



Larval morphology and diagnosis of the Giant Microcaddisfly species, *Ugandatrichia* spp. (Hydroptilidae: Trichoptera) in Thailand

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Abstract

Fifth instar larval morphology and ultrastructure of *Ugandatrichia kerdmaung* Malicky and Chantaramongkol 1991, *U. maliwan* Malicky and Chantaramongkol 1991, *U. hongae* Olah 1989 and *U. hairanga* Olah 1989 were investigated. The *Ugandatrichia* spp. are case bearing and net spinning caddisflies. The presence, number and characteristics of the sclerites on abdominal sterna III, IV, and V can be used to identify the *Ugandatrichia* species found in Thailand. The larva of *U. hongae* has no sclerites on the abdominal sterna; that of *U. hairanga* has a sclerite on each of abdominal sterna III, IV, and V; that of *U. kerdmaung* has a sclerite on each of abdominal sterna IV and V, and that of *U. maliwan* has six sclerites on abdominal sterna IV and V. SEM micrographs of *Ugandatrichia* spp. showed that the spherical palpiger has a labial palp, an anterior silk gland opening, and dense bristles anteriorly and inside of its mouth. There are three main types of integument surface: an irregular dome shape which is found on the head, pronotum, mesonotum, and metanotum; a regular dome shape which is found on the membrane between the nota; and an amoeboid, dot shape which is found on the abdominal segments.

Key word: Microcaddisflies, Hydroptilidae, *Ugandatrichia*, Larva, Thailand

Introduction

Hydroptilids are tiny caddisflies, the vast majority of which are no longer than 6 mm long. They are often referred to as microcaddisflies (Dudgeon, 1999). The larvae are free living for the first four instars, and build a case for the final instar. The three thoracic nota of the insects are covered with sclerotized plates, abdominal gills are lacking, and long setae occur on the head and thoracic nota. There is usually a sclerotized plate on the dorsum of abdominal segment IX and small claws at the lateral posterior end (Wiggins 1996, Malicky 1999, Dudgeon 1999, Laudee 2002).

The study of Trichoptera biodiversity in Thailand has revealed more than 800 species, many of which have not been described (Malicky & Chantaramongkol 1999, Thapanya *et al.* 2004, Malicky & Prommi 2006). Hydroptilidae is represented in Thailand by two genera, *Orthotrichia* and *Ugandatrichia*. Five species of *Ugandatrichia*, *U. hairanga* Olah 1989, *U. hongae* Olah 1989, *U. maliwan* Malicky and Chantaramongkol 1991, *U. sanana* Olah, 1987 and *U. kerdmaung* were reported in Thailand (Malicky and Chantaramongkol, 1999), but many more are expected.

The study of Trichoptera in Thailand has been mainly on the biodiversity of the adults. In comparison with adult Trichoptera in Thailand, only a very few larva can be identified to the species level. However, Malicky (1999) described the morphology and biology of the larva of *U. maliwan* and compared its case and final instar morphology with those of *U. maliwan* and *U. kerdmaung*. His investigation showed that these caddisflies were different according to the number and shape of sclerites on abdominal sterna IV and V.

Thani and Chantaramongkol (1999) studied the life cycle of *U. maliwan* in Mae Klang stream in Doi Inthanon National Park, Northern Thailand. The results showed that the caddisfly had a non-seasonal life cycle, and a frequency analysis of the larval head capsule width revealed the presence of five instars. Laudee (2002) studied the life cycle, larva morphology, and some biology of *Ugandatrichia kerdmuang*. The insect has five instars in a non-seasonal life cycle and feeds on filamentous algae and benthic diatoms.

This research establishes a taxonomic guide to identify the larvae of *Ugadatrichia* spp. occurring in Thailand.

Material and methods

Larvae and pupae of *Ugandatrichia kerdmuang*, *U. hairanga*, and *U. hongga* were collected by hand picking from Vipawadi waterfall, Surat Thani Province. *Ugandatrichia maliwan* larvae were collected by hand picking from Doi Inthanon National Park, Chiangmai Province, Thailand. *Ugandatrichia maliwan* and *U. kerdmuang* were diagnosed as species by Malicky (1999) and Laudee (2002). The final instar larvae and mature pupae of *Ugandatrichia hairanga* and *U. hongga* collected from the study site were preserved in 70% ethyl alcohol. The insects were sorted to morphospecies. Pharate adult genitalia were macerated by heating in 10% NaOH at 60°C for 30 minutes. The association between the adults and fully developed pupae was established with genitalic characteristics. Further, the identified pupae were then associated with final larvae instar by the larval sclerites remaining in the posterior end of the pupal case (metamorphotype method, Wiggins 1996). The morphological terminology is based on that of Wiggins (1996).

Features of the identified larvae were drawn by stereomicroscopy with a drawing tube. An ocular micrometer was used to measure larval dimensions. For ultrastructure information, specimens were fixed in 2.5% glutaraldehyde with a phosphate buffer of pH 7.4, and 1% osmium tetroxide, for 24 and 2 hours, respectively. Fixed specimens were dehydrated with a graded series of ethanol and acetone, and finally dried in a critical point dryer. The dried samples were mounted on stubs, coated with gold, and examined with a Scanning Electron Microscope.

Voucher specimens were deposited in the Department of Science, Faculty of Arts and Sciences, Prince of Songkla University, Surat Thani Campus, Thailand.

Descriptions

Ugandatrichia kerdmuang (Fig. 1): Head capsule width of last instar 0.38–0.42 mm (n=12). Head sclerotized, brownish, with numerous setae. Head capsule oval in dorsal view. Frontoclypeus approximately three-fifths head capsule length. Pronotum, mesonotum, and metanotum brownish, covered by sclerites with numerous setae. Each tibia with two spurs, each tarsal claw curved and with acute basal seta. Abdominal segments membranous, white. White, three-lobed area of chloride epithelium present dorso-medially on each of abdominal terga I–VIII. Abdominal sterna IV and V each with one sclerite, each slightly elevated at posterior edge. Abdominal segment IX with three sclerotized plates dorsally and pair of small claws at lateral posterior end. Each anal claw bent and pointed sharply at apex. Larval case oval, surrounded by four lobes of netting with numerous holes, including one anterior lobe, one posterior lobe and pair of lateral lobes. Pupal case bag-like with two stalks at anterior end and broad lobe at posterior end.

Ugandatrichia maliwan (Fig. 2): Head capsule width of last instar 0.42–0.45 mm (n=7). Head sclerotized, brownish, with numerous setae. Head capsule oval in dorsal view. Frontoclypeus about three-fifths head capsule length. Pronotum, mesonotum, and metanotum brownish, covered by sclerites with numerous setae. Each tibia with two spurs, each tarsal claw curved and with acute basal seta. Abdominal segments mem-

branous, white. White, three-lobed area of chloride epithelium present dorso-medially on each of abdominal terga I–VIII. Six sclerites on abdominal sterna IV and V, with very small transverse pair behind large dumb-bell-shaped sclerite of sternum IV and small oval pair before large semicircular sclerite of sternum V. Abdominal segment IX with three setose sclerotized plates dorsally and pair of small claws at lateral posterior end. Each anal claw bent and pointed sharply at apex. Larval case with four lobes as for *U. kerdmuang*. Pupal case tube-like with four stalks, two at each end.

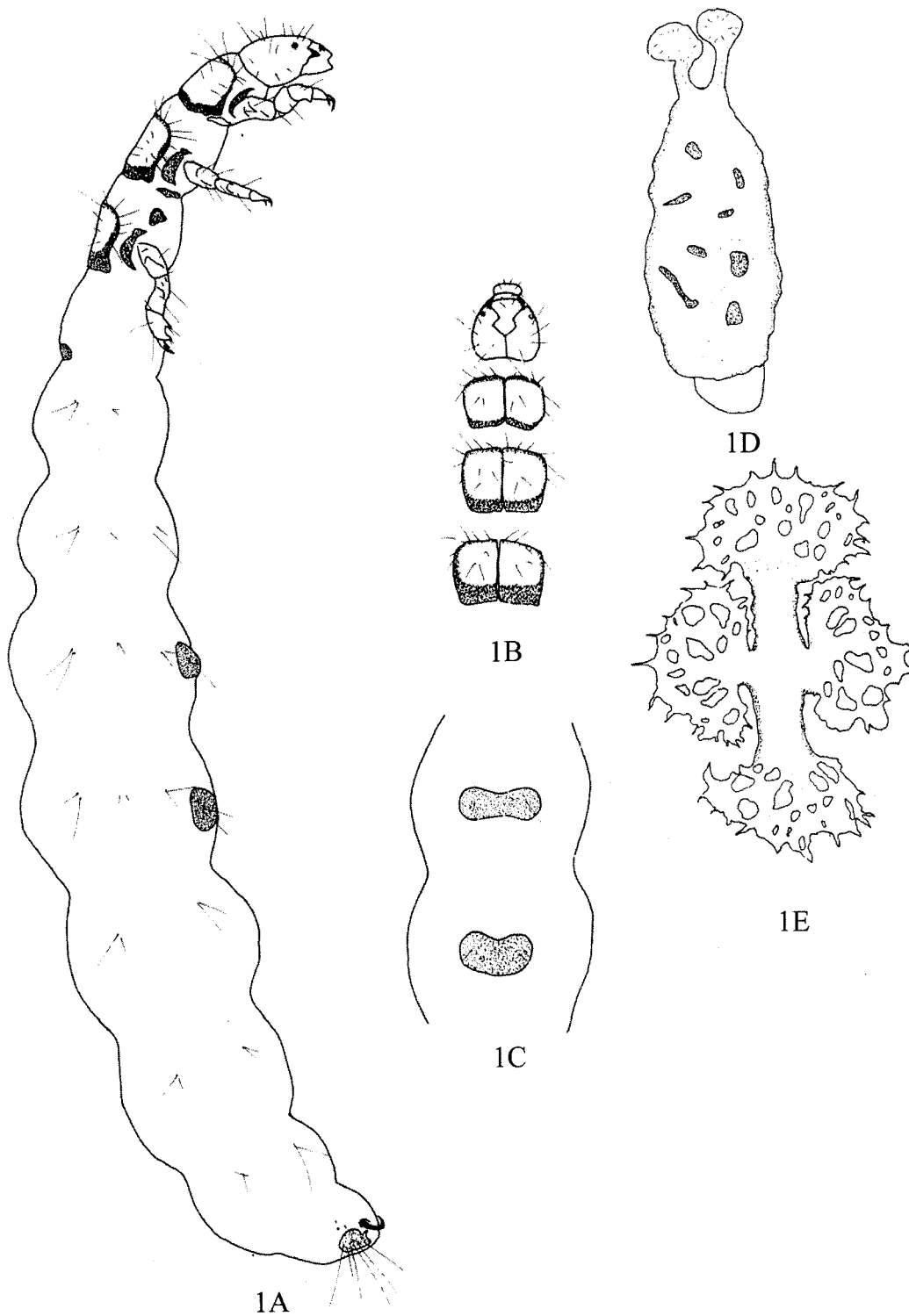


FIGURE 1. Larval features of *Ugandatrichia kerdmuang*. 1A—larva; 1B—dorsal aspect of head and nota; 1C—sclerites on abdominal sterna IV and V; 1D—pupal case; 1E—larval case.

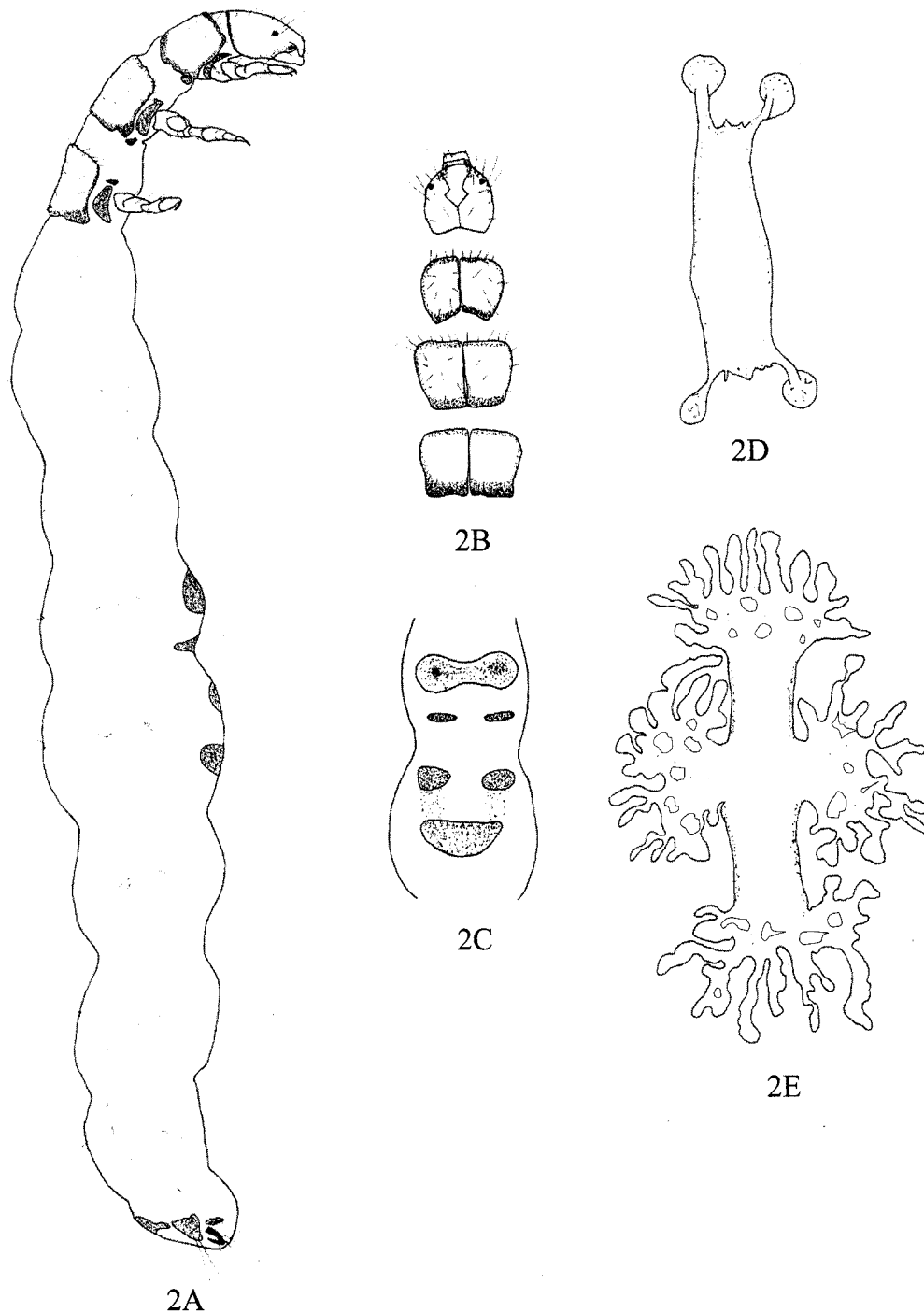


FIGURE 2. Larval features of *Ugandatrichia maliwan*. 2A—larva; 2B—dorsal aspect of head and nota; 2C—sclerites on abdominal sterna IV and V; 2D—pupal case; 2E—larval case.

Ugandatrichia hairanga (Fig. 3): Head capsule width of last instar 0.27–0.30 mm (n=8). Head sclerotized, brownish, with numerous setae. Head capsule circular in dorsal view. Frontoclypeus approximately three-fifths head capsule length. Pronotum, mesonotum, and metanotum brownish, covered by sclerites with numerous setae. Each tibia with two spurs, each tarsal claw curved and with acute basal seta. Abdominal segments membranous. White three-lobed area of chloride epithelium present dorso-medially on each of abdominal terga I–VIII. Sclerite present on each of abdominal sterna III, IV, and V, transverse and subtriangular on sternum III, transverse and rectangular on sternum IV, square on sternum V. Abdominal segment IX with three

sclerotized plates dorsally and pair of small claws at lateral posterior end. Each anal claw bent and pointed sharply at apex. Larval case tube-like with circular net. Pupal case spherical, bag-like, with numerous small stalks and pores around case.

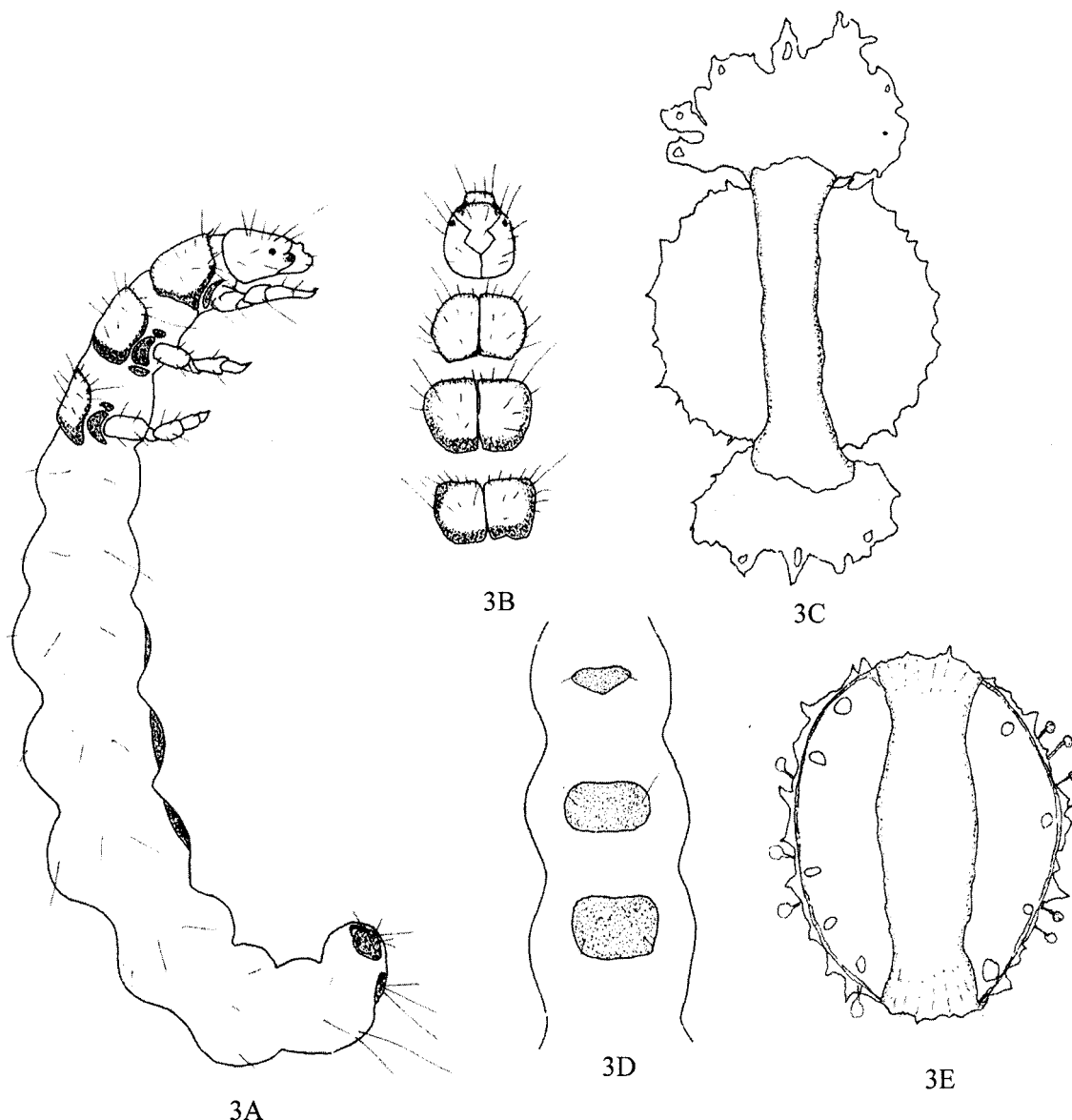


FIGURE 3. Larval features of *Ugandatrichia hairanga*. 3A—larva; 3B—dorsal aspect of head and nota; 3C—larval case; 3D—sclerites on abdominal sterna III, IV and V; 3E—pupal case.

Ugandatrichia hongae (Fig. 4): Head capsule width of last instar 0.25–0.30 mm (n=7). Head sclerotized, brownish, with numerous setae. Head capsule circular in dorsal view. Frontoclypeus approximately three-fifths head capsule length. Pronotum, mesonotum, and metanotum brownish, covered by sclerites with numerous setae. Each tibia with two spurs, each tarsal claw curved and with acute basal setae. Abdominal segments membranous. White three-lobed area of chloride epithelium present dorso-medially on abdominal terga I–VIII. Sclerites absent on abdominal sterna. Abdominal segment IX with three sclerotized plates dorsally and pair of small claws at lateral posterior end. Each anal claw bent and pointed sharply at apex. Larval case tube-like, covered with subquadrangle net. Pupal case square, bag-like, with pore at each corner.

The ultrastructure of the integumental surfaces of Thai *Ugandatrichia* spp. larvae is very similar. The head integumental surface is pebbled with small, convex granules of irregular outline. There are dense bristles

along the antero-ventral edges of the labrum. The spherical labial palpigers each have a labial palp, and a silk gland opens anteriorly between them emitting a pair of silk strands. There are dense bristles on the anterior and oral surfaces of the labium. Each maxillary palp has four segments, and the oral surface of each maxillary lobe is covered with tufts of bristles. The integumental surface of the pronotum, mesonotum, and metanotum is pebbled with small convex granules of irregular outline. The integumental surfaces of the membranes between the nota have many rounded protuberances. The integumental surfaces of the abdominal segments have many granules, some are larger amoeboid or star-like pavement granules and others are tiny and convex; in some places these are intermixed and in other areas they are of only one type. Each anal claw has hairs around its base. At the end of the abdomen the anus is situated between the anal claws; two tiny gills are evident in the anal opening.

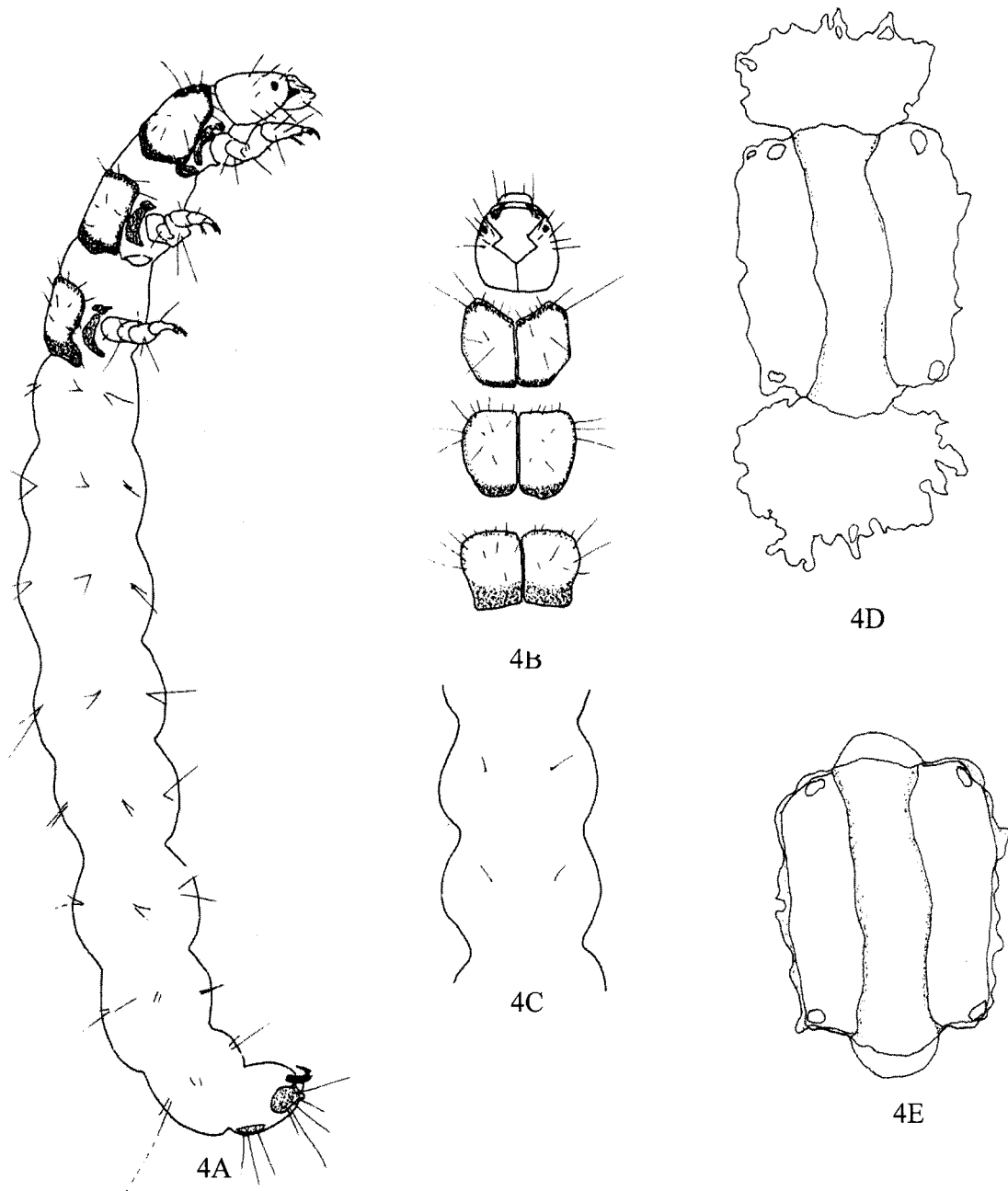
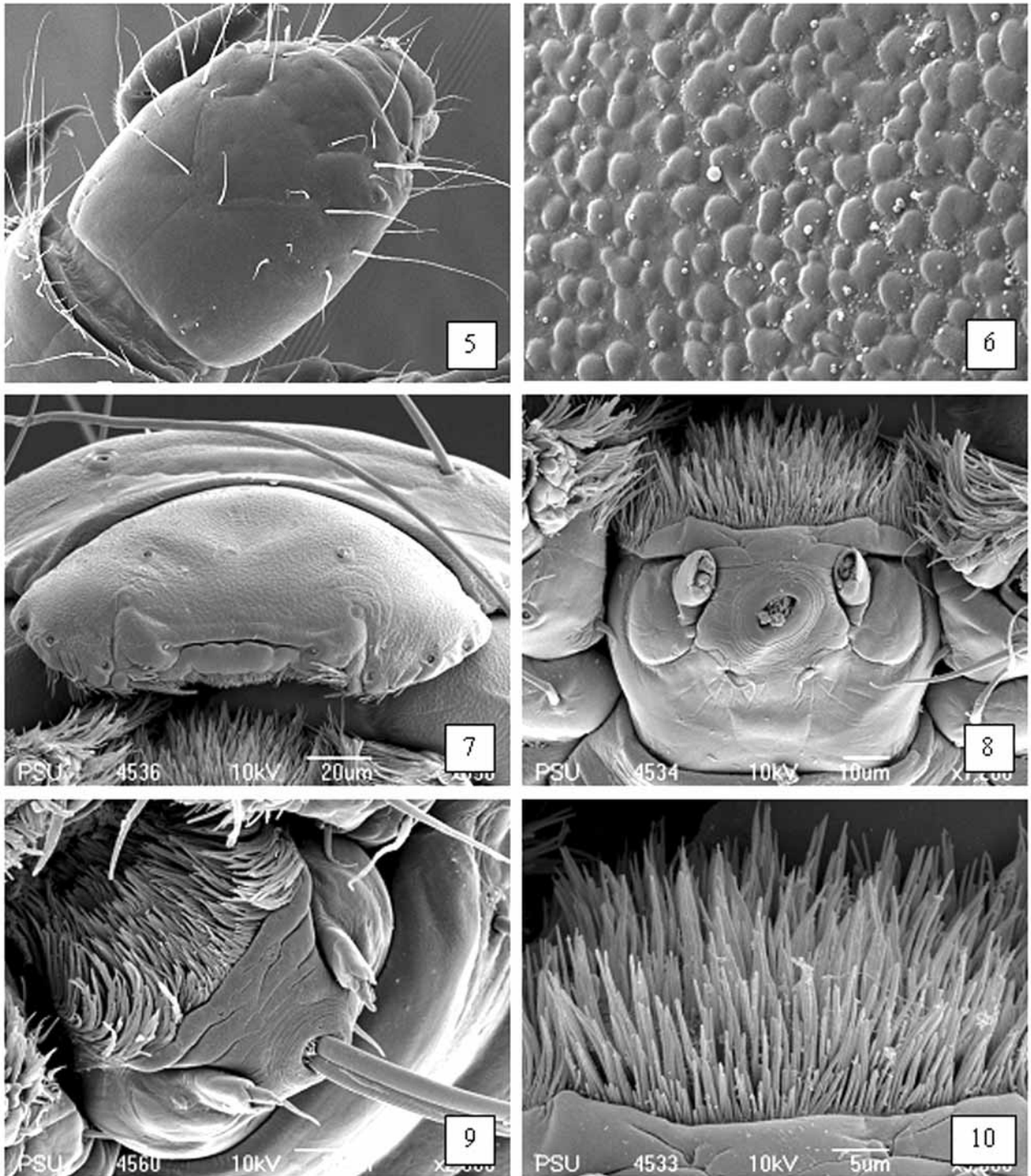


FIGURE 4. Larval features of *Ugandatrichia hongia*. 4A—larva; 4B—dorsal aspect of head and nota; 4C—sclerites on abdominal sterna IV and V; 4D—larval case; 4E—pupa case.

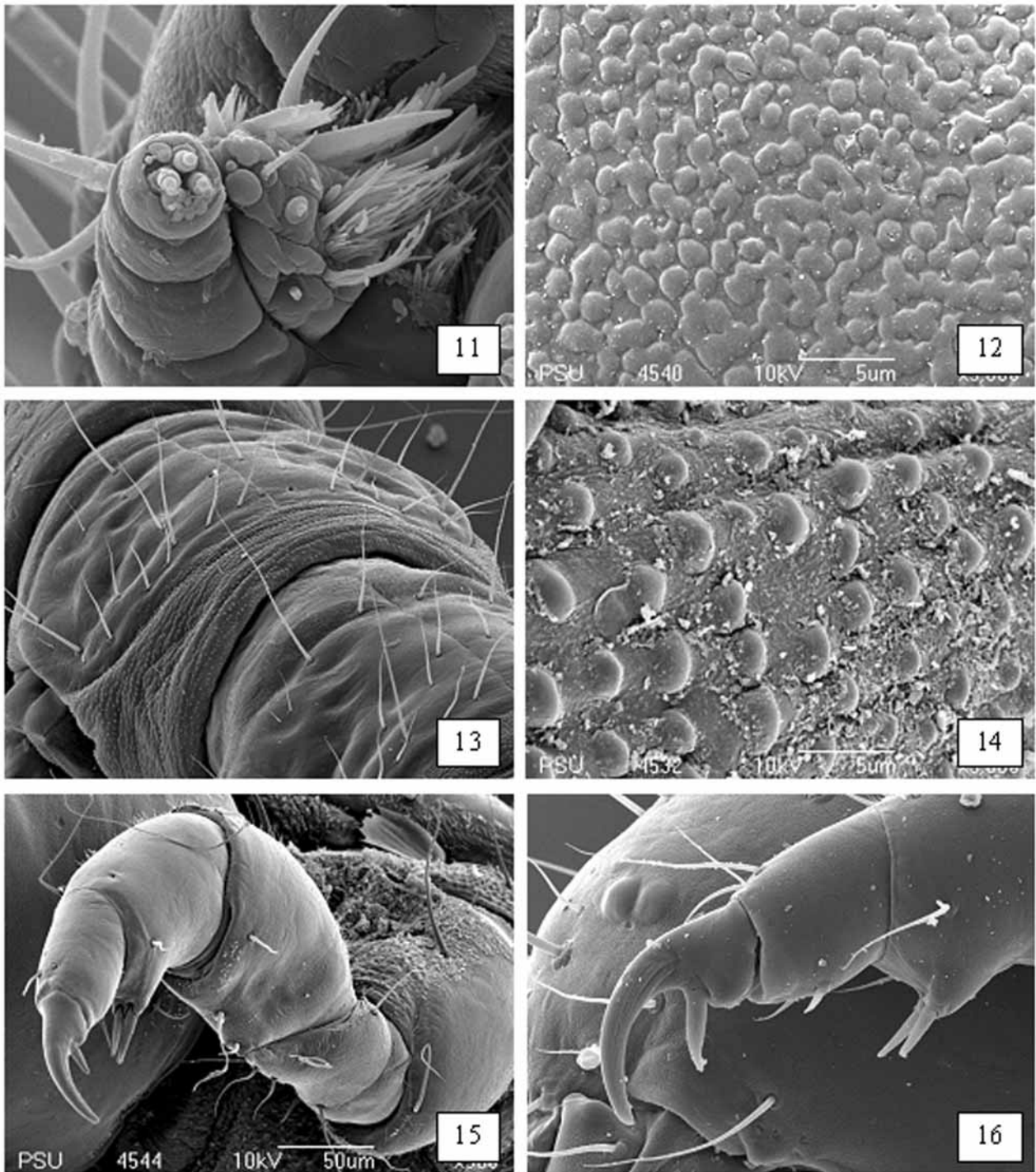


FIGURES 5–10. Head of *Ugandatrichia* spp. 5—head; 6—integument surface of head; 7—labrum; 8—palpiger; 9—silk gland opening; 10—dense bristles.

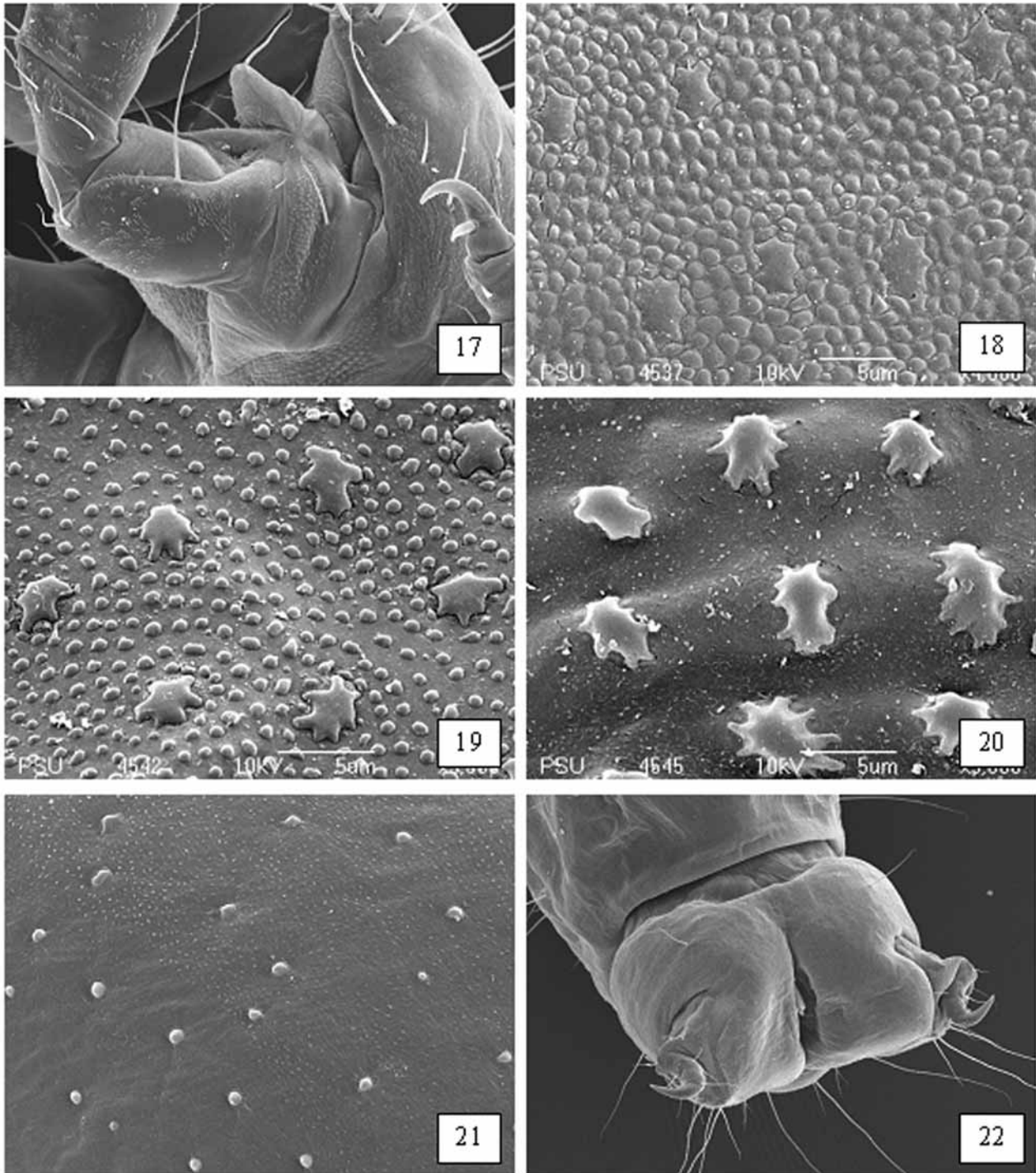
Key to species of the larvae of *Ugandatrichia* known in Thailand

- 1. Head capsules 0.38–0.45 mm wide2
- Head capsules 0.25–0.30 mm wide3
- 2. Six sclerites on abdominal sterna IV and V..... *Ugandatrichia maliwan*

- One sclerite on each of abdominal sterna IV and V *U. kerdmuang*
- 3. One sclerite on each of abdominal sterna III, IV and V *U. hairanga*
- No sclerite on its abdominal sterna..... *U. hongga*



FIGURES 11–16. Ultrastructure of *Ugandatrichia* spp. 11—maxillary palp and maxillary lobe; 12—integumental surface of pronotum, mesonotum, and metanotum; 13 & 14—integumental surfaces of membrane between nota; 15 & 16—legs, claw, and tibial spurs.

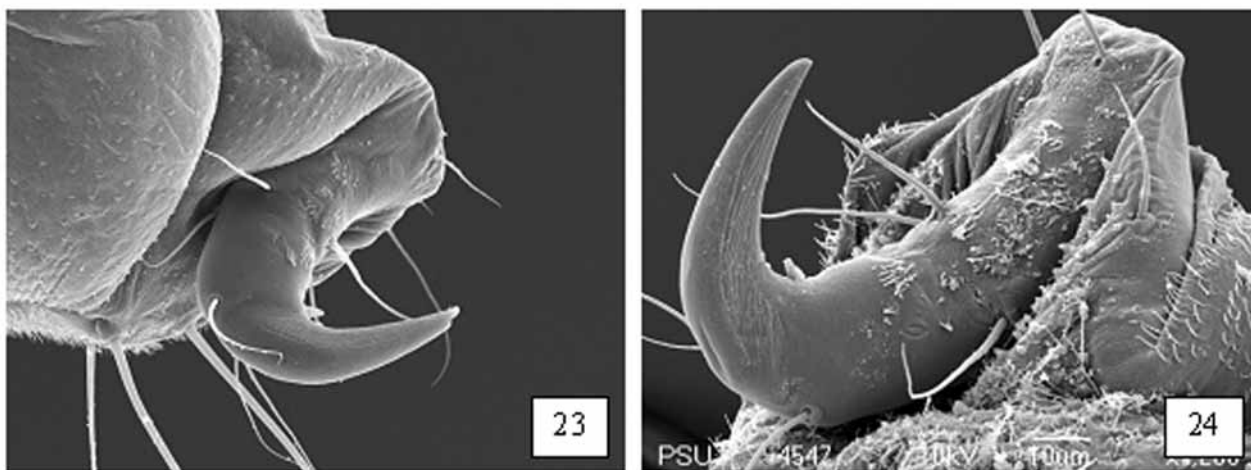


FIGURES 17–22. Ultrastructure of *Ugandatrichia* spp. 17—forecoxa and foretrochantin; 18–21—integumental surface of abdominal segments; 22—anal claw and anal opening.

Discussion

The larvae of *Ugandatrichia* spp. have the general morphology of the Hydroptilidae, including the three thoracic nota covered with sclerotized plates, lack of abdominal gills, the presence of long setae on the head and thoracic nota, a sclerite on abdominal tergum IX, and small claws at the lateral posterior end (Wiggins 1996,

Wells 1997). The larval morphology of *Ugandatrichia* spp. described in this study can be used as a guide to identify the larvae of *Ugandatrichia* species in Thailand. The size of the mature head capsule distinguishes the insects into two groups: group I including *U. maliwan* and *U. kerdmuang* have head capsules 0.38–0.45 mm wide, and Group II including *U. hongga* and *U. hairanga* have head capsules 0.25–0.30 mm wide. The distribution and shapes of sclerites on abdominal sterna III, IV and V are key characteristics to identify the insects. *Ugandatrichia maliwan* had six sclerites on abdominal sterna IV and V (Malicky 1999); *U. kerdmuang* had one sclerite on each of abdominal sterna IV and V (Laudee 2002); *U. hairanga* had one sclerite on each of abdominal sterna III, IV and V; and *U. hongga* had no sclerite on its abdominal sterna. In Malaysia, Wells (1997) mentioned that the genus *Ugandatrichia* has abdominal sternites, but *U. hongga* has no abdominal sternites.



FIGURES 23–24. Anal claw of larval *Ugandatrichia kerdmuang* with hairs.

Malicky (1999) differentiated the pupal cases of *U. maliwan* and *U. kerdmuang*. There are four stalks on the pupal case of *U. maliwan* whereas for *U. kerdmuang* there were only two stalks on the pupa case. Moreover, the pupal case of *U. maliwan* was tube-like instead of bag-like as in *U. kerdmuang* (Laudee 2002). The pupal case of *U. hairanga* was spherical and bag-like, with numerous small stalks, and pores around the case, but the *U. hongga* pupal case, whilst bag like, is nearly square, with pores at each corner of its case.

The integument surface of the *Ugadatrichia* spp. was the same as reported by Laudee (2002). There were irregular convex granules found mainly on the head, nota and abdomen of the insects and on the membranes between the nota. Amoeboid or star-shaped granules and tiny convex granules are found mainly on the abdomen of the insects.

Batta et al. (1999) studied the morphology of the caddisfly labrum using SEM. Their study mentioned that the characters of the labrum and other mouthparts may be related to the dietary regimes of the larvae. The SEM micrographs of mouthparts of *Ugandatrichia* spp. larvae show the bristles which the insect uses to graze benthic diatoms and algae.

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