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External Morphology of Larvae of *Choristoneura houstonana* (Lepidoptera: Tortricidae)

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Abstract

Postembryonic changes in external morphological structures of *Choristoneura houstonana* (Grote) from first to last instars are described. A setal map for first and last instars are described and illustrated. Possible generic characters are suggested.

According to Powell (1964) *Choristoneura houstonana* (Grote) is distributed throughout the pinyon-juniper woodland areas of southwestern United States and the Great Basin. Its occurrence in Kansas was first reliably recorded in 1964, although a museum record indicates that the insect possibly was collected in the state in 1889. Throughout its range it feeds on a number of *Juniperus* species (Powell 1964). In western Kansas *C. houstonana* attacks *Juniperus virginiana* (L.), eastern redcedar; it is a serious pest in ornamental plantings around homes, golf courses, and cemeteries (Heinrichs and Thompson 1968).

The taxonomic status of *C. houstonana* is in question. Frederic Rindge (pers. comm. 1966) of the American Museum of Natural History, New York, stated that Obratzov, before his death, was revising the Nearctic Tortricinae. He proposed placing *C. houstonana* in the genus *Cudonigera*, but this revision was not published.

This study was conducted (a) to provide information on postembryonic changes during larval development, (b) to aid in identifying *C. houstonana* larvae, and (c) to provide information on the taxonomic relationship of *C. houstonana* to other *Choristoneura* species.

Materials and Methods

Eggs (from which were reared first instar larvae) and later instar larvae were collected from infested host plants at the Larned, Kansas Country Club golf course. Larvae were preserved in 70% ethanol. Then heads of larvae were removed, and heads and larval skins placed in 10% KOH, washed in water, and mounted in Hoyer's medium. Drawings were made, aided by a camera lucida where applicable; the insects were measured with an ocular micrometer. Approximately 10 larvae of each instar were examined to determine shape and size of head structures; 4 first and 10 last instar larval skin slide mounts to determine body size; and 40 last instar whole specimens to determine setal pattern. Heinrich's (1916) and Hinton's (1946) terminology is adhered to for the head and body setae, respectively; and MacKay's (1959) for anal shield setae. Peterson (1948) was followed for locating and naming antennal structures and Ripley (1923) for maxillary palpi.

A series of *C. houstonana* larvae has been deposited in the Canadian National Collection of Insects.

Observations and Discussion

Structural Characters

Antenna

A noticeable change in shape after each molt. Scape (1) about 0.98 times as long as wide in first instars (Fig. 1k); a gradual increase to about 3.08 times as long as wide in last instar (Fig. 2m). Pedicel (2) with a two-fold increase in length:width ratio from first to last instar. Third segment, little change. Change in shape of antenna possibly related to a change in function. (Earlier instars mine; therefore a short, stubby antenna could be easier to manipulate than a long, slender one in limited space.)

Mandible

About 1.40 times as long as wide in first (Fig. 1e) to 1.20 in last instar (Fig. 2j). Teeth of last instar often worn (Fig. 2k). With 5 teeth: tooth 5 shortest, 1 and 4 about 2 times as long as 5, and 2 and 3 about 4 times in both first and last instars.

Labrum

Little change apparent in width:depth of labrum with growth; about 1½–2 times as wide as deep in first and last instars (Figs. 1d, 2f). Depth of notch on anterior margin about ⅓ that of labral lobe depth in first and last instars. Epipharyngeal setae (ET) present in last but not visible in first instar.

Maxilla

Medial segment (2) of maxillary palpus about half as long as wide in first instar (Fig. 1g) to almost twice as long as wide in last instar (Fig. 2d). Distal segment (3) about twice as long as wide in first and last instars. Medial segment 0.46 times as long as distal segment in first instar, increasing to 1.65 times as long in last instar.

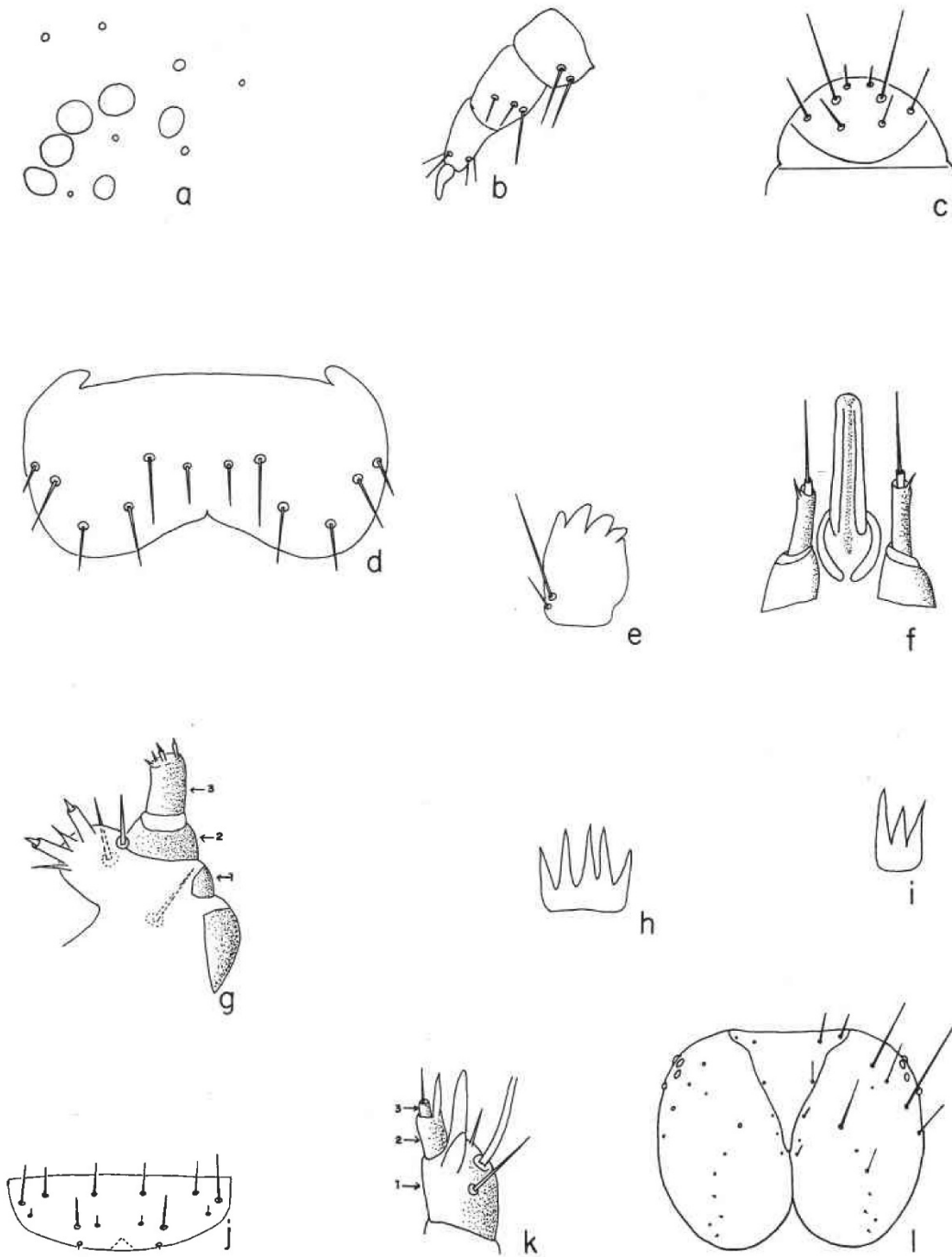


Figure 1. *Choristoneura houstonana*. First instar: a, ocelli and surrounding setae; b, prothoracic leg; c, anal shield; d, labrum; e, mandible (dorsal view); f, spinneret and labial palps (ventral view); g, maxilla; h-i, anal fork; j, thoracic shield; k, antenna; l, head (dorsal view).

Spinneret

About 4.50 times longer than width in all instars (Figs. 1f, 2i). Moderate to well developed; rounded at tip.

Proximal sclerite (PS) present at base of spinneret. Arms of sclerite usually separated ventrally but joined in some specimens; character variable within an instar.

Labial Palpus

About the same length as spinneret in all instars (Figs. 1f, 2i). Proximal segment (1) about 8.00 times as long as medial segment. Distal, setalike segment (3) about length of proximal segment.

Ocelli

No apparent change in shape, relative size, or position with growth (Figs. 1a, 2b).

Thoracic Legs

Nearly the same length on all thoracic segments. Little or no postembryonic change in length of one segment in relation to another. Relative length of tarsal claw greatest in first, about 0.6 times tarsus (Ta) length (Fig. 1b) and shortest in last instar, about 0.3 times (Fig. 2c).

Crochets

Uniordinal in early and triordinal in last instar. Average number per proleg on abdominal segments 3–6, 8 in first and 38 in last instar. Average number of anal crochets 6 in first and 29 in last instar.

According to MacKay (1963) an internal feeder apparently requires fewer, less-differentiated crochets than does a leaf roller or one that ties leaves. The feeding habits of *C. houstonana* change from leaf mining in early instars to feeding in a web in later instars; the change in arrangement and number of crochets probably has some advantage for larva.

Integument

Spinules sparse in first instar (about 6 to 11 between D1 setae on first abdominal segment), dense in later instars (about 45 to 70 in last instar), a gradual increase in number in intervening instars.

Anal Fork

Poorly to moderately developed; average prong length about 2 times base depth. Usually 5 prongs; vary from 3 to 8.

The shape of the anal fork and prong number in an instar varies (Fig. 1h–l). In late-instar specimens, it was at times difficult to distinguish between prongs and the greatly enlarged spinules occurring near the anal fork. Tips of the anal prongs tended to bifurcate, beginning in the middle instars and becoming most prominent in the last instar (Fig. 2g–h).

Spiracle

Nearly circular on all segments. Spiracles in all instars much larger than SDI setal base (Fig. 2a). Spiracle on prothorax and segment 8 largest.

Chaetotaxy

All head setae primary. Relative lengths similar in all instars. With growth shifted position, seta O² moving posteriorly and dorsally in later instars (Figs. 1a, 2b). Angle formed by seta p¹ and Adf² and P², with P¹ at the apex, acute in first (85°) and obtuse (96°) in last instar (Figs. 11, 2n).

Setae D1 and SD2 on thoracic shield much smaller (about 0.2) than SD1 setae in the first (Fig. 1j) and about 0.6 times the length of SD1 in the last instar (Fig. 21). L1 setae on anal shield about 5 times as long as D2 (shortest) setae in first (Fig. 1c) and about 1.7 times as long in last instar (Fig. 2e).

Color

Head black in first and reddish brown in last instar. Body yellow in early instars, trending to green in middle instars, culminating in an olive green in last instar. Anal shield same as body. Thoracic shield same as body in early instars; darker in later instars: yellowish brown but overlying darker band runs along lateral and posterior edge (Fig. 2l). A narrow white band extends longitudinally along mid-dorsal line in last instar. Legs light in early and dark brown in middle and late instars. Pinacula off-white in all instars except L, SV, and V on prothorax, which become dark brown in later instars.

*Description of Last Instar**General*

Length about 15 to 21 mm. Average length and width of head on 50 specimens 1.78 and 2.13 mm, the smallest being 1.50 and 1.73 mm and the largest 2.03 and 2.43 mm. Average postclypeal index for 13 specimens 1.49 within a range of 1.27 to 1.68. Head reddish brown with darker pigment in ocellar area and at postgenal juncture. Thoracic shield yellowish brown bordered laterally and posteriorly with a dark brown or black band. Thoracic legs brown. Body olive green. Pinacula pale except L, SV, and V on prothorax, which are dark brown. Anal shield of body color or slightly darker. Anal fork poorly to moderately developed, prong length of seven specimens averaging 1.72 times greater than base depth, prong number usually 5; prongs often bifurcate.

Head

P¹ about equidistant between P² and Adf² (perhaps closer to P²) and at the apex of an obtuse angle formed with the two setae (Fig. 2n). Adfrontal sutures sinuate, meet at the coronal suture to form a sharp point.

Prothorax

D1s consistently closer to corresponding D2s than to each other. Spiracle circular or nearly so (Fig. 2a). L1 closer to L2 than to L3 and in a straight line with them (Fig. 2a).

Thorax

Seta SD2 on meso- and meta-thorax dorsal to SD1 (Fig. 2a). SV setal group on meso- and meta-thorax a single seta.

Abdomen

Spiracle circular (Fig. 2a) and SDI $\frac{1}{2}$ to 2 times its (spiracle) diameter from it. SD1 on segment 8 usually anterior to spiracle and slightly less than its (spiracle) diameter from it. SD2 on segments 1–8 on SD1 pinaculum. SV setae on segments 1, 2, 7, 8, and 9 unstable but usually 3:3:2:2:2. D2 pinaculum on anterior abdominal segments with its mesal margin about level with lateral margin of D1 pinaculum (not D1 seta). D1 on segment 9 on its own pinaculum. V1 setae on segment 9 farther apart than those on 8. Pinacula moderately large.

Anal Shield

Rounded posteriorly (Figs. 1c, 2e). D2s shorter and the others about equal to or longer than the anal segment. DIs consistently closer to corresponding SDIs than to each other. L1 of six specimens averaging 1.7, 1.3, and 1.1 times as long as D2, D1, and SD1, respectively.

Conclusions

Choristoneura houstonana differs from all *Choristoneura* Lederer groups (MacKay 1962) in that the SV group on abdominal segment 7 usually (98%) consists of 2 rather than 3 setae; it differs from group 3 in that the dorsal (d) and subdorsal (SD) pinacula on meso- and meta-thorax are not elongated posteriorly; it differs from groups 1 and 2 in that P¹ appears to be at the apex of an obtuse, rather than an acute, angle formed with P² and Adf²; and it differs from group 2 in that the D2 pinaculum on anterior abdominal segments usually has its mesal margin on the level of the lateral margin of the D1 pinaculum rather than on a level of the D1 seta.

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