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New Records of Heptageniid Mayflies *Asionurus* and *Thalerosphyrus* (Ephemeroptera: Heptageniidae) from Northeastern Thailand

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ABSTRACT The heptageniid mayflies *Asionurus* and *Thalerosphylus* are newly recorded from Northeastern Thailand. Larvae of both genera are described and illustrated.

KEYWORDS: Heptageniidae, *Asionurus*, *Thalerosphyrus*, Northeastern Thailand.

INTRODUCTION

Heptageniid mayflies are an important component of benthic communities in Palaearctic and Oriental streams. The larvae inhabit clean water and are very sensitive to environmental changes. These larvae and other benthic macroinvertebrates are used as bioindicators for freshwater pollution measurement.[1] This family is rather poorly known in Asia.[2] It comprises 19 genera and 114 species in the Oriental region.[3] Four genera (*Cinygmina*, *Compsoneuria*, *Epeorus*, *Rhithrogeniella*) and 10 species of heptageniid mayflies have been recorded from Thailand.[4] Genus *Asionurus* Braasch & Soldán, 1986 has been reported from Vietnam and Malaysia[5, 6], and *Thalerosphyrus* Eaton, 1881 from China[7] through Southeast Asia including Vietnam[8], Malaysia[6], the Philippines, and Sulawesi[9] to India.[10] These last two genera have been collected recently from Northeastern Thailand and we report them here as the first records for Thailand. All specimens are deposited at the Department of Biology, Khon Kaen University. A description of larvae and their ecology is presented.

MATERIALS AND METHODS

Twenty-seven headwater streams of the Chi River Basin, Pasak River Basin, and Mae Khong River Basin of Northeastern Thailand were explored for aquatic insects during February 1997 to November 2000 (details in Table 1). The aquatic insect larvae were collected in all microhabitats by using aquatic net mesh size 450 mm. The specimens were preserved in 70 % ethanol and identified to the lowest possible taxon using several published papers.[2, 5, 6, 8, 10, 11]

RESULTS AND DISCUSSION

Among heptageniid mayflies, five genera were found: *Asionurus*, *Cinygmina*, *Rhithrogena*, *Rhithrogeniella*, and *Thalerosphyrus*. *Cinygmina* was widely Distributed, but *Rhithrogena* and *Rhithrogeniella* were more limited in distribution. *Asionurus* was rarely found and only occurred in Yakraue (**1**, part of Cheon River) and Phromlaeng streams (**2**, part of Phrom River), Nam Nao National Park, and Daeng stream (**3**, Pasak River basin). Genus *Thalerosphyrus* was found in Yakraue and Phromlaeng streams, Nam Nao National Park, Vein Pri stream (**4**); Phu Phan National Park, Daeng and Sak-Nga streams (**5**); Pasak River basin, Prong-Hi (**6**); Mai Sod Yai (**7**); Nam Phrom (**8**); and Nam Chi streams (**9**), Chi River basin (Fig 1). The last two genera mentioned above are newly recorded for Thailand, bringing the number of heptageniid genera reported from Thailand to six (Table 2). The description of larvae and their ecology are as follows:

Asionurus Braasch & Soldán, 1986 (Fig 2)

Description: Mature nymph (in alc) (Fig 2.1): Length of body, 5.06-7.31 mm. Head capsule, 1.65-2.09 mm, width 1.5 times length, anterior and lateral margins smoothly convex, posterior margin slightly concave; dorsum brownish-yellow. Antennal scapes and pedicels yellowish- brown, flagella pale. Eyes black. *Mouthparts*: half as wide as head capsule, anterior margin concave, densely setaceous dorsally. *Mandibles*: each with outer incisor longer, serrate; prostheca consisting of tuft of 9 long setae; apical margin between incisor and molar areas with setae,

Table 1. Summary of 27 sampling localities.

Locality	Geographical Co-ordinates	Altitude (m sL)	District	Province	Habitat
Chi River Basin					
1. Hin Lad	16° 33′ N 101° 33′ E	848	Khon San	Chaiyaphum	Dry Evergreen Forest
2. Mai Sod Noi	16° 27′ N 101° 37′ E	620	Khon San	Chaiyaphum	Dry Evergreen Forest
3. Mai Sod Yai	16° 26′ N 101° 36′ E	750	Khon San	Chaiyaphum	Dry Evergreen Forest
4. Nam Phrom	16° 27′ N 101° 39′ E	580	Khon San	Chaiyaphum	Dry Evergreen Forest
5. Nong Tak	16° 24′ N 101° 38′ E	800	Khon San	Chaiyaphum	Dry Evergreen Forest
6. Phrom Laeng	16° 38′ N 101° 34′ E	720	Khon San	Chaiyaphum	Dry Evergreen Forest
7. Prong-Hi	16° 26′ N 101° 36′ E	750	Khon San	Chaiyaphum	Dry Evergreen Forest
8. Sai	16° 23′ N 101° 39′ E	850	Khon San	Chaiyaphum	Dry Evergreen Forest
9. Tong Toe	16° 25′ N 101° 38′ E	850	Khon San	Chaiyaphum	Dry Evergreen Forest
10. Tam Yan	16° 24′ N 101° 38′ E	850	Khon San	Chaiyaphum	Dry Evergreen Forest
11. Lam Pure	16° 17′ N 101° 28′ E	330	Nong Bua Daeng	Chaiyaphum	Dry Evergreen Forest
12. Lam Saphung	16° 10′ N 101° 40′ E	250	Nong Bua Daeng	Chaiyaphum	Dry Evergreen Forest
13. Nam Chi	16° 17′ N 101° 28′ E	330	Nong Bua Daeng	Chaiyaphum	Dry Evergreen Forest
14. Yakraue	16° 23′ N 101° 33′ E	840	Nam Nao	Petchabun	Dry Evergreen Forest
Pasak River Basin					
1. Daeng	17° 14′ N 101° 22′ E	880	Dan Sai	Loei	Dry Evergreen Forest
2. Sak Nga	17° 44′ N 101° 22′ E	600	Dan Sai	Loei	Dry Evergreen Forest
Mae Khong River Basin					
1. Pai	17° 29′ N 101° 25′ E	900	Phu Rua	Loei	Dry Evergreen Forest
2. Pla Ba	17° 23′ N 101° 23′ E	760	Phu Rua	Loei	Disturbed Forest
3. Song Korn	17° 21′ N 101° 24′ E	750	Phu Rua	Loei	Disturbed Forest
4. Ta Wat	17° 29′ N 101° 25′ E	900	Phu Rua	Loei	Dry Evergreen Forest
5. Kang San Sawan	17° 27′ N 101° 17′ E	750	Phu Rua	Loei	Disturbed Forest
6. Kring	17° 28′ N 101° 58′ E	600	Na Haeo	Loei	Dry Evergreen Forest
7. Tarn Sawan	17° 28′ N 101° 03′ E	510	Na Haeo	Loei	Dry Evergreen Forest
8. Gang Mod Dang	16° 53′ N 103° 52′ E	300	Phu Phan	Sakhon Nakhon	Dry Evergreen Forest
9. Vein Pri	16° 44′ N 103° 34′ E	900	Phu Phan	Sakhon Nakhon	Dry Evergreen Forest
10. Ma Ngaew	16° 59′ N 103° 47′ E	360	Kut Bak	Sakhon Nakhon	Mixed Decidous Forest
11. Pla Duk	16° 58′ N 103° 47′ E	360	Kut Bak	Sakhon Nakhon	Mixed Decidous Forest

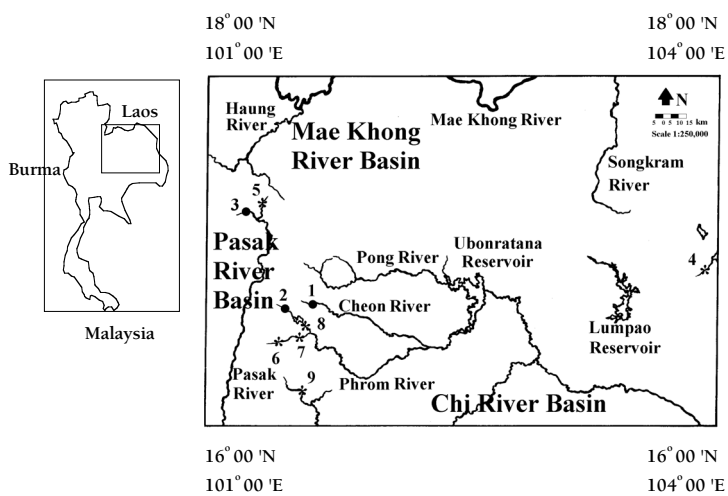

Fig 1. Study area in Northeast Thailand, showing location of both genera (●) and only *Thalerosphyrus* (*) (1. Yakraue 2. Phromlaeng 3. Daeng 4. Vein Pri 5. Sak-Nga 6. Prong-Hi 7. Mai Sod Yai 8. Nam Phrom 9. Nam Chi).

Table 2. Diagnostic characters of six genera of family Heptageniidae in Thailand.

Asionurus	*Cinygmina*	*Epeorus*	*Rhithrogena*	*Rhithrogeniella*	*Thalerosphyrus*
Gill VII lanceolate with pointed tip and spines bare on apex of each tibia.	Lamellae of gills V and VI each with pointed apical prolongation.	Lacking terminal filament and abdominal terga each with dense median row of setae.	Opposing gills I overlapping ventrally to form "sucking disc".	With lateral bristles on cerci and with stout spines on alternating segments of cerci.	Abdomen with lateral processes well develop on segments III-VII.

lateral margin setaceous. *Maxillae*: each galea-lacinia with pectinate spines on crown, ventral setae scattered. *Hypopharynx*: with lingua convex at apex, each superlingua with lateral arm developed. *Labium*: with broad U-shaped separation of glossae; glossae oval, stalked; paraglossae laterally elongate; apical segment of each palp acutely pointed. *Thorax*: dorsum brownish-yellow, venter pale. *Front legs*: femora yellowish-brown, each with spines on anterior margin and dorsal surface (Fig 2.3), posterior margin with fringe of long setae, spines on surface distally rounded (Fig 2.6). *Middle and hind legs*: similar to front legs. Claws each with 3 subapical denticles (Fig 2.5). *Abdomen* (Fig 2.4): posterolateral spines less developed, terga whitish-yellow, with spot. Sterna I-X whitish-yellow. *Gills* (Fig 2.2): with lamellae broad on abdominal segments II-VI, narrower on segments I and VII, each with filament portion of gill I-VI well developed, gill VII without bundle of filaments, gill I leaf-like and asymmetrical, gills II-VI each triangular, or cordate and tapering to blunt apex, gill VII lanceolate (three times longer than broad). Caudal filament and cerci with whorls of spines, 1.5 times length of body.

Thailand - NORTHEASTERN: Chaiyaphum (Phromlaeng stream, Nam Nao National Park), Petchabun (Yakraue stream, Nam Nao National Park); Loei (Daeng stream, Pasak River).

Distribution - Malaysia, Vietnam (type) and Thailand.

Ecology - Larvae occur chiefly in slow-flowing streams, occasionally found in pools. They cling to undersides of debris and pebbles in shallow water (depth 5-10 cm). Larvae are herbivores, feeding on detritus and periphyton. They coexist with

Cinygmina and leptophelbiid mayfly larvae.

Thalerosphyrus Eaton, 1881 (Fig 3)

Description: Mature larva (in alc.) (Fig 3.1): Length of body, 7.70-14.85 mm. Head capsule, 2.53-4.89 mm, 2 times as wide as long, anterior and lateral margins smoothly convex, posterior margin slightly concave; dorsum brownish-yellow, sutures pale, area around ocelli whitish. Antennae each with scape and pedicel brown, flagellum brownish-yellow. Eyes black. *Mouthparts*: *Labrum*: half as wide as head capsule, anterior margin concave, densely setaceous dorsally. *Mandibles*: each with outer incisor longer, serrate; prostheca consisting of tuft of 7-8 long setae; apical margin between incisor and molar areas with setae, lateral margin setaceous. *Maxillae*: each galea-lacinia with 18 pectinate spines on crown, ventral setae scattered. *Hypopharynx*: with lingua convex at apex, superlinguae each with lateral arm developed. *Labium*: with broad U-shaped separation of glossae; glossae oval, stalked; paraglossae laterally elongate; apical segment of each palp acutely pointed. *Thorax*: dorsum brownish-yellow, venter pale. *Front legs*: femora yellowish-brown, each with median, zigzag pale yellow band, with spines in anterior margin and dorsal surface (Fig 3.3), posterior margin with fringe of long setae, spines on dorsal surface distally rounded (Fig 3.6, 3.7). *Middle and hind legs*: similar to front legs. Claws each with 3 subapical denticles (Fig 3.5). *Abdomen* (Fig 3.4): posterolateral spines well developed, terga I-III dark brownish-yellow, terga IV-X brownish-yellow maculae, sterna I-X brownish-yellow. *Gills* (Fig 3.2): with lamellae broad on abdominal segments II-VI, narrower on segments I and VII, fibrilliform portion of each gill I-VI well developed, absent on gill VII, gill I leaf-like, gills II-VI each triangular or cordate and tapering to blunt apex, gill VII asymmetrical and leaf-like shape. Caudal filament and cerci with whorls of spines, 2 times length of body. The larva of the genus *Thalerosphyrus* can be distinguished from that of *Asionurus* by the following combination of characters: gill VII leaf-like in *Thalerosphyrus* rather than lanceolate with a pointed tip in *Asionurus*; sternites of abdominal segment III-VII with

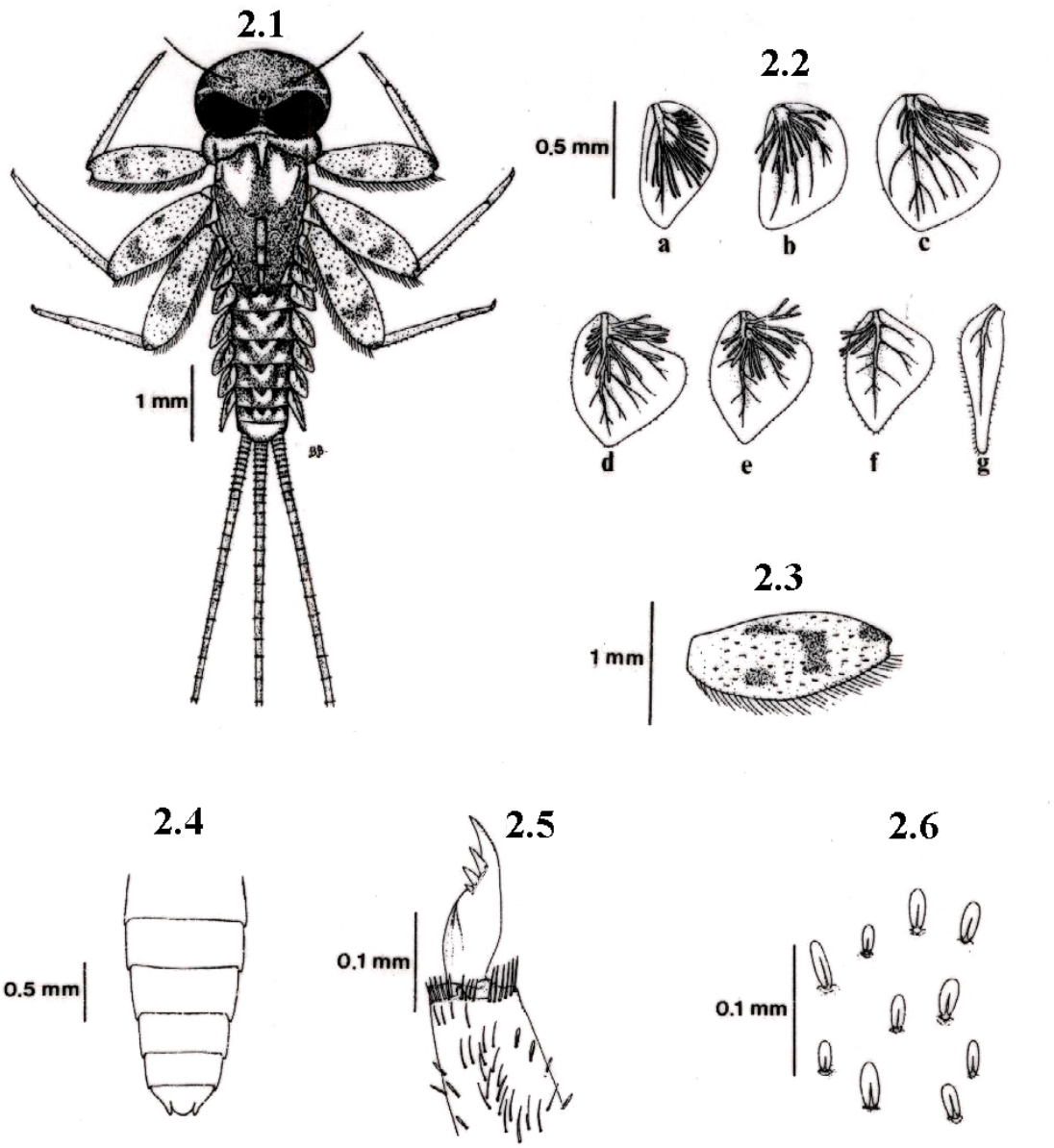

Fig 2. *Asionurus*; (2.1) dorsal view of male mature nymph; (2.2) gills, a-I, b-II, c-III, d-IV, e-V, f-VI, g-VII (respectively); (2.3) femur of front leg; (2.4) ventral view of abdominal segment; (2.5) tarsal claw of front leg; (2.6) bristles on dorsal surface of front femur.

prominent long lateral projections in *Thalerosphyrus* rather than posterolateral spines less developed in *Asionurus*.

Thailand - NORTHEASTERN: Chaiyaphum (Phromlaeng stream, Nam Nao National Park; Nam Phrom, Nam Chi and Mai Sod Yai streams, Chi River), Petchabun (Yakraue stream, Nam Nao National Park); Loei (Daeng and Sak-Nga Streams, Pasak River); and Sakhon Nakhon (Vein Pri stream, Phu Phan National Park).

Distribution - India and China to the Sunda Islands.

Ecology - The larvae cling to submerged boulders and cobbles. They have large, curved, tarsal claws and body usually dorso-ventrally flattened. They feed on periphyton and detritus. They live in mountain streams, water velocity approximately 3-7 cm sec^{-1}; water depth 7-17 cm.

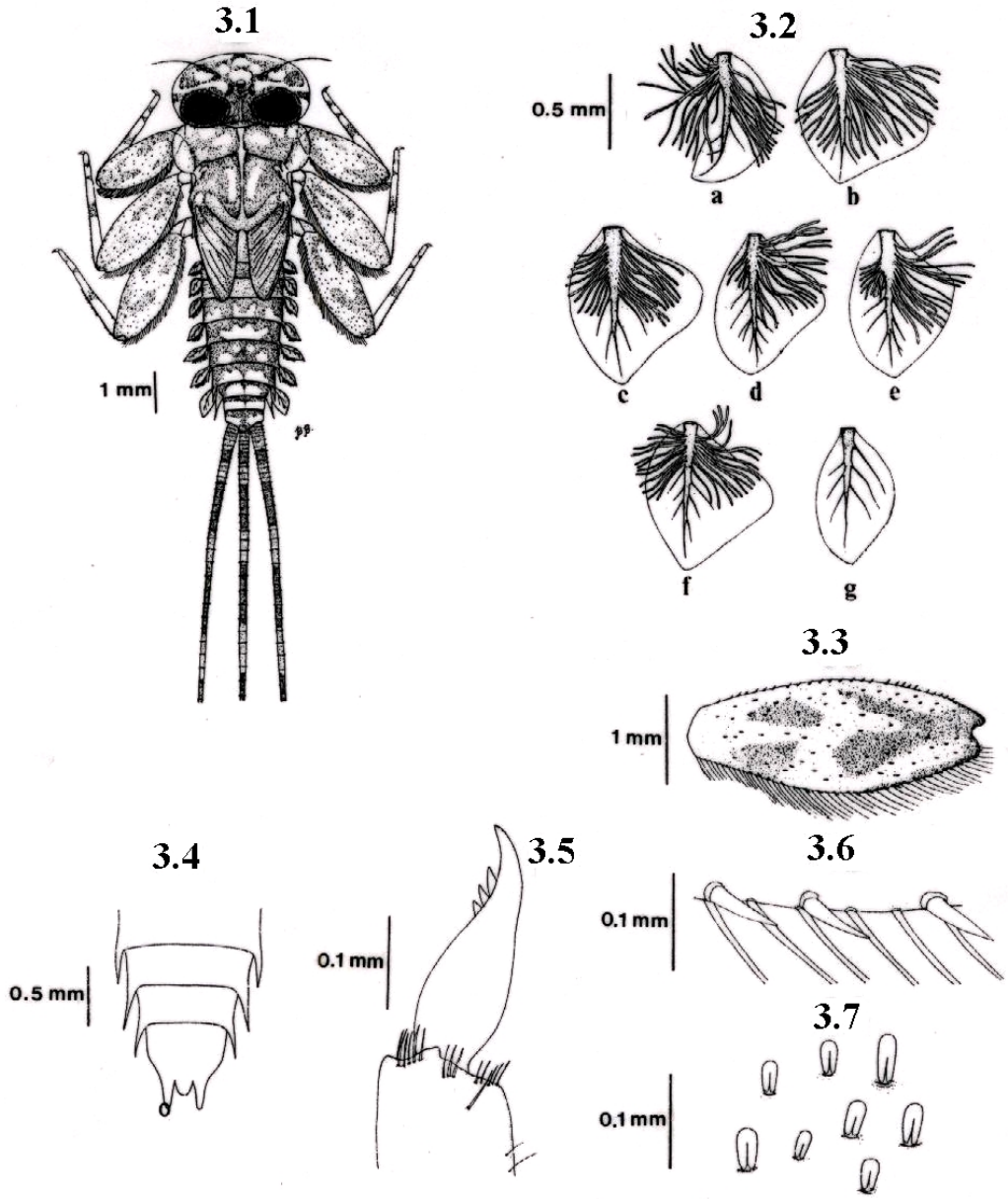

Fig 3. *Thalerosphyrus*; (3.1) dorsal view of male mature nymph; (3.2) gills, a-I, b-II, c-III, d-IV, e-V, f-VI, g-VII (respectively); (3.3) femur of front leg; (3.4) ventral view of abdominal segment; (3.5) tarsal claw of front leg; (3.6) posterior margin of front leg; (3.7) bristles on dorsal surface of front femur.

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