SAWFLY LARVAE OF THE SUBFAMILY NEMATINAE ATTACKING CONIFERS IN THE FORESTS OF THE CANADIAN PRAIRIES

A THESIS

BY

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This is to certify that the

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CONTENTS

INTRODUCTION

In the Prairie Provinces the greatest damage to conifers by sawfly larvae is caused by various species of the genus Neodiprion of the family Diprionidae, and different genera of the subfamily Nematinae, in the family Tenthredinidae.

The object of this paper is to present a descriptive key to identify sawfly larvae of the subfamily Nematinae attacking conifers in the Prairie Provinces, together with a seasonal life history of each species. During the course of the author's work at the Forest Insect Laboratory, Winnipeg, Manitoba, a lack of a descriptive key was evident, on the identification of the larvae defoliating conifers. A key of this nature would enable the systematist to identify the common sawfly larvae found attacking conifers in the Prairie Provinces, when used in conjunction with the works of Atwood and Peck (1) on the species of Neodiprion attacking conifers in Eastern Canada.

How Material Was Obtained and the Area Sampled

The material used in this study was collected from coniferous trees in the forests of the Provinces of Manitoba, Saskatchewan and Alberta. Sawfly larvae were collected by dislodging them from the tree onto a beating sheet placed under the branches. The dislodged larvae were placed in containers and sent to the Winnipeg Laboratory, where they were reared in insectaries. Since the inception of the Forest Insect Laboratory, Winnipeg in 1937, coniferous trees in the Prairie Provinces were sampled regularly from early May to late September.

Method of Rearing

Each insect container received by the Winnipeg Laboratory was designated by a record number, and each species of insect in the container was given a subnumber, and a rearing sheet to record its seasonal life history.

The larva or larvae to be reared were placed in jelly jars containing food and a small amount of moistened soil to assist the larvae in cocooning. In the case of larvae collected from tamarack a little moss was placed on the bottom of the rearing jar. A screen top was placed over each jar and the record number indicated with a wax pencil. Coniferous food in the jelly jar was changed every two days, with the exception of tamarack, which was changed every day. Cocoons when formed, were transferred to another jelly jar containing

moistened cotton. The larvae or cocoons were observed every day and any changes that occurred were indicated on the rearing sheet.

Since all the sawfly larvae studied overwintered in the cocoon stage, they were incubated (to speed up the emergence of the adults) by the following method. The screen lids of the rearing jars containing the cocoon and moist cotton were replaced by closed ones, and the jars packed into wooden cases in early October. The cases were stored in the root cellar at a temperature of 40° F. with a relative humidity of 85-90 percent.

In the second week of January the wooden cases were taken from the root cellar, and the closed lids on the rearing jars were again replaced by screened tops. The rearing jars were placed in the incubator at a temperature of 45° F., and a relative humidity of 75 percent. The temperature in the incubator was raised two degrees every two days until the temperature was 70° F. During the time of incubation, the relative humidity ranged from 80-90 percent.

The method outlined above in incubating sawfly larvae was unfortunately, not successful for all species. Those species which would not respond to incubation were overwintered in the ground. The cocoons to be overwintered were transferred from the rearing jars and placed in a two dram vial with a little moss. The vials were corked with a non-absorbant cotton plug and placed between two layers of moss in a screen rectangle. The rectangular screen was placed just below the ground with the top of the screen covered with leaf litter. About the middle of May, when the leaves of shrubs

were beginning to show, the screen rectangle was taken out of the ground. The cocoons were placed on moist cotton in rearing jars, and set in a cool place in the laboratory for adults to emerge.

Classification

The classification followed in this paper is the one proposed by Ross (15). The most extensive study on the classification of sawfly larvae made by Yuasa (18), on the other hand, followed closely the system proposed by MacGillivray (8), who used wing venation as the basis for his classification. According to Ross (15) this system of classification was unsatisfactory due to the variations in wing venation. Yuasa in following MacGillivray's classification grouped Diprionidae, Nematinae and Hoplocampinae, which will be dealt with in this paper in the family Tenthredinidae. Ross' classification gives Diprionidae family status, and groups Hoplocampinae and Nematinae in the subfamily Nematinae. In treating Hoplocampinae as a subfamily, Yuasa used as one of the characteristics, to separate this subfamily from Nematinae, the absence of eversible glands on the ventrum of abdominal segments 1-7. This characteristic is not reliable in the case of Anoplonyx (Marlattia), which has eversible glands, and agrees with the definition for Nematinae. In defining the subfamily Hoplocampinae, however, Yuasa stated that ventral glands were usually present. There does not appear to be a valid definition, which will distinguish this subfamily from Nematinae in Yuasa's key, since the characteristics used

separated the three genera studied, Marlattia, Hemichroa, and Caulocampus, from other genera and subfamilies. The more recent studies by Drs. H. H. Ross and R. B. Benson on classification of adult sawflies, show such a variation from Yuasa's classification of the immature forms, that a new classification for sawfly larvae will have to be made.

Terminology

To obtain uniformity in describing sawfly larvae, the plan proposed by Middleton (10) will be followed as closely as possible. This plan was also used by Atwood (1) in describing Neodiprion larvae. Where structural characters are used in this paper which are not mentioned by Middleton, the name designated by Yuasa (18) will be used.

Key to Families of Sawflies Defoliating Conifers

The sawfly families which defoliate conifers in the Prairie Provinces of Canada are:

Pamphiliidae
Diprionidae
Tenthredinidae

Only a few pamphiliid larvae have been collected, and in no instances have they caused any appreciable damage; diprionid larvae are more numerous but have never caused as much damage as tenthredinid larvae.

The larvae of the preceding families can be separated by the following key:

1. Antennae 7 segmented (Fig. 1). Larvae without uropods on abdominal segment. . . . . .Pamphiliidae.
   Antennae less than 7 segmented. Larvae with uropods present on abdominal segments . . . . . .2.

2. Antennae 3 segmented, third segment peg-like. (Fig. 2). Uropods present on abdominal segments 2-8 and 10. . . . . Diprionidae.

3. Antennae never with third segment peg-like. (Fig. 3). Uropods present on abdominal segment 2-7 and 10 or 2-8 and 10..Tenthredinidae.

Morphology of the Larvae in the Subfamily Nematinae

With the grouping of the subfamily Nematinae and Hoplocampinae into the subfamily Nematinae, Yuasa's definition of Nematinae will have to be modified to read as follows: Larvae small to moderately large; body cylindrical, slender or tapering caudad; antennae 4, 5 or apparently only 3 segmented, conical, subconical, limpet-shaped or flattened; thoracic legs normal in form; mesothorax consists of 4 transverse folds; third abdominal segment consists of 4, 5 or 6 transverse folds; uropods present on abdominal segment 2-7 and 10; ventral glands usually present on abdominal segments 1-7; tenth abdominal tergum with or without caudal protuberances, the number will vary from 2 to many if present; setae and glandubae usually distinct though may appear to be absent on some species.

The following characteristics were noted in the sawfly larvae studied:

Head - The head is subglobose, chitinized and covered with setae. In some species like Pristiphora erichsonii (Htg.) the head is divided into minute irregular areas; pretentorina and depressions along the epicranial arm and epicranial stem, just above the frons, distinct in larger species. The depressions along the epicranial arm were referred to by Yuasa as points of muscular attachment. Paired elongate depressions in frons are very distinct in Pristiphora erichsonii (Htg.) and Pikonema sp.; labrum emarginate along the meson; maxillary palpus with 4 conical segments; labial palpus with 3 conical segments. The eye is subglobose, transparent, set in a dark brown or black circular area.

Antennae - The antennae are 4 segmented, flat or semi-conical; the segments vary from flat, ring-like or mammillate; segments 1, 2 and 3 varied from ring-like structures to flat; segment 4 varied from flat to mammillate. The antennal structure will vary within certain species, and was constant in others. Small white spots are evident on antennal segments 1, 2 and 3; usually 2 spots on segments 2 and 3, and 1 or 2 spots on segment 1.

Setae - With the exception of Anoplonyx spp. the setae are distinct on the body. Most setae are moderately long, stiff

and colored light to dark brown. The number of setae in a given area will vary within the same species. They appeared to be constant however on the clypeus, and labrum. In the species examined the labrum and clypeus each have 4 setae with 2 setae located on each side of the structure. The mandibles have 1 and sometimes 2 setae; the maxillary palpus generally 1 setae; the palpifer, and stipes appear to have 2-3 setae. Setae often arise from a small light circular area on the body.

Glandubae - These are the external chitinized ring openings of cutaneous glands of sawfly larvae. Glandubae are evident over most of the body of the species examined. Two types of glandubae were observed; stalked glandubae found only on Pikonema spp., are located at the end of tubular protuberances; the sessile type found flush with the body, was present on all others. The position and location of the glandubae will vary within the same species.

Spiracles - Spiracles are present on annulet B of the prothorax and first eight abdominal segments. There are two types of spiracles found on larvae of Tenthredinoidea. The winged type, which have semicircular or irregular chitinized colored areas on each side of the spiracle, and

the unwinged type, which do not have these chitinized areas. The spiracles of the larvae examined are unwinged or indistinctly winged.

Thorax - The thorax is composed of 4 transverse folds designated A, B, C and D; setae are present on dorsum of A and C, and usually on pleurum of B; also on the preepipleurite, posthypopleurite, and thoracic legs.

Glandubae present on dorsum of C, preepipleurite and sometimes pleurum of B of larger species. In the smaller species like Anoplonyx spp. and Pristiphora sp., the glandubae could not be readily discerned with the microscope. Neck plate distinct and usually the same color as the thoracic legs.

Abdomen - The third abdominal segment consists of 5-6 transverse folds indicated as A, B, C1, C2 and D or A, B, C1, C2, C3 and D. Setae are present on dorsum of B, C2 and on C1 and C2 of the postspiracular area. Setae are also present on the preepipleurite, postepipleurite, uropods, epiproct, paraproct and ventrum. Glandubae are present on C2, uropod, postepipleurite, epiproct, paraproct and sometimes C1 of the postspiracular area. Glandubae are also present on the preepipleurite of the larger species, except Pristiphora spp., where it is usually absent. In the smaller species of sawfly larvae, the setae and glandubae are microscopic and often indistinguishable. The

caudal protuberances, present on some nematinid larvae, are absent on the coniferous feeding species.

Uropods - Uropods are present on abdominal segments 2-7 and 10. In certain species like Pristiphora sp., and Anoplonyx spp., a rudimentary uropod is present on 8th abdominal segment.

Eversible Glands - All species examined possess eversible glands on the ventrum of abdominal segments 1-7, located between the uropods in segments 2-7. These ventral glands varied in shape and size, and in some species are black tipped.

Key to Determine Nematinid Larvae on Conifers in the Prairie Provinces

1. Larvae feeding on tamarack . . . . . 2.
   Larvae feeding on spruce . . . . . 4.*

2. Larvae with black head, without stripes on dorsum or pleurum . . . . . .Pristiphora erichsonii (Htg.)...(Page 12).
   Larvae with yellow-brown head, olive stripes on dorsum or pleurum . . . . . .3.

3. Larvae without addorsal stripe on body, with dark brown patch behind eye. . . . . Anoplonyx sp...(Page 18).
   Larvae with addorsal stripe on body, without brown patch behind eye . . . . . Anoplonyx laricis (Marlatt)...(Page 15) .

4. Larvae with rudimentary uropod on 8th abdominal segment; antennae subconical . . . . . .Pristiphora sp...(Page 14).
   Larvae without rudimentary uropod on 8th abdominal segment, antennae flat. . . . . 5.

5. Larvae with split olive middorsal and laterodorsal stripes, head reddish or yellow-brown . . . . . .Pikonema alaskensis (Roh.)...(Page 23).
   Larvae without split laterodorsal stripe, middorsal stripe absent or partially split. Head not yellow-brown. . . . . 6.

6. Head fuscous, olive colored body, short dark green longitudinal stripes on pleurum joining the laterodorsal and epipleural stripes. . . . . Pikonema sp...(Page 21).
   Head green, body green, brown dash on side of head . . . . . Pikonema dimmockii (Cress.)...(Page 19).

* Larvae of Neodiprion abietis (Harr.) are very common on spruce and balsam in the Prairie Provinces. These larvae can be distinguished from the above species by the characteristics listed for the family Diprionidae, and the presence of 8 olive stripes on the body. The life history of N. abietis has been thoroughly studied by Bird (2).

Description of Species

The descriptions of the species listed below were made from preserved specimens in the last feeding stage. It should be noted that the color and size of the larvae will vary within species, depending on the food and rearing conditions. Due to the limited number of larvae examined, the number and location of setae and glandubae may show wider variation when more species are studied.

Pristiphora erichsonii (Htg.)

(Figures 4 and 5)

Synonymy

Lygaeonematus erichsonii (Htg.)
Nematus erichsonii Htg.

Head - Head capsule predominately black, with following parts fuscous to black: vertex, lower part of frons, adfrons, preclypeus and mouth parts; numerous minute irregular areas on head; antennae subconical, segment 1 flat, segments 2 and 3 ring-like, segment 4 mammillate; 15-19 setae on frons, usually however 17 setae are present.

Thorax - Following parts black to light black: thoracic legs, neck plate, paired swellings between each thoracic leg, and posthypopleurite; from C on the prothorax, the dorsum (above the spiracles) is grey green, composed of numerous fine grey green dots; ventrum is lightly

covered with grey green dots; rest of the thorax is light olive green; each brown seta is set on a light green area; 10-14 setae and 2-3 glandubae on preepipleurite, 3-5 setae on posthypopleurite.

Abdomen - Same as thorax; dorsum (above spiracles) and epiproct grey-green; ventrum, hypopleurite and paraproct sprinkled with grey-green dots; rest of body light olive green; third abdominal segment with 6 transverse folds; 6-7 setae on preepipleurite; 6-9 setae and 2-3 glandubae on postepipleurite; 1-2 setae on lateral aspect of uropod, with usually 1 glanduba present.

Approximate length of larvae 18-20 mm.

The larch sawfly is believed to have been introduced from Europe in the 19th century. This insect is probably the most serious defoliator of tamarack in North America. It has caused severe infestations the last few years in Manitoba and Saskatchewan. The biology of this insect was published by Hewitt (7) and Packard (12). The seasonal life history of this species in the Prairie Provinces is as follows:

Larval Activity - early June to late September.
Cocoons formed - early July to late September.
Emergence (incubation) - February.
Average days of incubation - 35.
Host - Tamarack.
Parasites: Diptera -
Bessa harveyi (Tns.)
Megaselia sp.
Fannia canicularis L.

Hymenoptera -
Tritneptis sp.
Mesoleius aulicus (Grav.)
Mesoleius sp.
Chalcids

Pristiphora sp.

(Figures 6 and 7)

Head - Yellow-brown head, area along epicranial arm usually of a lighter shade; following areas light brown to brown: postclypeus, adfrons, mouth parts and edge of head capsule; light areas often present on labrum, preclypeus and mandibles; antennae subconical, segment 1 flat minute, segments 2 and 3 may be complete or incomplete ring-like structures, segment 4 mammillate; frons with usually 17 setae.

Thorax - Thorax green with an olive middorsal stripe, and a wider laterodorsal stripe, which is twice as wide as the middorsal; both stripes start at B on the prothorax and are composed of numerous olive or light black dots; following parts light black to black: thoracic legs, neck plate, paired swellings between pro and mesothoracic legs; light olive patch on preepipleurite; brown setae are not too distinct on body; 6-9 setae and usually 2 glandubae on preepipleurite; generally 3 setae on posthypopleurite.

Abdomen - Abdomen is green with the olive middorsal and laterodorsal stripes of the thorax extending to epiproct; following parts also olive colored: epiproct, prepipleurite and postepipleurite; third abdominal segment with 6 transverse folds; rudimentary uropod on 8th abdominal segment; glandubae are microscopic; 4-5 setae on preepipleurite and postepipleurite; uropods with zero or 1 seta on lateral aspect.

Approximate length of larvae 12 mm.

The writer is indebted to Dr. H. H. Ross of the Illinois State Biological Survey for the identification of this species. The larvae of Pristiphora sp. could be mistaken for Pikonema alaskensis (Roh.) since coloration, markings, host and seasonal life history resemble the latter. Unlike P. alaskensis however, the larvae have never been observed to cause any appreciable damage. The seasonal life history of Pristophora sp. in the Prairie Provinces is as follows:

Larval activity - early June to early August.
Cocoons formed - middle of June to middle of August.
Emergence (incubation) - February
Average days of incubation - 28
Hosts - White Spruce and Balsam.

Anoplonyx laricis (Marlatt)

(Figures 14 and 15)

Synonymy

Hemichroa laricis Marlatt
Marlattia laricis (Marlatt)

Head - Head yellow-brown; area along epicranial arm and lower part of frons a lighter shade; adfrons, postclypeus, mouth parts and edge of head capsule brown or fuscous; light areas usually present on labrum, preclypeus and mandibles; many minute irregular areas visible on head; antennae subconical, segment 1 small, segments 2 and 3 may or may not be complete ring-like structures, segment 4 mammillate; frons with usually 13 setae.

Thorax - Thorax is green with a faint olive addorsal stripe and an olive supraspiracular stripe commencing on B of prothorax; an olive transverse stripe joins the addorsal and supraspiracular stripes on B of the prothorax; light yellow brown thoracic legs and neck plate; setae and glandubae not distinct on thorax.

Abdomen - Abdomen same color as thorax, with addorsal and supraspiracular stripes of thorax meeting at the epiproct; faint olive epipleural stripe is usually visible from A of 1st abdominal segment, and fading in the 8th abdominal segment; third abdominal segment with 5 transverse folds; rudimentary uropod present on 8th abdominal segment; eversible glands on ventrum are black; setae and glandubae are not very distinct on body; setae on uropod more distinct, usually 2 present on the lateral cephalic side.

Approximate length of larvae 14 mm.

The description of Marlattia laricis (Marlatt) by Yuasa (18) agrees with this species, except for the supraspiracular and epipleural stripes on the body. Dyar's (5) description of Hemichroa laricis (Marlatt), Packard's (12) description of (Selandria? sp.), and Bradely's (3) description of Anoplonyx laricis (Marlatt) agree very closely with this species, except for the epipleural stripe. Since no mention was made of the epipleural stripe by the various writers (3, 5, 12 and 18), the adult form of this species was checked to determine if it is Anoplonyx laricis (Marlatt). It was found that the adult fits the description of Hemichroa laricis by Marlatt (9), who originally identified and described the adult of the larvae described by Dyar (5). As a further check the adult disagreed with the descriptions of the other Nearctic species by Harrington (6), and Rohwer and Middleton (14). Anoplonyx laricis (Marlatt) is commonly found associated with the larch sawfly, but unlike the larch sawfly, it has caused negligible damage to tamarack. The seasonal life history of this species in the Prairie Provinces is as follows:

Larval activity - late June to late August.
Cocoons formed - very early July to very early September.
Emergence - May.
Host - Tamarack.
Parasites: Hymenoptera - Mesoleius sp.

Anoplonyx sp.

(Figures 16 and 17)

Head - Head yellow-brown with a lighter shade along epicranial arm, and lower part of frons; adfrons, postclypeus, mouth parts and edge of head capsule yellow brown to brown; light areas often present on preclypeus, labrum and mandibles; many minute irregular areas visible on head; dark brown patch on each side of head behind eye; antennae flat with segments 2, 3 and 4 compact, and segment 1 flat and slightly isolated; segment 4 is slightly mammillate, segments 2 and 3 ring-like; frons with 14-16 setae.

Thorax - Thorax green with light yellow-brown legs; fuscous neck plate; olive supraspiracular stripe commencing on subdorsum of B on prothorax; setae and glandubae not distinct.

Abdomen - Abdomen green, with supraspiracular stripe extending from thorax, and fading in the 9th abdominal segment; epiproct may be tinged with light olive color; third abdominal segment with 5 transverse folds; rudimentary uropod on 8th abdominal segment; setae and glandubae not distinct on body; setae more distinct on uropod, which has 3-4 setae on lateral cephalic side.

Approximate length of larvae 8-10 mm.

The writer believes this to be a separate species from A. laricis because of the following reasons: firstly, because of its later appearance in the season; secondly, because of the difference in coloration, size and certain morphological features, especially the antennae; and thirdly, the setae are more numerous on the uropod.

The adults unfortunately have not been reared to substantiate this claim. Only a few larvae have been collected, with very little defoliation being observed.

The seasonal life history of this species in the Prairie Provinces is as follows:

Larval activity - late August to early September.
Cocoons formed - October.
Emergence - ?
Host - Tamarack.

Pikonema dimmockii (Cress.)

(Figures 8 and 9)

Synonymy

Nematus dimmockii Cresson
Pachynematus dimmockii (Cresson)
Nematus ocreatus Harrington

Head - Head predominately green with brown dash on each side, dorsad of eye; lighter shade along epicranial arm and lower frons; light areas usually present on preclypeus, labrum and mandibles, setae dark brown; adfrons, postclypeus, edge of head capsule and mouth parts brown to fuscous; antennae dark brown and flat, with all

segments varying from flat to ring-like in structure; frons with usually 17-19 setae.

Thorax - Thorax green; olive stripe on subdorsum of B on prothorax, descends to laterodorsum on the mesothorax and then becomes the supraspiracular stripe on metathorax; the wide olive epipleural stripe on the spiracular area, preepipleurite and postepipleurite of prothorax extend to the preepipleurite and postepipleurite on the meso and metathorax; thoracic legs and neck plate light brown; area around setae light colored; white spiracular stripe between 2 olive lateral stripes; preepipleurite with usually 6-10 setae and 2-3 glandubae present; posthypopleurite usually with 4-5 setae present.

Abdomen - Abdomen green; the olive supraspiracular stripe from thorax extends along the abdomen to the subdorsum of the epiproct; wide olive epipleural stripe from thorax end on B of the 9th abdominal segment; white spiracular stripe (between 2 olive lateral stripes) terminates on the 9th abdominal segment. Third abdominal segment with 6 transverse folds; preepipleurite and postepipleurite with usually 4-6 setae and 2-3 glandubae present. Uropods with generally 4-5 setae on lateral cephalic side with usually 1 glanduba on uropod, which is not stalked.

Approximate size of larvae 14-16 mm.

Only a small number of the green-headed spruce sawfly were collected in the Prairie Provinces. This species has never been known to cause serious defoliation to forest trees. The seasonal life of this species in the Prairie Provinces is as follows:

Larval activity - early June to middle of September.
Cocoons formed - early July to early October.
Emergence (Incubation) - February - March.
Average days of incubation - 24.
Hosts - Spruce and Balsam
Parasites: Hymenoptera -
Syndipnus rubiginosus Wly.
Hypamblys sp.
Erromenus bedardi Prov.
Chalcids.

Pikonema sp.

(Figures 10 and 11)

Head - Head fuscous, frons slightly darker than surrounding area; lighter shade along the epicranial arm, lower part of frons, and preclypeus; 2 dark spots in the light area of lower frons; 2 light brown depressions dorsad of frons on either side of epicranial suture; antennae flat with segments varying from flat to ring-like in structure; frons usually with 9-13 setae.

Thorax - Thorax olive colored; following parts fuscous: thoracic legs, neck plate, paired swellings between pro and mesothoracic legs; wide fuscous middorsal stripe from B of prothorax slightly split by median

line; wide fuscous laterodorsal stripe, and epipleural stripe on preepipleurite and postepipleurite, not split by median line; A and spiracular area of prothorax fuscous; B of meso and metathorax fuscous, joining the two lateral stripes; posthypopleurite and area between thoracic legs on the lateroventrum is fuscous; area around setae is lightly colored; 5-10 setae and usually 2 glandubae on preepipleurite; postepipleurite with 4-5 setae and often 1 glandubae.

Abdomen - Abdomen olive colored; wide fuscous middorsal stripe, (slightly split by median line) continues from thorax to epiproct, where it meets the wide fuscous laterodorsal stripe; epiproct fuscous; fuscous epipleural stripe from thorax terminate at 10th abdominal segment; longitudinal folds C1 and C2 fuscous, joining the two lateral stripes; area between uropods on the lateroventrum also fuscous. 4-5 setae and usually 1-3 glandubae on preepipleurite; postepipleurite with 5-6 setae and generally 2-3 glandubae. 4-5 setae on lateral cephalic side of uropod with usually 1 glandubae, which is not stalked.

Approximate length of larvae 14-16 mm.

This species may be a different form of Pikonema alaskensis (Roh.) but the markings and color of the larvae and cocoon would indicate it to be a separate species. Unfortunately only a few

larvae of this species were collected, and attempts to rear it to the adult stage by the method outlined have proved thus far unsuccessful. The seasonal life history of Pikonema sp. in the Prairie Provinces is as follows:

Larval activity - late July to August.
Cocoons formed - late August to early September.
Host - Spruce.

Pikonema alaskensis (Roh.)

(Figures 12 and 13)

Synonymy

Nematus ocreatus Harrington
Pachynematus ocreatus (Harr.)
Pachynematus alaskensis Roh.
Pachynematus piceae Roh.

Head - Head reddish or yellow-brown; lighter shade along epicranial arm, and lower frons; adfrons, postclypeus, edge of head capsule and mouth parts brown to fuscous; light areas usually present on preclypeus, labrum and mandibles; antennae flat, segments 1 and 4 flat, segments 2 and 3 may be complete or incomplete ring-like structures; frons with 12-15 setae present.

Thorax - Thorax yellowish green; neck plate and thoracic legs fuscous. Olive middorsal stripe from B of prothorax, split by median line; wide olive laterodorsal stripe is split by a median line at D of prothorax; wide olive epipleural stripe on spiracular area, preepipleurite, and postepipleurite on prothorax and on preepipleurite

and postepipleurite of meso and metathorax not split by median line; light olive patch on posthypopleurite, and between thoracic legs on the lateroventrum; 8-10 setae and generally 3-5 glandubae on preepipleurite; posthypopleurite with 4-5 setae and often 1 or 2 glandubae.

Abdomen - Abdomen yellowish green; olive middorsal stripe extends from thorax to edge of epiproct, and split by a median line to the 9th abdominal segment; wide laterodorsal stripe extends to epiproct, where it meets the middorsal stripe; distal half of epiproct olive colored; epipleural stripe from thorax extends to 9th abdominal segment, and not split by median line; olive patch on postepipleurite; third abdominal segment with 6 transverse folds; preepipleurite with 4-7 setae and generally 2 glandubae; postepipleurite with 4-5 setae and often 2-4 glandubae. Uropods with 4-5 setae on their lateral cephalic side with usually 1 glanduba, which is not stalked.

Approximate length of larvae 18-20 mm.

The yellow-headed spruce sawfly is responsible for severe defoliations to ornamental and shelterbelt trees in Manitoba and Saskatchewan.

Damage to forest trees by this insect on the other hand is light to moderate in the Prairie Provinces. The life history of

this species has been studied by Nash (11). The seasonal life history of P. alaskensis in the Prairie Provinces is as follows:

Larval activity - early June to early September.
Cocoons formed - early July to middle September.
Emergence (incubation) - middle of March to early April.
Average days of incubation - 43.
Hosts - White, black and blue spruce.
Parasites: Diptera -
Bessa harveyi (Tns.)
Neophorocera sp.
Hymenoptera -
Monoblastus sp.
Syndipnus gaspesianus (Prov.)
Erromenus sp.
Rhorus (*Cyphanza*) sp.

DISCUSSION

The tenthredinid larvae attacking conifers consist of a small compact group. Out of the ten subfamilies in the family Tenthredinidae, only one subfamily (Nematinae) was observed defoliating conifers; and of the twenty genera in this subfamily, only three genera (Pristiphora, Pikonema and Anoplonyx), consisting of seven species were collected from conifers in the Prairie Provinces.

It is interesting to note that the food plants of nematinid larvae studied were restricted to spruce and tamarack. The larvae of Diprionidae and Pamphiliidae, which attack conifers feed on spruce, pine, balsam fir, and other coniferous plants, but very rarely tamarack.

Though only indicated for the Canadian Prairies, the identified species are also found across Canada and northeastern United States.

In dealing with a group of insects which is widely distributed and possess diverse habits there is to be expected variations in morphological characters. This is treated under morphology of nematinid larvae (Page 6). The variations noted in this section were taken into consideration in the construction of keys and descriptions.

REFERENCES

1. Atwood, C. E. and Peck, O. 1943. Some native sawflies of the genus Neodiprion attacking pines in Eastern Canada. Can. J. Research, 21: 109-144.

2. Bird, R. D. 1929. Notes on the fir sawfly Neodiprion abietis Harr. Ann. Rept. Entomol. Soc. Ontario. 60: 76-82.

3. Bradely, G. A. 1939. Some common sawfly larvae attacking conifers in northeastern North America. Thesis for the degree of M. S. Michigan State College.

4. Brown, A. W. A. 1941. Foliage insects of spruce in Canada. Canada Dept. of Agri. Tech. Bul. 31.

5. Dyar, H. G. 1897. On the larvae of certain sawflies. J. New York. Entomol. Soc. 5: 18-30.

6. Harrington, W. G. 1902. A Canadian Anoplonyx. Can. Entomol. 34: 93-94.

7. Hewitt, C. G. 1912. The large larch sawfly, with an account of its parasites, other natural enemies and means of control. Canada Dept. Agri. Div. Ent. Bul. 10.

8. MacGillivray, A. D. 1906. A study of the wings of the Tenthredinoidea, a superfamily of Hymenoptera. Proc. U. S. Nat. Museum. 29: 569-654.

9. Marlatt, C. L. 1896. Some New Nematids. Can. Entomol. 28: 251-258.

10. Middleton, W. 1921. LeConte's sawfly, an enemy of young pine. J. Agri. Research. 20: 741-760.

11. Nash, R. W. 1939. The yellow-headed spruce sawfly in Maine. J. Econ. Entomol. 32: 330-334.

12. Packard, A. S. 1890. Fifth Report U. S. Entomol. Comm., Revised and enlarged edition of Bul. No. 7, on insects injurious to forest and shade trees.

13. Peterson, A. 1948. Larvae of Insects. Lepidopter and Hymenoptera. Part I. Edwards Brothers, Inc., Ann Arbor, Michigan.

14. Rohwer, S. A. and Middleton, W. 1932. Descriptions of five nearctic species of sawflies of the tribe Hemichroini. Proc. Entomol. Soc. Wash. 34: 93-98.

15. Ross, H. H. 1937. A generic classification of the nearctic sawflies (Hymenoptera, Symphyta). Illinois Biol. Monogr. 15, No. 2.

16. Ross, H. H. 1938. The nearctic species of Pikonema a genus of spruce sawflies (Hymenoptera, Tenthredinidae). Proc. Entomol. Soc. Wash. 40: 17-20.

17. Schaffner, J. V., Jr. 1943. Sawflies injurious to conifers in the northeastern states. J. of Forestry 41: 580-588.

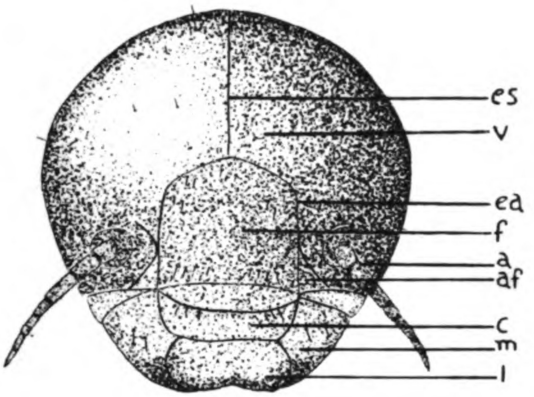
18. Yuasa, H. 1922. A classification of the larvae of the Tenthredinoidea. Illinois Biol. Monogr. 7, No. 4.

PLATE I

CEPHALIC ASPECT OF HEAD

Figure 1. Family Pamphiliidae
Figure 2. Family Diprionidae
Figure 3. Family Tenthredinidae

a	antenna
af	adfrons
c	clypeus
e	eye
ea	epicranial arm
es	epicranial stem
f	frons
l	labrum
m	mandible
v	vertex



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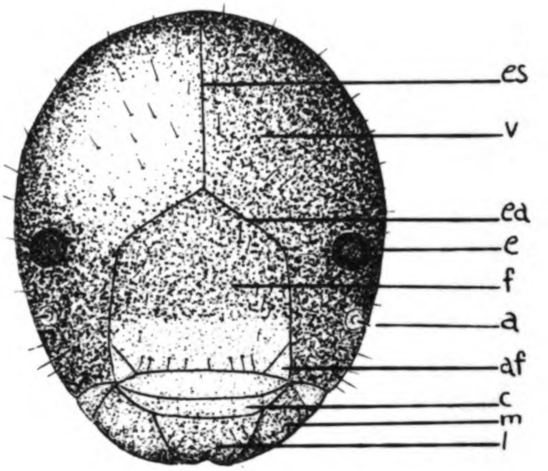

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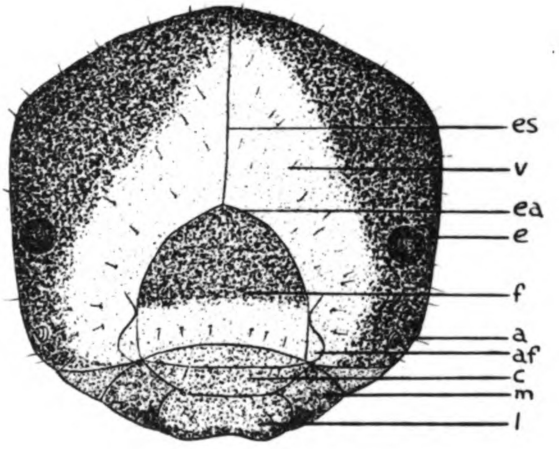

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PLATE II

LATERAL ASPECT OF LARVAE

Note - Glandubae are exaggerated for clarity.

Figure 4. Mesothorax of Pristiphora erichsonii (Htg.)
Figure 5. Third Abdominal Segment of Pristiphora erichsonii (Htg.)

A, B, C, D	transverse folds on thorax
A, B, C^1, C^2, C^3, D	transverse folds on abdomen
eg	eversible gland
g	glanduba
hypop	hypopleurite
prep	preepipleurite
prhyp	prehypopleurite
psa	postspiracular area
psep	postepipleurite
pshyp	posthypopleurite
s	seta
sa	spiracular area
sp	spiracle
tl	thoracic leg
u	uropod

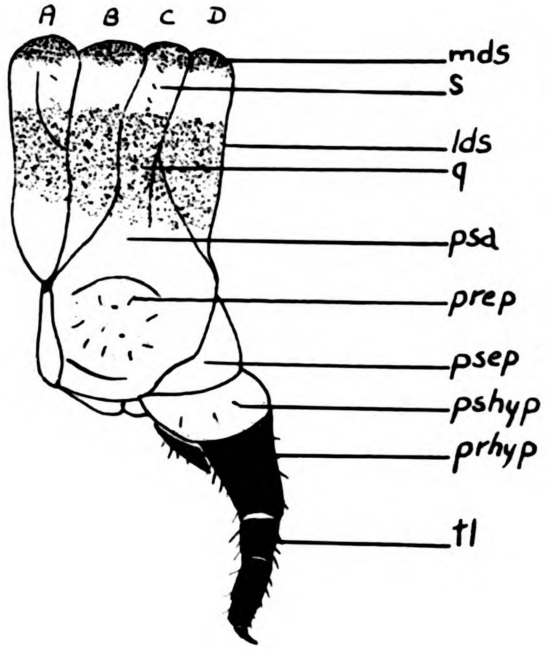
PLATE III

LATERAL ASPECT OF LARVAE

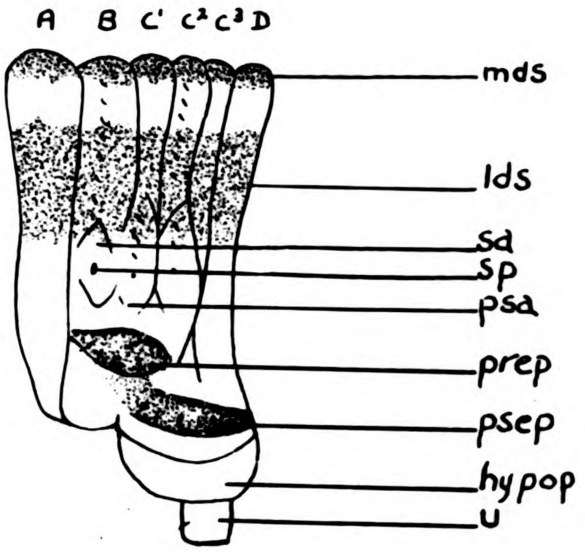
Note - Glandubae are exaggerated for clarity.

Figure 6. Mesothorax of *Pristiphora* sp.
Figure 7. Third Abdominal Segment of *Pristiphora* sp.
Figure 8. Mesothorax of *Pikonema dimmockii* (Cress.)
Figure 9. Third Abdominal Segment of *Pikonema dimmockii* (Cress.)

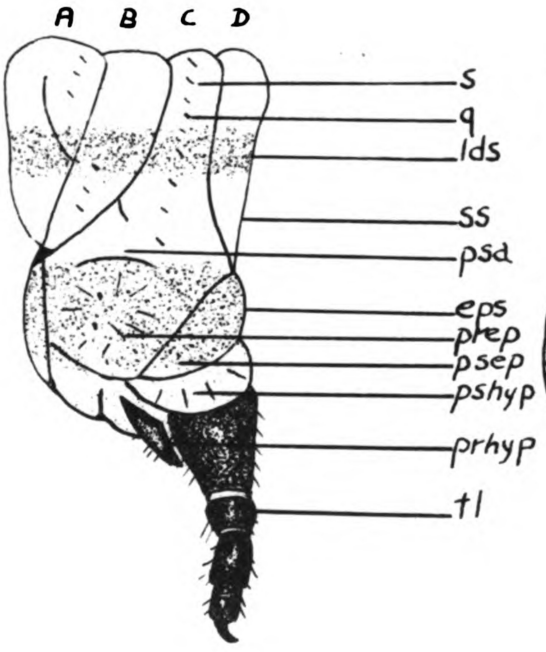
A, B, C, D	transverse folds on thorax
A, B, C^1, C^2, C^3, D	transverse folds on abdomen
eps	epipleural stripe
g	glanduba
hypop	hypopleurite
lds	laterodorsal stripe
mds	middorsal stripe
prep	preepipleurite
prhyp	prehypopleurite
psa	postspiracular area
psep	postepipleurite
pshyp	posthypopleurite
s	seta
sa	spiracular area
sp	spiracle
sps	supraspiracular stripe
ss	spiracular stripe
tl	thoracic leg
u	uropod


A
B
C
D
mds
s
lds
q
psd
prep
psep
pshyp
prhyp
tl

6


A
B
C'
C²
C³
D
mds
lds
sd
sp
psd
prep
psep
hypop
u

7


A
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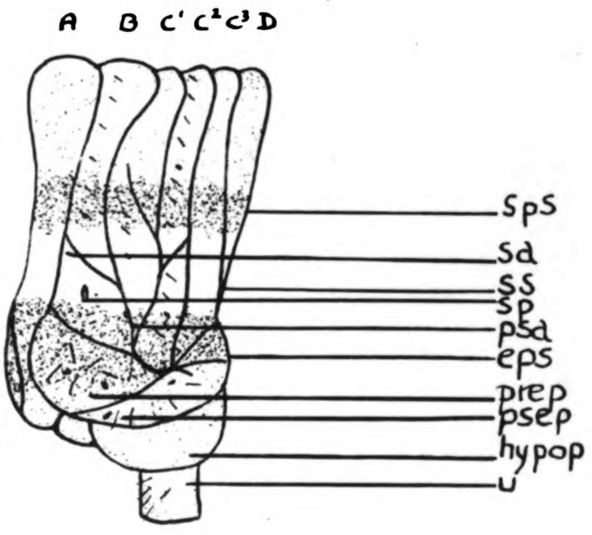
prhyp
tl

8


A
B
C'
C²
C³
D
sps
sd
ss
sp
psd
eps
prep
psep
hypop
u

9

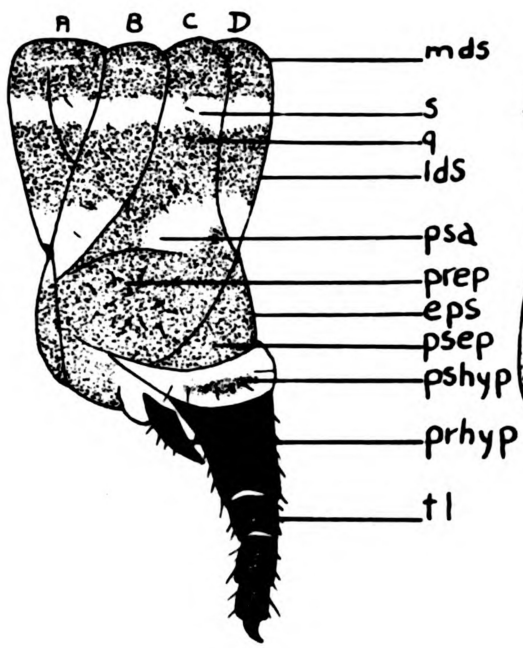
PLATE IV

LATERAL ASPECT OF LARVAE

Note - Glandubae are exaggerated for clarity.

Figure 10. Mesothorax of Pikonema sp.
Figure 11. Third Abdominal Segment of Pikonema sp.
Figure 12. Mesothorax of Pikonema alaskensis (Roh.)
Figure 13. Third Abdominal Segment of Pikonema alaskensis (Roh.)

A, B, C, D	transverse folds on thorax
A, B, C^1, C^2, C^3, D	transverse folds on abdomen
eps	epipleural stripe
g	glanduba
hypop	hypopleurite
lds	laterodorsal stripe
mds	middorsal stripe
prep	preepipleurite
prhyp	prehypopleurite
psa	postspiracular area
psep	postepipleurite
pshyp	posthypopleurite
s	seta
sa	spiracular area
sp	spiracle
tl	thoracic leg
u	uropod


A
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C
D
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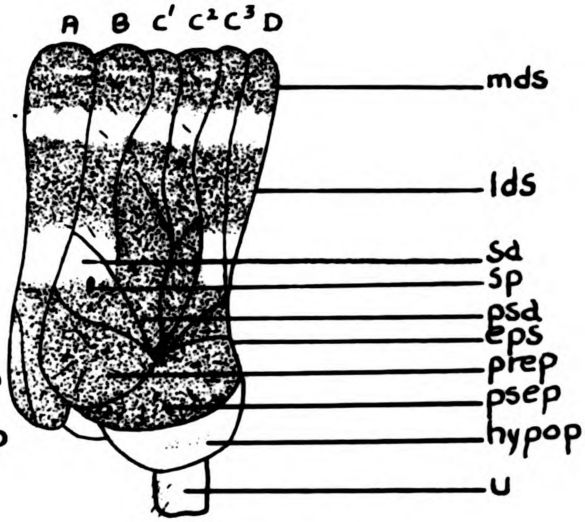
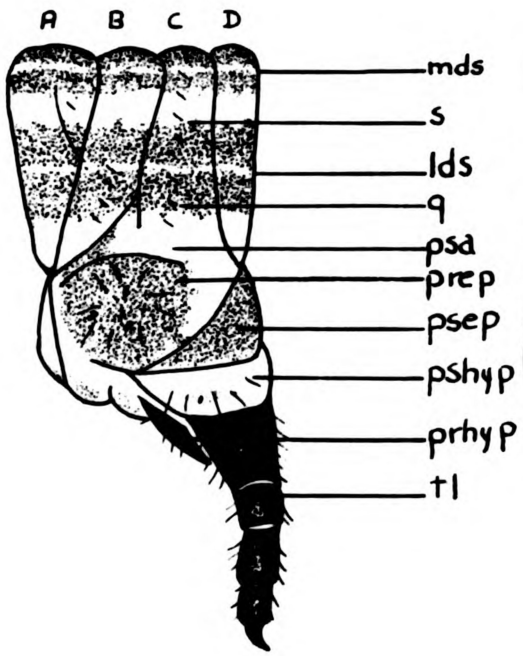
s
q
lds
psa
prep
eps
psep
pshyp
prhyp
tl

10


A
B
C'
C²
C³
D
mds
lds
sa
sp
psa
eps
prep
psep
hypop
u

11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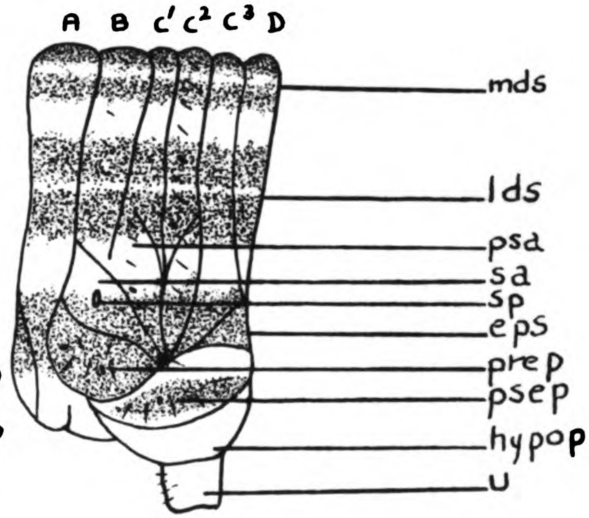
12


A
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C'
C²
C³
D
mds
lds
psa
sa
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eps
prep
psep
hypop
u

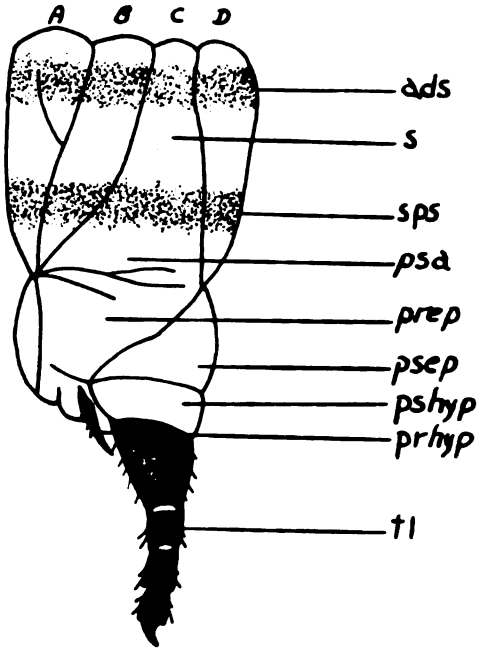
13

PLATE V

LATERAL ASPECT OF LARVAE

Figure 14. Mesothorax of *Anoplonyx laricis* (Marl.)
Figure 15. Third Abdominal Segment of *Anoplonyx laricis* (Marl.)
Figure 16. Mesothorax of *Anoplonyx* sp.
Figure 17. Third Abdominal Segment of *Anoplonyx* sp.

A, B, C, D	transverse folds on thorax
A, B, C^1, C^2, D	transverse folds on abdomen
ads	addorsal stripe
eps	epipleural stripe
hypop	hypopleurite
prep	preepipleurite
prhyp	prehypopleurite
psa	postspiracular area
psep	postepipleurite
pshyp	posthypopleurite
s	seta
sa	spiracular area
sp	spiracle
sps	supraspiracular stripe
tl	thoracic leg
u	uropod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C
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ads
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sps
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prep
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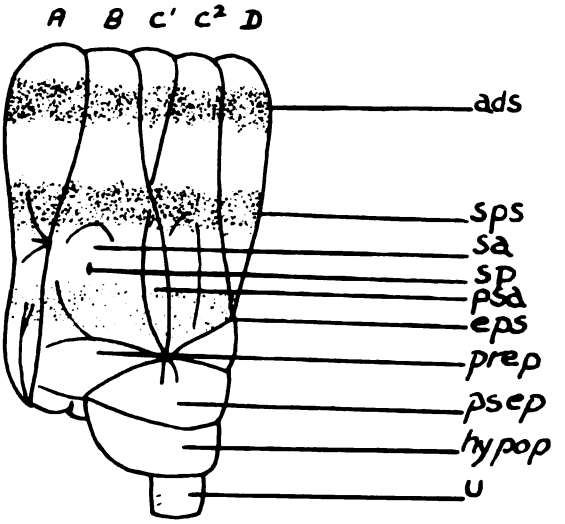
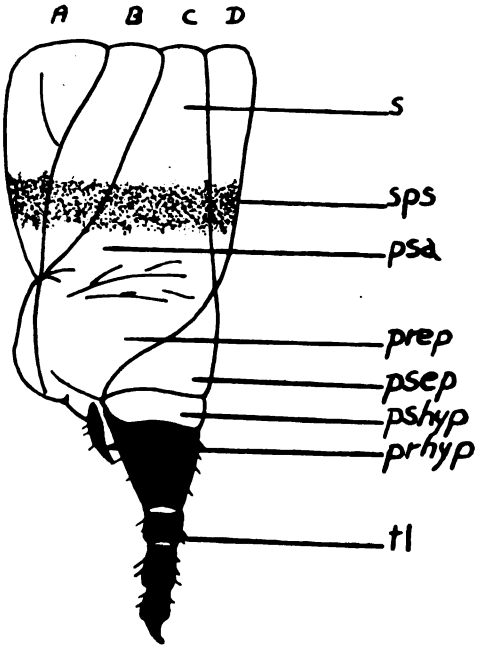
pshyp
prhyp
tl

14


A
B
C'
C²
D
ads
sps
sa
sp
psa
eps
prep
psep
hypop
u

15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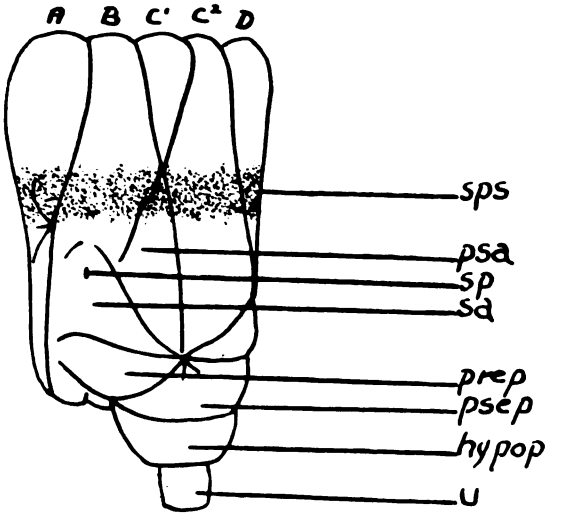
16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17