

REVIEW OF THE HYDROMETRIDAE (HETEROPTERA) OF THAILAND, WITH DISTRIBUTION RECORDS

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ABSTRACT

Water measurers of the genus *Hydrometra* (Insecta: Heteroptera) are common inhabitants of lentic systems and pooled water of lotic systems in Thailand. Extensive distributional data are given for the 11 species previously recorded from Thailand, and for two additional species reported from Thailand for the first time. Further, the female of *H. julieni* Hungerford and Evans is described and illustrated. This paper brings together taxonomic, biological, and ecological information on the genus in Thailand from various sources.

Key words: Hydrometridae, Heteroptera, Thailand, distribution, aquatic, *Hydrometra*

INTRODUCTION

The genus *Hydrometra* (Insecta: Heteroptera: Hydrometridae) is cosmopolitan and common throughout Southeast Asia, and is the only genus in the family recorded from Thailand (CHEN & ZETTEL, 1996). The fauna of Indochina and the western Malay Archipelago was revised by POLHEMUS & POLHEMUS (1995) and comprises 19 species (SITES & POLHEMUS, 2003). The distribution in the Archipelago is largely allopatric and POLHEMUS & POLHEMUS (1995) considered certain species of *Hydrometra* to be functional ecological equivalents, replacing or excluding each other in different parts of the area, due to restriction to particular habitats. In Thailand, ZETTEL & CHEN (1996) apportioned the eight species known at the time into three of five Southeast Asian species groups. Recently, another species was reported from the Phetchabun Mountains in north-central Thailand (VITHEEPRADIT, 2000) and two new species were described from north-central Thailand (SITES & POLHEMUS, 2003). Given the topographic and hydrologic diversity as well as the elongated longitudinal geographic orientation of Thailand, it is very likely that more species of *Hydrometra* exist.

Presented herein are extensive distributional data on species known from Thailand, new records of two additional species, and a description of the female of *H. julieni* Hungerford and Evans. Thus, if used in conjunction with the taxonomic keys of POLHEMUS

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& POLHEMUS (1995) and ZETTEL & CHEN (1996), this paper brings together the current state of knowledge of taxonomy, biology, ecology, and distribution of *Hydrometra* in Thailand.

SPECIMEN REPOSITORIES

- BPBM: Bishop Museum, Honolulu, Hawaii, USA.
CAS: California Academy of Sciences, California, USA.
CCB: F. Chérot Collection, Systématique et Ecologie Animales, Université Libre de Bruxelles, Brussels, Belgium.
CFF: Franco Faraci Collection, Bardolino, Italy.
CMUT: Chiang Mai University, Faculty of Sciences, Department of Biology, Chiang Mai, Thailand.
CNTN: Nico Nieser Collection, Tiel, The Netherlands.
CSS: William D. Shepard Collection, Sacramento, California, USA.
CUL: Wolfgang G. Ullrich Collection, Lübeck, Germany.
JTPC: John T. Polhemus Collection, Englewood, Colorado, USA.
KKUA: Khon Kaen University, Faculty of Agriculture, Department of Entomology, Khon Kaen, Thailand.
MNHG: Muséum d'Histoire Naturelle, Genève, Switzerland.
NHMA: Natural History Museum, Aarhus, Denmark.
NHMW: Natural History Museum, Vienna, Austria.
NSM: National Science Museum, Pathum Thani, Thailand.
PPCC: Ping-Ping Chen Collection, Tiel, The Netherlands.
RFD: Thai Royal Forestry Department, Bangkok, Thailand.
UMC: Enns Entomology Museum, University of Missouri-Columbia, USA.
USNM: National Museum of Natural History, Smithsonian Institution, D.C., USA.
ZMUC: The Zoological Museum, University of Copenhagen, Denmark.
ZRC: The Zoological Reference Collection, Raffles Museum for Biodiversity Research, National University of Singapore, Singapore.

LOCALITY ABBREVIATIONS

- NP: National Park.
WS: Wildlife Sanctuary.
WMS: Wildlife Management Station.
WRSC: Wildlife Research Station Center.

Many of the collecting localities (L-numbers) given in the collection records for AV and RWS may be viewed by accessing a Locality Image Database linked to the Enns Entomology Museum internet site. Representative specimens of all species currently listed as being housed at UMC will be transferred to, and deposited in, NSM and RFD. All diagnoses are intended to distinguish among only species known from Thailand. Identification of females generally is not reliable without the association with male specimens. Coordinates were obtained via GPS (map datum WGS 84).

***Hydrometra akekawati* Sites and Polhemus**
(Fig. 1)

Hydrometra akekawati Sites and Polhemus 2003: 140–142.

Diagnosis.—This species can be distinguished by an anteclypeus that is elongate, conical, slightly convex-sided, and narrowly-rounded apically. The pronotum is heavily punctate on the pro- and mesothoracic pleura. Males have a pair of posteriorly-directed, black-tipped, sclerotized prongs near the anterior margin of sternite VII. This species resembles *H. chaweewanae* Sites and Polhemus and *H. cracens* Polhemus and Polhemus, however the anteclypeus of *H. chaweewanae* has an acuminate process at the apex and the anteclypeus of *H. cracens* is parallel-sided. The female apical process of tergite VIII is slightly angled upward throughout its length.

Discussion.—The type locality was a quadrangle, apparently anthropogenic pond adjacent to a small gas station. The pond was situated between a highway and cornfield. The perimeter of the pond was heavily vegetated with emergent and submergent vegetation. This species was collected with five congeners: *H. annamana* Hungerford and Evans, *H. carinata* Polhemus and Polhemus, *H. chaweewanae*, *H. greeni* Kirkaldy, and *H. orientalis* Lundblad. Since the species is known only from the type locality, its distribution in Thailand cannot be assessed until additional records are available.

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepradit & Sawangsak, L-228 (4 males, 7 females; UMC, RFD, JTPC).

***Hydrometra annamana* Hungerford and Evans**
(Fig. 1)

Hydrometra annamana Hungerford and Evans 1934: 68.

Diagnosis.—This species can be distinguished by an anteclypeus that is broadly triangular to obtusely angled anteriorly. Males have a pair of small, tightly-clustered, black setae at the midlength of sternite VII. Females have the upwardly-directed terminal process of tergum VIII at least as long as that part of the tergum anterior to it. This species resembles *H. maidli* Hungerford and Evans, however males of the latter species have a pair of large patches of brown setae on the posterior half of sternite VII.

Discussion.—This species has been recorded from China (Hong Kong), Japan, Laos, Taiwan, Thailand, and Vietnam (POLHEMUS & POLHEMUS, 1995) and occurs in a wide variety of aquatic habitats. In Thailand, this species was previously collected in Chiang Mai and Bangkok provinces (POLHEMUS & POLHEMUS, 1995). Herein, we add records from Chaiyaphum, Chanthaburi, Kamphaeng Phet, Kanchanaburi, Khon Kaen, Nakhon Ratchasima, Sakon Nakhon, Satun, and Songkhla provinces. These new records fill the gap between the previously disjunct distribution records. Moreover, the record from Satun Province is the southernmost known limit of *H. annamana* in Southeast Asia. This species apparently occurs widely in both lotic and lentic habitats at low elevations in Thailand. In north-central Thailand, *H. annamana* was collected in the Phetchabun Mountains at the

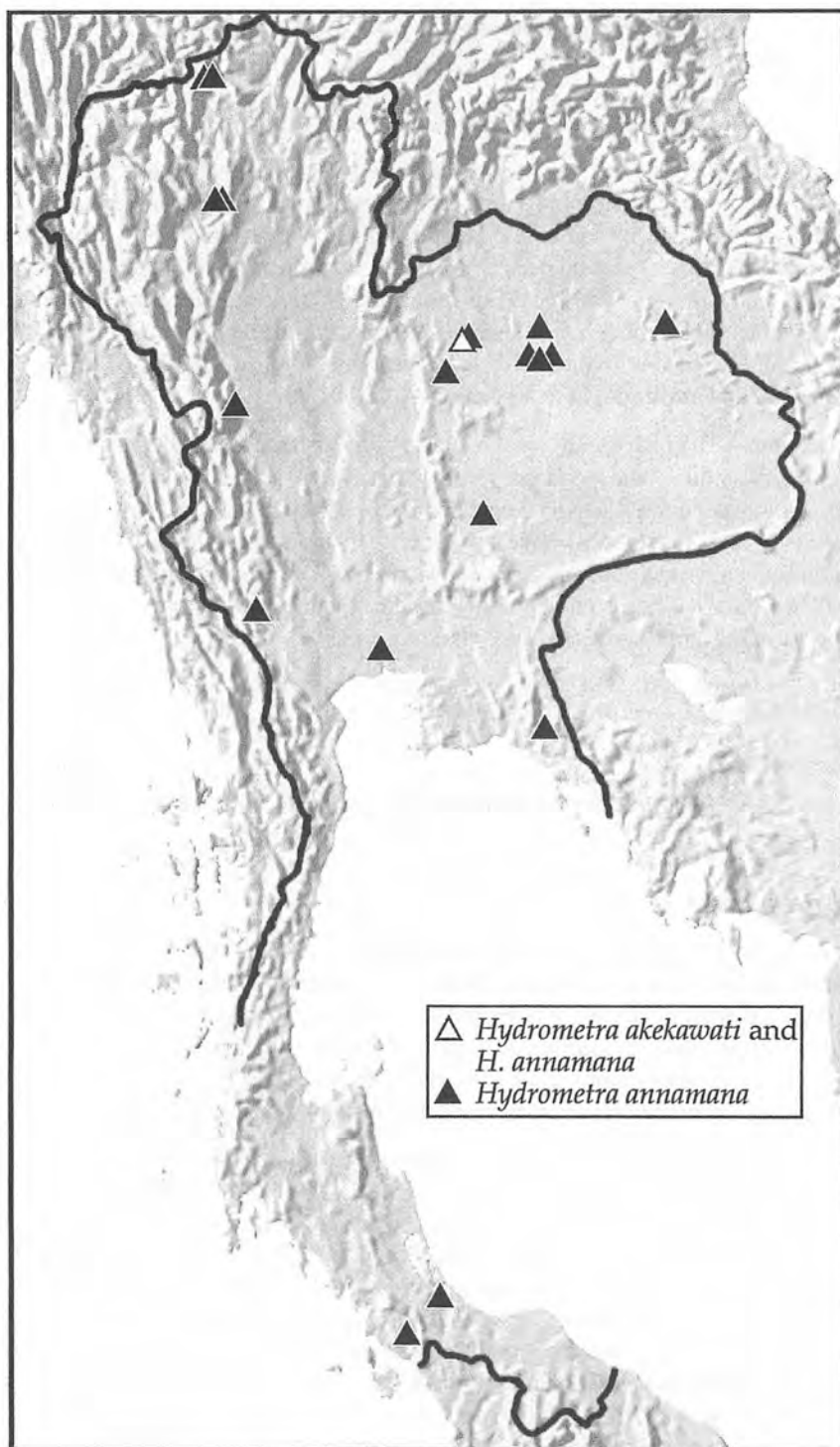


Figure 1. Distribution of *Hydrometra akekawati* and *H. annamana* in Thailand.

margins of a pond in association with vegetation, where it co-occurred with *H. akekawati*, *H. carinata*, *H. chaweewanae*, *H. greeni*, and *H. orientalis* (VITHEEPRADIT, 2000).

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepradit & Sawangsak, L-228 (1 male, 2 females; UMC); Amphur Khon San, Tumbon Heuy Yang, vegetated pond near rice field, 2-VII-1998, Vitheepradit & Sawangsak, L-229 (1 male, 2 females; UMC); Phu Khieo WS, tributary to Nam Prom, 13-III-1994, W.D. Shepard, 1038 (1 female; CSS); CHANTHABURI Prov.: Namtok Phlew NP, Nam Tok Phlew waterfall, 14-I-1997, H.H. Tan, THH9705 (1 male; ZRC); CHIANG MAI Prov.: Chiang Mai, Chiang Mai Zoo, Water Reservoir, 10-IX-1995, H. Zettel, 11 (1 male; NHMW); Chiang Mai, 12-I-1980, F. Faraci (1 female; CFF); KAMPHAENG PHET Prov.: stream near Khong Nam Lai Waterfall, 13-IX-1998, T.B.Lim, YCM228 (1 female; ZRC); KANCHANABURI Prov.: Amphur Muang, Heuy Lam Ta Pern, 14°08'N 99°22'E, 48 m, 15-IV-2002, Vitheepradit & Kirawanich, L-344 (1 female; UMC); KHON KAEN Prov.: Khon Kaen University, lakes, 19-II-1994, W.D. Shepard, 1017 (1 female; CSS); Khon Kaen University, pasture pools, 20-II-1994, W.D. Shepard, 1018 (8 males, 9 females; CSS, NHMW); same locality, 23-II-1994, W.D. Shepard, 1019 + 1020 (18 males, 19 females; CSS, NHMW); Khon Kaen University, ponds at south entrance, 17-II-1994, W.D. Shepard, 1014 (1 female; CSS); 30 km NNW of Khon Kaen, Nam Pong, near Ban Hua Phu, 20-XI-1995, H. Zettel, 19 (1 female; NHMW); NAKHON RATCHASIMA Prov.: Nakhon Ratchasima, near Wat Leab, ditch near Padi, 16-I-1997, H.H. Tan, THH9715 (8 males, 5 females; ZRC); SAKON NAKHON Prov.: Sakon Nakhon, constructed wetland, 23-XI-1995, H. Zettel, 21 (2 males, 1 female; NHMW); SATUN Prov.: Thale Ban NP, Thale Ban, large shallow lake with emergent vegetation, 9-VII-1997, Sites & Permkam, L-133, (1 male, 11 females; UMC); SONGKHLA Prov.: Amphur Hat Yai, PSU pond near reservoir, 07°00'N, 100°30'E, 58 m, 4-V-2002, Vitheepradit & Kirawanich, L-391 (2 females; UMC).

Previous records (POLHEMUS & POLHEMUS, 1995).—BANGKOK Prov.: Bangkok, 10-V-1974, E. Heiss (1 male; JTPC); CHIANG MAI Prov.: ponds at Fang Horticultural Research Station, 15-XI-1985, J.T. & D.A. Polhemus, CL 2201 (2 males, 1 female; JTPC); Huay Hia Creek, Fang Horticultural Research Station, 500 m, 15-XI-1985, J.T. & D.A. Polhemus, CL 2198 (1 female; JTPC).

Hydrometra carinata Polhemus and Polhemus

(Fig. 2)

Hydrometra carinata Polhemus and Polhemus 1995: 17–19.

Diagnosis.—This species can be distinguished by an anteclypeus that is large, tapering, rounded anteriorly, and with lateral margins curved. The body is relatively long (ca. 14.86 and 16.26 mm for males and females, respectively). The maxillary plate is extremely large and covers almost the entire gular lobe, except anteriorly. Sternite VII of the male has a pair of spine-like clusters of dark, stiff setae laterally about 2/5 from the anterior margin. Tergite VII of female has long, black, caudal setae, and tergite VIII is straight. This species resembles *H. longicapitis* Torre-Bueno and *H. ripicola* Andersen; however, the maxillary plates of latter two species are smaller and do not cover the gular lobe.

Discussion.—This species has been recorded from Indonesia (Kalimantan), Malaysia (Malay Peninsula) (POLHEMUS & POLHEMUS, 1995), and Thailand (ZETTEL & CHEN, 1996), although no Thai locality data have been published. Herein, we present records from Chaiyaphum, Kanchanaburi, Khon Kaen, Nakhon Ratchasima, Narathiwat, Phattalung, Phetchabun, and Phitsanulok provinces. Our records extend the known range of *H. carinata* north of the Isthmus of Kra and indicate that this species occurs mainly in lentic habitats at low elevations in Thailand. Moreover, our collection from Phitsanulok Province is the northernmost known limit of this species in Southeast Asia. The absence of records of this

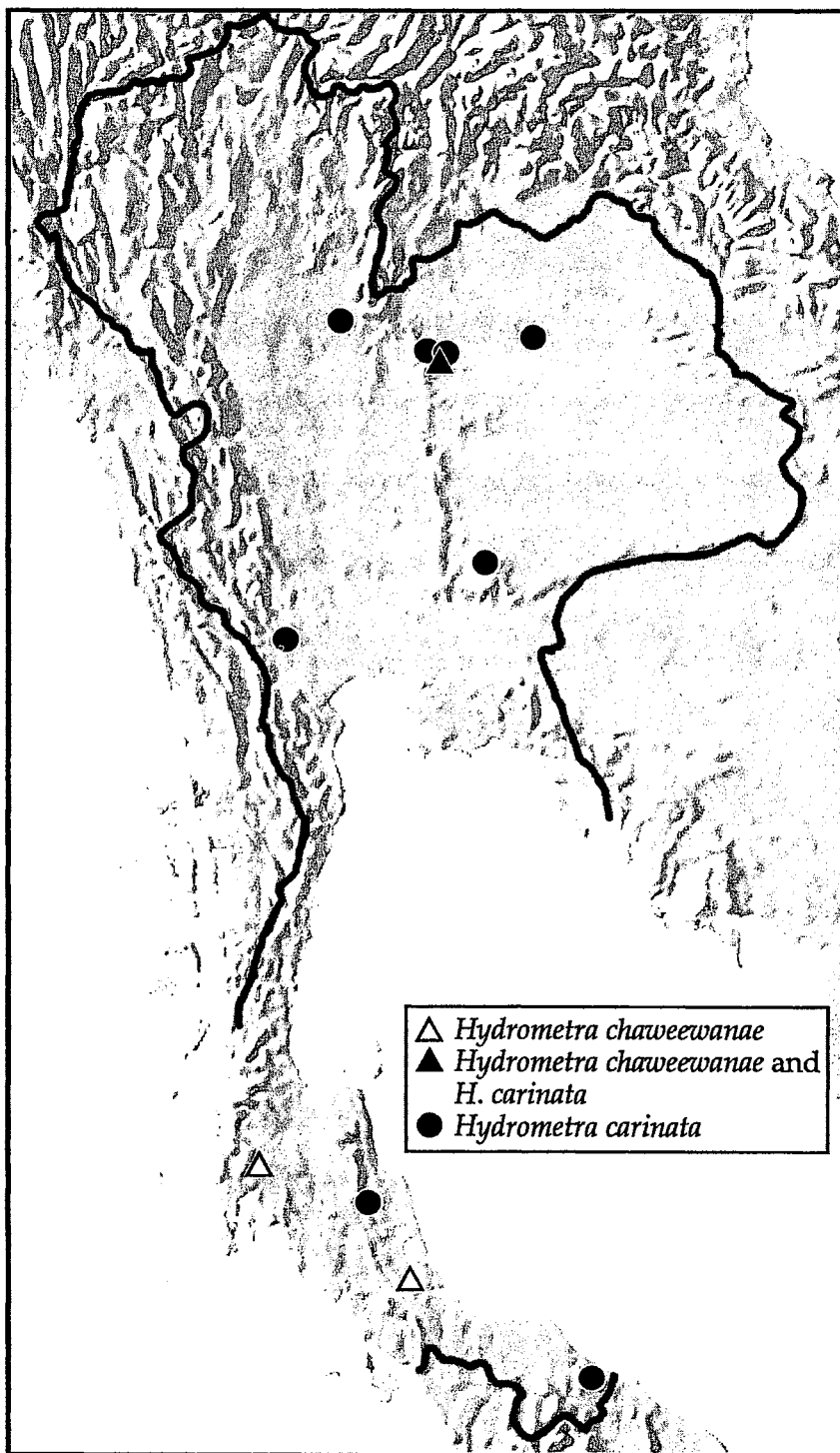


Figure 2. Distribution of *Hydrometra chaweewanae* and *H. carinata* in Thailand.

species in northern Thailand is probably due to the higher elevations of collection sites. Although this species was collected mainly from lentic habitats (i.e., ponds and peat swamps), a specimen was collected from the margin of a river in Kanchanaburi Province, and in Indonesia, this species was collected from the margins of black water streams in a disturbed lowland peat swamp (POLHEMUS & POLHEMUS, 1995). This species occurred with *H. akekawati*, *H. annamana*, *H. chaweewanae*, *H. greeni*, and *H. orientalis* in the Phetchabun Mountains at the margins of a pond in association with plants (VITHEEPADIT, 2000).

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepadit & Sawangsak, L-228 (10 males, 13 females; UMC); Amphur Khon San, Tumbon Heuy Yang, Ban Klong Teoy, vegetated pond near rice field, 2-VII-1998, Vitheepadit & Sawangsak, L-229 (3 males, 4 females; UMC); KANCHANABURI Prov.: River Kwai, 1-XII-1990, M.A. Jäch, 5 (1 female; NHMW); KHON KAEN Prov.: 30 km NNW Khon Kaen, Nam Phong, near Ban Hua Phu, 20-XI-1995, H. Zettel, 19 (1 female; NHMW); NAKHON RATCHASIMA Prov.: Nakhon Ratchasima, 16-I-1997, H.H. Tan, THH9715 (1 female; ZRC); NARATHIWAT Prov.: Tasik Padi, Padi, peat swamp, 23-X-1998, H.H. Tan & H.K. Lua, THH9887 (1 female; ZRC); PHATTALUNG Prov.: Praiwan Waterfall, 3 km W of Ban Phut, pond with vegetation, 11-VII-1997, Sites & Permkam, L-135 (1 male; UMC); PHETCHABUN Prov.: Amphur Nam Nao, Ban Srab Rak, 21 N of intersection Hwy 12 x 2216, on Hwy 2216, vegetated pond near fish pond, 3-VII-1998, Vitheepadit & Sawangsak, L-231 (4 males, 2 females; UMC, JTPC); PHITSANULOK Prov.: Nam Tok Chattrakan NP, vegetated pond near Chattrakan Waterfall, 9-VI-1998, Sites, Simpson, Vitheepadit, L-171 (1 male; UMC).

Hydrometra chaweewanae Sites and Polhemus (Fig. 2)

Hydrometra chaweewanae Sites and Polhemus 2003: 139–140.

Diagnosis.—This species can be distinguished by an anteclypeus that is broadly triangular and markedly acuminate anteriorly, and is the smallest known species of *Hydrometra* in Southeast Asia. Males have a pair of posteriorly-recurved, black, sclerotized hooks near the anterior margin of sternite VII. Tergite VIII is about as long as wide and with a pointed apical process. The female apical process of tergite VIII is slightly deflexed at the apex. This species resembles *H. akekawati* and *H. cracens*, however the anteclypeus of *H. akekawati* is conical and the anteclypeus of the latter species is parallel-sided.

Discussion.—This species was described from Thailand (SITES & POLHEMUS, 2003) and is also known from Singapore and Borneo (YANG & ZETTEL, *IN LIT.*). The type locality was a quadrate, apparently anthropogenic pond adjacent to a small gas station and situated between a highway and corn field. The perimeter of the pond was heavily vegetated with emergent and submergent vegetation. This species was collected with five congeners: *H. akekawati*, *H. annamana*, *H. carinata*, *H. greeni*, and *H. orientalis*. In southern Thailand, this species also was taken from a lake and pond in Phang Nga and Songkhla provinces, respectively. Although only three records of this species exist, a single record from the north-central region and two records from southern Thailand indicate that this species likely occurs throughout the country. Surveys in other regions of Thailand are needed for a more complete understanding of the distribution of *H. chaweewanae*.

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepadit & Sawangsak, L-228 (3 males, 11 females; UMC, JTPC, RFD); PHANG NGA Prov.: lake at Samanora Park, 3 km E of Amphur

Muang, 13-VII-1997, Sites & Permkam, L-141 (1 male; UMC); SONGKHLA Prov.: Hat Yai, PSU campus, vegetated pond, 5-I-1995, Sites & Nichols, L-56 (1 female; UMC).

Hydrometra cracens Polhemus and Polhemus
(Fig. 3)

Hydrometra cracens Polhemus and Polhemus 1995: 19–20.

Diagnosis.—This species can be distinguished by an anteclypeus that is small, parallel-sided, and broadly-rounded apically. Males have a pair of small, black, widely-separated, posteriorly-directed, spine-like clusters of stiff setae in the anterior 1/5 of sternite VII. The terminal process of tergite VIII of females is directed straight with stiff, laterally-directed setae. This species resembles *H. chaweewanae* and *H. akekawati*, however the anteclypeus of latter two species is not parallel-sided.

Discussion.—This species has been recorded previously from Malaysia (Johor, Kelantan, Sabah, and Sarawak) (POLHEMUS & POLHEMUS, 1995). The specific status and separation from the two closely related taxa, *H. mindoroensis* Polhemus (POLHEMUS & REISEN, 1976), which is widespread from Borneo and the Philippines to New Guinea, and *H. lombok* Polhemus and Polhemus, which occurs on the Lesser Sunda Islands, recently has been questioned (GAPUD ET AL., 2003). Our collection represents the first record of *H. cracens* in Thailand and is the northernmost known limit of this species in Southeast Asia. Since this species is known from a single locality in Mae Hong Son Province and from Malaysia, it probably occurs through the Isthmus of Kra and southern Thailand. The ecology of this species is not well known, however specimens from Johor in Malaysia were collected from the margins of smoothly-flowing streams in lowland swamp forests (POLHEMUS & POLHEMUS, 1995).

Material examined.—MAE HONG SON Prov.: Salween Basin, Pha Pha Valley, Nam Mae Yuam, tributary, 20-III-1996, S.H. Tan & N. Sivasothi, TG5 (1 male, 1 female; ZRC).

Hydrometra gilloglyi Polhemus and Polhemus
(Fig. 3)

Hydrometra gilloglyi Polhemus and Polhemus 1995: 20–22.

Diagnosis.—This species can be distinguished by an anteclypeus that is broad, expanded anteriorly, truncate, and with the anterior margin straight but depressed medially. Sternite VII of the male has a weak transverse depression 2/3 from the anterior margin and sternite VIII is carinate with a lateral fringe of setae. The terminal process of tergite VIII of the female is directed ventrad. This species is more similar to *H. poissoni* Hungerford from Africa than to its congeners in Southeast Asia (POLHEMUS & POLHEMUS, 1995).

Discussion.—This species has been recorded from Malaysia (Malay Peninsula, Sabah, and Sarawak), Thailand, and Vietnam, although no specific Thai locality data have been published (POLHEMUS & POLHEMUS, 1995; ZETTEL & CHEN, 1996). The venter of this species has been reported to be darker than that of other species in the region, although coloration varies regionally (POLHEMUS & POLHEMUS, 1995). We found specimens from

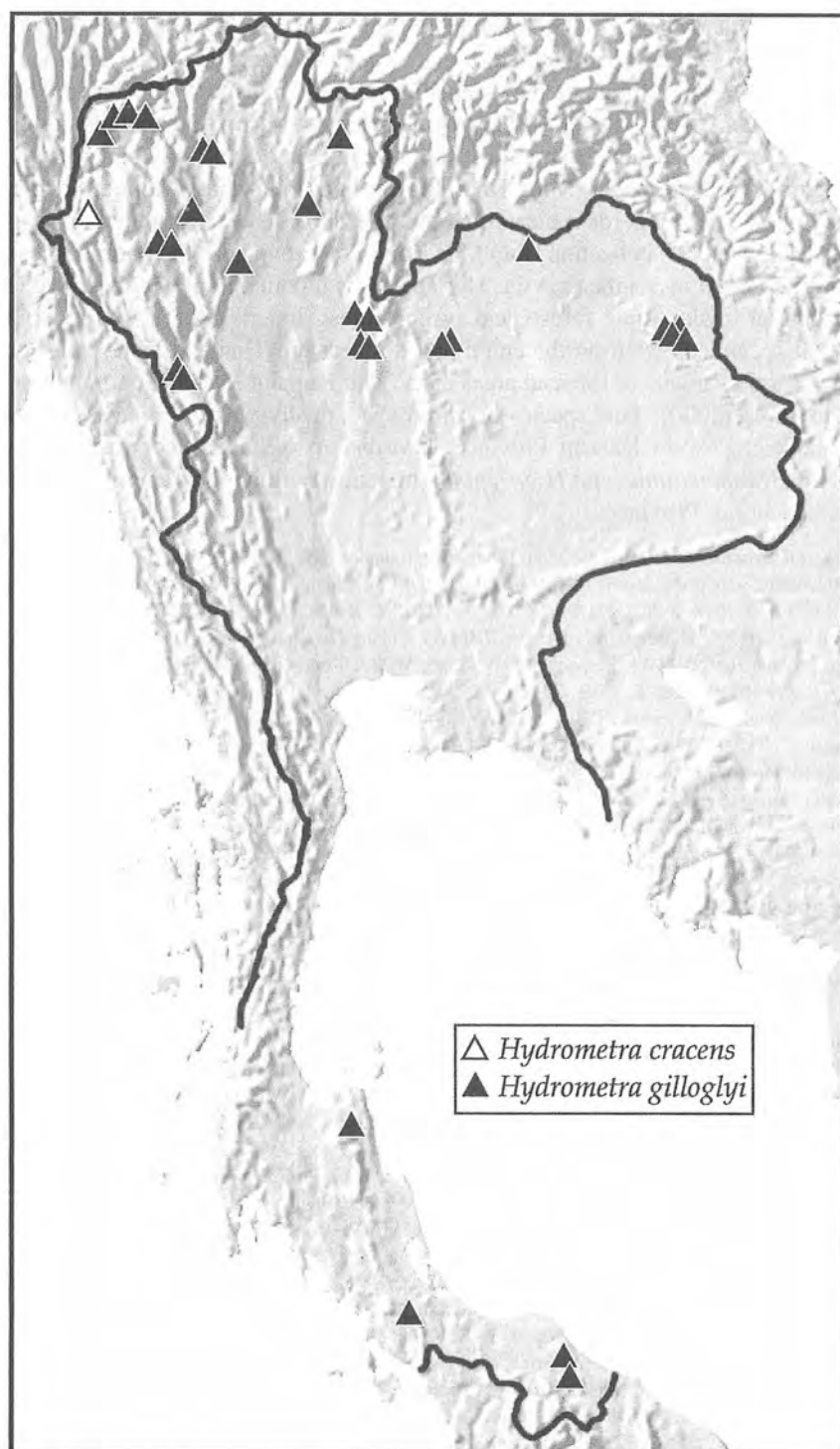


Figure 3. Distribution of *Hydrometra cracens* and *H. gilloglyi* in Thailand.

southern Thailand to be much darker than those from north-central and northeastern Thailand. Because *H. gilloglyi* varies in both color and structural characters, more than one species might be represented, although the populations from Thailand and Vietnam belong to typical *H. gilloglyi* (YANG & ZETTEL, *IN LIT.*). Herein, we present records from Chiang Mai, Kalasin, Khon Kaen, Lampang, Loei, Mae Hong Son, Mukdahan, Nakhon Si Thammarat, Nan, Narathiwat, Nong Khai, Phetchabun, Phitsanulok, Phrae, Songkhla, and Tak provinces. These records indicate that this species is likely distributed throughout the country. Moreover, our collection from Mae Hong Son Province is the northernmost known limit of *H. gilloglyi* in Southeast Asia. This species is reported to prefer shaded areas along the margins of lowland rain forests and swamp forest streams (POLHEMUS & POLHEMUS, 1995). All specimens from north-central and northeastern Thailand were collected at the margins of lotic habitats in forested areas of the Phu Pan and Phetchabun mountain ranges (VITHEEPRADIT, 2000). This species occurred synoptically with *H. greeni* in a stream at Huay Mahk Ngyow in Kalasin Province. *Hydrometra gilloglyi* also was collected with *H. greeni*, *H. longicapitis*, and *H. orientalis* in a slowly flowing stream at Huai Tub Dah Mi in Phitsanulok Province.

Material examined.—CHIANG MAI Prov.: Doi Inthanon NP, Sob Ab Waterfall, 18° 31'N, 98° 36'E, 3-IV-2002, UMC and CMU teams, L-319 (1 female; UMC); Chiang Dao River, 11 km from Chiang Dao to Chiang Rai, 12-VI-1998, Y.Y. Goh & Y.X. Cai, GYY078 (7 males, 8 females; ZRC); Doi Inthanon NP, Mae Klang Falls, 4-XI-1995, H. Zettel, 6 (1 female; NHMW); Chiang Dao, near Chiang Dao Cave, 500 m, 7-XI-1995, H. Zettel, 9b (1 male; NHMW); Samoeng, 29-VI-1995, W.G. Ullrich (1 female; CUL); ca. 10 km E Samoeng, 18° 51' 40.2"N, 98° 38' 49.5"E, river, 29-XII-1997, W.G. Ullrich (1 male; CUL); same locality, 28-XII-1997, W.G. Ullrich (3 males, 1 female; CUL, NHMW); same locality, 18-VII-1997, W.G. Ullrich (1 female; CUL); same locality, 2-I-1998, W.G. Ullrich (4 males, 3 females; CUL, NHMW); KALASIN Prov.: Phu Pan NP, Huay Mahk Ngyow, stream with borders, 4-VI-1998, Sites, Simpson, Vitheepradit, L-149 (1 male; UMC); Phu Pan NP, Gang Mawt Dang, stream, 4-VI-1998, Sites, Simpson, Vitheepradit, L-150 (1 male, 1 female; UMC); Phu Pan NP, stream with waterfall and vegetation, 5-VI-1998, Sites, Simpson, Vitheepradit, L-154 (1 male, 1 female; UMC); KHON KAEN Prov.: Chai Ya Pun, 82 km from Khon Kaen, artificial lake with water lilies, 20-VI-1998, Y.Y. Goh, GYY107 (1 male; ZRC); LAMPANG Prov.: 7 km SW of Sop Prop, Mae Nam Wang, 23-III-1994, W.D. Shepard, 1041 (1 female; CSS); LOEI Prov.: 3 km W of Amphur Phu Kradung, Lam Phong Ko, 8-III-1994, W.D. Shepard, 1029 (1 female; CSS); MAE HONG SON Prov.: ca. 12 km N of Mae Hong Son, Tam Pla Resort at Tam Pla River, 19° 25' 34.2"N, 97° 59' 16.7"E, 21-XII-1997, W.G. Ullrich (39 males, 23 females; CUL, NHMW); same locality, 8-VIII-1997, W.G. Ullrich (53 males, 32 females; CUL, NHMW); same locality, 9-VIII-1998, W.G. Ullrich (9 males, 7 females; CUL, NHMW); same locality, 8-VIII-1997, W.G. Ullrich (1 female; CUL); ca. 60 km NNE of Mae Hong Son, Nam Kong River, 19° 35' 56.8"N, 98° 6' 35.5"E, 21-XII-1997, W.G. Ullrich (2 males, 1 female; CUL, NHMW); ca. 50 km NNE of Mae Hong Son, Mai Di Kom Village, Mae Kong River, 19° 35' 2.2"N, 98° 6' 41.9"E, 24-XII-1997, W.G. Ullrich (2 males, 7 females; CUL, NHMW); Soppong, Pai River, 8-IX-1998, C.M. Yang & T.B. Lim, YCM206A + YCM211 (8 males, 8 females; ZRC); MUKDAHAN Prov.: Huay Huat NP, Nam Tok Kang Pho, 6-VI-1998, Sites, Simpson, Vitheepradit, L-157 (8 males, 3 females; UMC); NAKHON SI THAMMARAT Prov.: Nopphitam, Ban Pitam, 14.9 km NW of intersection Hwy 4140 x 4186, gravel stream, 08° 47'N, 99° 39'E, 98 m, 30-IV-2002, Vitheepradit & Kirawanich, L-383 (1 female; UMC); NAN Prov.: N of Nan, Nam Gae, 16-VI-1998, Y.Y. Goh, CYY075 (2 males, 1 female; ZRC); NARATHIWAT Prov.: stream below Bacho Waterfall, 15-VI-1995, Sites, Nichols, Permkam, L-78 (2 males; UMC); Nam Tok Chi Po, 24-X-1998, H.H. Tan & H.K. Lua, THH9891 (1 male, 1 female; ZRC); NONG KHAI Prov.: 3 km from Phu Lang Ka Waterfall, 18-VI-1998, Y.Y. Goh, GYY102 (7 males, 6 females; ZRC); PHETCHABUN Prov.: Nam Nao NP, Heo Sai, 25-XI-1995, H. Zettel, 24 (1 female; NHMW); PHITSANULOK Prov.: Chattrakan Waterfall NP, Chattrakan Waterfall, spillway over rock, 9-VI-1998, Sites, Simpson, Vitheepradit, L-170 (2 females; UMC); Thung Salaeng Luang NP, Kaeng Sopa Waterfall, stream with waterfall, 30-VI-1998, Vitheepradit & Sawangsak, L-218 (1 male, 1 female; UMC); Thung Salaeng Luang NP, Huai Tub Dah Mi, 16° 50'N, 100° 51'E, 440 m, 8-III-2002, Sites, Vitheepradit, Kirawanich, L-274 (12 males, 8 females; UMC); 21 km SE of Nakhon Thai, Palad Waterfall, 27-III-1994, W.D. Shepard, 1048 (2 males; CSS,

NHMW); PHRAE Prov.: 50 km NE of Phrae, Huai Kaet, 17-XI-1995, H. Zettel, 17a (1 male; NHMW); SONGKHLA Prov.: Ton Nga Chang WS, stream at Buddhist temple, 6-VII-1997, R.W. Sites, L-127 (2 males, 2 females; UMC); TAK Prov.: Mae Sot, Huay Ya U, stream, 27-V-1999, H.H. Tan & H.H. Ng, THH9931 (3 males, 2 females; ZRC); Salween Basin, north of Phop Phrae, 19-III-1996, S.H. Tan & N. Sivasothi, TG3 (1 female; ZRC).

Note: The specific locality in Khon Kaen Province could not be determined with confidence and is not included in Fig. 3.

Hydrometra greeni Kirkaldy

(Fig. 4)

Hydrometra greeni Kirkaldy 1898: 2.

Diagnosis.—This species can be distinguished by an anteclypeus that is conical, triangular, and sharply-angled anteriorly. Males have sternite VII with a broad, transverse sulcus, and sternite VIII is unmodified with scattered, short setae. The posterior margin of tergite VII of the female is raised and has short, black setae, and the terminal process of tergite VIII is directed ventrad. This species most closely resembles *H. kelantan* Polhemus and Polhemus, from which it may be distinguished by a stouter body, lighter color, and a smaller ratio of lengths of mesotarsomeres II/III (ca. 1.8 and 2.0 for males and females, respectively).

Discussion.—This species has been recorded from Bangladesh, China, India, Indonesia (Nias Island), Malaysia (Malay Peninsula), Nepal, Sri Lanka, Thailand, and Vietnam (POLHEMUS & POLHEMUS, 1995), and also is known from Hainan, Sumatra, and Laos (YANG and ZETTEL, *IN LIT.*). This species occurs through a broader elevational and habitat range than other species of *Hydrometra* in Asia (POLHEMUS & POLHEMUS, 1995). In Thailand, this species was previously recorded from Chiang Mai Province, east of Bangkok Province, and the Chi and Maekhong rivers (POLHEMUS & POLHEMUS, 1995; HANBOONSONG ET AL., 1996). Herein, we add records from Chaiphaphum, Kalasin, Kanchanaburi, Krabi, Lamphun, Loei, Mae Hong Son, Nakhon Ratchasima, Nan, Phayao, Phetchabun, Phitsanulok, Phrae, Sakon Nakhon, Satun, Songkhla, Tak, Ubon Ratchathani, and Yala provinces. These records indicate that *H. greeni* is widespread throughout the country at a wide range of elevations, and it is attracted to lights. This species was most frequently collected at the margins of vegetated ponds in the Phetchabun Mountains, although some specimens were collected from the margins of a stream in the Phu Pan Mountains (VITHEEPRADIT, 2000). This species occurred with *H. akekawati*, *H. annamana*, *H. carinata*, *H. chaweewanae*, and *H. orientalis* at an anthropogenic pond in the Phetchabun Mountains (VITHEEPRADIT, 2000). In northern Thailand, *H. greeni* occurred in large numbers at the vegetated margins of small, sandy stream from a waterfall.

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Ban Tong Leoy Lai, 27.5 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepradit & Sawangsak, L-226 (1 female; UMC); Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepradit & Sawangsak, L-228 (7 males, 8 females; UMC); Phu Khieo WS, Nam Prom, 12-III-1994, W.D. Shepard, 1037 (1 female; CSS); Tat Ton NP, Tat Bong, 27-XI-1995, H. Zettel, 29 (7 males, 3 females; NHMW); Tat Ton NP, Tat Ton, 27-XI-1995, H. Zettel, 30 (1 male; NHMW); CHIANG MAI Prov.: Doi Inthanon NP, Siriphum Waterfall (lowest level), 18° 32'N 98° 31'E, 1380 m, 2-III-2002, Vitheepradit & Kirawanich, L-251 (1 male, 1 female; UMC); same locality, 21-III-2002, L-315 (1 female; UMC); Doi Inthanon NP, Mae Pan Waterfall, 18° 31'N, 98° 27'E, 3-III-2002, Vitheepradit & Kirawanich, L-253 (1 female;

UMC); same data, G.W. Courtney (2 males, 13 females; UMC); Doi Inthanon NP, stream from Huai Sai Luang Waterfall, 18° 31'N, 98° 27'E, 1060 m, 3-III-2002, Vitheepredit & Kirawanich, L-254 (>100 males, >100 females; UMC, NSM); same locality, 20-III-2002, Sites, Vitheepredit, Kirawanich, L-312 (>100 males, >100 females; UMC, NSM); Doi Inthanon NP, Nam Tok Vachiratham, 18° 31'N, 98° 27'E, 3-III-2002, Vitheepredit & Kirawanich, L-256 (1 male; UMC); Doi Inthanon NP, Nam Tok Sob Ab, 18° 31'N, 98° 36'E, 4-III-2002, Vitheepredit & Kirawanich, L-258 (9 males, 12 females; UMC); same locality, 3-IV-2002, UMC and CMU teams, L-319 (5 males, 7 females; UMC); same locality, 8-V-2002, UMC and CMU teams, L-398 (1 male; UMC); Doi Inthanon NP, Nam Tok Mae Klang, 18° 29'N, 98° 40'E, 415 m, 4-III-2002, Vitheepredit & Kirawanich, L-260 (1 male, 2 females; UMC); same locality, 3-IV-2002, UMC and CMU teams, L-320 (2 males, 1 female; UMC); Doi Suthep-Pui NP, immediate below Monthatharn Falls, 18° 49'N, 98° 55'E, 690 m, 15-III-2002, Sites & Kirawanich, L-296 (1 female; UMC); Fang Horticulture Experiment Farm, Nam Mae Chai, 19° 57'N, 99° 09'E, 600 m, 17-III-2002, Sites, Vitheepredit, Kirawanich, L-301 (1 male; UMC); Chiang Dao NP, vapor light at Nam Tok Sri Sungwan, 19° 37'N, 98° 57'E, 600 m, 17-III-2002, CMU team, (1 male; UMC); creek at Chiang Dao WRSC, 19° 21'N, 98° 55'E, 520 m, 18-III-2002, Sites, Vitheepredit, Kirawanich, L-303 (1 female; UMC); Doi Suthep-Pui NP, creek from Mohk Fah Waterfall, 19° 06'N, 98° 46'E, 564 m, 18-III-2002, Sites, Vitheepredit, Kirawanich, L-304 (5 males, 4 females; UMC); Doi Inthanon NP, Mae Klang River at Ecologde, 18° 32'N, 98° 32'E, 1000 m, 4-IV-2002, UMC and CMU teams, L-324 (1 male, 2 females; UMC); Doi Suthep-Pui NP, Amphur Mae Rim, Mae Sa Waterfall, 18° 52'N, 98° 48'E, 1030 m, 6-IV-2002, UMC and CMU teams, L-327 (1 male, 2 females; UMC); Doi Suthep-Pui NP, Amphur Mae Sa, Mae Sa River, 18° 53'N, 98° 51'E, 649 m, 6-IV-2002, UMC and CMU teams, L-328 (1 male; UMC); Doi Inthanon NP, Mae Pan Noi at Ban San Pathana, 18° 31'N, 98° 25'E, 750 m, 7-V-2002, UMC and CMU teams, L-393 (1 female; UMC); W of Mae Rim, Doi Suthep-Pui NP, Mae Sa Falls, 30-31-X-1995, H. Zettel, 2 (1 male, 3 females; NHMW); Doi Suthep-Pui NP, Monthatharn Falls, 24-III-1994, W.D. Shepard, 1044 (1 male, 3 females; CSS); same locality, 750-800 m, 2-XI-1995, H. Zettel, 4 (2 males; NHMW); Doi Inthanon NP, P. Chantaramongkol, (1 male, 3 females; CMUT); Doi Inthanon NP, Mae Klang Falls, 4-XI-1995, H. Zettel, 6 (2 males, 2 females; NHMW); Doi Inthanon, 1000 m, 8-XI-1985, Burckhardt & Löbl (2 females; MNHG); Chiang Dao, near Chiang Dao Cave, 500 m, 7-XI-1995, H. Zettel, 9b (2 males, 9 females; NHMW); Chiang Dao, Ban Yang Thung Pong, 500 m, 8-XI-1995, H. Zettel, 10 (2 males, 4 females; NHMW); Chiang Mai Zoo, Water Reservoir, 10-XI-1995, H. Zettel, 11 (1 male, 3 females; NHMW); Chiang Mai, Samoeng Resort, 18° 51' 45.2"N, 98° 43' 18.7"E, 18-IV-2000, W.G. Ullrich (6 males, 9 females; CUL, NHMW); same locality, 29-VI-1995, W.G. Ullrich (3 males; CUL); same locality, 19-IV-2000, W.G. Ullrich (1 male, 2 females; CUL); same locality, 20-IV-2000, W.G. Ullrich (8 males, 8 females; CUL); Chiang Mai, ca. 10 km E of Samoeng, river, 18° 51' 40.2"N, 98° 38' 49.5"E, 28-XII-1997, W.G. Ullrich (1 male, 2 females; CUL); same locality, 29-XII-1997, W.G. Ullrich (2 females; CUL); same locality, 2-I-1998, W.G. Ullrich (15 males, 25 females; CUL, NHMW); same locality, 11-IV-2000, W.G. Ullrich (13 males, 9 females; CUL, NHMW); Mae Nam Lin, near Mae Khachan, 55 km to Chiang Mai, 13-VI-998, Y.Y. Goh, GYY86 (2 males, 1 female; ZRC); Pai River, near Pai, 7-IX-1998, C.M. Yang & T.B. Lim, YCM204 (1 female; ZRC); NW of Chiang Mai, puddle on trail to waterfall, 7-IX-1998, C.M. Yang & T.B. Tan, YCM203B (4 males, 4 females; ZRC); CHIANG RAI Prov.: Amphur Muang, Agricultural Station, Mt. Phangan, stream, 15-I-1995, P.P. Chen (4 males, 6 females; PPCC); KALASIN Prov.: Phu Pan NP, Huay Mahk Ngyow, stream with borders, 4-VI-1998, Sites, Simpson, Vitheepredit, L-149 (1 female; UMC); KANCHANABURI Prov.: stream at 3 km SW of intersection Hwy 3199 x 3457, 14° 12'N, 99° 12'E, 89 m, 15-IV-2002, Vitheepredit & Kirawanich, L-343 (1 female; UMC); creek at Ban Prachamai, 14° 35'N, 99° 35'E, 24-II-2002, G. W. Courtney, (1 male; UMC); Amphur Sai Yok, Sai Yok, VII-1998, O. Pauwels (3 males, 1 female; CCB); KRABI Prov.: Krabi, Ao Nang Hill, 20-II-1991, M. Madl, 3 (1 male, 1 female; NHMW); LAMPHUN Prov.: Mae Ping NP, Nam Tok Tadsador, 17° 34'N, 98° 49'E, 6-III-2002, Sites, Vitheepredit, Kirawanich, L-265 (1 male, 2 females; UMC); same data, CMU team (1 male; UMC); Mae Ping NP, Nam Tok Koh Luang, 17° 34'N, 98° 49'E, 6-III-2002, Sites, Vitheepredit, Kirawanich, L-266 (1 female; UMC); same locality, 7-III-2002, Sites, Vitheepredit, Kirawanich, L-268 (3 males; UMC); LOEI Prov.: Na Haew NP, Nam Tok Wahng Tahd, 17° 28'N, 100° 57'E, 750 m, 9-III-2002, Sites, Vitheepredit, Kirawanich, L-277 (3 males; UMC); Na Haew NP, rock pools above Tahd Heung International Waterfall, 17° 33'N, 100° 59'E, 500 m, 10-III-2002, Sites, Vitheepredit, Kirawanich, L-281 (3 males; UMC); 3 km W of Amphur Phu Kradung, Lam Phong Ko, 8-III-1994, W.D. Shepard, 1029 (1 male, CSS); Ban Pha Baen, unnamed stream, 8-III-1994, W.D. Shepard, 1031 (1 male; CSS); Tha Li, Nam Kham, 8-III-1994, W.D. Shepard, 1032 (5 males, 4 females; CSS, NHMW); 1 km S of Ban Kok Lao, Huai Nam Huai, 9-III-1994, W.D. Shepard, 1034 (6 males, 1 female; CSS, NHMW); MAE HONG SON Prov.: Nam Tok Maw Pang, 19° 22'N, 98° 22'E, 850 m, 19-III-2002, Sites, Vitheepredit, Kirawanich, L-305 (2 males, UMC); Huai Pha, 18 km N of Mae Hong Son,

19° 25'N, 97° 59'E, 340 m, 19-III-2002, Sites, Vitheepradit, Kirawanich, L-306 (1 male; UMC); Nam Tok Mae Surin NP, Mae Nam Pai, 19° 21'N, 97° 59'E, 310 m, 19-III-2002, Sites, Vitheepradit, Kirawanich, L-307 (4 females; UMC); Huai Mae Saket, just S of Mae Hong Son, 19° 14'N, 97° 58'E, 280 m, 20-III-2002, Sites, Vitheepradit, Kirawanich, L-309 (2 males, 1 female; UMC); 17 km along road N of Mae Hong Son, Mok Cham Pae, near Fish Cave, 11-XI-1995, H. Zettel, 12b (1 male; NHMW); 3 km SE of Mae Hong Son, 13-XI-1995, H. Zettel, 14a + 14b (2 males, 1 female; NHMW); Amphur Pang Mapha, Ban Tham, Tham Lod, 650 m, 20-XII-1996, stream ca. 4 m wide, in mixed deciduous forest, P. Schwendinger (1 female; NHMW); ca. 12 km N of Mae Hong Son, Tam Pla Resort at Tam Pla River, 19° 25' 34.2"N, 97° 59' 16.7"E, 21-XII-1997, W.G. Ullrich (8 males, 14 females; CUL); same locality, 16-IV-2000, W.G. Ullrich (3 females; CUL); ca. 50 km NNE of Mae Hong Son, Mai Di Kom Village, Mae Kong River, 19° 35' 02.2"N, 98° 06' 41.9"E, 24-XII-1997, W.G. Ullrich (1 female; CUL); Soppong, Pai River, 8-9-IX-1998, C.M. Yang & T.B. Lim, YCM206B + YCM212B + YCM 213B (2 males, 5 females; ZRC); Salween Basin, Pha Pha Valley, Nam Mae Yuam, tributary, 20-III-1996, S.H. Tan & N. Sivasothi, TG5 (1 male, 1 female; ZRC); near Mae Hong Son, C.M. Yang & T.B. Lim, YCM215A (1 male; ZRC); NAKHON RATCHASIMA Prov.: Lamtakhong Reservoir, outlet, 16-I-1997, H.H. Tan, THH9717 (1 female; ZRC); NAN Prov.: Doi PhuKa NP, Nam Tok Sila Phet, 19° 05'N, 100° 56'E, 400 m, 13-III-2002, Sites, Vitheepradit, Kirawanich, L-292 (1 female; UMC); Mae Charim NP, Nam Wa River, 18° 36'N 100° 59'E, 335 m, 13-III-2002, Vitheepradit & Kirawanich, L-293 (6 males, 1 female; UMC); Amphur Pua, Ban Sale village, pond, 8 km NE of Pua town, 600 m, 19-XI-1994, P.P. Chen & Piyaichart (1 female; PPCC); PHAYAO Prov.: Doi Luang NP, Nam Tok Cham Pa Thong, 19° 13'N, 99° 44'E, 620 m, 17-III-2002, Sites, Vitheepradit, Kirawanich, L-300 (1 female; UMC); PHETCHABUN Prov.: 4.2 km E of intersection Hwy 21 x 225, on Hwy 225, vegetated pond, 25-VI-1998, Vitheepradit & Sawangsak, L-216 (1 female; UMC); Amphur Lom Sak, Ban Pak Chong, 14 km E of intersection Hwy 12 x 21, on Hwy 12, vegetated pond near rice field, 30-VI-1998, Vitheepradit & Sawangsak, L-220 (1 male, 1 female; UMC); Amphur Nam Nao, 83 km N of intersection Hwy 12 x 2216, on Hwy 2216, vegetated pond, 3-VII-1998, Vitheepradit & Sawangsak, L-232 (1 male, 1 female; UMC); Nam Nao NP, Huay Prom Laeng, 22-III-1994, W.D. Shepard, 1040 (1 female; CSS); Nam Nao NP, Huai Ya Krua, near Headquarters, 24-XI-1995, H. Zettel, 23 (1 male, 1 female; NHMW); 36 km SE of Sila, N of Ban Nam Nao, Ban Pala Yai, 25-XI-1995, H. Zettel, 27 (1 female; NHMW); Huai Sui Thong, Huai Su Nam, 27-III-1994, W.D. Shepard, 1049 (5 males, 2 females; CSS, NHMW); PHITSANULOK Prov.: 3.4 km ESE of Ban Songsalung, pond with vegetation, 9-VI-1998, Sites, Simpson, Vitheepradit, L-169 (1 male; UMC); Thung Salaeng Luang NP, Huai Tub Dah Mi, 16° 50'N, 100° 51'E, 440 m, 8-III-2002, Sites, Vitheepradit, Kirawanich, L-274 (9 males, 7 females; UMC); Phu Hin Rongkla NP, Waterwheel Falls and stream, 16° 59'N, 101° 00'E, 1280 m, 10-III-2002, Sites, Vitheepradit, Kirawanich, L-285 (1 male; UMC); same data, CMU team (4 males; UMC); same locality, 22-IV-2002, CMU team (1 male; UMC); same data, N. Changtong (1 male; UMC); Phu Hin Rongkla NP, Nam Tok Palad, 16° 59'N, 101° 00'E, 300 m, 12-III-2002, Sites, Vitheepradit, Kirawanich, L-289 (1 male; UMC); 21 km SE Nakhon Thai, Pa Lad Waterfall, 27-III-1994, W.D. Shepard, 1048 (1 male, 1 female, CSS); PHRAE Prov.: Wieng Ko Sai NP, Nam Tok Mae Koeng Luang, 17° 58'N, 99° 35'E, 350 m, 14-III-2002, Vitheepradit & Kirawanich, L-295 (3 males; UMC); 50 km NE of Phrae, Huai Kaet, 17-XI-1995, H. Zettel, 17a + 17b (2 males, 2 females; NHMW); same locality, 18-XI-1995, H. Zettel, 18a (1 male; NHMW); SAKON NAKON Prov.: 11 km NE of Kham Poem, 5-III-1994, W.D. Shepard, 1026 (1 male; CSS); SATUN Prov.: Thale Ban NP, 10-16-III-1993, M. Madl (1 female, NHMW); SONGKHLA Prov.: Ton Nga Chang WS, waterfall level 2 and 3, 6-I-1995, Sites & Nichols, L-66 (1 female; UMC); TAK Prov.: Lan Sang NP, creek below Nam Tok Lan Sang, 16° 46'N, 99° 00'E, 380 m, 7-III-2002, Sites, Vitheepradit, Kirawanich, L-270 (4 males, 2 females; UMC); same data, G.W. Courtney (1 male; UMC); Salween Basin, north of Pop Phra, 19-III-1996, S.H. Tan & N. Sivasothi, TG3 (1 male, 2 females; ZRC); YALA Prov.: Than To, Banglang NP, 14-I-1995, Sites & Nichols, L-73 (2 males; UMC); UBON RATCHATHANI Prov.: Kong Chaim, 16-III-1996, Y. Hanboonsong, 8.0 + 8.3 (5 males, 3 females; KKUA).

Previous records (POLHEMUS & POLHEMUS, 1995).—CHIANG MAI Prov.: Mt. Doi Suthep, stream, 26-III-1952, M.E. Griffith (2 females; JTPC); Huay Yang Creek, near Ban Yang, 16-XI-1985, J.T. & D.A. Polhemus, CL 2199 (3 males, 2 females; JTPC); pond at Fang Horticultural Station, 15-XI-1985, J.T. & D.A. Polhemus, CL 2201 (7 males, 6 females; JTPC); Nam Chai River, Fang Horticultural Research Station, above hydro station intake, 15-XI-1985, J.T. & D.A. Polhemus, CL 2197 (11 males, 12 females; JTPC); Huay Hia Creek, Fang Horticultural Research Station, 15-XI-1985, J.T. & D.A. Polhemus, CL 2198 (11 males, 13 females; JTPC); Fang Horticultural Research Station, tributary to Nam Chai River, 500 m, 15-XI-1985, J.T. & D.A. Polhemus, CL 2202 (3 males, 5 females; JTPC); Mae Sa Waterfall, 7 km W of Mae Rim, 18-XI-1985, J.T. &

D.A. Polhemus CL 2203 (5 males, 7 females; JTPC); 10 km NW of Mae Rim, 18-XI-1985, J.T. & D.A. Polhemus CL 2204 (20 males, 16 females; JTPC); Chiang Dao, 450 m, in standing stagnant water, 5-11-IV-1958, T.C. Maa (4 males, 3 females; BPBM); UNSPECIFIED Prov.: km 124.5 on Bangkok- Prabuddha Rd., Botanic Garden, stream, 23-II-1967, J.I.F. (2 females; USNM).

Note: Because place names are transliterated from the Thai alphabet, which results in inconsistent spellings, they are nearly impossible to locate with certainty in the absence of provincial affiliations. Thus, the locality in the unspecified province for *H. greeni* could not be determined with confidence and is not included in Fig. 4.

***Hydrometra julieni* Hungerford and Evans**
(Fig. 4)

Hydrometra julieni Hungerford and Evans 1934: 55.

Diagnosis.—This species can be distinguished by an anteclypeus that is rugulose, broad, truncate, almost parallel-sided, and with the anterior margin straight but depressed medially. Males have a pair of lateral clusters of elongate setae near the posterior end of sternite VII. This species is more similar to *H. julienoidea* Polhemus and Polhemus from Indonesia than to its Thai congeners (POLHEMUS & POLHEMUS, 1995)

Description.—The following characteristics are based on macropterous and brachypterous specimens. The female is similar in most respects to the male, but is slightly larger and broader in the abdomen. Although a formal description has not been given, the terminalia of the female has been illustrated by GAPUD ET AL. (2003).

MACROPTEROUS FEMALE. Length, 13.14 mm; width, 0.88 mm (n=1).

Hemelytra brown and reaching middle of tergite VI. Pronotum dorsally with median, light-brown, longitudinal stripe in anterior 1/3. Other structures and coloration as in macropterous male but with following differences: Abdominal pleuron with longitudinal brown stripe on segments II-VIII, becoming less pronounced on the posterior part of segment VII. Abdominal terminalia as in Fig. 5. Tergum VII convex and raised slightly posteriorly with short, dark, erect setae, and tergite VIII covered with short, light setae. Apical process of tergite VIII directed posteroventrad with long ventral setae.

BRACHYPTEROUS FEMALE. Length, 13.17–13.49 mm; width, 0.60–0.61 mm (n=2).

Similar to macropterous form in most respects but with following differences: Hemelytra reaching middle part of tergite III. Pronotum narrower posteriorly, usually with fewer pits; median longitudinal stripe extends nearly to posterior margin.

Discussion.—This species has been recorded from Indonesia (Kalimantan), Malaysia (Malay Peninsula), Philippines (Mindoro), and Vietnam (POLHEMUS & POLHEMUS, 1995) and was thought to be a likely inhabitant of Thailand (ZETTEL & CHEN, 1996), although no Thai records have been published. In the key by ZETTEL & CHEN (1996), *Hydrometra* sp. actually refers to a female of *H. julieni* collected from Chiang Mai Province, rather than to an undescribed species. Herein we present the first report of *H. julieni* in Thailand, with records from Chaiphaphum, Chiang Mai, and Mae Hong Son provinces. Moreover, our record from Mae Hong Son Province is the northernmost known limit of this species in Southeast Asia. Our records indicate that *H. julieni* probably occurs in low and intermediate elevations throughout Thailand, but is not common. Although records of this species in other regions of the country do not exist, the presence of *H. julieni* is expected. This

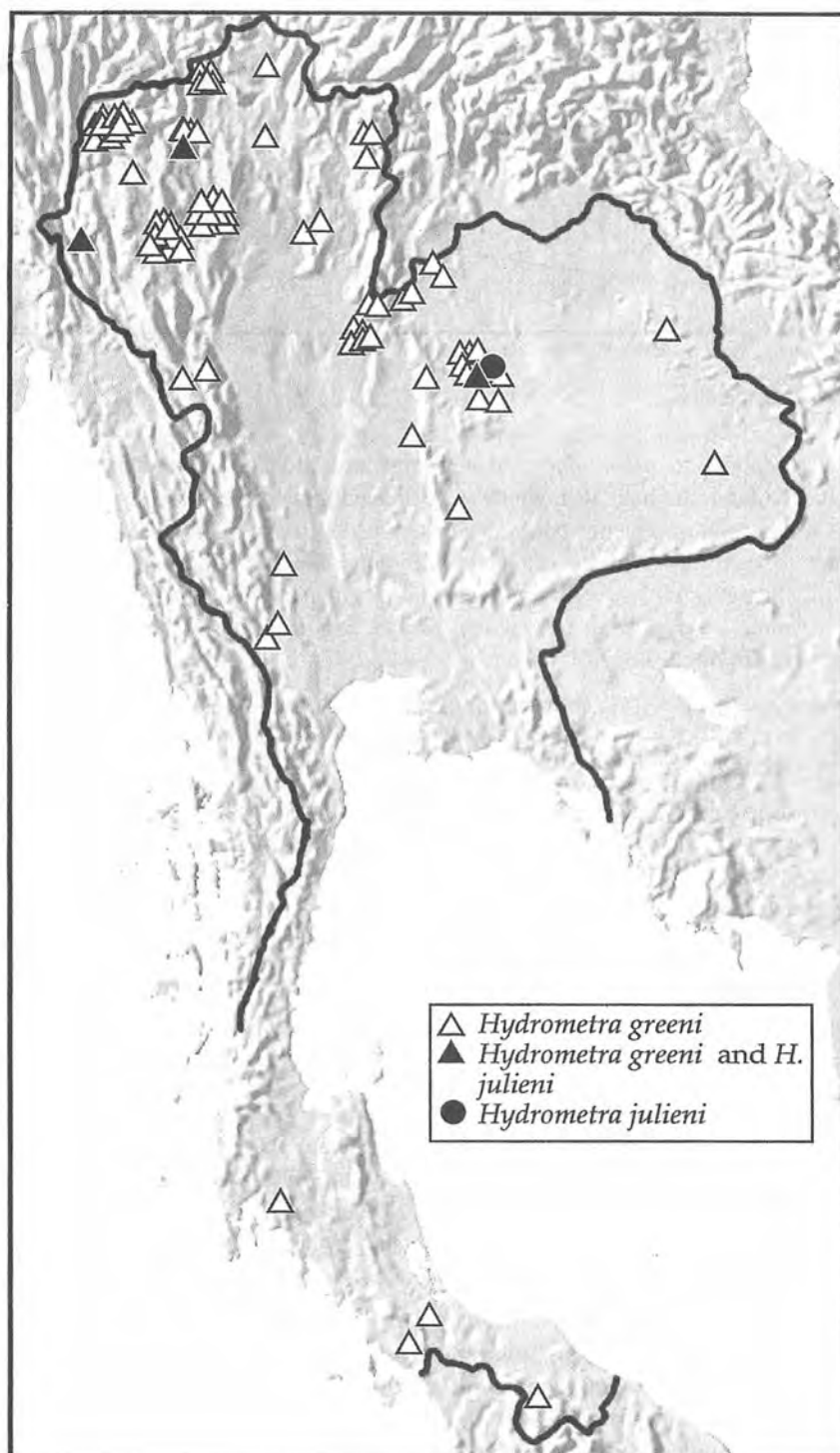


Figure 4. Distribution of *Hydrometra greeni* and *H. julieni* in Thailand.

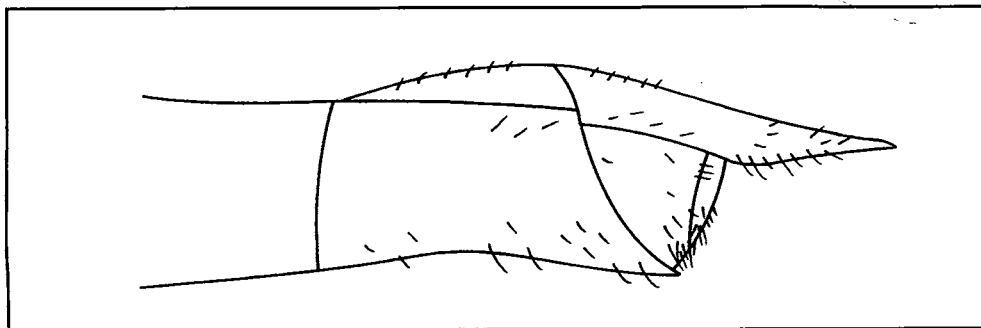


Figure 5. Lateral view of terminal abdominal segments of female *H. julieni*.

species was reported to prefer ponds and slow streams in lowlands (POLHEMUS & POLHEMUS, 1995). In Thailand, the habitat in which we collected this species in Chaiphaphum Province (L-229) was an anthropogenic pond adjacent to a rice paddy. The perimeter of the pond and water surface were heavily vegetated with emergent and submergent vegetation, and *H. julieni* was collected with *H. annamana* and *H. carinata*. This species also co-occurred with *H. annamana*, *H. carinata*, *H. greeni*, and *H. orientalis* in another vegetated pond in Chaiphaphum Province (L-228).

Material examined.—CHAIYAPHUM Prov.: Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepadit & Sawangsak L-228 (1 female; UMC); Amphur Khon San, Tumbon Heuy Yang, Ban Klong Teoy, vegetated pond near rice field, 2-VII-1998, Vitheepadit & Sawangsak, L-229 (1 male, 2 females; UMC); CHIANG MAI Prov.: Chiang Dao, Ban Yang Thung Pong, 500 m, 8-XI-1995, H. Zettel, 10 (1 female; NHMW); MAE HONG SON Prov.: Salween Basin, Pha Pha Valley, Nam Mae Yuam, tributary, 20-III-1996, S.H. Tan & N. Sivasothi, TG5 (1 male, 1 female; ZRC).

Hydrometra kelantan Polhemus and Polhemus (Fig. 6)

Hydrometra kelantan Polhemus and Polhemus 1995: 28–29.

Diagnosis.—This species can be distinguished by an anteclypeus that is conical, triangular, and sharply-angled anteriorly. Male sternite VII is transversely-depressed and with long setae, sternite VIII has scattered, short setae, and the posterior process is not modified. Female tergite VII is raised posteriorly and has short, dark setae, and VIII is short with a long, angled distal process. This species most closely resembles *H. greeni*, from which it may be distinguished by a more slender body, darker color, and larger ratio of lengths of mesotarsomeres II/III (ca. 2.3 and 2.4 for males and females, respectively).

Discussion.—This species has been recorded previously from the Malay Peninsula (POLHEMUS & POLHEMUS, 1995). This is the first record of *H. kelantan* from Thailand and the northernmost record of this species in Southeast Asia. In Malaysia, this species was found in a rocky stream in low hills (POLHEMUS & POLHEMUS, 1995), and in Thailand, it was collected from the vegetated margin of a fast-flowing, rocky stream. Since the species is known from a single locality in Kanchanaburi Province and from peninsular Malaysia,

it probably occurs in rocky mountain streams through the Isthmus of Kra and southern Thailand.

Material examined.—KANCHANABURI Prov.: Amphur Thong Pha Phum, Heuy Ou Long, 14° 46'N, 98° 40'E, 139 m, 11-IV-2002, UMC and CMU teams, L-332 (1 male, UMC).

Hydrometra longicapitis Torre-Bueno
(Fig. 6)

Hydrometra longicapitis Torre-Bueno 1927: 31.

Diagnosis.—This species can be distinguished by an anteclypeus that is large, truncate, with lateral margins that are almost straight, and a denticle or sharp knob at the apex. The body is relatively long (males ≤ 14.2 mm, females ≤ 15.0 mm). The maxillary plate is elongate and does not cover the gular lobe. Male abdominal sternite VII has a pair of large fleshy tubercles near the anterior margin and becomes excavate behind. Brachypterous females often have a long, hairy tubercle arising from the posterior margin of the pronotum (see variation described in POLHEMUS & POLHEMUS [1987]). The terminal process of tergite VIII is slightly curved and directed ventrad. This species is similar to *H. carinata* and *H. ripicola*; however, the maxillary plate of *H. carinata* covers the gular lobe and *H. ripicola* has an anteclypeus without a denticle or sharp knob at the apex and males have tightly-clustered setae instead of fleshy lobes on sternite VII.

Discussion.—This species has been recorded from Indonesia (Sumatra), Malaysia (Malay Peninsula and Sarawak), and Thailand (POLHEMUS & POLHEMUS, 1995), and also is known from China (Hainan), Indonesia (Java), Laos, and Vietnam (YANG & ZETTEL, *IN LIT.*). More specifically in Thailand, this species previously has been reported from Chaiyaphum, Chiang Mai, Kanchanaburi, Loei, Phuket, and Prachin Buri provinces (POLHEMUS & POLHEMUS, 1987, 1995; ANDERSEN, 1992). Herein, we add records from Chiang Rai, Kampaeng Phet, Lampang, Mae Hong Son, Phetchabun, Phitsanulok, Phrae, Songkhla, Surat Thani, Tak, and Trat provinces. *Hydrometra longicapitis* has been collected from a variety of both upland and lowland habitats (POLHEMUS & POLHEMUS, 1995) and thus is likely widespread throughout Thailand. The insects have been observed moving on rocks or stones close to the water margin (ANDERSEN, 1992). When they were pursued, they ran up onto the bank and hid amid roots and streamside vegetation (POLHEMUS & POLHEMUS, 1987, 1995; ANDERSEN, 1992).

Material examined.—CHAIYAPHUM Prov.: Phu Khieo WS, tributary to Nam Prom, 13-III-1994, W.D. Shepard, 1038 (2 males; CSS); CHIANG MAI Prov.: Doi Inthanon NP, Nam Tok Sob Ab, 18° 31'N, 98° 36'E, 4-III-2002, Vitheepadit & Kirawanich, L-258 (1 males, 2 females; UMC); creek at Chiang Dao WRSC, 19° 21'N, 98° 55'E, 520 m, 18-III-2002, Sites, Vitheepadit, Kirawanich, L-303 (5 male, 5 females; UMC); Doi Suthep-Pui NP, creek from Mohk Fah Waterfall, 19° 06'N, 98° 46'E, 564 m, 18-III-2002, Sites, Vitheepadit, Kirawanich, L-304 (1 male, 1 female; UMC); Doi Suthep-Pui NP, stream at Pa Ngerb, 18° 48'N, 98° 56'E, 530 m, 5-IV-2002, UMC and CMU teams, L-325 (6 males, 3 females; UMC); Chiang Mai, Doi Suthep-Pui NP, Mae Sa Falls, 25-III-1994, W.D. Shepard, 1045 (1 nymph; CSS); W of Mae Rim, Doi Suthep-Pui NP, Mae Sa Falls, 30-31-X-1995, H. Zettel, 2 (3 females; NHMW); Doi Suthep-Pui NP, Monthatharn Falls, 750-800 m, 2-XI-1995, H. Zettel, 4 (1 male; NHMW); Doi Inthanon NP, Mae Klang Falls, 4-XI-1995, H. Zettel, 6 (1 male; NHMW); Doi Suthep-Pui NP, Doi Suthep, near Ruesse Cave, 900-1000 m, 5-XI-1995, H. Zettel, 7 (1 male; NHMW); Chiang Dao, near Chiang Dao Cave, 500 m, 7-XI-1995, H. Zettel, 9b (1 male; NHMW); Chiang Mai, Suan Rim, Nam Mae Sa, 25-III-1994, W.D. Shepard, 1046 (1 male; CSS); Chiang Mai, Samoeng, 29-VI-1995, W.G. Ullrich

(1 female; CUL); Chiang Mai, ca. 10 km E of Samoeng, river, 18° 51' 40.2"N, 98° 38' 49.5"E, 29-XII-1997, W.G. Ullrich (1 female; CUL); same locality, 2-I-1998, W.G. Ullrich (1 male, 1 female; CUL, NHMW); same locality, 11-IV-2000, W.G. Ullrich (2 males, 1 female; CUL, NHMW); N of Chiang Mai, stream, 7-IX-1998, C.M. Yang & T.B. Lim, YCM201B (1 male; ZRC); CHIANG RAI Prov.: Doi Luang NP, Namtok Poo Kaeng, 19° 26'N, 99° 42'E, 540 m, 17-III-2002, Vitheepadit and Kirawanich, L-299 (3 males, UMC); KAMPAENG PHET Prov.: Khlong Lan NP, 16° 07'N, 99° 16'E, 8-III-2002, Sites, Vitheepadit, Kirawanich, L-272 (2 males, 2 females; UMC); forest near Kamphaeng Phet, puddles, 12-IX-1998, C.M. Yang & T.B. Lim, YCM224 (2 males, 5 females; ZRC); KANCHANABURI Prov.: Thong Pha Phum Forest Restoration Station, Nam Tok Pong Kra Dang Nga, 14° 31'N, 98° 37'E, 203 m, 12-IV-2002, UMC and CMU teams, L-334 (6 males, 5 females; UMC); LAMPANG Prov.: Jae Sawn NP, Nam Tok Jae Sawn, 18° 50'N, 99° 28'E, 650 m, 16-III-2002, Sites, Vitheepadit, Kirawanich, L-297 (1 female; UMC); LOEI Prov.: Na Haew NP, Nam Tok Wahng Tahd, 17° 28'N, 100° 57'E, 750 m, 9-III-2002, Sites, Vitheepadit, Kirawanich, L-277 (2 males, 4 females; UMC); Na Haew NP, stream below Tahd Heaung International Waterfall, 17° 33'N, 100° 59'E, 500 m, 10-III-2002, Sites, Vitheepadit, Kirawanich, L-279 (1 male; UMC); MAE HONG SON Prov.: Namtok Maw Pang, 19° 22'N, 98° 22'E, 850 m, 19-III-2002, Sites, Vitheepadit, Kirawanich, L-305 (1 female, UMC); Amphur Pang Mapha, Ban Tham, Tham Lod, stream ca. 4 m wide, in mixed deciduous forest, 650 m, 20-XII-1996, P. Schwendinger (1 male, 1 female; NHMW); ca. 12 km N of Mae Hong Son, Tam Pla Resort at Tam Pla River, 19° 25' 34.2"N, 97° 59' 16.7"E, 9-VIII-1998, W.G. Ullrich (1 female; CUL); same locality, 6-IV-2000, W.G. Ullrich (9 males, 6 females; CUL, NHMW); same locality, 8-VIII-1997, W.G. Ullrich (1 female; CUL); ca. 60 km NNE of Mae Hong Son, Nam Kong River, 19° 35' 56.8"N, 98° 06' 35.5"E, 21-XII-1997, W.G. Ullrich (1 male, 2 female; CUL, NHMW); Tom Mae Lana, 8 km N of Mae Lang, 700 m, 14-XI-1985, Burckhardt & Löbl (1 female; MNHG); Soppong, Pai River, 8-9-IX-1998, C.M. Yang & T.B. Lim, YCM206B + YCM212A (1 male, 1 female; ZRC); PHETCHABUN Prov.: Nam Nao NP, Haui Prom Laeng, 16° 38'N, 101° 34'E, 800 m, 9-III-2002, Sites, L-276 (1 male; UMC); Nam Nao NP, Huai Ya Krua, near headquarter, 24-XI-1995, H. Zettel, 23 (1 male, 2 females; NHMW); PHITSANULOK Prov.: Thung Salaeng Luang NP, Huai Tub Dah Mi, 16° 50'N, 100° 51'E, 440 m, 8-III-2002, Sites, Vitheepadit, Kirawanich, L-274 (28 males, 23 females; UMC); same data, CMU team (1 male, 1 female; UMC); Phu Hin Rongkla NP, Nam Tok Palad, 16° 59'N, 101° 00'E, 300 m, 12-III-2002, Sites, Vitheepadit, Kirawanich, L-289 (24 males, 20 females; UMC); PHRAE Prov.: Wieng Ko Sai NP, Nam Tok Mae Koeng Luang, 17° 58'N, 99° 35'E, 350 m, 14-III-2002, Vitheepadit & Kirawanich, L-295 (3 males, 2 females; UMC); Ban Huai Kaet village, road side, stream Kaet, 49 km N of Phrae, 18-XI-1994, P.P. Chen & Piyapichart (1 female; PPCC); 50 km NE of Phrae, Huai Kaet, 17-XI-1995, H. Zettel, 17a (1 male; NHMW); SONGKHLA Prov.: Amphur Hat Yai, stream from Ton Nga Chang Waterfall at Buddhist temple, 06° 56'N, 100° 15'E, 78 m, 3-V-2002, Vitheepadit, Kirawanich, Suwanno, L-388 (1 male; UMC); SURAT THANI Prov.: Ko Pha-Ngan, 09° 44'N, 100° 04'E, 21-25-XI-2002, F. Seyfert (1 male; NHMW); TAK Prov.: Lan Sang NP, creek below Nam Tok Lan Sang, 16° 46'N, 99° 00'E, 380 m, 7-III-2002, Sites, Vitheepadit, Kirawanich, L-270 (1 female; UMC); TRAT Prov.: Nam Tok Saphan Hin, 15-I-1997, H.H. Tan, THH9710 (1 female; ZRC).

Previous Records (POLHEMUS & POLHEMUS, 1987, 1995; ANDERSEN, 1992).—CHAIYAPHUM Prov.: Thung Kamang, Phu Khiaw, 1000 m, stream, 25-I-1989, M. Andersen & H. Read, loc. 26 (1 male; ZMUC); CHIANG MAI Prov.: Nam Chai River above hydrostation intake, Fang Horticultural Research Station, 550 m, 15-XI-1985, J.T. & D.A. Polhemus, CL 2197 (4 females; JTPC); Huay Hia Creek, Fang Horticultural Research Station, 15-XI-1985, J.T. & D.A. Polhemus, CL 2198 (2 males, 13 females; JTPC); tributary to Nam Chai River, Fang Horticultural Research Station, 500 m, 15-XI-1985, J.T. & D.A. Polhemus, CL 2197 (1 male; JTPC); Mae Sa Waterfall, 7 km W of Mae Rim, 18-XI-1985, J.T. & D.A. Polhemus, CL 2203 (1 female; JTPC); Chiang Dao, 450 m, 5-11-IV-1958, T.C. Maa (1 male, 2 females; BPBM); Mae Sa, 16 km NW of Chiang Mai, base of Doi Suthep, 23-XII-1981, A.R. Gillogly (1 male; JTPC); Chiang Mai, 1-III-1962, Lot No. 275, D.C. & E.B. Thurman (1 male, 1 female; JTPC); waterfall at Chiang Mai, 29-XI-1978, M. Holmen (1 male; ZMUC); Horticultural Experimental Station, 7 km NW of Fang, along narrow river and small streams, 30-X-2-XI-1979, N.M. Andersen, loc. 18 (5 males, 5 females; ZMUC); KANCHANABURI Prov.: near Sai Yok, 5-I-1962, P. Johnsen (3 males, 2 females; NHMA); waterfall at Sai Yok, 21-22-XII-1981, N. M. Andersen (4 males, 2 females; ZMUC); LOEI Prov.: Phu Luang WS, 700-900 m, 10-12-X-1984, P. Nielsen (1 male, 1 female; ZMUC); PRACHIN BURI Prov.: Kabunburi, 2-5-XII-1965, Koi Mongkolpanya (1 female; JTPC); PHUKET Prov.: Phuket Island, waterfall at Ton Sai, 17&25-I-1987, N.M. Andersen (2 males, 1 female; ZMUC); UNSPECIFIED Prov.: Khao Yai NP, 750 m, 26-VII-1962, E.S. Ross & D.Q. Cavagnaro (1 male, 2 females; JTPC, CAS).

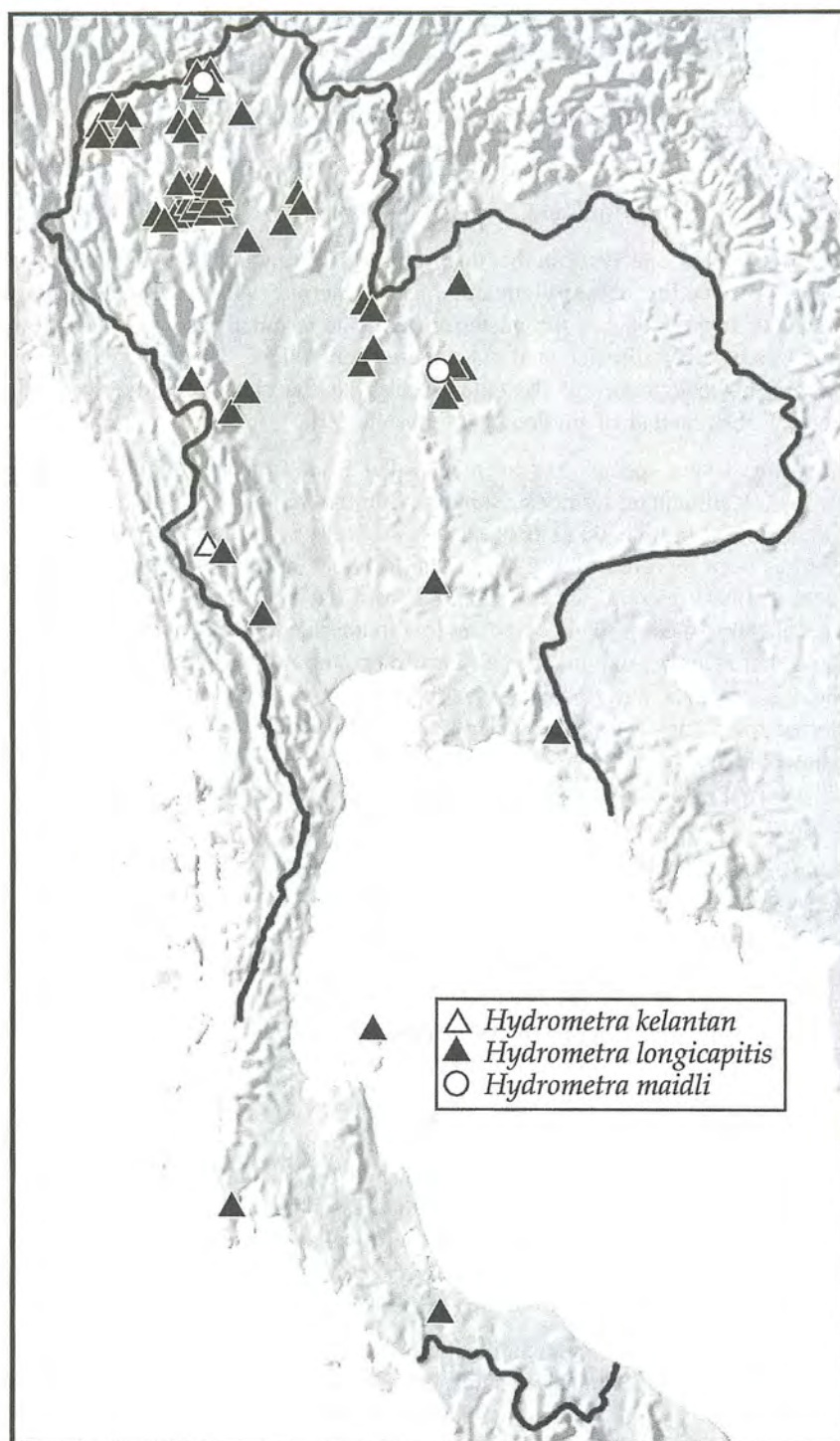


Figure 6. Distribution of *Hydrometra kelantan*, *H. longicapitis*, and *H. maidli* in Thailand.

Note: Because Khao Yai NP occupies a large area including portions of four provinces, the provincial affiliation of this record could not be determined with certainty, and is not included in Fig. 6.

***Hydrometra maidli* Hungerford and Evans**
(Fig. 6)

Hydrometra maidli Hungerford and Evans 1934: 73.

Diagnosis.—This species can be distinguished by an anteclypeus that is broadly triangular and rounded to obtusely-angled apically. Sternite VII of the male has a pair of large patches of brown setae in the posterior half. The terminal process of tergite VIII of the female is upwardly-directed and falcate in lateral view. This species is similar to *H. annamana*, however males of the latter species have a pair of tightly-clustered, black setae laterally, just caudad of midlength of sternite VII.

Discussion.—This species has been recorded from China (Hong Kong), Indonesia (Celebes, Java, Kalimantan, Lombok, Sumatra, Sumba, Sumbawa, Timor), Laos, Malaysia (Malay Peninsula), and Thailand (POLHEMUS & POLHEMUS, 1995). *Hydrometra maidli* previously has been reported from Chiang Mai Province in northern Thailand (POLHEMUS & POLHEMUS, 1995). Herein, we add a record from Phetchabun Province in north-central Thailand. Thus, this species likely occurs in low to intermediate elevation throughout much of Thailand, but is not common. The absence of records of this species in other regions of Thailand is probably due to a lack of collecting in its preferred habitats. This species was reported to occur at the margins of ponds and pools of slow streams at low to intermediate elevations (POLHEMUS & POLHEMUS, 1995). In north-central Thailand, *H. maidli* occurred with *H. orientalis* in an unplanted rice paddy in the Phetchabun Mountains (VITHEEPADIT, 2000).

Material examined.—PHETCHABUN Prov.: Amphur Lom Sak, Ban Non Ma Ka, 9.5 E of intersection Hwy 12 x 21, on Hwy 12, unplanted rice paddy, 3-VI-1998, Vitheepadit & Sawangsak, L-233 (2 females; UMC).

Previous record (POLHEMUS & POLHEMUS, 1995).—CHIANG MAI Prov.: Pangmakamphon (Pankampawng), near Fang, 450 m, 15-16-XI-1957, T.C. Maa (1 male; BPBM).

***Hydrometra orientalis* Lundblad**
(Fig. 7)

Hydrometra orientalis Lundblad 1933: 430.

Diagnosis.—This species can be distinguished by a sharply-triangular anteclypeus. Sternite VII of the male is flattened or slightly depressed medially with long, slender, erect setae, and sternite VIII is unmodified. The terminal process of female tergite VIII is directed posterodorsad. This species more closely resembles *H. lineata* Eschscholtz than its Thai congeners (POLHEMUS & POLHEMUS, 1995).

Discussion.—This widespread and common species has been recorded from Australia, Indonesia (Celebes, Java, Samba, Sumatra), Malaysia (Malay Peninsula), Myanmar, New Guinea, Philippines (Luzon, Lubang, Mindoro, Busuanga, Palawan, Mindanao), Thailand, and Vietnam (POLHEMUS & POLHEMUS, 1995; GAPUD ET AL., 2003). In Thailand,

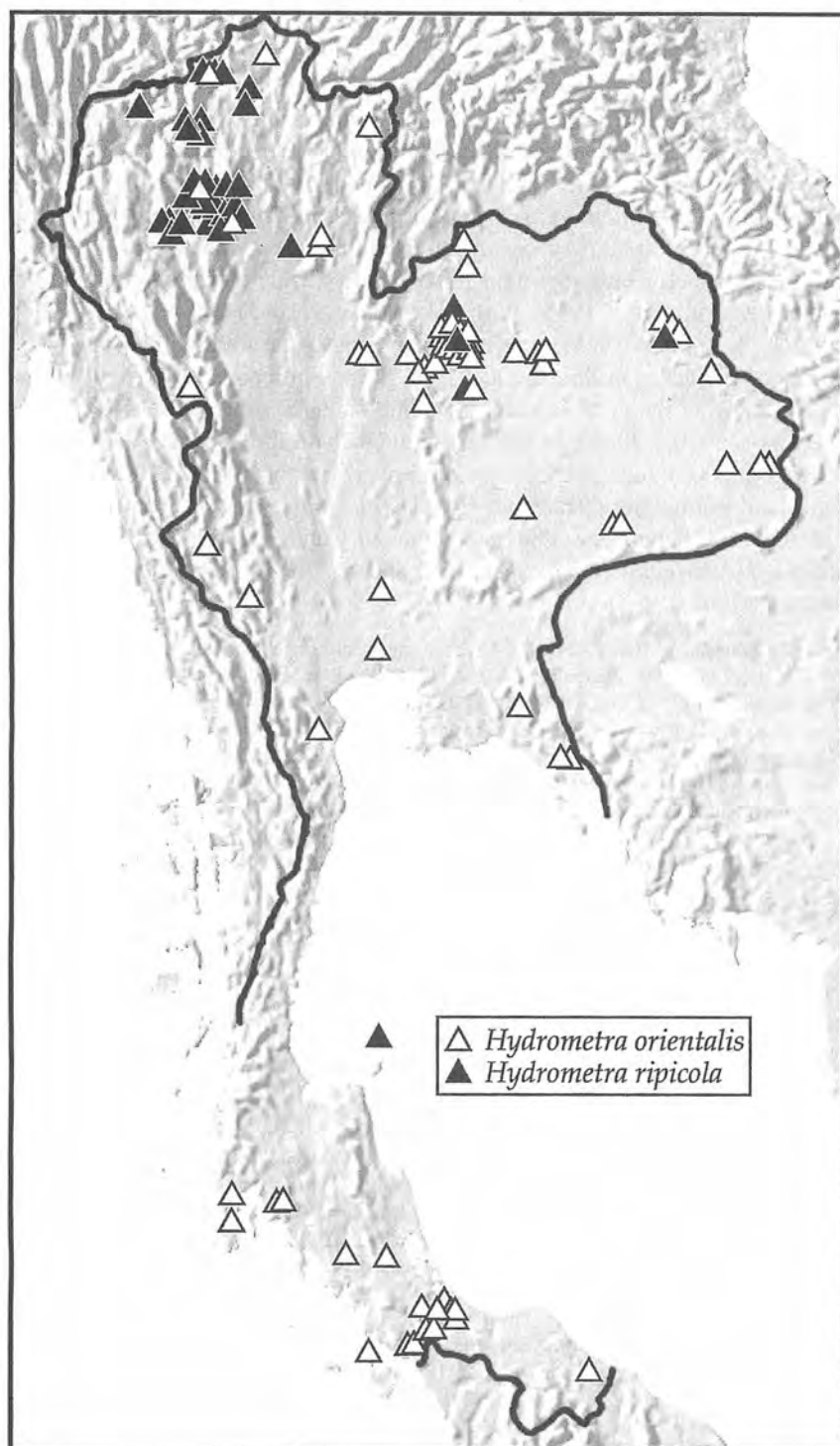


Figure 7. Distribution of *Hydrometra orientalis* and *H. ripicola* in Thailand.

H. orientalis previously was recorded from Chiang Mai Province and Mae Khong and Mun rivers (POLHEMUS & POLHEMUS, 1995; HANBOONSONG *ET AL.*, 1996). Herein, we add records from Amnat Charoen, Ayuttaya, Chaiyaphum, Chanthaburi, Chiang Rai, Kalasin, Kanchanaburi, Khon Kaen, Krabi, Loei, Nakhon Ratchasima, Nan, Narathiwat, Phang Nga, Phattalung, Phetchabun, Phetchaburi, Phitsanulok, Phrae, Phuket, Sakon Nakhon, Saraburi, Satun, Songkhla, Surin, Tak, Trat, and Ubon Ratchathani provinces. This is the most widespread and common species of *Hydrometra* in Thailand. Records from Khon Kaen Province indicate that this species is attracted to lights. Generally, *H. orientalis* was reported to occur in pools on rocky upland streams in a wide elevational range (100–800 m) (POLHEMUS & POLHEMUS, 1995). Earlier, LUNDBLAD (1933) reported this species from three localities of stagnant waters unrelated to streams, i.e. from a garden pond and from the shorelines of two lakes in Sumatra and Java. In the Philippines, *H. orientalis* has been collected from a wide range of habitats including streams, rain pools, rice paddies, and estuaries (GAPUD *ET AL.*, 2003). In northeastern Thailand, this species was observed on floating plants and walking on the water surface in rice paddies (HECKMAN, 1979). In north-central and northeastern Thailand, *H. orientalis* was collected from ponds and rice paddies in the Phetchabun and Phu Pan mountains and occurred with *H. akekawati*, *H. annamana*, *H. carinata*, *H. chaweewanae*, and *H. greeni* in an anthropogenic pond (VITHEEPADIT, 2000).

Material examined.—AMNAT CHAROEN Prov.: small stream, about 19 km from Amnat Charoen, 17-VI-1998, Y.Y. Goh, GYY095 (2 females; ZRC); AYUTTAYA Prov.: roadside pond ca 5 km E of Ayuttaya, 2-VII-1997, R.W. Sites, L-126 (2 males; UMC); CHAIYAPHUM Prov.: Amphur Khon San, Ban Na Kho, 5 km W of Amphur Khon San on Hwy 12, 19-VI-1998, vegetated pond, L-193 (1 female; UMC); Tumbon Na Klang, Ban Duk Noi, vegetated pond near rice paddy, 20-VI-1998, Vitheepadit & Sawangsak, L-197 (2 females; UMC); Amphur Khon San, Tumbon Heuy Yang, 7.4 km S of intersection Hwy 2055 x 12, on Hwy 2055, vegetated pond, 2-VII-1998, Vitheepadit & Sawangsak L-228 (1 male; UMC); Tat Ton NP, Tat Ton, 27-XI-1995, H. Zettel, 30 (4 males, 2 females; NHMW); CHANTHABURI Prov.: Amphur Pong Nam Rong, Khlong Nam Ron, 14-I-1997, H.H. Tan, THH9706 (3 males, 3 females; ZRC); CHIANG MAI Prov.: Chiang Mai, Chiang Mai Zoo, Water Reservoir, 10-XI-1995, H. Zettel, 11 (1 male, 2 females; NHMW); Chiang Mai, Samoeng Resort, 18° 51' 45.2"N, 98° 43' 18.7"E, 18-IV-2000, W. G. Ullrich (1 male; CUL); same locality, 19-IV-2000, W. G. Ullrich (1 female; CUL); CHIANG RAI Prov.: Amphur Muang, Agricultural Station, Mt. Phangan, stream, 15-I-1995, P.P. Chen (1 male; PPCC); KANCHANABURI Prov.: Amphur Sai Yok, Thong Pha Phum Forest Restoration Station, Mae Nam Noi, 14° 31'N, 98° 37'E, 204 m, 12-IV-2002, UMC and CMU teams, L-335 (1 female, UMC); stream at 3 km SW of intersection Hwy 3199 x 3457, 14° 12'N, 99° 12'E, 89 m, 15-IV-2002, Vitheepadit & Kirawanich, L-343 (1 male, 2 females; UMC); KALASIN Prov.: Phu Pan NP, pond with sedges and grasses, 5-VI-1998, Sites, Simpson, Vitheepadit, L-153 (3 males, 3 females; UMC); Phu Pan NP, 1 km E of Ban Nong San, unplanted rice paddy, 7-VI-1998, Sites, Simpson, Vitheepadit, L-163 (1 female; UMC); Phu Pan NP, park headquarter, water supply pond, 7-VI-1998, Sites, Simpson, Vitheepadit, L-165 (3 females; UMC); KHON KAEN Prov.: Khon Kaen University, lakes, 19-II-1994, W.D. Shepard, 1017 (1 male, 1 female; CSS); Khon Kaen University, 7-III-1994, at electric lights, W.D. Shepard (2 males; CSS); same locality, 31-III-1994, at electric lights, W.D. Shepard (1 male; CSS); Phu Phan Kham NP, Ban Noon Hua Chang, Huai Sam Caen, 21-XI-1995, H. Zettel, 20b (1 male, 2 females; NHMW); same data, N. Nieser, 9523 (1 male; CNTN); Khon Kaen University, plastic pond, 26-XI-1995, H. Zettel, 28 (2 males, 1 female; NHMW); KRABI Prov.: Krabi, Ao Nang, 22-II-1991, M. Madl, 2 (2 males, 2 females; NHMW); Krabi, Nopparat Thera, 22-II-4-III-1993, M. Madl (1 female; NHMW); LOEI Prov.: 3 km N of Nong Kang, vegetated pond near rice paddy, 11-VI-1998, Sites, Simpson, Vitheepadit, L-179 (1 male; UMC); Phu Kradung NP, Sra-Keaw, vegetated pond, 22-VI-1998, Vitheepadit & Sawangsak, L-206 (2 males; UMC); Tumbon Phu Luang, 19 km E of intersection Hwy 2140 x 201, vegetated pond near rice paddy, 22-VI-1998, Vitheepadit & Sawangsak, L-207 (1 female; UMC); 5 km W of Loei, unnamed stream, 9-III-1994, W.D. Shepard, 1033 (1 male, 3 females; CSS); NAKHON RATCHASIMA Prov.: Nakhon Ratchasima, 16-I-1997, H.H. Tan, THH9715 (10 males, 4 females; ZRC); NAN Prov.: Doi Phuka NP, Nam Tok Sila Phet,

19° 05'N, 100° 56'E, 400 m, 13-III-2002, Sites, Vitheepadit, Kirawanich, L-292 (1 female; UMC); NARATHIWAT Prov.: Mae Nam Wan Nara, 24-X-1998, H.K. Lua, LHK404 (1 male; ZRC); PHANG NGA Prov.: 10 km SW of Phang Nga, pond at km 31, 13-VII-1997, Sites & Permkam, L-142 (1 female; UMC); PHATTALUNG Prov.: ca. 3 km E of Khao Chong WMS on Hwy 4, 12-I-1995, Sites & Nichols, L-69 (13 males, 17 females; UMC); Khao Chai Son, pond near hot springs, 12-I-1995, Sites & Nichols, L-71 (1 male; UMC); PHETCHABUN Prov.: Ban Bai Poon, unplanted rice paddy, 12-VI-1998, Vitheepadit, L-188 (3 females; UMC); Amphur Lom Sak, Tumbon Chang Ta Lood, vegetated pond near corn field, 20-VI-1998, Vitheepadit & Sawangsak, L-199 (1 female; UMC); 1 km S of intersection Hwy 203 x 2343, on Hwy 203, pond, 24-VI-1998, Vitheepadit & Sawangsak, L-210 (1 female; UMC); Amphur Muang, Ban Om Kong, 19 km N of Amphur Muang, on Hwy 21, pond with leaf pack, 24-VI-1998, Vitheepadit & Sawangsak, L-211 (1 male; UMC); Amphur Lom Sak, Ban Non Ma Ka, 9.5 E of intersection Hwy 12 x 21, on Hwy 12, unplanted rice paddy, 3-VII-1998, Vitheepadit & Sawangsak, L-233 (1 female; UMC); Nam Nao NP, Haay Prom Laeng, 16° 38'N, 101° 34'E, 800 m, 9-III-2002, Sites, L-276 (1 female; UMC); same data, G.W. Courtney (1 male, 1 female; UMC); Huai Sui Thong, Huai Su Nam, 27-III-1994, W.D. Shepard, 1049 (1 male, 4 females; CSS, NHMW); Nam Nao NP, Huay Prom Laeng, 24-XI-1995, H. Zettel, 22 (2 males, 1 female; NHMW); Nam Nao NP, Heo Sai, 25-XI-1995, H. Zettel, 24 (3 males, 4 females; NHMW); 37 km SE of Sila, N Ban Nam Nao, Ban Pala Noi, 25-XI-1995, H. Zettel, 26 (1 male, 1 female; NHMW); PHETCHABURI Prov.: Amphur Banlat, Salakern village, canal, 6-II-1998, O. Pauwels (8 males, 5 females; CCB); PHITSANULOK Prov.: Thung Salaeng Luang NP, Huai Tub Dah Mi, 16° 50'N, 100° 51'E, 440 m, 8-III-2002, Sites, Vitheepadit, Kirawanich, L-274 (1 males, 4 females; UMC); Wang Thong near Phitsanulok, 21-III-1996, S.H. Tan & N. Sivasothi, TG9 (1 male; ZRC); 21 km SE of Nakhon Thai, Pa Lad Waterfall, 27-III-1994, W.D. Shepard, 1048 (3 males, 1 female, CSS, NHMW); PHRAE Prov.: 15 km E of Phrae, Mae Khaem, 16-XI-1995, 300-400 m, H. Zettel, 16a (1 male; NHMW); 50 km NE of Phrae, Huai Kaet, 17-XI-1995, H. Zettel, 17a (3 males, 1 female; NHMW); PHUKET Prov.: Nam Tok Tone Sai, 8-IV-1999, P.K.L. Ng & H.H. Tan, THH9916 (1 female; ZRC); SAKON NAKHON Prov.: Huay Huat NP, park headquarter, pond, 6-VI-1998, Sites, Simpson, Vitheepadit, L-159 (2 males, 1 female; UMC); SARABURI Prov.: Khao Yai, 14° 25'N, 101° 24'E, 680 m, 9-10-XI-2002, F. Seyfert (1 male; NHMW); SATUN Prov.: Thale Ban NP, Thale Ban, large shallow lake with emergent vegetation, 9-VII-1997, Sites & Permkam, L-133, (12 males, 12 females; UMC); Thale Ban NP, 10-16-III-1993, M. Madl (1 female; NHMW); Tarutao NP, Ko Tarutao Island, water reservoir in rain forest, 10 m, 12-I-1996, P. Schwendinger (14 males, 6 female; NHMW); SONGKHLA Prov.: Hat Yai, PSU campus, vegetated ponds near reservoir, 4-I-1995, Sites & Nichols, L-55 (1 male, 1 female; UMC); Hat Yai, PSU campus, stream on campus, 5-I-1995, Sites & Nichols, L-57 (1 male, 1 female; UMC); stream from Ton Plieuw, 7-I-1995, Sites & Nichols, L-62 (5 males, 3 females; UMC); same locality, 8-I-1995, Sites & Nichols, L-64 (1 male; UMC); Hat Yai, PSU campus, vegetated ponds, 8-I-1995, Sites & Nichols, L-67 (11 males, 12 females; UMC); same locality, 30-I-1995, Sites & Nichols, L-83 (2 females; UMC); Ton Nga Chang WS, stream at Buddhist temple, 6-VII-1997, Sites, L-127 (15 males, 13 females; UMC); Amphur Rattaphum, NNE of Satun on Hwy 406, 07° 00'N, 100° 08'E, 79m, 3-V-2002, Vitheepadit, Kirawanich, Suwanno, L-389 (1 male, 1 female; UMC); Amphur Hat Yai, PSU pond near reservoir, 07° 00'N, 100° 30'E, 58 m, 4-V-2002, Vitheepadit & Kirawanich, L-391 (3 males, 4 females; UMC); SURIN Prov.: Surin, 150 m, pond (20 x 20 m, 3-4 m deep) and stream (ca. 5 m wide with muddy bays), 5-10-XII-1995, P. Schwendinger (14 males, 18 females; NHMW); Amphur Muang, Ban Lak Wo, 200 m, stream (ca. 5 m wide, banks with bush, rice paddies), 2-I-1997, P. Schwendinger (14 males, 17 females; NHMW); TAK Prov.: Salween Basin, near Phop Phra, north of Walle Thai, 19-III-1996, S.H. Tan & N. Sivasothi, TG3 (1 female; ZRC); TRAT Prov.: stream 9 km N of Ban Noen Sung, 3-XII-1993, M. Kottelet, CMK93-120 (1 male; ZRC); Khlong Fuai, 15-I-1997, H.H. Tan, THH9712 (1 male, 2 females; ZRC); UBON RATCHATHANI Prov.: Amphur Muang, 16-III-1996, Y. Hanboonsong, 1 (1 female; KKUA); Piboon, 16-III-1996, Y. Hanboonsong, 4 (1 female; KKUA); Kong Chaim, 16-III-1996, Y. Hanboonsong, 8.3 (1 female; KKUA); UNSPECIFIED Prov.: ca. 150 km NW Bangkok, 10 km W Han Kha, 90 m, VII-1990, light trap, Thielen (2 males, 1 female; NHMW).

Previous records (POLHEMUS & POLHEMUS, 1995).—CHIANG MAI Prov.: Nam Chi River above hydrostation intake, Fang Horticultural Research Station, 550 m, 15-XI-1985, J.T. & D.A. Polhemus, CL 2197 (1 female; JTPC); UNSPECIFIED Prov.: Saraburi, Forestry Station, 21-III-1952, M.E. Griffith (1 male, 1 female; JTPC); km 124.5 on Bangkok-Prabuddhaht Rd., Botanic Garden, stream, 23-II-1967, J.I.F. (6 males, 3 females; USNM); Lepburi, Heuy Sablek, 20-III-1952, M.E. Griffith (2 males; JTPC).

Note: The localities in the unspecified provinces for *H. orientalis* could not be determined with confidence and are not included in Fig. 7.

Hydrometra ripicola Andersen

(Fig. 7)

Hydrometra ripicola Andersen 1992: 2–4.

Diagnosis.—This species can be distinguished by an anteclypeus that is large, truncate, and with lateral margins that are nearly straight and slightly divergent anteriorly, and the anterior margin is weakly convex. Abdominal sternite VII of the male has a pair of small tubercles with short, dark, tightly-clustered setae near the anterior margin. The terminal process of tergum VIII of the female is directed ventrad but with an upward deflexion. This species is similar to *H. carinata* and *H. longicapitis*; however, the maxillary plate of *H. carinata* covers the gular lobe and *H. longicapitis* has an anteclypeus with a denticle or sharp knob at the apex and males have fleshy lobes instead of tightly-clustered setae.

Discussion.—This species was known only from the hill region of Chiang Mai Province in northern Thailand and Loei Province in northeastern Thailand (ANDERSEN, 1992; POLHEMUS & POLHEMUS, 1995). Herein, we add records from Chaiphaphum, Chiang Rai, Kalasin, Mae Hong Son, Phayao, Phetchabun, Phrae, and Surat Thani provinces. The record of this species from Kalasin Province establishes the species from the remote Phu Pan Mountains in northeastern Thailand where it was collected from a leaf pack in a slow stream (VITHEEPRADIT, 2000). The collection from an island in Surat Thani Province is the southernmost known limit of *H. ripicola* in Southeast Asia. This species prefers the margins of pools of rocky upland streams (POLHEMUS & POLHEMUS, 1995) and occurs at intermediate to high elevations in Thailand. Its disjunct distribution apparently is a result of the distribution of available upland habitat. When individuals of *H. ripicola* are pursued, they leave the aquatic habitat and move to the banks (ANDERSEN, 1992). This species was collected with *H. greeni* and *H. longicapitis* at the margin of a stream from a waterfall in Phrae Province.

Material examined.—CHAIYAPHUM Prov.: Phu Khieo WS, tributary to Nam Prom, 13-III-1994, W.D. Shepard, 1038 (1 male; CSS); CHIANG MAI Prov.: Doi Inthanon NP, Nam Tok Vachiratharn, 18° 31'N, 98° 27'E, 3-III-2002, Vitheepradit & Kirawanich, L-256 (1 male, 1 female; UMC); Doi Suthep-Pui NP, Huai Kaew above lower falls at Nam Tok Monthatharn, 18° 49'N, 98° 55'E, 750 m, 5-III-2002, Sites & Kirawanich, L-261 (1 female; UMC); Doi Suthep-Pui NP, immediately below Monthatharn Falls, 18° 49'N, 98° 55'E, 690 m, 15-III-2002, Sites & Kirawanich, L-296 (5 males, 14 females; UMC); creek at Chiang Dao WRSC, 19° 21'N, 98° 55'E, 520 m, 18-III-2002, Sites, Vitheepradit, Kirawanich, L-303 (1 male, 5 females; UMC); same data, CMU team (1 male; UMC); Doi Suthep-Pui NP, stream at Pa Ngerb, 18° 48'N, 98° 56'E, 530 m, 5-IV-2002, UMC and CMU teams, L-325 (5 males, 5 females; UMC); same locality, 5-V-2002, CMU team, L-404 (1 female, UMC); Doi Suthep-Pui NP, Sai Yoi Waterfall, 18° 48'N, 98° 55'E, 1100 m, 5-IV-2002, UMC and CMU teams, L-326 (1 female; UMC); Doi Inthanon NP, stream from Huai Sai Luang Waterfall, 18° 31'N, 98° 27'E, 1060 m, 8-V-2002, UMC and CMU teams, L-396 (2 males, UMC); Doi Suthep-Pui NP, Nam Tok Monthatharn, 18° 49'N, 98° 55'E, 700 m, 5-IV-2002, CMU team, L-403 (4 males, 8 females, UMC); W of Mae Rim, Doi Suthep-Pui NP, Mae Sa Falls, 30-31-X-1995, H. Zettel, 2 (6 males, 7 females; NHMW); Doi Suthep-Pui NP, near Wat Doi Suthep, 900 m, 1-XI-1995, H. Zettel, 3 (1 male, 1 female; NHMW); Doi Suthep-Pui NP, Monthatharn Falls, 750–800 m, 2-XI-1995, H. Zettel, 4 (2 females; NHMW); same locality, 700–750 m, 6-XI-1995, H. Zettel, 8 (2 females; NHMW); Doi Suthep-Pui NP, Doi Suthep, near Ruesse Cave, 900–1000 m, 5-XI-1995, H. Zettel, 7 (1 male, 1 female; NHMW); Chiang Dao, near entrance of Doi Chiang Dao WRSC, near cave, 500 m, 7-XI-1995, H. Zettel, 9a (3 males, 1 female; NHMW); Chiang Dao, Ban Yang Thung Pong, 500 m, 8-XI-1995, H. Zettel, 10 (1 male, 4 females; NHMW); ca. 10 km E of Samoeng, 18° 51' 40.2"N, 98° 38' 49.5"E, river, 2-I-1998, W.G. Ullrich (1 male; CUL); CHAIANG RAI Prov.: Doi Luang NP, Nam Tok Poo Kaeng, 19° 26'N, 99° 42'E, 540 m, 26-V-2002, CMU team (1 male; UMC); KALASIN Prov.: Phu Pan NP, slow stream with leaf pack, 5-VI-1998, Sites, Simpson, Vitheepradit, L-152 (3 males, 2 females; UMC); MAE HONG SON Prov.:

Amphur Pang Mappha, Ban Tham, Tham Lod, stream ca. 4 m wide, in mixed deciduous forest, 650 m, 20-XII-1996, P. Schwendinger (1 male; NHMW); PHAYAO Prov.: Doi Luang NP, Nam Tok Cham Pa Thong, 19° 13'N, 99° 44'E, 620 m, 17-III-2002, Sites, Vitheepradit, Kirawanich, L-300 (5 males, 4 females; UMC); PHETCHABUN Prov.: Nam Nao NP, stream behind visitor center, 16° 44'N, 101° 34'E, 820 m, 9-III-2002, Vitheepradit, L-275 (2 males; UMC); Nam Nao NP, Huai Ya Krua, 14-III-1994, W.D. Shepard, 1039 (1 female; CSS); PHRAE Prov.: Wieng Ko Sai NP, Nam Tok Mae Koeng Luang, 17° 58'N, 99° 35'E, 350 m, 14-III-2002, Vitheepradit & Kirawanich, L-295 (3 females; UMC); SURAT THANI Prov.: Ko Phangan, 09° 44'N, 100° 04'E, 21-25-XI-2002, F. Seyfert (1 male, 1 female; NHMW).

Previous records (ANDERSEN, 1992; POLHEMUS & POLHEMUS, 1995).—CHIANG MAI Prov.: tributary to Nam Chai River, Fang Horticulture Research Station, 15-XI-1985, J.T. & D. A. Polhemus, CL 2202 (2 males, 12 females; JTPC); Huay Hia Creek, Fang Horticulture Research Station, 15-XI-1985, J.T. & D.A. Polhemus, CL 2198 (3 males, 2 females; JTPC); Chiang Mai, 1-III-1952, D.C. & E. R. Thurman, lot #275 (1 female; JTPC); Chiang Dao, 450 m, 5-11-IV-1958, T.C. Maa (1 male [head missing]; BPBM); Doi Suthep, waterfall at Konthantan, 24-X-1979, N.M. Andersen, locality no. 2 (3 males, 3 females; ZMUC); Horticultural Experimental Station, 7 km NW of Fang, along narrow river and streams, 30-X-2-XI-1979, N.M. Andersen, locality nos. 15, 16, and 18 (2 males, 1 male; ZMUC); Doi Suthep, 1100 m, 2-X-1981 (2 males and 4 females; ZMUC); Doi Suthep-Pui NP, waterfall at Mae Sa, 300 m, 28-IX-1981 (5 males, 3 females; ZMUC); Doi Inthanon NP, main road, 1300 m, 8-X-1981 (1 male; ZMUC); Doi Inthanon NP, Mae Ya, 6-700 m, 11-X-1981 (1 male, ZMUC); LOEI Prov.: Phu Luang WS, 700-900 m, 10-12-X-1984, P. Nielsen (2 females; ZMUC).

SPECIES OF POSSIBLE OCCURRENCE IN THAILAND

Hydrometra jaczewskii Lundblad

Hydrometra jaczewskii Lundblad 1933: 433.

Diagnosis.—This species can be distinguished by an anteclypeus that is small and broadly triangular. Abdominal sternite VII of male has two small, black, widely-separated, posteriorly-directed processes near the anterior margin, and sternite VIII is flattened medially. Females have the abdominal terminalia curved upward caudally and with stiff, upright setae along the connexival margin distally on tergite VII. Female tergite VIII is straight ventrally, and has short to moderate length, erect setae. This species is similar to *H. okinawana* Drake (DRAKE, 1951), however the posterior part of sternite VII in the latter species is bare, whereas it is hirsute in *H. jaczewskii*.

Discussion.—This species has been recorded from Myanmar (Burma) and Indonesia (Java and Sumatra) (POLHEMUS & POLHEMUS, 1995), and also is known from the Malay Peninsula (CHEN & ZETTEL, *IN LIT.*). In Java, *H. jaczewskii* was collected from montane forests (POLHEMUS & POLHEMUS, 1995). We anticipate that this species eventually will be found in western and southern Thailand.

Hydrometra papuana Kirkaldy

Hydrometra papuana Kirkaldy 1901: 807.

Diagnosis.—This species can be distinguished by an anteclypeus that is large, broad, truncate and slightly concave anteriorly, and with nearly straight lateral margins. Abdominal sternite VII of the male has a pair of large, prominent, pad-like, lateral projections, which occupy about 3/5 of the segment and is covered with stiff, black hairs. This species is not

similar to its congeners in Southeast Asia (POLHEMUS & POLHEMUS, 1995). Tergite VII of the female lacks a distal process.

Discussion.—This species has been recorded from Australia, Indonesia (Kalimantan), Malaysia (Malay Peninsula), and New Guinea (POLHEMUS & POLHEMUS, 1995). However, Oriental populations apparently belong to an undescribed species (YANG & ZETTEL, *IN LIT.*). In Southeast Asia, this species was collected only from lowland swamp forests. We anticipate that this species eventually will be found in southern Thailand.

Hydrometra okinawana Drake

Hydrometra okinawana Drake 1951: 101.

Diagnosis.—This species can be distinguished by an anteclypeus that is sharply pointed at the apex. Sternite VII of males has a pair of black prongs near the anterior margin and is bare posteriorly. Tergite VII of the female has the distal process directed straight caudad. This species is similar to *H. jaczewskii* (DRAKE, 1951), however the posterior part of sternite VII in the latter species is covered with long setae.

Discussion.—This species was described from Japan. YANG and ZETTEL (in lit.) could not find any differences between specimens from peninsular Malaysia and type specimens of *H. yasumatsui* Miyamoto 1964, which was synonymized by POLHEMUS (1991). We anticipate that this rare species eventually will be found in southern Thailand.

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