

# THE LARVAE OF THE GENUS NOSODENDRON LATR. (Coleoptera, Nosodendridae)

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The genus *Nosodendron* Latr. (*Dendrodipnis* Woll.) is found widespread over the world. Lucas (1920) in his *Catalogus Coleoptorum* gives the distribution as Europe, Japan, Sumatra, New Guinea, New Zealand and the Americas. Only two species have been described from North America and one from Europe. The genus was formerly placed in the family Byrrhidae (Pill Beetles) but in recent years has been considered as a separate family, Nosodendridae.

The adult beetles have been taken under bark and around the flowing sap of old elm and alder trees and the larvae are usually found in the same places with the beetles. Blatchley (1910, p. 672) records the occurrence of *N. unicolor* adults in Indiana from April 22 to July 4. The adults of *N. californicum* (fig. 15) are small rounded-oval, strongly convex beetles about five mm. long. They are black, somewhat shining and rather densely and coarsely punctate. Larvae of this genus are thought to be predators on dipterous larvae.

The larva of the only European species *N. fasciculare* Ol. was early described by Chapuis and Candèze (1853) and later a better and more exact description was published by Dufour (1862). Laboulbène (1862) concerned himself with a discussion of the spiracles of the larva but failed to describe the eighth or terminal spiracle. He mistakenly thought that the two large tubercles located dorsally near the base of the terminal segment were spiracles. Ganglbauer (1904, Vol. 4, pt. 1, p. 89-90) has given us our most recent description of this European larvae and adult although Kuhnt (1913, p. 1124) has more recently figured the larvae of this species.

Our two American species, *N. unicolor* Say found in the eastern states, and *N. californicum* Horn from the western states, have not been described in the larval stage although Böving and Craighead (1931, pl. 66) have illustrated some of their morphological characteristics but have not described them. The pupae have not been described for any species as far as the authors are aware, and no specimens are available in the U. S. National Museum Collection.

Larvae of *N. unicolor*, believed to be nearly full grown, in possession of the writers, were collected in fungi on a dying elm tree, June 16, 1939, at Urbana, Illinois. A single specimen in the Illinois State Natural History Survey Collection was taken at Chicago, Illinois, in "old *Cossus* borings in Silver Leafed Poplar" by E. G. Titus, September 20, 1901. Through the kindness of Dr. C. F. W. Muesebeck of the Insect Division of the U. S. Bureau of Entomology the specimens of *N. unicolor* and *N. californicum* present in the U. S. National Museum

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Collection were loaned to the writers for this study. In this material the following specimens were available:

*N. unicolor*.—One larvae in sap oozing from willow "Victoria Jx," April 11, 1913, J. D. Mitchell Coll. Det. R. A. St. George; five larvae labeled *Nosodendron sp.* from "Hubbard No. 573," no date; seven larvae labeled *Nosodendron sp.* from sap of elm, Detroit, Michigan, 187, "Hubbard 559"; four larvae labeled *Nosodendron sp.* No. 2201 box 10, div. 3, Michigan? These unidentified specimens are all *N. unicolor*.

*N. californicum*.—Four larvae and one adult from sap at wound on white fir, May 10, 1915, Ashland, Oregon, H. G. Champion; one larva and two adults with no data.

Since no description of larvae of our American species exists, it is thought desirable to describe the larva of *N. unicolor* and make comparisons with *N. californicum* and with the better known European *N. fasciculare*.

#### **Nosodendron unicolor** Say

*Larval Size and Number of Instars*.—Nothing is known of the life history of the species of *Nosodendron*. The writers have been unable to find any mention in the literature of any recorded rearings. Therefore, one is only able to speculate as to the number of instars. Most of the larvae available are apparently full grown. These have a body length varying from 9.5 to 10.2 mm., with a head width of 2–2.1 mm. Among specimens received from the U. S. National Museum there are larvae of five different sizes. Each of these apparently represent a different instar, making at least five instars. The body length and width of head of the various instars are found in the following tabulation:

TABLE I  
Size of Larval Instars in *N. Unicolor*

Instar	Body Length in mm.	Head Width in mm.
First.....	3.	0.7
Second.....	4.8	1.1–1.2
Third.....	5.5	1.55
Fourth.....	8.5	1.80
Fifth.....	9.5–10.2	2.–2.1

The principal differences in the various instars seem to be in the matter of punctation and the position of the spiracles. The first instar has the head and prothorax less strongly punctured than the other body segments but this difference is not noticeable in the second instar. It is difficult to determine the presence of ocelli in the first and second instars, although they are present, but they are quite evident in the third and later instars. The first instar larva apparently has but two pairs of functional spiracles. There is only one dorsal pair on the first abdominal segment and one pair on the distal end of the last abdominal spiracle.

*The Head*.—*Dorsal Aspect*. The head (fig. 12) is much wider than

long. It is densely covered with minute, brown tubercles (fig. 5) which, under high magnification, seem to be provided with a clear central area. The entire surface of each tubercle is covered with minute spinulae. Near the meson and caudally the tubercles are arranged in a reticulated network enclosing a number of smooth circular areas.

There is an epicranial suture (ES) that lacks the epicranial stem. Near the anterior-lateral margin of the head are located five *ocelli* (OC). They are clear, colorless and raised slightly above the surrounding surface. The anterior ocellus is far enough laterad to be seen from the ventral surface and is just behind the base of the antenna. The others are more dorsally and caudally located and arranged in a subquadrate group. Because of their clear coloration they may be easily overlooked and are difficult to see in the early instars.

The front and clypeus (FC) are fused into a single area by the absence of a fronto-clypeal suture. A clypeo-labral suture (CS) separates the labrum from the rest of the head. The labrum (L) is trapezoidal in shape and about one-half as long as the width at the base. The cephalic margin is emarginate and the cephalic and lateral margins bear a fringe of long setae.

*Ventral Aspect.* Most of the ventral aspect of the head (fig. 13) is occupied by the maxillae (MX) and labium (LAB). The genae (G) are folded under the head to occupy the lateral regions. They are covered with the same cuticular nodules that are found on the dorsal aspect. Near the cephalo-lateral angle the anterior ocellus is to be seen. A curving longitudinal ridge on the gena extends caudo-laterally from the base of the mandibles to the back of the head and mesad of this ridge is a sloping area devoid of cuticular nodules. The ridge and mesal area are finely but densely setaceous. A membrane closes the area between the head and the labium.

*Antennae.* The antennae (fig. 12, ANT) are located dorsally on the cephalo-lateral margin of the head. They are considered by Böving and Craighead (1931) as being three-segmented although Ganglbauer (1904, p. 89) calls them four-segmented. A large basal area looking like a basal segment is here considered to be a part of the head capsule. This basal area is as wide as long and somewhat conical in shape. It is the part considered as an antennal segment by Ganglbauer but not by Böving and Craighead. The writers feel that this basal structure is definitely not an antennal segment. The first segment, therefore, is the short bead-like segment which is about as broad as long and about one-half the length of the basal area. It is setaceous distally. The second segment is long, cylindrical and nearly three times as long as the first. A minute, third segment is almost globular and bears several, small, sensory processes.

*Labrum.* The labrum (fig. 12, L) is roughly trapezoidal with its cephalic margin deeply emarginate and its latero-caudal angles extended into acute angles. Its cephalic margin bears a row of setae and the entire ectal surface is rather densely punctate.

*Epipharynx.* The distal margin of the labrum (fig. 22) is deeply excised. This margin bears a row of dense setae which are about one-half the length of the lateral tufts of setae on the thorax and abdomen. The lateral epipharyngeal area is membranous with several trans-

verse striated rows not quite reaching the lateral margin. The central area bears a chitinous Y-shaped sclerite that is non-setaceous.

*Mandibles.* The two mandibles (fig. 14) are similar in shape and indentation. They articulate with the head by three condyles. These have been termed by Böving and Craighead (1931) the *dorsal condyle*, the *ventral condyle* (VC) and the *accessory ventral condyle* (ACV). The *dorsal condyle* is small and articulates with a small acetabulum on the head capsule located at the lateral ends of the clypeo-labral suture. The *ventral condyle* articulates in a socket on the gena just behind the antennae and the *accessory ventral condyle* likewise works on the genae somewhat farther caudad. The three condyles make up what is known as a tricondylic articulation.

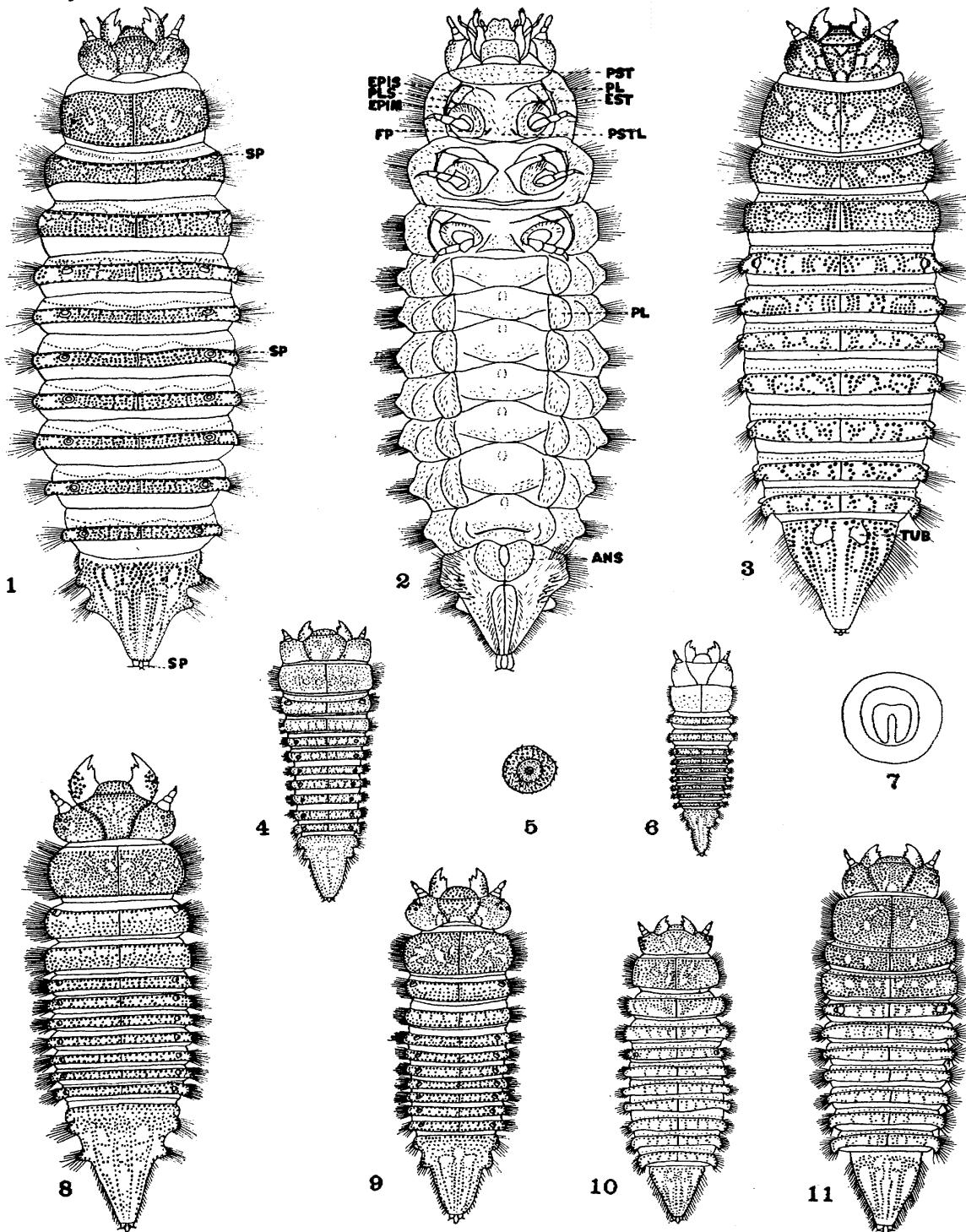
The scrobe (SB) is covered with small tubercles. There is a single large terminal tooth and the scissorial area (SR) is provided with a two-toothed *retinaculum* (RT). The distal tooth of the retinaculum is wider and about twice the length of the basal one. The molar area (M) is not adapted for grinding. Its margin is broadly rounded and provided with a cluster of setae (brustia). Caudally, the molar area extends into a broad, thin area which bears the accessory ventral condyle. The caudo-mesal margin is provided with a brush of fine setae.

*Maxillae.* The *cardo* (fig. 17, CD) is triangular in shape and is apparently divided in two parts. A small, proximal, triangular area (SC) is often called the subcardo and a larger subquadrangular area is the so-called eucardo (EC). On the mesal margin of the two parts of the cardo is a membrane which attaches to the labium. This is the so-called labacoria of MacGillivray. The *stipes* (ST) is elongated and subrectangular. Its ventral aspect bears a longitudinal row of short setae. The ectal margin is enlarged somewhat to form a palpifer (PF)

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#### LIST OF ABBREVIATIONS

ACV.....	accessory ventral condyle	M.....	molar area
ANS.....	anal segment	MD.....	mandible
ANT.....	antenna	MP.....	maxillary palpus
CD.....	cardo	MT.....	mentum
CL.....	claw	MX.....	maxilla
CS.....	clypeolabral suture	OC.....	ocellus
CX.....	coxa	PF.....	palpifer
EC.....	eucardo	PGL.....	paraglossa
EPIM.....	epimeron	PL.....	pleuron
EPIS.....	episternum	PLS.....	pleural suture
ES.....	epicranial suture	PM.....	prementum
EST.....	eusternum	PST.....	presternum
FC.....	frontoclypeus	PSTL.....	postssternellum
FP.....	furcal pit	RT.....	retinaculum
FUR.....	femur	SB.....	scrobe
G.....	gena	SC.....	subcardo
GA.....	galea	SM.....	submentum
GL.....	glossa	SP.....	spiracle
HS.....	lateral sclerite of hypo- pharynx	SR.....	scissorial area
HYP.....	hypopharynx	ST.....	stipes
HYP. BR..	hypopharyngeal bracon	TR.....	trachea
L.....	labrum	TRO.....	trochanter
LAB.....	labium	TT.....	tibio-tarsus
LC.....	lacinia	TUB.....	tubercle
		VC.....	ventral condyle



EXPLANATION OF PLATE I

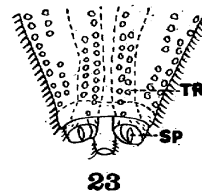
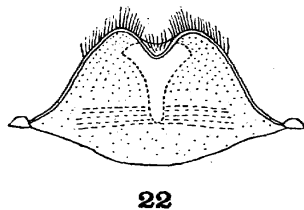
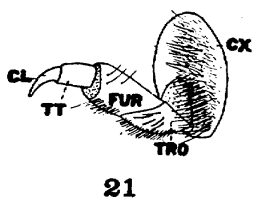
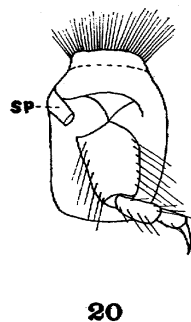
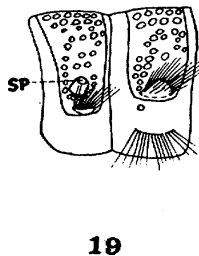
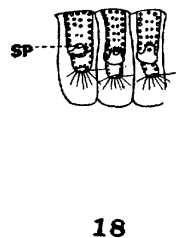
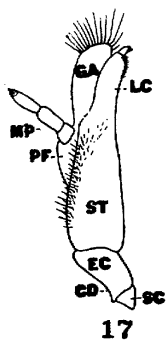
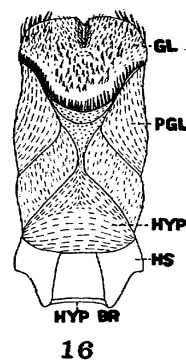
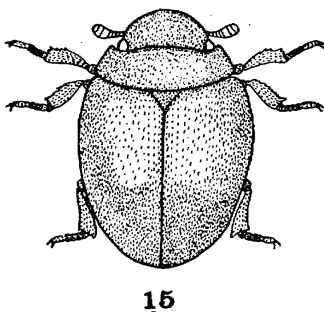
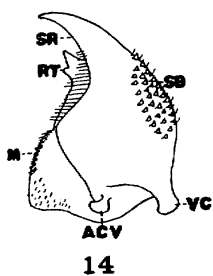
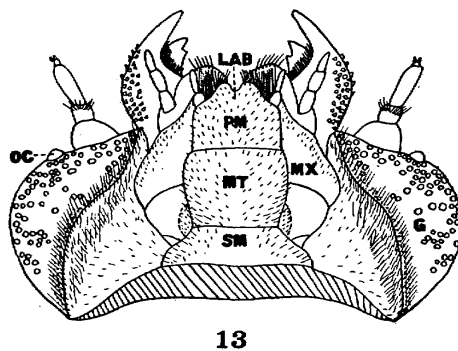
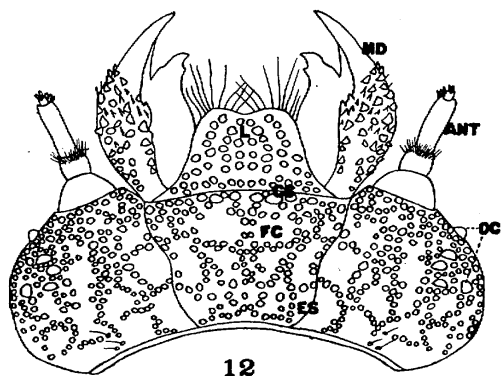
Fig. 1. *Nosodendron unicolor* Say, full-grown larva, dorsal aspect. Fig. 2. *Nosodendron unicolor* Say, full grown larva, ventral aspect. Fig. 3. *Nosodendron caulifornicum* Horn, full-grown larva, dorsal aspect. Fig. 4. *Nosodendron unicolor* Say, probable 2nd instar larva. Fig. 5. A tubercle on dorsum of *Nosodendron unicolor* Say. Fig. 6. *Nosodendron unicolor* Say, probable 1st instar larva. Fig. 7. An abdominal spiracle of *Nosodendron unicolor* Say. Fig. 8. *Nosodendron unicolor* Say, probable 4th instar larva. Fig. 9. *Nosodendron unicolor* Say, probable 3rd instar larva. Fig. 10. *Nosodendron caulifornicum* Horn, intermediate instar. Fig. 11. *Nosodendron caulifornicum* Horn, intermediate instar.

which bears a three-segmented maxillary palpus (MP). The first segment is small, being about as wide as long, the second is about twice the length of the first and somewhat enlarged distally. The third segment is about the length of the second and is somewhat pointed. It bears small, sensory structures on its distal end. The galea (GA) is shaped somewhat like a spatula with its distal end bearing a row of elongated setae. The lacinia (LC) does not seem to be separated from the stipes by a suture. It becomes gradually attenuated distally and its apex is terminated in two, small, claw-like hooks. A few very small setae occur on the mesal margin immediately proximad of the terminal hooks.

*Labium.* The labium (fig. 13, LAB) is composed of three main sclerites. The submentum (SM) is about twice as wide as long, somewhat trapezoidal and with its caudo-lateral angles prolonged. The mentum (MT) is roughly quadrangular with its lateral margins somewhat rounded. The prementum (PM) is a single piece with its sides parallel and its anterior margin tapering distally to form two small lobes which are separated by a small angulate emargination. The distal margin bears a number of rather large, yellowish setae.

*Hypopharynx.* The hypopharynx (fig. 16) located on the ental aspect of the labium, is a fleshy structure covered with sensory processes. The distal area, densely covered with setae and lying entad of the prementum, is regarded as the infolded glossae (GL). Caudo-laterad of the glossa on each side is a faintly striated area, roughly triangular in outline, that is considered the *paraglossa* (PGL) by Böving and Craighead. Meso-caudad of the paraglossa is a single triangular area that is the hypopharynx proper (HYP). Under high magnification the glossa is seen to be finely striated. Caudad of the hypopharynx is a pair of lateral sclerites (HS) connected by a transverse bridge. These sclerites make up the hypopharyngeal bracon (HYP.BR.) of Böving and Craighead or the suspensorial plates and apodemal process of Snodgrass (1935, p. 115).

*Prothorax.* The thorax (fig. 1) is the broadest part of the body. The *prothorax* on the dorsal surface is twice as long as either the meso- or metathorax. In width, the prothorax is about two times as wide as its length. Its dorsal surface is rather densely covered with the same small tubercles found on the head. These tubercles (fig. 5) are so spaced as to form a number of smooth, circular areas on the disk. On the anterior and posterior margins, the absence of tubercles produces a cephalic and caudal area that is quite smooth. The lateral margins each bear a row of rather long, yellowish setae. The prothoracic sternum is divided into three parts. A transversely narrow, cephalic area, the *presternum* (fig. 2, PST), overlaps the ventro-caudal area of the head. A second larger area, the *eusternum* (EST) is defined by Böving and Craighead as "the anterior sternal area in front of the suture between the furcal pits." In this species, the furcal pits (FP) are evident as small slits meso-caudad of the coxal cavities and no distinct suture separates the eusternum from the region caudad of the pits which is the *poststernellum* (PSTL). A narrow, inflexed pleuron (PL) is separated from the sternum by a longitudinal curved suture. The coxae are articulated to the pleuron by a small coxal condyle. From the condyle, a short pleural suture (PLS) extends cephalo-laterad



EXPLANATION OF PLATE II

Fig. 12. *Nosodendron unicolor* Say, dorsal aspect of head. Fig. 13. *Nosodendron unicolor* Say, ventral aspect of head. Fig. 14. *Nosodendron unicolor* Say, left mandible, ventral aspect. Fig. 15. *Nosodendron californicum* Horn, adult beetle. Fig. 16. *Nosodendron unicolor* Say, hypopharynx. Fig. 17. *Nosodendron unicolor* Say, right maxilla, ventral aspect. Fig. 18. *Nosodendron unicolor* Say, first three abdominal segments. Fig. 19. *Nosodendron californicum* Horn, first two abdominal segments. Fig. 20. *Nosodendron californicum* Horn, mesothorax. Fig. 21. *Nosodendron unicolor* Say, right prothoracic leg. Fig. 22. *Nosodendron unicolor* Say, epipharynx. Fig. 23. *Nosodendron unicolor* Say, last abdominal segment, ventral aspect.

toward the tergum dividing the pleuron into a small but distinct episternum (EPIS) and an epimeron (EPIM).

*Mesothorax.* The *mesothorax* (fig. 1) on the dorsal surface is about one-half the length of the prothorax. It differs from the other thoracic segments in having a pair of conspicuous round spiracles (SP). Each spiracle is raised on a small protuberance and located near the cephalo-lateral angle. The three, transverse annulets found on the prothorax are also found on the mesothorax but the anterior region is interspersed with small tubercles and a row of larger tubercles connecting the two spiracles separates the anterior annulet from the larger middle annulet which is densely covered with tubercles, a few of which are arranged to produce a few, smooth, circular areas. The caudal, transverse annulet is smooth as in the prothorax. The pleural and sternal areas are similar to those of the prothorax.

*Metathorax.* The *metathorax* differs little from the mesothorax. It does, however, lack the presence of a pair of spiracles. The lateral margins of both the meso- and metathorax bear rows of long, yellowish setae. The lateral margins are not tuberculated as they are in the abdominal segments.

*Legs.* (fig. 21). The three pairs of legs are about equal in length and made up of similar segments. The large *coxa* (CX) is moderately setaceous and has a row of larger setae near the distal end. The *trochanter* (TRO) is triangular from the lateral aspect and its margin is densely setaceous. The *femur* (FUR) is cylindrical and about twice as long as wide. It bears a row of dense setae on its margin. The *tibio-tarsus* (TT) likewise is cylindrical and only slightly longer than wide. It is somewhat narrower than the femur and is separated from the claw (CL) by a distinct suture.

*Abdomen.* The first seven abdominal segments are similar. Each becomes slightly narrower than the preceding segment. Dorsally (fig. 1) each is divided into three transverse areas. The anterior annulet has a few sparsely placed tubercles with a tendency for most of them to be arranged in a transverse row. The middle annulet is narrower than the middle annulets of the thoracic segments and, like them, the tubercles have about the same density and some are arranged to form indistinct, smooth circular areas. The caudal annulet is narrow and without tubercles. The middle annulet in each of the first seven segments bears a pair of raised spiracles (SP). These are located a short distance from the lateral margins which bear a lateral protuberance that carries a tuft of long, yellow setae. The lateral margins of the cephalic and caudal annulets are without setae on the first seven segments. In available drawings of the European *N. fasciculare*, the dorsal abdominal tubercles appear to be arranged into six longitudinal rows of setae.

On the ventral aspect (fig. 2) the first seven abdominal segments are similar. An inflexed portion of the tergum is separated from a narrow pleuron (PL) by a longitudinal suture and the pleuron is in turn separated from the single sclerite sternum by another longitudinal suture. Each sternum of segments two to seven has on the mid-ventral line, a small, transversely, oval area which appears as though it could be a glandular opening but which is probably the external evidence of an internal apodeme.



The eighth abdominal, or last, segment is equal in length to the two preceding segments. It becomes gradually narrowed to the caudal end where it terminates in three minute lobes. The two lateral lobes bear the last pair of spiracles (fig. 23, SP) which open between the lateral and median lobes. The lateral margins of the segment bear, near the base, two rounded protuberances on each side. These are densely covered with long yellowish setae. A row of shorter setae is located on the margin behind the protuberances. The dorsal surface of the segment is covered with conspicuous nodules, similar to those on the anterior segments. Some of these have a tendency to form longitudinal rows and others are so arranged as to form circular cleared areas. There are no dorsal protuberances near the base of the segment as described in the European *N. fasciculare* and in *N. californicum*.

The ventral aspect of the eighth segment is smoother than the dorsal aspect and has a row of small, setaceous tubercles near the lateral margins. The anal segment (fig. 2, ANS) is located near the base of the eighth segment. It is composed of two rounded lobes which surround the anal opening.

*Spiracles.* The drawing of the larva of *N. fasciculare* by Chapius and Candèze (1853, pl. 3, fig. 6) shows no trace of spiracles and in their description (p. 106) the authors state that in spite of minute study they had not been able to find the ordinary nine pairs of spiracles. They were able to find only a single pair of spiracles on the dorsal surface of the first abdominal segment located a little in front of the lateral prolongation of the tergum. The anterior spiracles of *N. fasciculare* are borne on a small conical projection, the writers further point out that "Les segments suivants n'offrent rien de semblable." (The following segments offer nothing of resemblance.)

Dufour (1862, p. 146) found seven pairs of spiracles in *N. fasciculare* on the lateral edges of the first seven abdominal segments, all of which were located at the summit of a pyramidal tubercle located in front of the lateral prolongations of the tergum ("lobule cilié"). He pointed out that the first pair on the first abdominal segment is difficult to see, being hidden by the edge of the metathorax and not occupying the lateral edges of the segment as do the other pairs but on the dorsum of this segment. Dufour stated that, since he had not found spiracles on the thorax he refused to believe that one pair was not present. Laboulbène (1862) has an article on the subject in the same journal and same volume as that of Dufour. From specimens collected by Dufour, Perris and himself near Saint Sever he has studied the spiracles of this species in some detail. In this work the presence of a thoracic spiracle is reported. It is located laterally on the mesothorax in front of the coxa. This is the position of the mesothoracic spiracle on *N. californicum* (fig. 20, SP) as shown in Böving and Craighead's (1931, pl. 66) drawing. Laboulbène describes the second spiracle as being located dorsally on the first abdominal segment and the remaining ones, third to eighth, are noted as lying below the lateral extensions of the tergal lobes on abdominal segments 2-7, as described by Dufour. Laboulbène brought up the question as to the presence of a ninth pair of spiracles. On the dorsum of the eighth abdominal segment in *N. fasciculare* there is, near the base of the segment, a pair of tubercles which Laboulbène

thought might bear spiracles. Upon dissecting his only larva which had been preserved for many years, he could not find tracheal trunks associated with these tubercles and therefore doubted the presence of a ninth pair of spiracles. He furthermore was unable to find tracheae associated with the mesothoracic spiracle but thought this was due to the poorly preserved condition of the internal parts of his larva. The tubercles of the eighth abdominal segment (fig. 3, TUB) are found in *N. californicum*. They are only feebly evident in *N. unicolor*. Ganglbauer (*l. c.*) described spiracles at the tip of the eighth segment and Böving and Craighead (*l. c.* fig. C) illustrate the attenuated posterior end of the eighth abdominal segment of *N. californicum* which shows a well-defined pair of spiracles on the tips of this segment and they are faintly indicated although unlabeled in their drawing (*l. c.* fig. P) of *N. unicolor*. The present writers have dissected this segment (fig. 23) and readily found two tracheal trunks (TR) leading to these terminal spiracles (SP), whereas Louboulbène was unable to find any leading to the dorsal tubercles in *N. fasciculare* which he thought were probably spiracles. The spiracles of the eighth segment are located on the mesal side of the two, terminal, lateral lobes. The opening is a slit located on a somewhat oval peritreme (fig. 23, SP).

In *N. unicolor*, it is apparent that the mesothoracic spiracles are located dorsally on the cephalo-lateral angle of the segment, while those of *N. fasciculare* and *N. californicum* (fig. 20, SP) are located ventrolaterally. The abdominal segments of *N. unicolor* (fig. 1) on segments 1-7 likewise are dorsal and not closely associated with the tergal lobes as they are in the other two species. The eighth abdominal (9th pair in the series) spiracles are located on the terminal lateral lobes and are concealed by their location on the mesal side of the lobes.

### **Nosodendron californicum** Horn

#### COMPARISON WITH *N. UNICOLOR* SAY

Four larvae, two mature and two half-grown, of *N. californicum* Horn available for study were collected at sap of a wound on white fir at Ashland, Oregon, May 10, 1915, by H. G. Champion. One other larva accompanied by two adults was available but without collection data. These are readily distinguished from *N. unicolor* by the fact that only the first abdominal spiracle is located dorsally and the others laterally, and the tergum of the last abdominal segment has two conspicuous dorsal tubercles. In these respects, this species resembles the European *N. fasciculare* more closely than it does our eastern species *N. unicolor*. Horn (1874, p. 22) in his original description of the adult of *N. californicum* pointed out that in the possession of "elytral tufts *N. californicum* resembles the transatlantic species *fasciculare*."

The largest available larvae measured about 10.3 mm. long with a head width of 1.8 mm. These are probably fifth instar forms. The half-grown larvae were 5 mm. long and have a head width of 1.15 mm. and are probably second instar larvae.

In the smaller larvae only the first abdominal spiracle is visible from above while in the full-grown larvae the spiracles of abdominal segments 2-7 are placed laterally and are on the ends of conspicuous tubules located laterally but which are long enough to be seen from the

dorsum where they protrude immediately cephalad of the lateral protuberances of the tergum.

#### KEY TO KNOWN FIFTH INSTAR LARVAE OF NOSODENDRON

1. Spiracles of mesothorax and spiracles of abdominal segments 1-7 located on tergum; tergum of eighth abdominal segment without two conspicuous dorsal protuberances near base of the segment. (Eastern United States,) ..... **unicolor**
- 1-. Spiracles of mesothorax located on the pleuron in front of mesothoracic leg; spiracles of abdominal segment 1, located dorsally and those of segments 2 to 7 located below and in front of the lateral protuberances; tergum of eighth abdominal segment with two conspicuous darkened tubercles near base of segment. .... **2**
2. Dorsum of abdominal segments with cuticular processes not arranged in longitudinal rows only faintly producing some smooth cuticular circles; eighth abdominal segment without distinct longitudinal ridges. (Western United States)..... **californicum**
- 2-. Dorsum of abdominal segments with cuticular processes arranged in six longitudinal rows; eighth abdominal segment with four longitudinal ridges. (European)..... **fasciculare**

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