Trichiosoma nanae sp. n., a monophag on *Betula nana* from Finland (Hymenoptera, Cimbicidae)

Veli Vikberg & Matti Viitasaari

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Trichiosoma nanae sp. n. is described from Finland. The species occurs in pine bogs, where the host plant of the larva, *Betula nana* Linnaeus grows. Records are given on its distribution in Finland. The thin cocoons, usually situated near the apex of twigs of the host plant, are frequently attacked by birds. Eight species of Ichneumonidae and one species of Torymidae (Hymenoptera) have been reared from cocoons, of which about 30 percent are parasitized. The three most common parasitoids are *Agrothereutes mandator* (Linnaeus), *Rhorus mesoxanthus* (Gravenhorst) and *Protarchus testatorius* (Thunberg).

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1. Introduction

Author VV started in 1967 a study on the sawfly fauna of the dwarf birch (*Betula nana* Linnaeus) in Northern Karelia, eastern Finland. Soon it became evident that there is a species of *Trichiosoma* Leach specialized on that plant. This species appeared new to the Finnish fauna. Observations were made on the parasitoids and predators of the species. The predators and parasitoids of eggs were not studied. The predators of larvae were not studied. Of larval parasitoids only those emerging from the cocoon were studied and observed.

Author MV has studied the available types of several species of *Trichiosoma* from the Holarctic area, in order to resolve the taxonomy of *Trichiosoma*. It become apparent thet the species feeding on *Betula nana* is undescribed and it is now described in this co-authored paper.

We dedicate this paper to the memory of Dr. Viljo J. Karvonen (1901–1989), a sharp-eyed Finnish amateur entomologist. He collected and studied many groups of Hymenoptera. For example, the first specimen of *Trichiosoma* on *Betula nana* was reared by him at Pudasjärvi (*Ob*) as long ago as 1916! Finland was then a part of Russia.

2. Material and methods

Observations on the new species were made in different parts of Finland, in 1967–1974 mainly in Northern Karelia, *Kb*: Kontiolahti in pine bogs near Selkie (Linnunsuo, Grid 27°E 6950:655–6), Venejoki (6984:643) and Romppala (6987:641), and to a longer extent in other parts of Northern Karelia; and in 1975–1990 in South Häme, *Ta*: Janakkala in the bogs Suurisuo (676:38) and Raimansuo (676:36).

The pale brown cocoons of the species situated on the distal part of the twigs of *Betula nana* are easily seen when the leaves have fallen in

autumn and in spring when the snow has melted. They were collected mostly in April and May and were brought indoors for the rearing of adults and parasitoids. At Janakkala old cocoons were also collected in order to elucidate what percentage of them was destroyed by birds, or attacked by parasitoids, etc.

Later in the season (at the end of May and the beginning of June) adults were observed and captured in marshy areas where the host plant was growing. In June, July and August larvae were collected on *Betula nana* by eye or sweepnet.

Genitalia and saws were prepared from relaxed specimens and mounted in water/glycerol between a slide and a cover slip. The drawings were made with the aid of a microscope drawing tubus.

Specimens of *Trichiosoma* were examined in the collections (= in coll.) of the Zoological Museum, University of Helsinki; of the Department of Agricultural and Forest Zoology (including those of A. Saarinen, T. Grönblom and V. J. Karvonen), University of Helsinki; of the Zoological Institute, Academy of Sciences, Leningrad; and of the Zoological Museum, University of Moscow; and in the private collections of J. K. Kangas, Pälkäne, H. Luoma, Myllykoski, M. Viitasaari (MV), Helsinki, V. Vikberg (VV) and A. Vuorinen, Turenki. Some specimens were received by courtesy of Mr. M. Vuola, Kaskinen.

3. Taxonomic description

Trichiosoma nanae sp. n.

Type material: Holotype female: Finland, *Ta*: Janakkala, Suurisuo, 676:38 17.4.1978 cocoon "o" on *Betula nana*, emerged 26.4.1978 (V. Vikberg). Deposited in coll. Department of Agricultural and Forest Zoology, University of Helsinki. Type locality: Finland, *Ta*: Janakkala, Suurisuo, Lat. 60° 59' N, Long. 24° 49' E, an open area with *Betula nana* vegetation on a pine bog, elevation above sea level approx. 130 m.

Paratypes (83♀♀ 93♂♂) from Finland: *Ab*: Vahto (1 specimen). *N*: Pyhtää (1 locality, 3 specimens). *Ka*: Anjalankoski (4 localities, 11 spec.). *Ta*: Janakkala (6 loc., 89 spec.); Hämeenlinna (1 loc., 6 spec.). *Kb*: Tuupovaara (1 spec.); Kontiolahti (5 loc., 42 spec.); Juuka (1 loc., 2 spec.); Lieksa (1 loc., 2 spec.); Ilomantsi (2 loc., 3 spec.). *Om*: Ruukki (1 spec.). *Ok*: Paltamo (1 spec.). *Ob*: Utajärvi (1 spec.); Kiiminki (1 spec.); Pudasjärvi (1 spec.). *Lk*: Pelkosenniemi (1 spec.); Sodankylä (1 spec.).

Most of the paratypes were reared from cocoons on *Betula nana*, 7 females were reared from larvae on *Betula nana* in *Kb*. 8 females and 20 males were captured in the wild. Almost all specimens were obtained during 1967–1990. There are only 4 previous records, from the years 1916, 1949, 1954 and 1965.

Paratypes are deposited in the Zoological Museum, University of Helsinki; in the Department of Agricultural and Forest Zoology, University of Helsinki; in the British Museum (Natural History); in the Zoological Institute, Academy of Sciences, Leningrad; in coll. J. Kangas, Pälkäne, Finland; in coll. H. Luoma, Myllykoski, Finland; in coll. M. Viitasaari, Helsinki, Finland and in coll. V. Vikberg and in coll. A. Vuorinen, Turenki, Finland.

The specific name *nanae* is based on that of the host plant of the species, *Betula nana* Linnaeus.

Female (Fig. 1a, c, d, e)

Length of body 13–15 mm. Length of fore wing 15–17 mm.

Head black. Apical half of mandible and ocelli amber red. Apical segments of palpi piceous. Antenna (Fig. 1a) black, reddish brown at the apex of 3rd segment, entire 4th segment, and 5th segment except apically. Head with long, black hairs, some hairs pale apically. Postocellar area coriaceous, dull or almost smooth, punctured, slightly convex. Form of clypeus: Fig. 1c.

Thorax black, coxae and trochanters black, femora bluish black, tibiae yellowish brown, tarsi brownish yellow. Wings clearly yellowish. Tegulae, axillary sclerites, humeral plate and median plate black. Costa reddish yellow, Sc+R brownish yellow, M+Cu1 brownish. Pterostigma and veins on remigium brownish black, veins on vannus yellowish brown. Brownish infuscation in cells 1R1+1RS, 1M and 2M+Cu1, apical margin of fore wing infuscate.

Mesoscutum punctured, smooth, medial margin of lateral lobe coriaceous, with long, black, apically pale hairs. Mesoscutellum punctured, shiny, medially with shallow longitudinal depression, apically with dense puncturation, with transverse striate-coriaceous sculpture. Post-

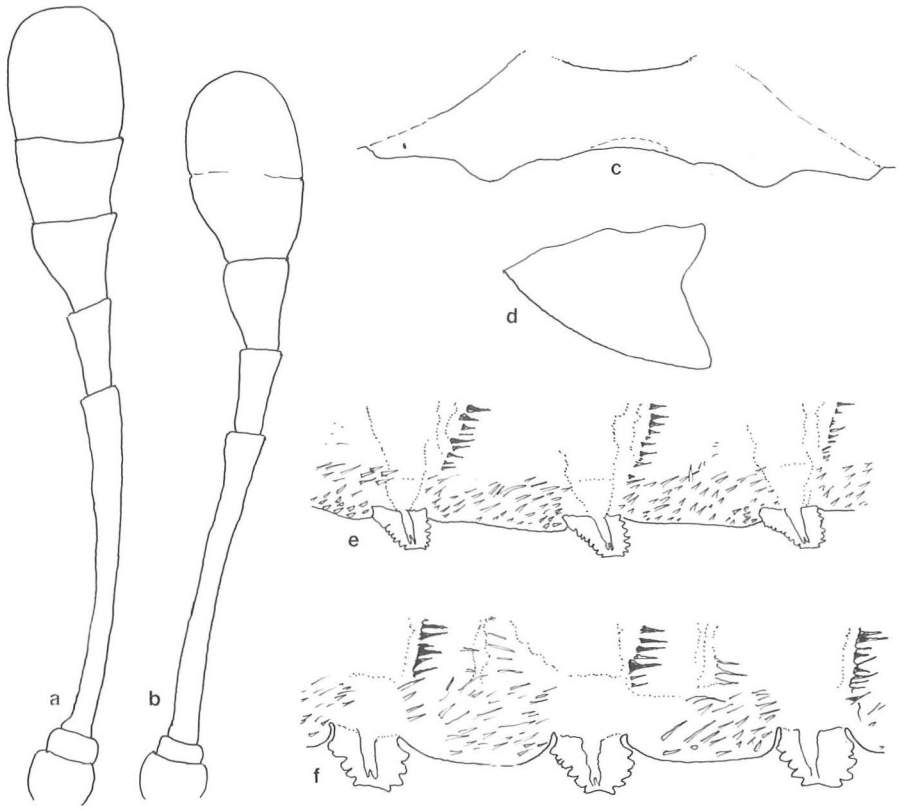

Fig. 1. *Trichiosoma*, female. — a, c–e: *T. nanae* sp. n.; b, f: *T. nigricoma*. — a–b: Antenna. c: Clypeus. d: Postspiracular sclerite. e–f: saw teeth 15–17 counted from apex of lamnium (outer surface, apex to the left).

spiracular sclerite (Fig. 1d) fairly broad. Central part of mesopleurae with strong, dense punctuation, interspaces between punctures narrow and slightly irregular.

Abdomen black with lateral margin of 8th tergite narrowly yellowish red brown, epipleurae of tergite 9, cerci and saw sheath yellowish red to dark red, epipleurae sometimes infuscate, rarely black. Tergite 1 entirely with long, dark, apically pale hairs, tergite 2 medially broadly, 3 medially with some and 4th medially with few long hairs. From tergite 4 on abdomen covered with short, black pubescence, on lateral parts of tergites 5–6 the pubescence shortest, on tergites 7–8 the pubescence slightly longer. Tergites 2 and 3 with an almost glabrous area outside the medial long hairs, laterotergites of all segments with long hairs.

The sculpture on tergites dense coriaceous, matt, with indistinct small punctures. tergite 1 more shining, with slightly stronger punctures, tergite 8 more shining than the others.

Structure of lamnium as in the *T. tibiale* group (see Viitasaari 1989) in general: Saw tooth evenly narrowing towards its apex. Base of saw tooth prolonged towards apexof the lamnium. Serrulae short. Distance between two saw teeth (behind the 15th saw tooth from apex) more than twice as long as greatest breadth of a saw tooth (Fig. 1e).

Measurements (in mm) of the type specimen: Head width 4.50, thorax width 6.50, 3rd antennal segment length 2.00, 4th antennal segment length 0.50, antennal club length 1.64, malar space 0.57, distance between proximal margins of antennal sockets 0.50, distance between antennal socket and inner orbit 0.40, vertex (length × width) 1.21 × 1.14, eye (shortest diameter × longest diameter) 1.07 × 2.04, POL: OOL = 1.03, POL: OCL = 0.46, hind femur length × breadth 3.85 × 1.15, hind tibia length 5.00, hind basitarsus length 1.15.

Variation. The colour of epipleurae can be reddish brown to black, in specimens reared at room temperature it is usually brown, in specimens reared outdoors or captured in the wild it is usually at least almost black. Apparently the temperature during the pupation period is decisive to the colour production and higher temperature favours the paler colouration.

Male (Fig. 2)

Length of body 13–19 mm, length of fore wing 13–18.5 mm. Breadth of head 3.8–6.5 mm. Mandibles large, up to 4.5 mm long, labrum large, up to 4.5 × 4.5 mm. Occipital carina ending ventrally in a long, acute tooth behind and mediad of mandibular condyle. Hind femur in small specimens thin (height 1.05 mm), stronger in large specimens (height 1.75 mm). Inner side of mid coxa with 2(–3), that of hind coxa with 1(–2) toothlike protuberances.

Abdomen more slender and with longer hairs than in female. Tergites 3–8 laterally with dark red spots; laterotergites, sternites and hypopygium dark red. A smooth area in median part of tergites 7–8 with hairs directed forward.

Penis valve (Fig. 2d) with valvura rather short, the dark sclerotized area ending close to the end of the valvura. Valviceps rather narrow.

Measurements (in mm) of one specimen (*Ka*: Anjalankoski, Vehkaojansuo from cocoon on *B. nana* 1973 (MV)): Length 17.3, length of fore wing 16.2, head width 5.85, thorax width 6.35, 3rd antennal segment length 2.33, 4th segment length 0.57, antennal club length 2.00, malar space 0.67, distance between proximal margins of antennal sockets 0.49,distance between antennal socket and inner orbit 0.29, vertex (length × width) 1.50 × 1.40, eye 2.34 × 1.47, POL: OOL = 1.06, POL: OCL = 0.34, hind femur length × width 4.90 × 2.0, length of hind tibia 6.40, length of hind basitarsus 1.45.

Diagnostic characters

The new species belongs to the same species group as *T. tibiale* Stephens. In this group the saw teeth narrow fairly evenly towards their apex.

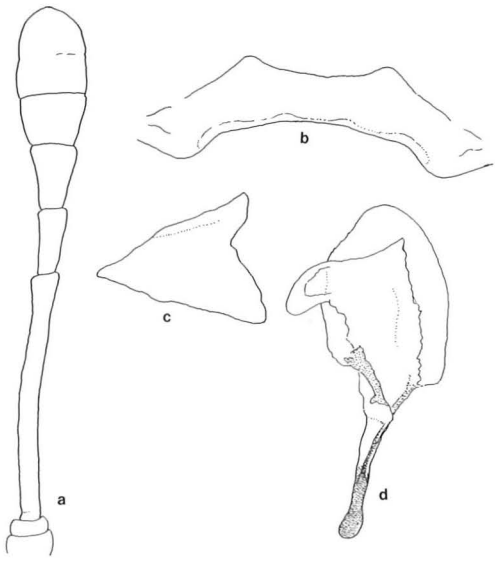

Fig. 2. *Trichiosoma nanae* sp. n., male. — a: Antenna. b: Clypeus. c: Postspiracular sclerite. d: Penis

The base of a saw tooth is often prolonged towards the apex of the saw. The serrulae are short. The distance between two saw teeth is clearly longer than greatest breadth of a saw tooth. At least the females have the abdominal fur mainly dark. The body is completely black, or the abdomen is with at least fading brownish or reddish brown pattern. The species most resembling the new species in this group are *T. tibiale* Stephens, 1835, *T. pusillum* Stephens, 1835 (= *T. nigripes* Gussakovskii, 1935) and *T. nigricoma* Konow, 1905.

The female of *T. nanae* sp. n. can be distinguished from the other at least almost entirely black, mainly dark haired species of the complex by the following characters:

Hind tibiae yellowish red to brown, dark at extreme base only. Epipleurae of tergite 9 often yellowish red to dark red. Abdomen may be completely black. Pubescence of dorsum of abdomen mainly dark, dense and fairly long. In basal part of abdomen apical part of hairs commonly pale. Segment 5 of antenna dilates strongly towards apex (Fig. 1a; *T. nigricoma:* Fig. 1b). Saw teeth narrowing evenly towards their apex (Fig. 1e; *T. nigricoma*: Fig. 1f), distance between two saw

teeth more than twice as long as breadth of saw tooth.

The male of the new species can be distinguished from the other species of the group by its dark haired abdomen, with the pubescence short at the sides of the dorsum of the basal part of the abdomen, and by the reddish brown margins of the apical part of the dorsum. The genital capsule shows no recognizable distinguishing characters.

In Finland all known females of *T. tibiale* have dark hind tibiae, but all known males have hind tibiae pale reddish brown. The male of *T. tibiale* closely resembles the male of *T. lucorum* (Linnaeus, 1758).

4. Biology and development

4.1. Phenology

The adults occur only in open marshy areas with *Betula nana*. The flight period is obviously rather short, and only 8 ♀♀ and 20 ♂♂ have been observed or captured in the wild.

In southern Finland the flight period is the second half of May; most specimens were captured between 20.5.–30.5. In the exceptionally warm spring of 1990 the flight started as early as May 5th. In northern Finland the few specimens found have been captured in the first half of June.

The species flies on sunny days or in otherwise warm weather near the ground, usually under 1 m high. The males appear to have their own territories which they guard by sitting low on Scots pines (*Pinus sylvestris*) or dwarf birches.

The species is rare in, or missing from, old collections, because its flight period occurs on bogs in early summer and lasts only a week or 10 days.

4.2. Life cycle and reproduction

There is one generation per year. The species overwinters as an eonymph in the cocoon. The adults emerge the next year; no emergence after two or more winters has been observed. The peak of emergence of males from cocoons collected on 31.3.–28.4. and brought to room temperature was on the 8th–9th day, and of females on the 9th–10th day.

The sex ratio (males: females) appears to be 1:1 :of 210 intact fresh cocoons collected in late October–November and March–May 70 males and 70 females of *T. nanae* emerged. 62 cocoons (30 percent) were parasitized.

In order to study the biology of the species, the females were observed in the wild and two ovipositiong experiments were carried out with captured or reared females in Kontiolahti (*Kb*) and Janakkala, Raimansuo (*Ta*) by author VV. Copulation: copulation was never observed in the wild nor was it possible to induce copulation in captivity with reared males and females.

Ovipositing was once observed in the wild (Janakkala, Raimansuo) and the behaviour of females was observed during the experiments indoors.

Ovipositing habits: the female feels the leaf with her antennae and mouthparts, the abdomen is curled and the saw is inserted on the upper side of the leaf near the leaf margin. The egg is secreted inside the leaf and bulges on the upper surface. Three ovipositings lasted 2 min 10 s, 2 min 30 s and 2 min 30 s respectively.

The newly laid egg is 2.2 × 1.0 mm, pale green. When inside the leaf the size is about 2.5 × 1.7 mm, with one side rather straight and one rounded. Usually one egg per leaf, sometimes 2 eggs per leaf near opposite margins or side by side. At a room temperature of 21–24°C the egg period lasted 7–8 days.

4.3. Larva

At a room temperature of 21–24°C the first larval instar lasted 4–5 days, the 2nd 4–5 days, the 3rd 5–6 days and the 4th 7–8 days. The 5th instar larva feeds for a much longer period: 18 days (indoors), 20–24 days (partly indoors, partly outdoors) to 30 days or more in the wild.

The larval instars can be best separated by measuring the width of the head capsule or of the frontal plate (in mm):

instar	head capsule	frontal plate
1	1.2–1.3	0.50–0.51
2	1.6–1.8	0.71–0.75
3	2.3–2.5	0.91–1.03
4	3.2–3.6	1.25–1.35
5	3.8–4.3	1.5 – 1.8

The width of the frontal plate was found useful because it can be used for comparisons when measuring moulted larval skins, as well as the last larval skin inside the cocoon.

The larva feeds on *Betula nana*. In the daytime the larvae mostly hide on the lower surface of leaves in a coiled position. Feeding consists of eating the leaf margin, the leaves of the annual shoots being preferred. All instars before the last one are covered with whitish powder.

At Kontiolahti, Venejoki and Selkie the first larvae were swept at the end of June (e.g. 22–24.6.1969 and 26–29.6.1969). There is no additional moult before the cocoon is made. In the wild full grown larvae can be found at the end of July and beginning of August.

Description of the last larval stage, based on larvae found in the wild: Length of body 25–30 mm, length of body of inflated larvae (= maximal extension) 30–42 mm. Width of head capsule 3.70–3.85 mm (7 larvae, one larva 4.00 mm). Width of frontal plate 1.5–1.6 mm (7 larvae), 1.75 mm (one larva). Head greenish yellow. Vertex and temples with a large orange area which is blackish brown in its posterior-most parts. The pigmented area interrupted in midline and narrowed near lateral furrows. Frontal plate green, pale.

Body yellowish green, the fat spots in the living larva pale yellow to yellow. Stigmae chocolate brown, above them a blackish brown, arched opening of gland. Abdominal segment 3 with 7 annulets; 2, 4 and 7 with fine pale setae. Anal tergite yellowish green, rounded posteriorly, medially with bluish white fat area widening caudally, lateral part of fat area with yellowish fat spots.

The number of larval stages of the male in ex ovo rearing was five. The larvae hatched from unfertilized eggs. In order to find out if the female and male have the same or a different number of larval instars, the four last larval skins in cocoons of either sex were examined. Small, medium and large specimens were selected, the head width of females studied varied between 3.3–4.4 mm and that of males 3.9–6.3 mm. The width of the frontal plate of female larvae was between 1.50–1.69 mm and of male larvae 1.48–1.70 mm. This seems to indicate that the female and the male have the same number of larval instars.

As a comparison *Trichiosoma asachalinense* Verzhutskii, 1973 has seven larval stages: the last larval instar is about 27–32 mm long, with the diameter of the head capsule 4.1–4.3 mm (Verzhutskii 1981). In an ex ovo rearing (*Sa*: Mäntyharju, 681:49) of *Cimbex luteus* (Linnaeus, 1758) by Mr. Erkki O. Peltonen, a female reared ex larva laid eggs without copulation. The larvae had six instars, and all imagines emerging were males.

4.4. Cocoon

The eonymph spins a cocoon near the apex of the host plant. The cocoon is pale brown to reddish brown, thinner than in those of other species of *Trichiosoma* that frequently spin their cocoon on twigs (*T. lucorum* and *T. tibiale*). The cocoon is 14–19 × 7–11 mm, often irregularly formed, slightly transparent and rather soft (easily compressed between the fingers). The fresh cocoon is usually situated on an annual shoot, 1–9 cm from the apex; some are situated far away (10–17 cm) from it. Most cocoons are parallel or subparallel to the twig, but some lie at a more obtuse angle to it. Occasional cocoons lie perpendicularly to the shoot. Some cocoons are made on other plants growing near the host plant, e.g. *Calluna vulgaris* (L.) Hull, *Myrica gale* L. and *Chamaedaphne calyculata* (L.) Moench. Sometimes the larva of *T. lucorum* feeding on *Betula pubescens* Ehrh. on a bog will form its cocoon on *B. nana*, but the cocoon in this case is darker and harder, not at all transparent.

5. Distribution

The localities where the adults, larvae and/or cocoons have been found are shown on the UTM map (Fig. 3). The modified UTM system adopted by Heikinheimo & Raatikainen (1981) was used. A more detailed map of this modified system can be found at the Department of Entomology, Zoological Museum, University of Helsinki.

The communes where adult captures were made were mentioned earlier. In addition only larvae or cocoons of the species on *Betula nana* have been found in the following localities in Finland: *Oa*: Töysä (1 larva). *Sb*: Varpaisjärvi (1

cocoon). *Om*: Alajärvi (1 cocoon); Perho (larvae); Pyhäntä (larvae). *Ok*: Kuhmo, Kiekinkoski (1 cocoon). *Ob*: Tornio, Kalkkimaa (cocoons).

So far the species has been recorded only from Finland. The most records come from southern, eastern and central Finland, but some are from the northern part of the country. No record is known from northernmost Lapland.

The distribution pattern in Finland suggests that the species perhaps belongs to the eastern component of the Finnish sawfly fauna (Vikberg 1988) but so far there are no records from European USSR or Siberia. The host plant *Betula nana* has a northern distribution and extends to the east over northern Russia to the Yenisey area in Siberia. Further East it is replaced by other closely related species.

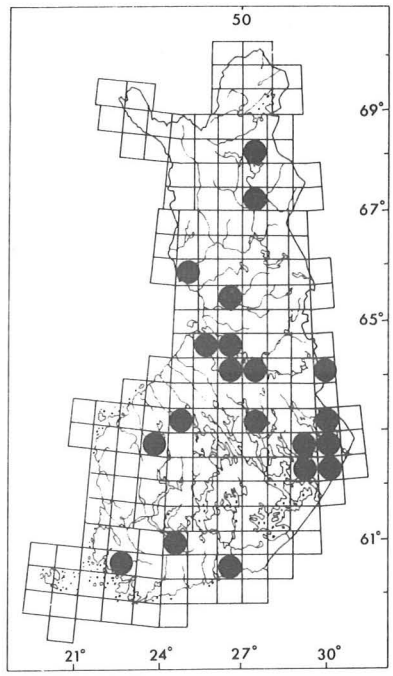

Fig. 3. Distribution (UTM, modified, see p. 72) of *Trichiosoma nanae* sp. n.

6. Parasitoids

6.1. Parasitoids of larvae

Rhorus mesoxanthus (Gravenhorst, 1829)
(Ichneumonidae, Ctenopelmatinae, Pionini)

15 females and 9 males were reared from cocoons of *Trichiosoma nanae* on *Betula nana* in: *Ta*: Janakkala (2 loc.). *Kb*: Kontiolahti (3 loc.); Ilomantsi (1 loc.); Tuupovaara (1 loc.) by VV. One specimen of the parasitoid emerged from each cocoon of the host (= solitary parasitoid). Of the 186 fresh intact cocoons collected in March–May 24 cocoons (11 percent) were parasitized by *R. mesoxanthus*.

A parasitoid of *Cimbex* and *Trichiosoma*.

Distribution: Western Europe, Poland, N.W. Europe. USSR: Leningrad region, Southern Siberia, Kamtchatka.

Literature: Townes, Momoi & Townes 1965; Kasparyan 1981.

Protarchus testatorius (Thunberg, 1822)
(Ichneumonidae, Ctenopelmatinae, Mesoleiini)

12 females of this parasitoid were reared from cocoons of *T. nanae* in: *Ta*: Janakkala (2 loc.). *Kb*: Kontiolahti (2 loc.) and Juuka (1 loc.) by VV. In addition an almost fully developed specimen was killed in *N*: Pyhtää by *Itoplectis viduata* (recorded by H. Luoma).

Solitary parasitoid.

Of the 186 fresh intact cocoons collected in March–May 12 cocoons (6 percent) were parasitized by *P. testatorius*.

A parasitoid of *Cimbex* and *Trichiosoma* (Cimbicidae); in Finland recorded only as a parasitoid of *Trichiosoma* (Viitasaari 1979).

Distribution: In Finland in the whole country, only females have been seen (Viitasaari 1979), Sweden, Sakhalin, Korea.

Literature: Kasparyan 1981.

Olesicampe Förster, 1868 sp.
(Ichneumonidae, Campopleginae, Limneriini)

Kb: Kontiolahti, Romppala, 698:64, 3♀♀ 2♂♂ together with 10♂♂ of *Mesochorus* sp. from cocoon on *B. nana* 1969 (VV).

Species of *Olesicampe* are known as parasitoids of sawflies. We do not know if any of them has been recorded from species of *Trichiosoma*.

6.2. Parasitoids and hyperparasitoids of eonymphs and prepupae

Agrothereutes mandator (Linnaeus, 1758)
(Ichneumonidae, Phygadeuontinae, Mesostenini)

82 females and 146 males of the parasitoid were reared from cocoons of *T. nanae* in: *Ka*: Anjalankoski (1 loc.). *Ta*: Janakkala (1 loc.). *Kb*: Kontiolahti (2 loc.), Ilomantsi (1 loc.). The number of specimens from one cocoon varied from 1 male to 44 males (sic, small specimens). The usual number was from 6 to 22 of both sexes, the mean about 9 specimens.

Of the 186 cocoons collected in March–May 21 (11 percent) were parasitized by *A. mandator*.

A well known gregarious parasitoid in cocoons of *Trichisoma lucorum* (Oehlke 1965). Distribution: Europe: British Isles, Germany, Sweden, Finland. Not mentioned from Eastern Palaearctic area (Townes et al. 1965). In North America represented by a different subspecies, *A. mandator americanus* Townes (Townes & Townes 1962).

Gelis areator (Panzer, 1804)
(Ichneumonidae, Phygadeuontinae, Phygadeuontini)

Kb: Kontiolahti, Venejoki, ♀ together with 9♀♀ 5♂♂ of *Agrothereutes mandator* from cocoon on *B. nana* 1973 (VV).

The species was identified using the key by Horstmann (1986). According to him *Gelis areator* is evidently one of the most polyphagous among the species of Ichneumonidae of the Western Palaearctic area together with *Itoplectis alternans* Gravenhorst). The hosts also include the cocoons of Lepidoptera and of Hymenoptera Symphyta (Cimbicidae, Diprionidae, Tenthredinidae), most probably it may be either a primary or a secondary parasitoid but obviously never the main parasitoid. Distribution according to Townes at al. (1965): Germany, Russia, Tomsk, Tuva.

Gelis cursitans (Fabricius, 1775)

Ta: Janakkala, Suurisuo, 676:38, ♀ 28.5.1988 (VV), a cocoon on *Betula nana* contained the larval skin of *Trichiosoma* and the killed pupa of the *Trichiosoma*; the thin cocoon of the parasitoid was fixed to the wall of the cocoon and the parasitoid had made a hole from its cocoon directly through the wall of the *Trichiosoma* cocoon.

Kb: Kontiolahti, Selkie, ♀ 3.6.1973 (VV). *Betula nana*, cocoon contained a larva of *T. nanae*, eaten completely empty, 25 long–haired larvae of a parasitoid (*Monodontomerus*) and one thin, almost colourless cocoon of a parasitoid (*Gelis*).

The key by Hellen (1970) runs to *Gelis cursitans* (Fabricius, 1775). This species is according to Townes et al. (1965) recorded as a secondary parasitoid of *Diprion pini* (Diprionidae), *Cimbex* (as *Clavellarius*) *femoratus* (Cimbicidae), *Dendrolimus pini* (Lasiocampidae), *Orgyia recens* (as *O. gonostigma*) (Lymantriidae) and *Archips oporanus* (as *A. piceanus*) (Tortricidae).

Distribution: Astrakhan, Chernigov, Kiev, Kuibyshev (= Samara), Leningrad, Minsk, Tambou (Townes at al. 1965).

Itoplectis viduata (Gravenhorst, 1829)
(Ichneumonidae, Pimplinae, Pimplini)

N: Pyhtää, Kananiemensuo, 6715:487, ♀ from cocoon 1980 (H. Luoma). Inside the cocoon of the *Trichiosoma* there was a large pale cocoon of the killed parasitoid. Inside a yellowish-brown pupa there was an almost completely developed imago of *Protarchus testatorius*. The hyperparasite was unable to escape from the *Trichiosoma* cocoon in two days, which indicates that the host was perhaps rather exceptional for the species.

Itoplectis species are mostly parasitic on lepidopterous pupae, but some (e.g. *I. conquisitor* (Say)) are sometimes secondary parasites on ichneumonids, while others (e.g. *I. fustiger* (Townes) and *I. clavicornis* (Thomson)) seem to be normally secondary parasitoids (Townes & Townes 1960).

Hosts according to Townes et al. (1965): *Malacosoma neustria* (Lasiocampidae), *Lymantria dispar* and *Orgyia aurolimbata* (Lymantriidae), *Autographa gamma* and *Cosmia subtilis* (Noctuidae), *Archips rosanus* (Tortricidae) and *Zygaena trifolii* (Zygaenidae).

Distribution according to Townes et al. (1965): Austria, China, Germany, W. North America, Russia.

I. viduata occurs in Finland on pine bogs. Finnish specimens have been reared from pupae of *Orgyia antiquoides* (Hubner) (= *ericae* (Germar): *Ka*: Virolahti, 671:53 ♂ 1973 (A. Aalto), Anjalankoski (Sippola) ♀ 1952 (E. Valkeala). *Ta*: Janakkala, Raimansuo, 676:36 ♂ (cocoon on *Betula nana* 5.11.1988) 29.12.1988 (VV). *Ob*: Kiiminki 3 1980 (J. Karvonen).

There is one record from another host: *Ka*: Anjalankoski, Haukkasuo, 6747:494 ♀ from pupa of *Pachytelia villosella* (Ochsenheimer) (Psychidae) 1969 (H. Luoma).

Mesochorus Gravenhorst, 1829 sp.
(Ichneumonidae, Mesochorinae)

Kb: Kontiolahti, Romppala, 698:64, 10♂♂ (and 3♀♀ 2♂♂ of *Olesicampe* sp.) from cocoon on *B. nana* 1969 (VV).

The species of *Mesochorus* are well known hyperparasitoids e.g. in cocoons of many species of Hymenoptera. Thus, the host of this species is *Olesicampe* sp. reared from the same cocoon.

Monodontomerus vicicellae (Walker, 1847)
(Torymidae, Monodontomerinae)

Ka: Anjalankoski, Vehkaojansuo, 6728:494, ♀ (and several other specimens) from cocoon on *B. nana* (MV).

Kb: Kontiolahti, Venejoki, 12♀♀ ♂ from cocoon on *B. nana* 1969 (VV).

In addition there are two records of *Orgyia antiquoides* on *Betula nana* EH: Vanaja, 2♀♀ reared as a hyperparasite from a mummified 9 mm. long larva. 1961 (E. Valkeila). *Kb*: Kontiolahti, Selkie, 19♀♀ 5♂♂ from 2 pupae 1969 (VV).

Monodontomerus vicicellae has often previously been misidentified or otherwise incorrectly named, e.g. *M. obsoletus*: Mayr 1874, Forsius 1925, Hellen 1934, or *M. viciellae*: Steffan 1952. The identification of the specimens were made using the keys in Mayr 1874 and Steffan 1952. According to Steffan (1952) and Bouček (1970) it is mainly parasitic in lepidopterous pupae of the genus *Zygaena* (Zygaenidae) and of *Psyche* spp., *Acanthopsyche atra* and *Pachytelia villosella* (Psychidae) but has also been reared from the Cimbicid sawfly *Trichiosoma lucorum* (as *T. betuleti*) in Germany (Mayr 1874), from a cocoon of *Trichiosoma* sp. in Bohemia, and from the Ichneumonid *Agrothereutes adustus* Gravenhorst in a cocoon of the sawfly *Diprion pini* (Linnaeus), coming from France. Further rearing records are as a hyperparasite of *Rhyacionia buoliana* (D. S.) (Tortricidae) and as a hyperparasite of *Diprion pini* (Linnaeus) in Yugoslavia (Bouček 1977). Widely distributed in Europe (Bouček 1977), also reported from southernmost Finland (Forsius 1925, Hellén 1934).

Monodontomerus minor (Ratzeburg, 1848) is another closely related species having a rather similar host spectrum. According to Steffan (1952) it is a regular hyperparasitoid of lepidoptera but a primary or secondary parasitoid of Tenthredinoidea. The recorded hosts are *Diprion pini*, *Apanteles glomeratus* (Linnaeus) ex *Pieris brassicae* (Linnaeus) (Pieridae), *Apechtis compunctor* (Linnaeus) ex *Euproctis chrysorrhaea* (Linnaeus) (Lymantriidae), a Tachinid ex *Thaumatopoea processionea* (Linnaeus) (Notodontidae) and *Agrothereutes mandator* (as *Spilocryptus migrator*) ex *Trichiosoma tibiale*. In Bohemia the species has been recorded parasitizing *Orgyia antiqua* Linnaeus and *Trichiosoma* sp., from the latter host it was reared together with *Monodontomerus vicicellae*. In Slovakia *M. minor* was reared from the pupa of *Hyphantria cunea* Drury (Bouček 1954). In Finland the species was described as *M. dilinae* as a parasitoid of *Rogas* sp. (Braconidae) in a larva of *Mimas tiliae* (Linnaeus) (Sphingidae) (Palmen 1940). Its distribution covers the whole Palaearctic region and it occurs now, perhaps by introduction, also in North America (Bouček 1977).

7. Predators

The rather thin exposed cocoons are easily discovered and attacked by some birds. When examining cocoons in April or May, we have found many fresh and old cocoons destroyed in such a way that birds are the only possible factor. We

have not seen a bird attacking cocoons, but the most probable birds are the tits (*Parus* sp., Paridae) and/or the Corvid species.

Observations on cocoons on *Betula nana*, opened by birds in Northern Karelia: Ilomantsi, 695:69, 8.5.1971, 3 cocoons. Kontiolahti, Selkie 3.5.1973, altogether about 20 cocoons found, all opened by birds (VV).

A more precise study on the role of birds in *Ta*: Janakkala, Suurisuo and in Raimansuo was made by VV. In Suurisuo 93 cocoons, including old cocoons, were collected in March–May in 1975, 1978, 1985, 1987 and 1988. 21 cocoons (22.6 percent) of them were destroyed by birds; the annual observation varied from 10 to 38 percent. In Raimansuo 106 cocoons were collected in 1985, 1987 and 1988. Out of these, 67 cocoons were destroyed by birds (= 63 percent), the annual observation varied from 58 to 72 percent. In Raimansuo the open areas are small, and thus the trees are much closer than in Suurisuo. Hence the dwarf birches are obviously more frequently visited by birds.

8. Discussion

The identification of *Trichiosoma* species is difficult. The validity of the new species is based largely on biological characters. Amazingly the species is so rare in older collections (no specimens were found in Saarinen's material, no specimens in coll. Zoological Museum, University of Helsinki and coll. Zoological Institute, Academy of Sciences, Leningrad.) The phytophagous fauna of *Betula nana* was studied in Central Europe in Bavaria, W. Germany and Austria by Bachmaier (1965); no sawfly larva was recorded. Larvae of one *Arge* sp. (Argidae) and three species of the subfamily Nematinae (Tenthredinidae), but no larvae of *Trichiosoma*, were found in Finland (Kuusamo, Oulanka) on *Betula nana* in 1960 (Perkiömäki 1971). Author VV has studied the sawfly fauna of *B. nana* in Finland. Some 15 species feed on the shrub, most of them belonging to the subfamily Nematinae of Tenthredinidae. Thus the phytophagous fauna of *Betula nana* is richer in the North where the plant has a continuous distribution area, than in the relict areas in Central Europe.

Author MV studied the *Protarchus* species of Finland and adjacent areas (Viitasaari 1979). Interestingly, only one of the three Finnish species feeds on *Trichiosoma nanae* sp. n. *P. sorbi* (Ratzeburg) is a common parasitoid of *T. lucorum* on Finnish bogs. Perhaps it flies higher or only around higher bushes and trees, and so the larvae of *T. nanae* avoid its attacks.

Attacks by birds on cocoons of *T. nanae* are very remarkable when compared with *Trichiosoma lucorum* cocoons. Author VV has collected some 200 cocoons of *T. lucorum* in Janakkala rather near Raimansuo (3 km apart) and only one cocoon had been attacked by a bird, and even that had occurred in late summer when the cocoon of *T. lucorum* was not complete but thin and soft. The cocoons of *T. lucorum* on *Betula pubescens* and *B. pendula* were highly parasitized (about 80 percent) by *Agrothereutes mandator* in Janakkala, but in Suurisuo and Raimansuo *A. mandator* was absent in our material of *T. nanae* on *Betula nana*, although it is not rare in eastern Finland, only one parasitized cocoon in Raimansuo was found in October 1988. There thus seem to be great local differences in the parasitization of *T. nanae* cocoons in different bogs.

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