the *relictana*-group and also Nearctic species close to *P. pacifica* MARLATT). It is evident, that the development and growth of the galls are caused successively by females and then by larvae. On the contrary, in the subgenus *Pontania* the galls of *dolichura*- and *proxima*-groups are fully grown at the time of larval eclosion. Besides, mature galls of *Pontania* s. str. without eggs or larvae can be found quite frequently; these galls are incited only by females through the injection of the collaterial fluid during egg-laying.

4.3. Subtribe Pristiphorina

The species of this subtribe are associated with either Angiospermae or Gymnospermae. Most of them are free-feeding, except the small genera *Sharliphora* and *Micronematus*.

Sharliphora WONG

The larva lives inside a developing buds of *Picea* (or *Abies*), fastening together the needles at bud apex with the secretion of its spinning glands (Fig. 10) (BENEŠ, VIITASAARI & VIKBERG 1981, GREBENSCHIKOVA 1986). It looks unusual that the same silky secretion is utilized both by larvae for fastening needles during the feeding period and by prepupae for making cocoons. These species are not gall-making, and they do not move from one bud to another, in contrast to the mining species of *Hoplocampa* and *Pseudodineura*.

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Micronematus KONOW

The larvae of the single known *Micronematus* species (*M. monogyniae* (HARTIG)) feed under the leaf margin of *Prunus spinosa*, like *Phyllocolpa* species. If the leaf-rolling of *Prunus* is really caused by the egg-laying of the female (LORENZ & KRAUS 1957), then *M. monogyniae* should be also considered as a gall-maker.

Pristiphora KONOW

It was mentioned earlier (ZINOVJEV 1982), that larvae of *Pristiphora angulata* LINDQVIST occupy somewhat intermediate position between free-living and endophytous forms. Nevertheless, they should be rather treated as free-living. The place of egg-laying is typical for free-living Nematinae: the eggs are laid under the epidermis of flower bud sepals or more rarely into the leaves (if flower buds are not available). Larvae can feed freely on the leaves, but obviously they prefer flower buds. In this case, the first instar larva makes a hole inside the bud when eating its content; only the end of the larval abdomen is visible outside the bud.

4.4. The genera *Nepionema* BENSON and *Neopareophora* MACGILLIVRAY

The placement of both *Nepionema* and *Neopareophora* is not clear. Probably they do not belong to Dineurini because of the mandibles typical for higher Nematinae. The premature stages in *Nepionema* are still unknown, but the shape of the ovipositor may indicate the possibility of hiding habit of the larvae, for instance similar to that of *Decanematus*. This assumption is also in the accordance with the supposed (BENSON 1960b, SMITH 1994) close relationships between *Nepionema* and *Neopareophora*. First instar larvae of the Nearctic *Neopareophora* develop in buds of *Vaccinium* (NEILSON 1958). Adults of *Nepionema helvetica* BENSON flying near *Rhododendron* were captured in the Alps. Nevertheless, no signs of the ovipositing or presence of Nematinae larvae on *Rhododendron* are known in Europe (BENSON 1961, observations made by M. VIITASAARI and V. VIKBERG in 1972). The second species of this genus described recently from E. North America, *N. appalachiana* SMITH, was collected in early spring in a habitat, where *Rhododendron* was also present (SMITH 1994).

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Besprechungen

Waldlebensräume in Deutschland: Ein Leitfaden zur Erfassung und Beurteilung von Waldbiotopen: Mit einer Übersicht der natürlichen Waldgesellschaften Deutschlands / Arbeitskreis Forstliche Landespflege (Hrsg.). - Landsberg a. L.: Ecomed Verlagsgesellschaft, 1996. - 124 S.: 25 Abb., 6 Tab. 5 Anh. - 48.- DM

Das Buch widmet sich der zunehmenden Bedeutung von Naturschutzfragen im Wald. Die Themen umfassen zum einen die Registrierung und den Schutz seltener bzw. geschützter Biotope und zum anderen Fragen nach der Naturnähe und Biodiversität der Wälder. Das Ziel des Werkes besteht darin, diese Fragen im Rahmen eines Leitfadens als Planungshilfe für die forstliche Praxis der Waldfunktionenplanung zu beantworten. Es wird versucht, die in Deutschland vorhandenen Verfahren zur Erfassung von seltenen und gefährdeten Biotopen zusammenfassend darzustellen. Außerdem werden Verfahren erörtert, die die Bedeutung der gesamten Waldfläche (also auch die nicht geschützten oder schutzwürdigen Gebiete) für den Natur- und Artenschutz erfassen können. Hierbei wird unter Zugrundelegung naturschutzplanerischer Bewertungskriterien die Bedeutung der einzelnen Flächen ermittelt. Dargestellt werden in diesem Zusammenhang zum einen die selektive Waldbiotopkartierung, die schützenswerte Biotope erfaßt, und zum anderen die flächendeckende Waldbiotopkartierung zur Würdigung der Naturschutzbedeutsamkeit der Wälder. - Außerdem werden die Verfahrensabläufe kurz vorgeführt, Fragen der Kartierung und der Datenerfassung angerissen und Bezüge zu anderen Planungen hergestellt. - Als Grundlage zur Herleitung der Naturnähe wird eine Übersicht der natürlichen Waldgesellschaften Deutschlands gegeben. Im Anhangwerden diese Waldgesellschaften kurz beschrieben.
Das Buch soll für die Erfassung und Darstellung von "Naturschutzleistungen der Wälder" einen bundesweit abgesteckten fachlichen Rahmen schaffen und diese sachlich begleiten und fördern. Es ist ein hilfreiches Werkzeug für forstliche und naturschutzrelevante Planungen.

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