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**Description of larvae and pupae of *Hydatomanicus klanklini* MALICKY & CHANTARAMONGKOL and *H. adonis* MALICKY & CHANTARAMONGKOL (Trichoptera: Hydropsychidae) from southern Thailand**

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**Abstract**

Larvae and pupae of *Hydatomanicus klanklini* MALICKY & CHANTARAMONGKOL and *H. adonis* MALICKY & CHANTARAMONGKOL (Trichoptera: Hydropsychidae) were collected from montane streams in southern Thailand. Pupal identifications were based on genitalic features in common with described adults, and larvae were associated with pupae. In addition, larvae and adults are associated by larvae and pupae rearing.

**Introduction**

Studies on Trichoptera in Thailand have been mostly concerned with adult systematics. More than 700 species have now been identified using adult male genitalia (MALICKY & CHANTARAMONGKOL, 1999; MALICKY & al. 2000; MALICKY & al. 2000a; MALICKY & al. 2001; MALICKY, 2000; THAPANYA & al. 2004), but our knowledge of the immature stage is very poor. However, very few larvae are known at the species level. For example, the net-spinning larvae of the giant microcaddisfly, *Ugandatrichia* spp. (Hydroptilidae) were described from Doi Inthanon and Chattrakan in northern Thailand (MALICKY 1999). The larvae from northern Thailand of genera *Himalopsyche* (Rhyacophilidae), *Arctopsyche* (Arctopsychidae), cf. *Eoneureclipsis* (Psychomyiidae) and *Inthanopsyche* (Odontoceridae) were also described (THAMSEANUPAP et al. 2005). The only species of Hydropsychidae in Thailand known in the larval stage is *Trichomacronema paniae* MALICKY (1991).

A total of 122 species, including 3 species of *Hydatomanicus* in the family Hydropsychidae has been recorded from Thailand (MALICKY & CHANTARAMONGKOL 1999, 2003; MALICKY & al. 2000; MALICKY & al. 2000a; MALICKY & al. 2001; MALICKY, 2002; THAPANYA & al. 2004). All of them were known only in the adult stage, thus larvae and pupae are unknown. Descriptions, diagnoses, and figures of the final larval instar and pupa of two species are presented below.

**Material and Methods**

Hydropsychid larvae and pupae were collected from streams in southern Thailand (Krabi, Trang, Nakhon Si Thammarat, Narathivas, Phang-nga, Patthalung, Ranong, Songkhla, Satun, and Surat Thani provinces). At each collection site, adults were collected using black light traps on timers to operate simultaneously from one hour before sunset to 1.5 hours after sunset near the stream margin. Insects attracted to the black light were collected in a tray filled with water and a few drops of detergent and transferred into 80% ethyl alcohol the next morning.

Larvae and pupae were collected by handpicking from the upper and lower surfaces of stones crevices, gravel, woody debris, and other stable substrates for attached filter nets and pupal chambers. The specimens were preserved in 95% ethyl alcohol and brought to the laboratory where they

were sorted to morphospecies. Adults genitalia were cleared by heating in 10% NaOH at 70°C for 30 minutes. The association between the adult and the fully developed pupa was established with genitalic characteristics. Furthermore, the identified pupa was then associated with the final larval instar. In addition, larvae and pupae were reared in aquarium in the laboratory and adults reared.

**Description of the larvae**

***Hydatomanicus klanklini* MAL. & CHANT.**

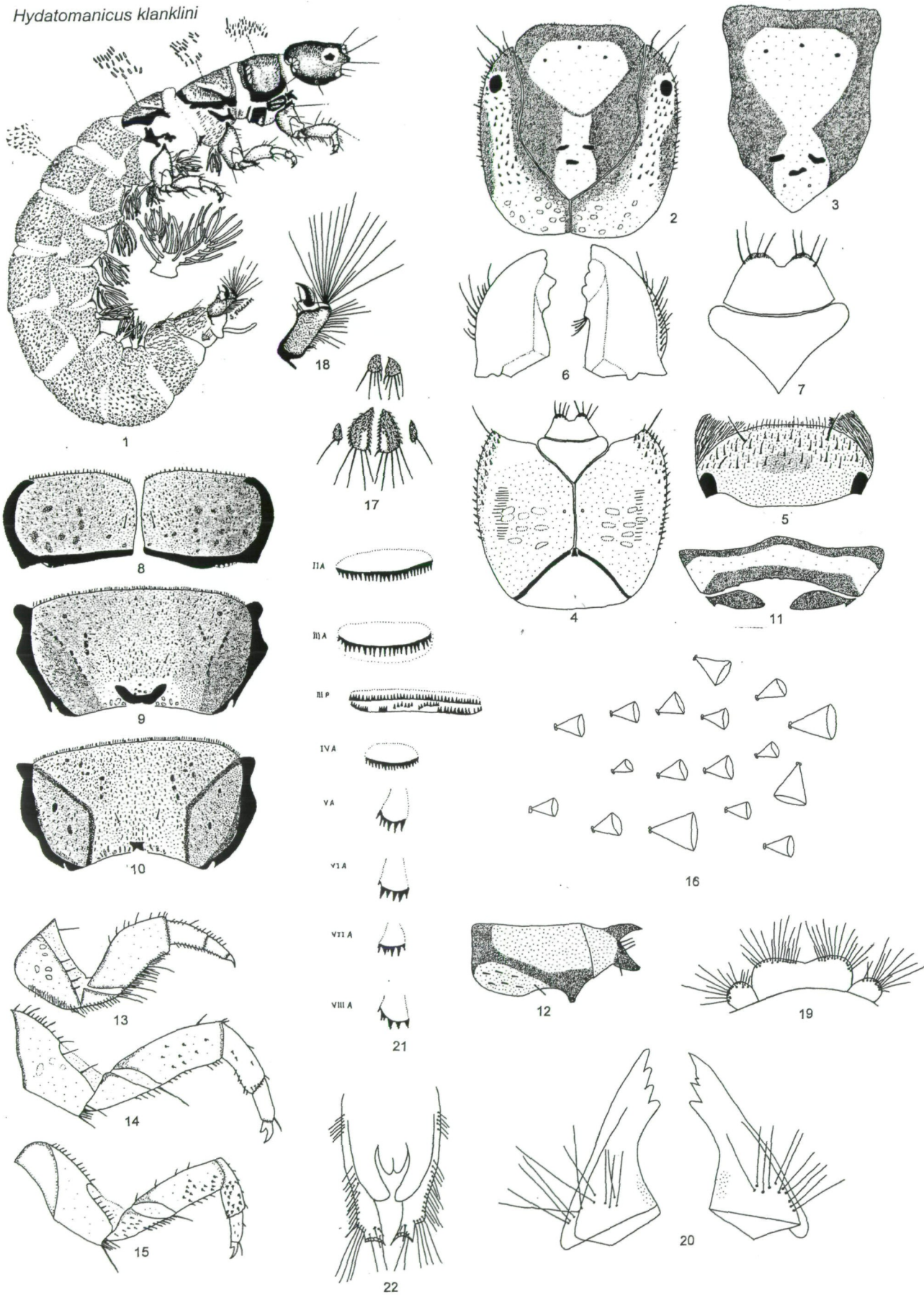
**Larva:** Overall body shape as usual in Hydropsychidae (Fig. 1). Head yellow to brown. Notal sclerites brown to brownish.

**Head:** Dorsal view rounded. Dorsum of head brown with a wide longitudinal yellow band on frontoclypeus. Area around and below eyes yellow. Dorsolaterally and area around and inside frontoclypeus dark brown. Anterior three-fourth of head dorsolaterally covered with medium and long, bristle-like, black setae to the corners of the frontoclypeus. Frontoclypeus devoid of such setae except for anterolaterally corners. Anterior margin of frontoclypeus slightly convex and finely crenulated; frontoclypeus slightly broad at posterior midlength. Posterior one-fifth of head with dark brown muscle scars. Anteromesally of frontoclypeus with three small, dark spots arranged transversely; posterior corner of frontoclypeus with a cluster of three, larger, dark spots (Figs. 2, 3). Ventral surface of head dark brown with a group of large, darker, muscle scars covering stridulatory surfaces mesolaterally. Ventrolateral surface of head covered with bristle-like, black setae (Fig. 4). Labrum yellow-brown, elliptical in dorsal view, bearing well-developed, lateral, golden brushes; anterior half setae with a pair of long, dark setae anteromesally; anterior margin hairy (Fig. 5). Mandibles reddish-brown with a lateral trough, numerous, long, black setae along the base of trough; left mandible with a mesal tuft of hairs (Fig. 6). Submentum with cleft; anterior margin of each cleft with long, black, setae (Fig. 7). Anterior ventral apotome fully delimited; posterior ventral apotome small, triangular (Fig. 4).

**Thorax:** Notal yellow to brown, except for darker spots on mesolateral edges. Each notum covered with short and medium, bristle-like, black setae; anterior margin each with black, scale-like setae and hairs projecting beyond anterior margin; large black U-shaped mark posteriorly on mesonotum with 4-5, round, muscle scars (Figs. 8, 9, 10). Prosternum transverse, with dark band anterior and posterior margin, paler mesally, with pair of dark posterolateral plates (Fig. 11). Propleuron with black, setae in ventral portion; trochantin forked with stout setae (Fig. 12). Forelegs with long, stout, black, setae on ventral margin; inner face of femur with scattered black, setae (Fig. 13). Mid- and hindlegs similar in size, shape, and structure; midlegs with outer face of femur and tibia with scattered, stout, spine-like setae emanating from prominent sockets; these setae with numerous in outer face of femur and tibia of hindlegs (Fig. 14, 15). Mesosternum with one pair of gills laterally, each with central stalk with numerous lateral filaments; metasternum with two pair of gills; one pair laterally and other mesally.

**Abdomen:** Abdominal segments yellow covered dorsolaterally with black, spine-like setae; these setae varying in size and conspicuous at 100X magnification (Fig. 16). Segments I-V each with two pair of gills laterally; gills arising from a common base. Segments II-IV each with one pair of gills mesally; each gills with a single stalk. Segments

*Hydatomanicus klanklini*



**Figures 1-18.** Larval features of *Hydatomanicus klanklini*: 1, larva; 2, dorsal aspect of head; 3, frontoclypeal apotome; 4, ventral aspect of head; 5, dorsal aspect of larbrum; 6, ventral aspect of mandibles; 7, submentum and anterior ventral apotome; 8, pronotum; 9, mesonotum; 10, metanotum; 11, prosternum; 12, right propleuron and trochantin; 13, outer face of foreleg; 14, outer face of midleg; 15, outer face of hindleg; 16, setae on abdominal segments; 17, sterna 8 and 9; 18, lateral aspect of anal claw.

**Figures 19-22.** Pupal feature of *Hydatomanicus klanklini*: 19, dorsal aspect of larbrum; 20, ventral aspect of mandibles; 21, hookplates, dorsal showing abdominal segment number and anterior or posterior position; 22, ventral aspect of apical appendages.

VI-VII each with one pair of gills laterally. Sterna of segments VIII and IX each with a pair of spine-bearing plates with numerous, golden-brown, stout, setae emanating from prominent sockets; posterior margin of sclerites with long, black, setae. Each sclerite of abdominal sternum IX distinct, not fused. Tergum IX with small lateral sclerite and pair of larger dorsal sclerites; posterior margin of each sclerites with long, black, setae (Fig. 17). Anal prolegs with dark setae on each side of lateral sclerites, a bent claw and cluster of long bristles (Fig. 18).

**Pupa:** Labrum semicircular with rounded basolateral lobes, each bearing numerous setae, anterior region with many, long, dark, setae (Fig. 19). Mandibles with 4-5 strong teeth, basolateral surface with 7, long, setae, measly surface with 4, long, setae (Fig. 20). Hook plates anteriorly on segments II-VIII and posteriorly on segment III; anterior plates on segments II-IV very broad, with a single row of hooks, plates on segments V-VIII very narrow, with a small cluster of hooks on a raised mesal portion of plates; posterior plate of segment III broadly transverse with 2 rows of hooks, hooks on lower row of this plate not continuing (Fig. 21). Dorsum of segments IV-V with surfaces covered with long, black, setae. Apical processes with a group of long, black, setae along ventrolaterally (Fig. 22).

**Diagnosis:** This species may be separated from *Hydatomanicus adonis* on the basis of the following combination of characters. First, the color pattern of the head and thoracic nota are much paler and mesally longitudinal yellow band on frontoclypeus is wide. The ventral surfaces of the head are brown; whereas, the venter of *Hydatomanicus adonis* has dark-brown to black area. Second, the abdominal segments are densely covered with black, spine-like setae varying in size. The abdominal segments of *Hydatomanicus adonis* are densely covered with the same size of black, spine-like setae and hairs.

**Material examined:** Krabi Prov.: Khaopanombenja National Park, Huai To Waterfall, 5-VIII-2004, 8 larvae, 5 Pupae; same locality, 6-X-2004, 6 larvae, 3 pupae, 3 adults; Trang Prov.: Khao Chong Wildlife Management Station, 4-VI-2004, Prommi, 1 adult; Nakhon Si Thammarat Prov.: Yong Waterfall National Park, stream from Yong Waterfall, 9-I-2004, Prommi, 1 adult; same locality, 11-X-2004, Prommi, 5 larvae; Pliew Waterfall, 6-IV-2005, Prommi, 28 larvae, 10 pupae, 2 adults; Khao Luang National Park; Promlok Waterfall, 3-XII-2004, Prommi, 8 larvae; Ei Khaew Waterfall, 3-XII-2004, Prommi, 2 adults; stream from Yord Luang Waterfall, 3-XII-2004, Prommi, 3 larvae; Sununtha

National Park, Sunantha Waterfall, 8-IV-2005, 21 larvae, 15 pupae, 1 adult; Sikhit National Park, stream from Sikhit Waterfall, 9-IV-2005, Prommi, 12 larvae, 5 pupae; Phangnga Prov.: Sriphangnga National Park, stream from Tonthontoe Waterfall, 7-VIII-2004, Prommi, 1 larva; Patthalung Prov.: Khaobantad Wildlife Sanctuary, stream from Momjui Waterfall, 4-X-2004, Prommi, 3 larvae; same locality, 12-IV-2005, Prommi, 5 larvae; Praiwan Waterfall, 4-X-2004, Prommi, 8 larvae, 3 pupae; Ranong Prov.: Ngao Waterfall National Park, Ngao Waterfall, 8-VIII-2004, Prommi, 4 larvae, 1 adult; same locality, 9-X-2004, Prommi, 3 larvae, 1 adult; Tunggraya-nasak Wildlife Sanctuary, Bokkrai Waterfall, 2-IV-2005, Prommi, 15 larvae, 8 pupae; same locality, 15-VIII-2005, Prommi, 12 larvae, 8 pupae; SONGKHLA Prov.: Ton Nga Chang Wildlife Sanctuary, Ton Nga Chang Waterfall, 11-I-2004, Prommi, 3 larvae, 1 pupa; same locality, 12-II-2004, Prommi, 2 larvae; same locality, 10-III-2004, Prommi, 3 larvae, 1 pupa; same locality, 7-IV-2004, 5 larvae, 2 pupae, 1 adult; same locality, 1-V-2004, Prommi, 4 larvae, 2 pupae; same locality, 8-VI-2004, 3 larvae; same locality, 1-VII-2004, Prommi, 4 larvae, 2 pupae; same locality, 4-VIII-2004, Prommi, 3 larvae, 1 pupa; same locality, 1-IX-2004, Prommi, 5 larvae, 2 pupae; same locality, 3-X-2004, Prommi, 8 larvae, 2 pupae; same locality, 6-XI-2004, Prommi, 6 larvae, 1 pupa; same locality, 1-XII-2004, Prommi, 4 larvae, 2 pupae; same locality, 1-I-2005, Prommi, 5 larvae, 1 pupa; same locality, 1-II-2005, Prommi, 4 larvae; same locality, 2-III-2005, Prommi, 6 larvae, 2 pupae; same locality, 12-IV-2005, Prommi, 8 larvae, 3 pupae, 1 adult; same locality, 13-V-2005, Prommi, 4 larvae, 1 pupa; same locality, 30-VI-2005, 5 larvae, 2 pupae; Satun Prov.: Thaleban National Park, Yaroi Waterfall, 12-XI-2004, Prommi, 17 larvae, 10 pupae, 2 adults; same locality, 15-III-2005, Prommi, 12 larvae, 8 pupae, 1 adult; Surat Thani Prov.: Khaosok National Park, stream from Sib-Et-Chan Waterfall, 7-X-2004, Prommi, 1 adult; Maeyai Waterfall, 4-IV-2005, Prommi, 10 larvae, 6 pupae; Tairomyen National Park, Dadfah Waterfall, 9-VIII-2004, Prommi, 10 larvae, 4 pupae.

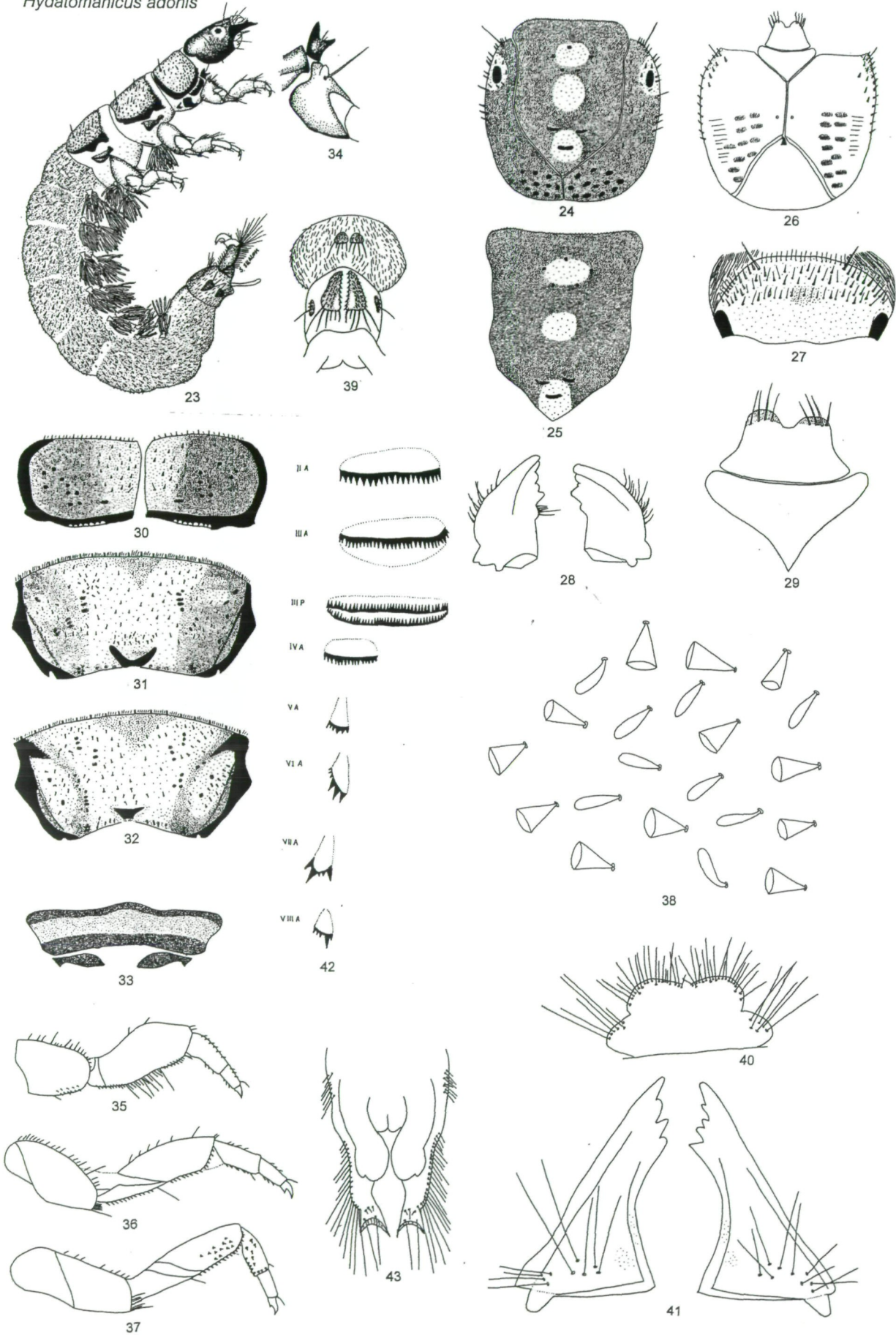
#### *Hydatomanicus adonis* MALICKY & CHANTARAMONGKOL

**Larva:** Overall body shape as usual in Hydropsychidae (Fig. 23). Head dark-brown to black. Notal sclerites dark-brown.

**Head:** Rounded in dorsal view. Dorsum of head dark-brown to black with three yellow areas arranged longitudinally on the frontoclypeus. Area around eyes yellow. Anterior three-fourths of the head dorsolaterally covered with medium and long, bristle-like, black setae to the corners of the frontoclypeus. Frontoclypeus devoid of such setae except for anterolaterally corners. Anterior margin of frontoclypeus slightly convex and finely crenulated; frontoclypeus slightly broad at posterior midlength. Posterior one-fifth of head with dark muscle scars. Anteromesally, frontoclypeus with a transverse of five, small, dark spots; posterior corner of frontoclypeus with a cluster of three, larger, dark spots (Figs. 24, 25). Ventral surface of head dark brown to black with a group of large, darker, muscle scars covering the stridulatory surfaces mesolaterally. Ventrolaterally surface of head covered with bristle-like, black setae (Fig. 26). Labrum dark-brown, elliptical in dorsal view, bearing well-developed, lateral, brown brushes; anterior half setae with a pair of long, dark setae anteromesally; anterior margin hairy (Fig. 27). Mandibles reddish-dark brown with a lateral trough, numerous, long, black setae along the base of the trough; left mandible with a mesal tuft of hairs (Fig. 28). Submentum with a cleft; anterior margin of each cleft with long, black, setae (Fig. 28). Anterior



*Hydatomanicus adonis*



**Figures 23-39.** Larval features of *Hydatomanicus adonis*: 23, larva; 24, dorsal aspect of head; 25, frontoclypeal apotome; 26, ventral aspect of head; 27, dorsal aspect of larbrum; 28, dorsal aspect of mandibles; 29, submentum and anterior ventral apotome; 30, pronotum; 31, mesonotum; 32, metanotum; 33, prosternum; 34, right propleuron and trochantin; 35, outer face of foreleg; 36, outer face of midleg; 37, outer face of hindleg; 38, setae on abdominal segments; 39, sterna 8 and 9.

**Figures 40-43.** Pupal feature of *Hydatomanicus adonis*: 40, dorsal aspect of larbrum; 41, ventral aspect of mandibles; 42, hookplates, dorsal showing abdominal segment number and anterior or posterior position; 43, ventral aspect of apical appendages.

ventral apotome fully delimited; posterior ventral apotome small, triangular (Fig. 26, 29).

**Thorax:** Not dark-brown, except for darker spots on mesolateral edges. Each notum covered with short and medium, bristle-like, black setae; anterior margin each with black, scale-like setae and hairs projecting beyond anterior margin (Figs. 30, 31, 32). Prosternum transverse, with dark band anterior and posterior margin, paler mesally, with a pair of dark posterolateral plates (Fig. 33). Propleuron with black, setae in ventral portion; trochantin forked with stout setae (Fig. 34). Forelegs with long, stout, black, setae on ventral margin; inner face of femur with scattered black, setae (Fig. 35). Mid- and hindlegs similar in size, shape, structure different; midlegs without stout, spine-like setae on outer face of femur and tibia; hindlegs with stout, spine-like setae on outer face of femur and tibia emanating from prominent sockets (Fig. 36, 37). Mesosternum with one pair of gills laterally, each with central stalk with numerous lateral filaments; metasternum with two pair of gills; one pair laterally and other mesally.

**Abdomen:** Abdominal segments brown, covered dorsolaterally with black, spine-like setae and hairs conspicuous at 100X magnification (Fig. 38). Segments I-VI each with two pair of gills laterally; gills arising from a common base. Segments II-V each with one pair of gills mesally; each gill with a single stalk. Segment VII with one pair of gills laterally. Sterna of segments VIII and IX each with a pair of spine-bearing plates with numerous, brown, stout, setae emanating from prominent sockets; posterior margin of sclerites with long, black, setae. Each sclerite of abdominal sternum IX distinct, not fused. Tergum IX with a moderately lateral sclerite and a pair of dorsal sclerites; posterior margin of each sclerite with long, black, setae (Fig. 39). Anal prolegs with dark setae on each side of lateral sclerites, a bent claw and cluster of long bristles (Fig. 23).

**Pupa:** Labrum semicircular with rounded basolateral lobes, each bearing numerous long, setae, anterior region with many, dark, setae (Fig. 40). Mandibles with 4-5 strong teeth, basolateral surface with 4, long, setae, measly surface with 5, longer, setae (Fig. 41). Hook plates anteriorly on segments II-VIII and posteriorly on segment III; anterior plates on segments II-IV very broad, with a single row of hooks, plates on segments V-VIII very narrow, with a small cluster of hooks on a raised mesal portion of plates; posterior plate of segment III broadly transverse with 2 rows of hooks (Fig. 42). Dorsum of segments IV-V with surfaces covered with

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**Diagnosis:** This species may be separated from *Hydatomanicus klanklini* on the basis of the following combination of characters. Firstly, the color pattern of the head and thoracic nota are much darker and the frontoclypeus mesally has three yellow areas in longitudinal length. The ventral surfaces of the head are dark-brown; whereas, the venter of *Hydatomanicus klanklini* has a brown area. Secondly, the abdominal segments are densely covered with black, spine-like setae with scale hairs. The abdominal segments of *Hydatomanicus klanklini* are densely covered with varying size of black, spine-like setae. In general, *Hydatomanicus adonis* is more robust and larger than *H. klanklini*.

**Material examined:** Krabi Prov.: Khaopanombenja National Park, Huai To Waterfall, 11-VI-2004, Prommi, 1 adult; same locality, 5-VIII-2004, 5 larvae, 2 pupae; same locality, 6-X-2004, 3 larvae, 1 pupa; Narathivas Prov.: Hala-Bala Wildlife Sanctuary, Sirindorn Waterfall, 9-III-2004, Prommi, 1 adult; Songkhla Prov.: Ton Nga Chang Wildlife Sanctuary, Ton Nga Chang Waterfall, 11-I-2004, Prommi, 5 larvae, 1 pupa; same locality, 12-II-2004, Prommi, 8 larvae, 3 pupae; same locality, 10-III-2004, Prommi, 6 larvae, 3 pupae, 1 adult; same locality, 7-IV-2004, 10 larvae, 4 pupae, 1 adult; same locality, 1-V-2004, Prommi, 13 larvae, 8 pupae; same locality, 8-VI-2004, 7 larvae, 2 pupae; same locality, 1-VII-2004, Prommi, 8 larvae, 3 pupae; same locality, 4-VIII-2004, Prommi, 10 larvae, 4 pupae; same locality, 1-IX-2004, Prommi, 6 larvae, 2 pupae; same locality, 3-X-2004, Prommi, 13 larvae, 5 pupae; same locality, 6-XI-2004, Prommi, 9 larvae, 3 pupae; same locality, 1-XII-2004, Prommi, 6 larvae, 2 pupae; same locality, 1-I-2005, Prommi, 8 larvae, 2 pupae; same locality, 1-II-2005, Prommi, 8 larvae, 3 pupae; same locality, 2-III-2005, Prommi, 11 larvae, 5 pupae; same locality, 12-IV-2005, Prommi, 12 larvae, 5 pupae; same locality, 13-V-2005, Prommi, 7 larvae, 2 pupae, 1 adult; same locality, 30-VI-2005, 8 larvae, 3 pupae.

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Photographs from the 12<sup>th</sup> International Symposium on Trichoptera, Mexico, 18 – 22 June 2006:

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