

**A Description of the mature larva of
Ptinus californicus Pic.**

and

**A discussion about the justification of considering
the Ptinidae as a valid family of beetles**

by

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The present description of the mature larva of *Ptinus californicus* Pic. is based on a comparatively large series of material of this species in the collection of insects in the U. S. National Museum in Washington, D. C. The material is labeled:

"*Ptinus californicus* Pic.; from nests of *Osmia lignaria*; two miles west of Woody, Kern Co., California. 18-II-1944; E. G. Linsley and J. W. MacSwain coll." Many larvae together with numerous imagines.

The size of the larva is moderately large (c. 10 mm.). The *head capsule* (figs. 1 and 2) is hypognath and protracted, subcircular in outline, posteriorly slightly oval and widest near the middle. There is no frontal cleavage-lines, but a long epicranial sulcus, extending forward about to the middle of the cranium. The pigmented field behind the likewise pigmented *epistoma* (Est) is about twice as long sagittally as epistoma. The color of the pigment is brown-ochre. Epistoma is provided on each side anteriorly with two series of marginal, moderately long setae; the series near the sagittal line consists of five setae, the exterior series of about ten setae. Some setae are placed more rearward. The remainder of the cranial surface is covered with thin, blackish, moderately long and short setae. In the pigmented field the setal cups appear light colored.

The *antenna* (fig. 3) is inserted in a small, well sclerotized, ring-shaped socket located in the pigmented peri-

stoma exterior to the base of the rather low *catapopphysis* (Cat). A triangular, thin casing projects from the peristoma on the ventral side of the socket. The antenna has no articles and the tactile appendix, which is about twice as long as wide, and the minute sensory setulae are borne by the dome-shaped membranous antennal base. The *anteclypeus* (Acl) (= clypeus auct.) (fig. 1) is membranous, colorless and lacks any plates or a sclerotized band at base near the *anteclypeal sulcus* (As). The *labrum* (fig. 4) is movably connected with the epistoma by *anteclypeus* (Acl). It is a transverse shield about three times as broad as long. The anterior margin is curved, medianly almost straight; it is generally yellowish and thinly sclerotized but with a pair of dark anterior marks on the other side of the shield. From each of these marks an almost colorless arm continues through the lumen of labrum to the beginning of the labral rod which forms the inner branch of the Y-shaped *torma* (Tor). The surface of labrum is densely set anteriorly with moderately long setae and is provided on each side, posteriorly at the margin, with a sensilla which is located in front of the space between the two branches of torma; a single, similar sensilla is found sagittally, and thus a transverse series of altogether three sensillae is formed.

The *epipharynx* (fig. 6) carries a group of about twelve short, slightly curved, stiff and pointed *coryphal setae* (Co) medianly in front of the *chaetoparial setae* (C); the number of the chaetoparial setae on each side is two or three; they form on each side an oblique series, and from the ends of the straight middle of the epipharyngeal front margin the two series which are located in the anterior half of epipharynx converge to the rear. A pair of minute setae is present posteriorly, in front of the space between the anterior ends of the tormal inner branches, and a group of altogether about fifteen similar, but mostly somewhat longer, setae are distributed without order in the

crepidal area (Cri) between the stems of the tormae. The *hypopharyngeal area* (Hphy) (fig. 11) lies behind the dorsal side of prementum and is located above the *mesomentum* (Msmt, fig. 16) which it covers. It reaches back to the beginning of *pharynx* (Phy), and on each of its lateral sides a *suspensorial bar* (= futura) (Su) is imbedded, which extends from the anterior part of the hypopharyngeal base obliquely upward to the entrance of pharynx. It is shaped somewhat like a golf club with the larger portion anteriorly, and the retractor muscle of the mouthcorner (Rtr) is attached to the end of the stick. The adoral surface of hypopharynx has on each side a large group of curved, fairly long setae (PgnS) and numerous sense-cones. Medianly between the fronts of the groups is a pair of moderately long, straight and stiff setae, and behind them is a pair of sensory pits.

The *mandible* (figs. 8 and 10) is roman-sepia colored, and equally long, broad and deep; the adoral surface (fig. 10) is concave all the way to the basal part which is convex; it lacks oblong grooves and keels; the aboral surface (fig. 8) is convex and bears a proximal group of ten to fifteen long, curved setae, a distal group of about six somewhat shorter setae and, near the middle of the inner mandibular margin, a circular pit without any sensory ovate setula. The distal part of the mandible projects into a single apical tooth and the inner margin is subapically built as a long, low, thin and rather straight wall extending down to a short tooth-shaped projection. There is no marginal brush of setae, and no arch-shaped thickening around such a brush. The proximal part of the mandible below the projection is simple, but more robust than the compressed distal part.

The *maxilla* (figs. 11, 12 and 13) is well developed; *cardo* (Cd) is a yellowish-brown, subtrapeziform shield, about twice as long as broad, and carries three moderately long setae; *stipes* (St) is also yellowish-brown, about

as broad as cardo but somewhat longer and carries many long setae. *Lacinia* (La) is vestigial, terminally armed with one strong spine and furnished with some setae. *Galea* (Ga) is well developed, is about three times as long as wide, is anteriorly rounded and extends as far forward as the base of the apical article of the maxillary palpus; the marginal setae are strong, and, adorally and aborally, the surface carries many setae, weaker adorally than aborally. The *maxillary palpus* (Plp) consists of three articles, which are approximately of the same lengths, but decreasing in width toward the apex in the proportion of 3:2:1. The apical article has no setae but one sensorial pore ventrally and externally, plus a setalike rod imbedded in a niche in the wall dorsally and externally. The subapical article has two setae and one sensory pore; and the proximal article carries altogether fourteen moderately long setae. The *maxillary articulating area* (Mxart, fig. 13) is fleshy, light colored and naked.

The *labium* (fig. 16) consists of *submentum*, *mesomentum* (Msmt) (= mentum auct.) and *prementum*. Submentum and mesomentum are separated by the transverse *labial sulcus* (Lbs). Both subdivisions are fleshy and large with curved sides; submentum somewhat broader than mesomentum; both carry a lateral group of about eight long setae and a few similar setae between the groups. *Premmentum* is transverse, has a ventral (Prmt-v, fig. 16) and dorsal (Prmt-d, fig. 11) surface, is about half as long as wide and a little less than half the width of mesomentum. It is ventrally limited posteriorly by a narrow, yellowish-brown, band-shaped, arched sclerotization, and bears a pair of medianly meeting lateral groups of densely set, some rather long setae; about ten setae present in each group. The dorsal premental surface carries medianly and anteriorly one pair of asymmetrically placed, moderately long, stiff setae, and on each side a group of about six setae. The *labial palpus* has two articles;

the apical article is similar to the apical article of the maxillary palpus, but is somewhat shorter. It is fully sclerotized, yellowish-brown, has a single sensilla, terminal sensory setulae, but no rod imbedded in a niche. The basal article is low, membranous and colorless. *Ligula* is absent. There are no gular area or gular sulcus.

The *tentorial bridge* (Tntb) (fig. 7) carries a pair of membranous, free, leaflike, short *anterior tentorial arms* (aTntAr).

The trunk of the body (fig. 2) is curved, subcircular in cross section, gradually increasing in size posteriorly, and the end of the body is rounded. The trunk consists of three thoracic and ten abdominal segments, which are soft, membranous and whitish. There are no urogomphi. The prothoracic and the last three abdominal segments are dorsally simple and entire, but the rest of the segments have each two distinct dorsal folds, named the prodorsal and postdorsal tergal areas. They are separated from each other by a laterally oblique transverse prodorsal sulcus. All the areas of the trunk have an abundance of densely set, rather short and very short, fine, soft setae, slightly longer and stronger on the ninth and tenth abdominal segments. Asperities are not found on any of the segments.

The *tenth abdominal segment* (10 abd) is small with a large, elongate, oval, bilobed anal cushion, named *nates* (Nat). This structure is located in the ventral portion of the segment, immediately in front of *anus* (An). It may possibly be interpreted as a special development of the lower anal lip. The arms of the cadmium-yellow, U-shaped *preanal sclerite* (fig. 15) anterior to the eversible lobes are approximately of equal lengths and embrace only the end of the lobes. A small triangular process with apex pointing away from the lobes extends forward from the inner margin of the preanal sclerite where the arms meet medianly. A continuous single series of setae is found on each arm close to the lobes.

The *spiracles* (figs. 2, 5 and 9) are located laterally; first thoracic anteriorly in prothorax and slightly lower than the abdominal ones. The eight abdominal spiracles have their place above the epipleural sulci. All the spiracles are regularly ring-shaped without spouts. The thoracic (fig. 5) is somewhat larger than the abdominal ones (fig. 9).

The *legs* (figs. 2, 14 and 17) are small but well developed, five segmented, thinly sclerotized and light yellow, but with dark-brown and hard ventral trochanteral plate, proximal dorsal end of *tibio-tarsus* and surface *claw*. The coxa is proximally enforced by a brownish basicoxal sclerotization. Trochanter is separated from femur; tibia and tarsus are united and fused into a single, gradually tapering segment (Tb-Ta) which is about as long as femur. *Pretarsus* (Ptar) consists of a membranous, low, basal part and a claw which is about three times as long as the basal part. The latter is armed dorsally with a single seta, and the claw is pointed, slender and curved. A soft *arolium* (ar) (= empodial lobe auct.) extends from the nethermore ventral portion of the basal part as far forward as to the end of the proximal fourth of the claw. The arrangement of the setae on tibio-tarsus is as follows: There are no setae on the proximal half of the dorsal (anterior) surface of the segment (fig. 17), but on its distal half are two setae located (exteriorly) near the base of pretarsus (1, 2), three exteriorly (ex) in a longitudinal, slightly oblique series extending from the beginning of the distal part to the middle of it (3, 4, 5), and three setae arranged in a triangle interiorly (in) in the middle of the distal half (6, 7, 8). On the ventral (posterior) surface (fig. 14) are found altogether eight setae as on the dorsal (anterior) surface, but they are arranged somewhat differently, namely, one seta (a) exteriorly (ex) in the proximal end of the distal part of the segment, three setae (b, c, d) across the middle of

the distal part in a slightly forward directed transverse row, three setae (e, f, g) in another transverse row; but this is sloping downward from near pretarsus exteriorly to the end of the former row interiorly and, finally, a single seta (h) sits interiorly near pretarsus where the dorsal and ventral surfaces meet.

The larva can be determined by inserting the following modification in Hall and Howe's revision¹⁾ of Dr. Manton's²⁾ very useful key to ptinid larvae in stored products:

1. Preanal sclerite small, variable in size and shape, the arms of the triangular or slightly U-shaped sclerite too short to embrace more than the extreme end of the anal groove... 7.
7. Claw with empodial lobe 9.
9. Arms of Y-shaped sclerites in the labrum approximately equal in length..... 11.
11. Distal margin of the epipharynx convex or straight in the middle line..... 12.
12. Epipharynx with setae lateral to the diverging rows, absent..... 12x.
- 12x. The upper side of the labium bearing no strong setae near and in addition to the pair near the middle line .. 13.
- The upper side of the labium bearing an abundance of long setae near and in addition to the pair near the middle line..... *Ptinus californicus* Pic.

In her key as well as in the rest of the text Dr. Manton has described and figured many anatomical details of twelve larval species belonging to the six genera, *Ptinus*, *Niptus*, *Trigonogenius*, *Gibbium*, *Tipnus* and *Stethomerzium*. Later on Hall and Howe have bred the larvae of *Mezium affine* and *Eurostus hilleri*, thus being able to describe and figure the larvae of two more genera and include them in their revision of the Manton-key.

¹⁾ Hall, D. W. and Howe, R. W. (1953), A revised key to the larvae of the Ptinidae associated with stored products.— Bull. Ent. Res., vol. 44, pp. 85—96.

²⁾ Manton, S. M. (1945), The larvae of the Ptinidae associated with stored products. — Bull. Ent. Res., vol. 35, pp. 341—365.

In addition to these taxonomic contributions, an accurate and full anatomic account with excellent figures pertaining to the larva appears in Guido Grandi's "Nota sul *Ptinus bidens* Oliv."³). Several other papers have been published in the past about some of the now well described larval forms and need not be considered here.

Out of the nine ptinid genera listed in Leng's Catalogue⁴) seven are known in the larval stage, and only of the two genera *Niptinus* Fall from Texas, and *Ptinus* Gorb. from California have the larvae not been accounted for.

In view of the fact that so large a majority of the larval genera and their species have been satisfactorily treated both anatomically and taxonomically, it is feasible to present a series of characters by which the entire assemblage of larvae can be included in the same family. These defining characters are as follows:

Taxonomic Definition of the Larval Family Ptinidae.

The larvae are quite homogeneous. The ligula is absent. The preanal sclerite is either small, variable in size and shape, with the arms too short to embrace more than the extreme end of the nates, or the sclerite is large, U-shaped, with the arms reaching to about the middle of nates. In both cases a small, single process may be found where the arms unite sagittally. The thoracic spiracle is located anteriorly in prothorax; the spiracles are simple annular or annular with a single spout.

In addition to these individual characters the family displays an exclusive character-combination, not found in other families, and particularly, not in the Anobiidae,

³) Grandi, Guido (1937), Nota sul *Ptinus bidens* Oliv. — Bollettino dell'Instituto di Entomologia della R. Univ. di Bologna, vol. IX, pp. 95—103; figs. I—VIII.

⁴) Leng, C. W. and Mutcheler, A. J. (1920—1939), Catalogue of Coleoptera of America North of Mexico.

namely, a cranium without frontal cleavage lines, plus a mandible with only a single apical tooth and a sub-apical margin proximally produced into a small, sharp or obtuse process and no marginal brush, plus a vestigial lacinia represented merely by a strong spine, plus hairy prodorsal areas, never armed with asperities, plus an antenna without articles but with a tactile appendix on a membranous, dome-shaped antennal base.

The taxonomic arrangement of the families which are included in the well defined superfamily Bostrichoidea has not been completely settled, especially not as far as the validity of the family-rank of the Ptinidae is concerned⁵). For unquestionably, the ptinid larvae appear more closely related to the majority-type of the anobiid larvae than do the larvae of some of the anobiid genera, viz. the genus *Ptilineurus*, the *Dorcatoma* assemblage, the genus *Caenocara* and the genus *Ptilinus*. But when the larval form, figured and described as *Gastrallus* sp. in my just mentioned paper⁵), might have accounted for an anobiid larva with ptinid characters, the naked fact is that, in reality, it is a ptinid larva and not an anobiid larva. Unfortunately it has not been determined by rearing but, wrongly, associated with imagines of the anobiid *Gastrallus* sp. with which it was found together in the same lot. However, a true larva of the genus *Gastrallus* has been reared from dead wood of many species of trees in Dehra-Dun, India and has been described and figured by J. C. M. Gardner as *Gastrallus birmanicus* var. *insulcatus* Pic⁶) It is easily recognized as an anobiid larva belonging to the group which lack claws and instead have a soft bladder at the terminal part of the legs.

⁵) Böving, Adam G. (1954). Mature larvae of the beetle family Anobiidae. — Dan. Biol. Medd., vol. 22, pp. 1—298, 50 plates.

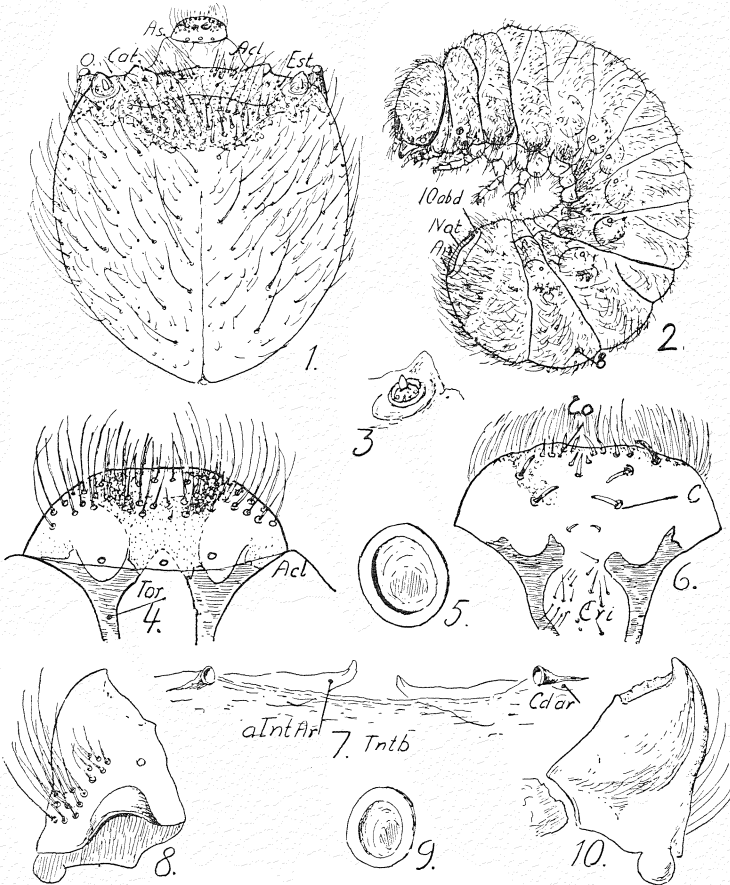
⁶) Gardner, J. C. M. (1937). Immature stages of Indian Coleoptera (22). Indian Forest Records, vol. III, No. 6, p. 134, pl. I, figs. 13—20.

Plate I — *Ptinus californicus* Pic. 7)

- Fig. 1. Head capsule, dorsal view; Acl, anteclypeus; As, anteclypeal sulcus; Cat, catapophysis; Est, epistoma; O, ocellus (Zeiss ocular 3, objective a₃; $\times 38$).
- Fig. 2. External structures of the body of *Ptinus californicus*; lateral view; An, anus; Nat, nates; 8, eighth abdominal segment; 10 abd, tenth abdominal segment.
- Fig. 3. Left antenna (Zeiss 3/C, $\times 180$).
- Fig. 4. Labrum, dorsal view; Acl, anteclypeus; Tor, torma (Zeiss 3/C, $\times 180$).
- Fig. 5. Thoracic spiracle (Zeiss 3/C, $\times 180$).
- Fig. 6. Epipharynx; C, chaetaparial setae; Cri, crepidal area; Co, coryphal setae (Zeiss 3/C, $\times 180$).
- Fig. 7. Tentorial elements and hypostomal articulating processes for cardines; aTnt Ar, anterior tentorial arm; Tntb, tentorial bridge (Zeiss 3/C, $\times 180$).
- Fig. 8. Left mandible, aboral surface (Zeiss 3/C, $\times 180$).
- Fig. 9. Third abdominal spiracle (Zeiss 3/C, $\times 180$).
- Fig. 10. Left mandible, adoral surface (Zeiss 3/C, $\times 180$).

7) The illustrations are made by the author. All the figures, except the freehand-drawn figure 2, are delineated with camera lucida.

Plate I.



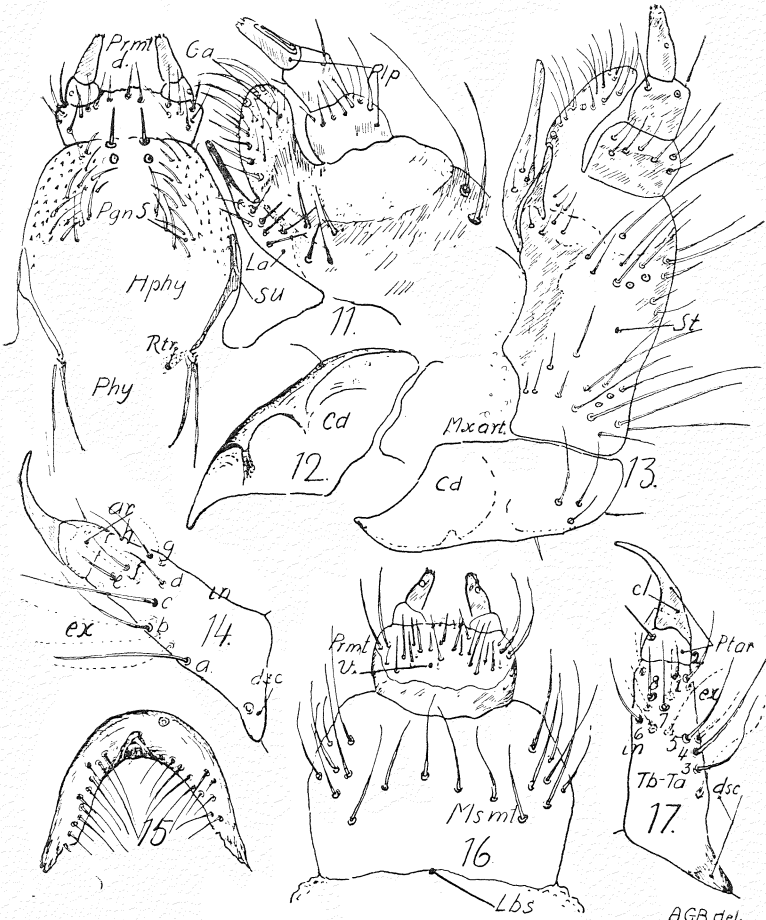
Ptinus californicus

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Plate II — *Ptinus californicus* Pic.

- Fig. 11. Hypopharyngeal structure and dorsal, adoral side of prementum and dorsal, adoral side of maxilla; Ga, dorsal side of galea; Hphy, hypopharyngeal surface; La, dorsal side of lacinia; PgnS, paragnathal setae; Phy, entrance to pharynx; Plp, maxillary palpus; Prmt d., adoral, dorsal side of prementum; Rtr, retractor muscle from hypopharyngeal suspensorial bar; su, suspensorial bar of hypopharynx (Zeiss 3/C, $\times 180$).
- Fig. 12. Inner surface of left, shield-shaped cardo (Zeiss 3/C, $\times 180$).
- Fig. 13. Outer, aboral surface of left maxilla; Cd, cardo; Mx art, maxillary articulating area; St, aboral, outer surface of stipes (Zeiss 3/C, $\times 180$).
- Fig. 14. First leg, ventro-posterior view of right limb; setae of dorso-anterior side are indicated by dotted lines, ar, arolium (empodial lobe); dsc, dorsal sclerite of tibio-tarsus; ex, exterior surface; in, interior surface; a—h, setae on the ventro posterior side of the leg (Zeiss 3/C, $\times 180$).
- Fig. 15. Preanal sclerite of nates (Zeiss 3/C, $\times 180$).
- Fig. 16. Prelabium with mesomentum (= mentum auct.) and premental structures, ventral view; Lbs, labial sulcus; Msmt, mesomentum; Prmt v., prementum, ventral surface (Zeiss 3/C, $\times 180$).
- Fig. 17. First leg, dorso-anterior view of right limb; setae of ventro-posterior side are indicated by dotted lines; cl, claw; dsc, dorsal sclerite of tibio-tarsus; ex, exterior surface; Ptar, pretarsus; Tb—Ta, tibio-tarsus; 1—8, setae on the dorso-anterior side of the leg (Zeiss 3/C, $\times 180$).
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Plate II.



Ptinus californicus

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