

**THE FUNCTION OF THE CAUDAL APPENDAGE IN COCOON
JUMPING OF *PHOBOCAMPE* SP.
(HYMENOPTERA: ICHNEUMONIDAE: CAMPOPLEGINAE)**

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The early-instar larvae of many species of Hymenoptera Parasitica have caudal appendages but these usually atrophy by the final instar (Hagen 1964). Finlayson (1964) described and illustrated caudal appendages of final-instar larvae of seven species of *Phobocampe* and three species of *Meloboris* (Ichneumonidae: Campopleginae). Caudal appendages of final-instar larvae were reported by Muesebeck and Parker (1933) in *P. disparis* (Vier.) and by Thompson and Parker (1930) in *Sinophorus crassifemur* (Thoms.) (Campopleginae). Clausen (1940) described cocoon jumping in the genera *Bathyplectes* and *Sinophorus* [= *Eulimneria*], Fiske (1903) and Howard and Fiske (1911) in *P. clisio-campe* (Weed) [= *Ameloctonus* and *Limnerium*], and Morley (1914) in *Spudastica* (Campopleginae).

Finlayson (1964) reviewed the various functions that have been ascribed to the caudal appendage by other authors. She noted that the possession of a final-instar caudal appendage in species of *Phobocampe* was coincidental with cocoon jumping and suggested a relationship between the two. Subsequently Dr. R. Carlson, U.S. National Museum, Washington, D.C., hypothesized that the caudal appendage may function in cocoon spinning (Pers. Comm.).

The purpose of this paper is to describe the function of the caudal appendage of the final-instar larva within the cocoon of an unnamed species of *Phobocampe*. The specimens examined were determined by ourselves and by Dr. Carlson as an undescribed species. They were reared from a mixed collection of *Operophtera bruceata* (Hulst) and *O. brumata* (L.) collected at Victoria, B.C. in May, 1977 and 1978.

The caudal appendage of *Phobocampe* sp. (Fig. 1) consists of two discrete sections: an anterior section that is unsclerotized and fluid-filled, and of visibly different texture from the skin; and a posterior section that is heavily-sclerotized and finely-annulated. The latter is the caudal appendage described by Finlayson (1964) from cast skins of various species of *Phobocampe* and *Meloboris*. A re-examination of the Finlayson specimens showed that there was an area of textureless skin anterior to the caudal appendage similar to that shown in Figure 1.

The entire structure is about 0.4 mm long, or one-twelfth the length of the larva. The sclero-

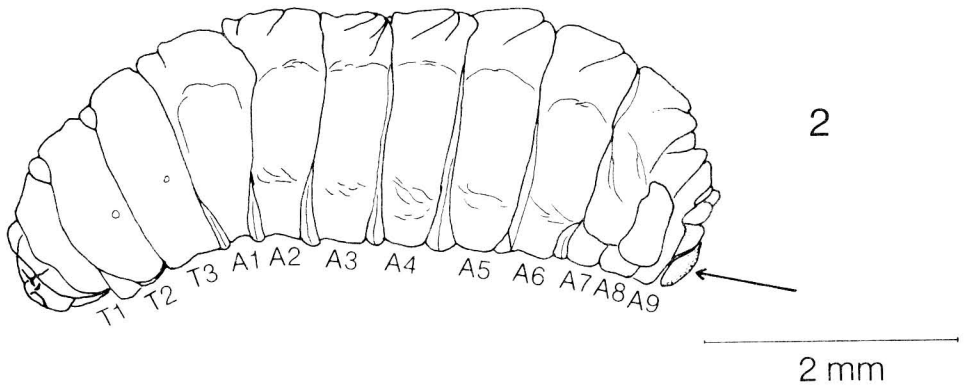
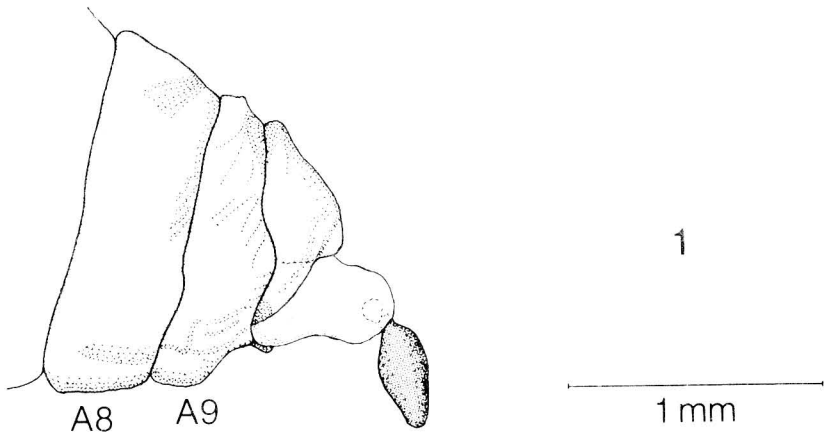
tized section can be moved by inflation and deflation of the unsclerotized portion. Figure 1 shows the inflated position, and Figure 2 the relationship between the caudal appendage in the deflated position and the remainder of the larva.

Cocoon spinning, as observed in two larvae, began when the larva had spun a bed of silk on the substrate. When an obstruction was met, or when the larva had proceeded about 2 cm, it stopped and looped its head back over the abdomen and began to spin a loose net of silk over its dorsal surface. When a fragile net of silk had been spun around itself, the larva reversed its position and began to close up the spaces between the silk. This process of reversing and further closing the spaces between the silk net was repeated many times until the cocoon was complete. The larva moved its head in a figure-of-eight pattern while spinning. This whole process took about three days, during which the cocoon became increasingly hardened and darkened until the final product had the consistency of mica. Based upon about 200 examples, cocoons were fine-textured, gray, and with terminal and sub-terminal, semi-transparent, dark areas (Fig. 3) through which the larva could be seen. The caudal appendage was not observed to participate in the cocoon-spinning process.

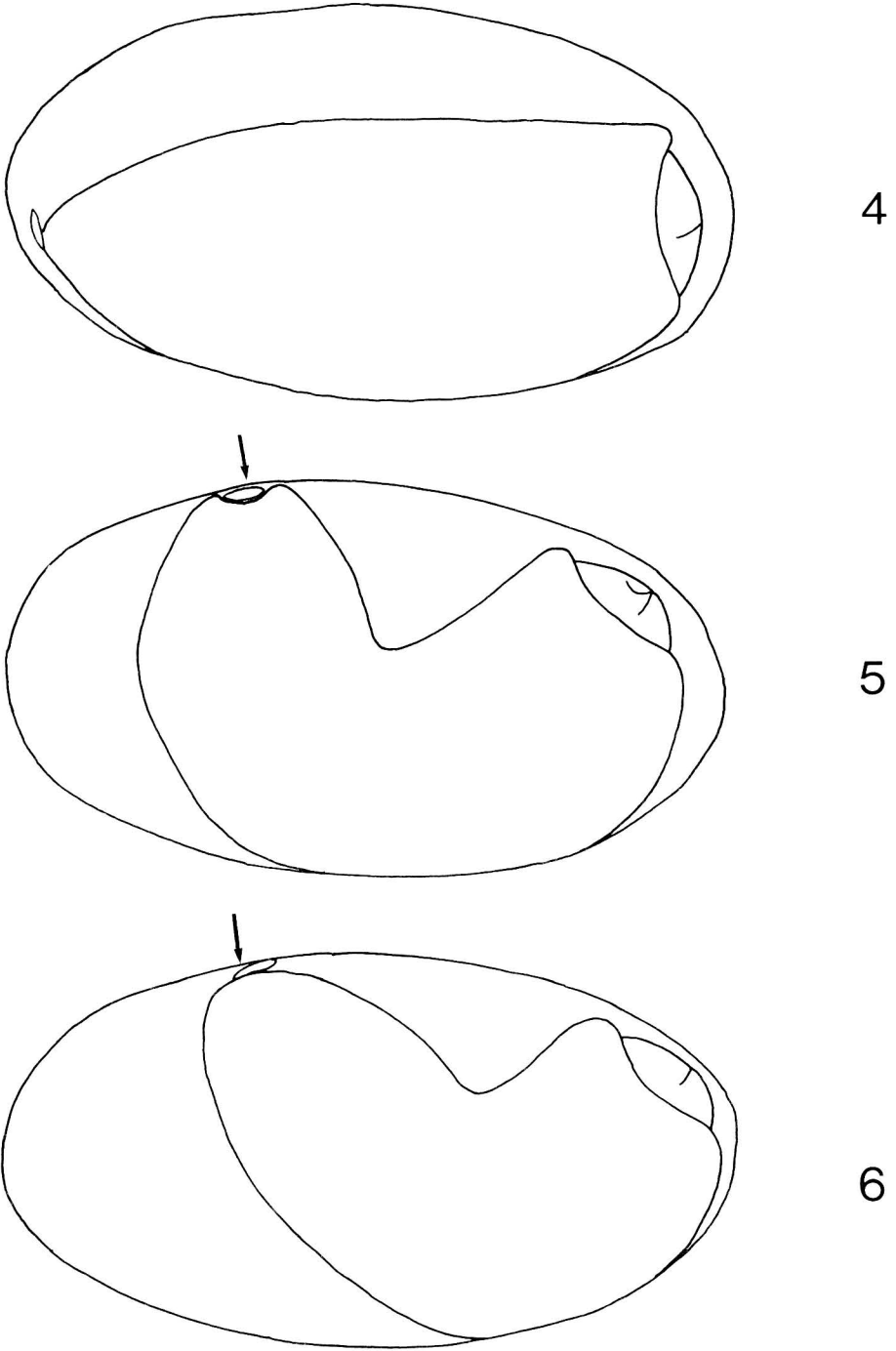
Cocoon jumping began when the cocoon was fully formed but was still thin enough for larval activity to be seen. From a supine position (Fig. 4), the larva reared its body until the anal segments and caudal appendage were in contact with the wall of the cocoon in the sub-terminal darkened area (Fig. 5). The anal segments were pushed away from the wall of the cocoon by inflation of the caudal appendage which held the abdomen in place (Fig. 6). When the caudal appendage was deflated, abdominal segments 4 to 9 were thrown forcefully downwards so that they struck the ventral rounded portion of the cocoon, causing the cocoon to jump. The whole sequence took about one second and happened not more than once every 5 seconds. The jump was usually about 2 cm vertically and up to 4 cm horizontally.

Exposure to light was necessary to initiate jumping. There was no evidence that tactile or auditory stimulation was involved. Without a response to sound or touch, it is unlikely that cocoon jumping could function as a predator- or parasite-avoidance mechanism, but solely for locomotion.

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Figs. 1-3. *Phobocampe* sp.: 1, terminal segments of final-instar larva showing caudal appendage in the inflated position; 2, final-instar larva with caudal appendage in the deflated position; 3, cocoon.



Figs. 4-6. Diagrams of sections of cocoons of *Phobocampe* sp. showing positions of final-instar larvae: 4, supine position; 5, anal segments and caudal appendage in contact with cocoon wall; 6, caudal appendage in inflated position showing anal segments pushed away from cocoon.

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