NUMBER 43, 72 pages 15 August 1995

BISHOP MUSEUM OCCASIONAL PAPERS

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REVISION OF THE GENUS *HYDROMETRA* LATREILLE IN INDOCHINA AND THE WESTERN MALAY ARCHIPELAGO (HETEROPTERA: HYDROMETRIDAE)

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AND
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ISSN 0893-1348

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A PRIMITIVE NEW SPECIES OF *HYDROMETRA* FROM TAHITI (HETEROPTERA: HYDROMETRIDAE)

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ABSTRACT. The most primitive *Hydrometra* so far discovered, *H. gagnei* n. sp., is described from Tahiti and compared to other relatively primitive taxa of Hydrometridae, most of which have terrestrial or phytophilous behaviors. Illustrations are provided of the dorsal habitus, head, and abdominal structures for the single known female of *H. gagnei*, and for the male abdomen of *H. aculeata* Montrouzier, another primitive species from New Caledonia.

INTRODUCTION

Some years ago Dr. Frank Howarth wrote to one of us (JTP) concerning a strange hydrometrid that had been collected from a dead tree fern on a mountain top in Tahiti, and asking if it could belong to one of the strange annectant genera that occur on the Marquesas to the east. From the color slide provided it appeared that the species might be *Hydrometra aculeata* Montrouzier, known from New Caledonia, or a closely related species, but it definitely belonged to the genus *Hydrometra*, and not to either of the Marquesan taxa. After the untimely death of Dr. Gagne, who intended to publish on this specimen, it was sent to JTP for further study which revealed that indeed the species is closely related to *aculeata*, but is undescribed and retains even more primitive characteristics than the latter (see discussion below).

For those who would subscribe to Hennig's progression rule (see Ashlock 1974), the mid-Pacific Hydrometridae provide an interesting study, with two primitive genera on the Marquesas, followed by the most primitive known species in *Hydrometra* (*H. gagnei*) on Tahiti, then the next most primitive (*H. aculeata*) on New Caledonia, and then geographically beyond this a basal group containing *H. cavernicola* J. &. D. Polhemus from Madagascar and *H. papuana* from New Guinea. These issues will be addressed in a cladistic analysis of groups within *Hydrometra* to be presented in a future paper. According to the cladistic analysis of Andersen (1982b), the three most plesiomorphic genera of Hydrometridae occur in Africa and the Neotropical region; a primitive genus of Hydrometridae is also known from Paleocene/Eocene fossils in Denmark (Andersen 1982a). We believe that the distributional pattern of primitive taxa in the Pacific most likely results from the persistence of such species in the absence of competition by more recently evolved groups.

A most striking attribute of the more primitive hydrometrid taxa, however, is that, where known, they are all either terrestrial, hygropetric, or phytophilous, thus supporting the hypothesis that this is the ancestral habitat of the Gerromorpha (see discussion in Andersen 1982, p. 335 ff.). Progressing from the most plesiomorphic to the most apomorphic genera, the habitats and geographical distribution are: *Veliometra* Andersen, on damp logs or litter at the edge of still water, Amazon Basin of South America; *Heterocleptes* Villiers, damp earth at the edge of still water or somewhat removed from it, Africa and Borneo; *Limnobatodes* Hussey, habitat unknown (taken only from light samples), Honduras, Brazil, French Guiana and Peru; *Dolichocephalometra* Hungerford, from high altitude but precise habitat unknown, Marquesas; *Chaetometra*, mountain top, on ferns, Marquesas; *Bacillometra* Esaki, large boulders in rivers, South America; *Hydrometra gagnei* n. sp., dead tree fern stump, Tahiti; *Hydrometra aculeata* Montrouzier, along the edges of small upland streams, New Caledonia; *Hydrometra cavernicola* Polhemus and Polhemus, on damp walls of shallow caves or rock face recesses, Madagascar; *Hydrometra papuana* Kirkaldy, along the edges of ponds or rivers, Papua New Guinea.

All measurements in the following description are given in mm. The holotype of *H. gagnei* is held deposited in the Bishop Museum, Honolulu, Hawaii (BPBM).

Hydrometra gagnei Polhemus & Polhemus **new species** Figs. 1–4

Description

MICROPTEROUS FEMALE. Length 6.81, width (across middle of thorax) 0.50 (Fig. 1).

Color. Ground color brown; abdominal tergites I–VI brown, dull, sparsely set with minute recumbent setae, faintly rastrate; VII and VIII mat, clothed with fine pubescence, VIII with shining posterior wedge. Head lighter dorsally between eyes, basally and anteriorly. Thorax dorsally with median irregular light areas, pronotum laterally with narrow arched frosted longitudinal stripe. Abdomen laterally lightly frosted, visible in oblique light. Laterotergites, laterosternites basally broadly yellowish. Legs, light brown to brown, darker distally, antennae brown to piceous; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head relatively short (2.41), widest at antennal tubercles (0.46); set with a few bristly setae beneath, longer, denser anteriorly; ventral lobe large, truncate, not obscuring basal rostral segments in lateral view; maxillary plate small, not extending ventrally (Fig. 2); rostrum long, reaching onto prosternum to anterior coxae; ratio anteocular/postocular portions: 1.38/0.87; interocular space/width of an eye: 0.15/0.10; clypeus almost parallel sided, broadly rounded anteriorly (Fig. 3). Antennal formula I:II:III:IV; 0.36 : 0.56 : 2.61 : 1.64. Prothorax with small median depression on anterior lobe, posterior lobe with a few large shallow pits. Pronotum length 0.82; remainder of thorax 0.72 (to lateral suture behind metacetabula); abdomen length 2.92. Metanotum short (on midline, 0.26), without pronounced median sulcus. Thoracic, abdominal sternites pilose, setae short, about equally dense on all segments. Distance between anterior and middle coxae (measured between closest margins) 0.31; between middle and hind coxae 0.41. Acetabulae without pits; posterior acetabula with a weak depression dorsally. Abdominal mediotergite I present, rectangular, about 1/2 the length of II (Fig. 1).

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 2.25: 2.71: 0.07: 0.36: 0.20; of middle-leg, 2.46: 3.07: 0.07: 0.36: 0.20; of hind-leg, 3.43: 4.92: 0.07: 0.41: 0.23.

Female abdominal terminalia as shown in Fig. 4. Sternite VII prolonged caudad medially, posterior margin shining, forming an obtuse triangle. Tergite VIII simple, unmodified, without sharp process.

BRACHYPTEROUS FORM, MACROPTEROUS FORM, and MALE. Unknown.

Etymology. The patronymic *gagnei* honors the contributions of Dr. Wayne Gagné to entomology in general and Hemipterology in particular.

Discussion. *Hydrometra gagnei* n.sp. is most closely related to *Hydrometra aculeata* Montrouzier from New Caledonia, with which it shares a distinct quadrate abdominal mediotergite I (compare Figs. 1, 5). It differs from *aculeata* by being shorter and stouter, lacking a caudal process on female tergite VIII, and by the different proportions as given in the description. The male of *H. gagnei* is not yet known, but likely to be similar to *H. aculeata*; a figure of the male abdomen of this latter species is provided (Fig. 6), which should allow comparison once this male of *gagnei* is finally discovered.

In general facies *H. gagnei* approaches the annectant genera *Dolichocephalometra* Hungerford and *Chaetometra* Hungerford, but these monotypic genera are set apart by the reduced eyes, equidistant coxal spacing and nearly quadrate abdominal mediotergites II–VII; in *H. gagnei* the eyes are normal, the hind coxae are farther removed from the middle ones than the fore coxae, and abdominal medio-tergites II–VII are elongate. The form of the female ventrite VII, shape of the anteclypeus and lack of pits on the acetabulae suggest a relationship of both *gagnei* and *aculeata* with *H. cavernicola* J. &. D. Polhemus and *H. papuana* Kirkaldy.

The characters discussed above, plus the reduced maxillary plate and ventral lobe of the head (Fig. 2) place *H. gagnei* as the most primitive *Hydrometra* species known, followed by *H. aculeata* from New Caledonia. *H. cavernicola* from Madagascar is intermediate between these two species and the remainder of those in the genus, having in common with them a number of the plesiomorphic characters, but sharing with all remaining *Hydrometra* species the reduced mediotergite I and typical very elongate body shape.

Distribution. Tahiti.

Material examined. Holotype, micropterous female: SOCIETY ISLANDS, Tahiti, Mt. Marau summit, 1400 m., 20 Sept. 1977, J. Gourves, Bishop Museum Acc. #1977.568 (BPBM).

ACKNOWLEDGMENTS

We are indebted to the late W. C. Gagné, Bishop Museum, Honolulu (BPBM), for the opportunity to study the specimen of the new species described here. Detailed habitat data for several of the genera were gathered during various expeditions supported by the National Geographic Society, to whom we are deeply grateful for their support. This research is supported in part by grant BSR–9020442 from the National Science Foundation, Washington, D. C.

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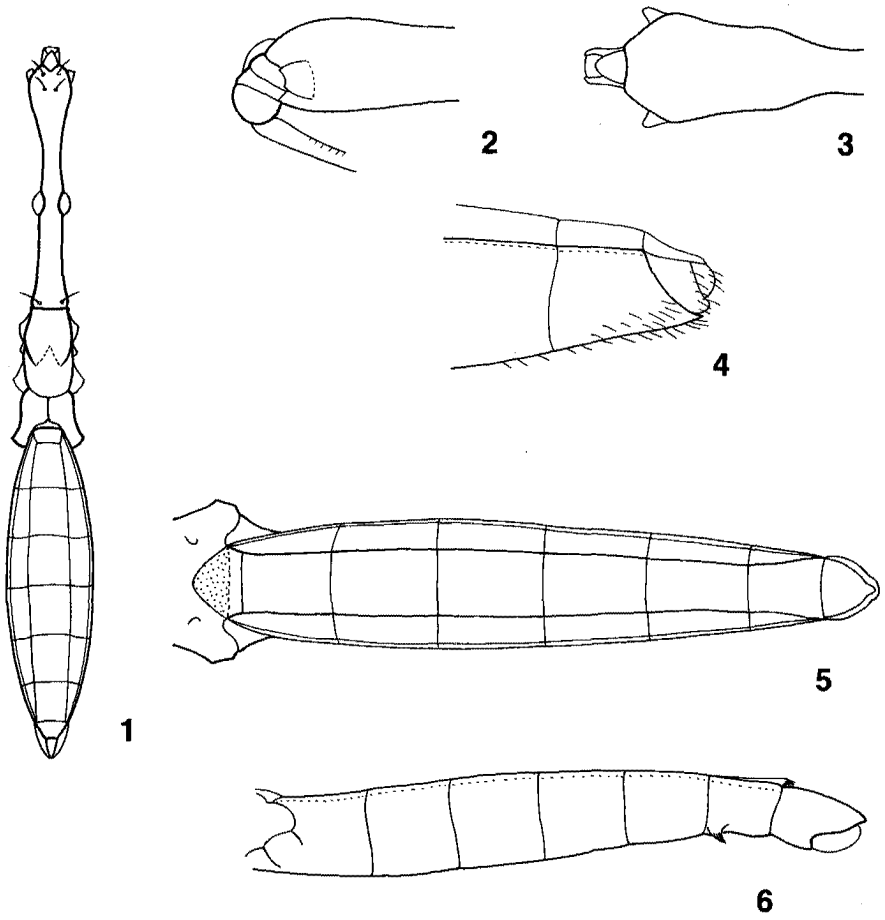

Figs. 1–4. *Hydrometra gagnei* n. sp., female. **1.** Dorsal habitus, legs omitted. **2.** Apex of head, lateral view. **3.** Apex of head, dorsal view. **4.** Terminal abdomen, lateral view. **5, 6.** *Hydrometra aculeata* Montrouzier. **5.** Female abdomen, dorsal view. **6.** Male abdomen, lateral view.

A NEW SPECIES OF *HYDROMETRA* FROM THE SEYCHELLES (HETEROPTERA: HYDROMETRIDAE)

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ABSTRACT. *Hydrometra seychellensis* n. sp. is described from Mahé, Seychelles Islands and compared to *Hydrometra mameti* Hungerford from Mauritius and *Hydrometra bifurcata* Hungerford & Evans from Madagascar. Illustrations are provided of the head and abdominal structures.

INTRODUCTION

The genus *Hydrometra* was previously reported from the granitic Seychelles by Distant (1909), who recorded *H. ambulator* Stål from Mahé. Although we have not seen the specimens on which this record was based, we suspect that they in are fact referable to *H. seychellensis*, a new species described herein.

All the *Hydrometra* species now known from the Indian Ocean islands appear to be members of a single monophyletic clade. Hungerford (1951) noted that his *H. mameti* from Mauritius was closely related to *Hydrometra bifurcata* Hungerford & Evans from Madagascar, and *H. sechellensis* n.sp. is also allied to this latter species. In particular, *H. seychellensis* and *H. bifurcata*, have the anterolateral angles of the anteclypeus produced into spine like processes, although in a long series of *bifurcata* collected by the authors this character is seen to vary infraspecifically, being more strongly expressed in certain individuals than others.

All measurements in the following description are given in mm. The holotype of *H. seychellensis* is deposited in the National Museum of National History, Smith-sonian Institution, Washington, D. C. (USNM); paratypes are held in the J. T. Polhemus collection, Englewood, Colorado (JTPC), and the Hope Entomological Collection, Oxford University Museum, Oxford (OXUM).

Hydrometra seychellensis Polhemus & Polhemus **new species** Figs. 1–5

Description

BRACHYPTEROUS MALE. Length 9.47–9.63, width 0.51.

Color. Ground color brown; abdominal tergites brown, shining, VII laterally clothed with fine pubescence except for median basal shining area, VIII mat and clothed with fine pubescence plus longer lateral setae. Head tinged with blackish antero-dorsally, slightly lighter basally and anterad of eyes, blackish ventrally, yellowish beneath anterior margin, very lightly frosted ventrally and on narrow median longitudinal yellow brown stripe dorsally behind eyes. Thorax dorsally with weak bro-

ken narrow median longitudinal frosted stripe, pronotum laterally with an arched frosted longitudinal stripe, pleura mostly frosted, abdomen with frosted spots laterally just below connexival margin and elongate frosted spots on inner connexiva caudad of each segmental suture, segment VIII frosted, visible in oblique light. Pronotum dorsally and ventrally, portions of pleura, abdominal sternites VI–VII, light brown. Legs, light brown to brown, darker distally except posterior femur lighter distally, antennae brown to piceous, lighter distally; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head relatively short (2.92), widest at antennal tubercles (0.41); set with scattered short bristly setae beneath; ventral lobe large, rounded (fig. 1); rostrum reaching well caudad of eyes, 2/3 toward pronotum; ratio anteocular/ postocular portions: 1.84/0.82; interocular space/width of an eye: 0.10/0.15; clypeus broadly notched anteriorly, lateral angles produced (fig. 2). Antennal formula I:II:III:IV; 0.56 : 1.18 : 3.69 : 1.84. Prothorax with widely spaced encircling pits on anterior lobe (5 dorsally), posterior lobe with distinct pits including on midline, dorsal pits organized into three parallel rows. Pronotum length 1.38; remainder of thorax 1.38; abdomen length 3.18. Abdomen slightly curved upward, recurved to about horizontal on segments VII–VIII. Hemelytra light brown medially between veins, reaching middle of tergite III. Thoracic, abdominal sternites with short to medium length scattered setae, densest on abdominal sternites II–IV. Distance between anterior and middle coxae (measured between closest margins) 0.36; between middle and hind coxae 1.13. Anterior and middle acetabulae with 2 pits each on anterior and posterior parts, posterior acetabula with a pit dorsally. Entire venter set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.12: 3.79: 0.07: 0.31: 0.20; of middle-leg, 3.69: 4.25: 0.10: 0.61: 0.26; of hind-leg, 4.31: 5.63: 0.07: 0.41: 0.26.

Abdominal terminalia as shown in figures 3 and 4. Male sternite VII with 2 (1+1) spine-like tufts of densely packed dark setae at middle on either side but far removed from the ventral midline, posterolaterally with 2 (1+1) fringes of posteriorly directed dark setae. Sternite VIII laterally depressed on each side of midline, forming a broad median carina, directed slightly ventrad.

BRACHYPTEROUS FEMALE. Length 10.39, width 0.61. Most structures and coloration as in male, but abdomen broader, deeper, slightly more curved, distal process of tergite VIII prominent, sharp, directed slightly venrtrad. Abdominal tergites dark, narrowly faintly rastrate medially. Abdominal terminalia as shown in figure 5.

MACROPTEROUS FORMS. Not studied.

APTEROUS FORMS. Unknown.

Discussion: *Hydrometra seychellensis* is a sister species to both *Hydrometra mameti* Hungerford from Mauritius and *Hydrometra bifurcata* Hungerford & Evans from Madagascar, and closely resembles them in most features. It differs from *mameti* in having the lateral angles of the anteclypeus produced instead of truncate, a slightly longer head (AO/PO = 1.84/0.82 for *seychellensis*, 1.79/0.82 for *mameti*) without dense setae ventrally on PO, males without numerous long setae on abdominal sternites II and III, and male sternite VIII lacking dense setae medially and not strongly excavate on each side of the broad median carina. It differs from *bifurcata* in having a brown instead of black ground color, smaller body size (9.63 mm versus 12.60 mm), and the spine-like tufts on male sternite VII located at the middle (measured on ventral midline) rather than slightly closer to the posterior margin.

Among the three species under discussion, it is *seychellensis* from Mahé and *bifurcata* from Madagascar that are the most similar structurally. The obvious close relationship between these two species is compatable with geological and zoogeographical hypotheses that position the Seychelles between Madagascar and India during the Mesozoic.

Distribution. Seychelles Islands.

Material examined. Holotype, brachypterous male, SEYCHELLES: Mahé Is., NW coast, Desert River, 19 Feb. 1974, F/Sey 23A, F Starmühlner (USNM). Paratypes. 1 brachypterous male, 1 brachypterous female, same data as holotype (JTPC); 5 macropterous males, 3 macropterous females, 1 brachypterous female, Silhouette Is., Point Machetee, 1 February 1991, G. Floater (OXUM).

ACKNOWLEDGMENTS

We thank Dr. Ivor Lansbury of the Hope Entomological Collection, Oxford University Museum for bringing to our attention the series from Silhouette Island. In addition, Dr. Neal Evenhuis and Dr. Scott Miller of the Bishop Museum, Honolulu, Hawaii and two anonymous reviewers read prepublication drafts of this manuscript and offered many useful suggestions for its improvement. This research was supported in part by grant BSR-9020442 from the National Science Foundation, Washington, D. C.

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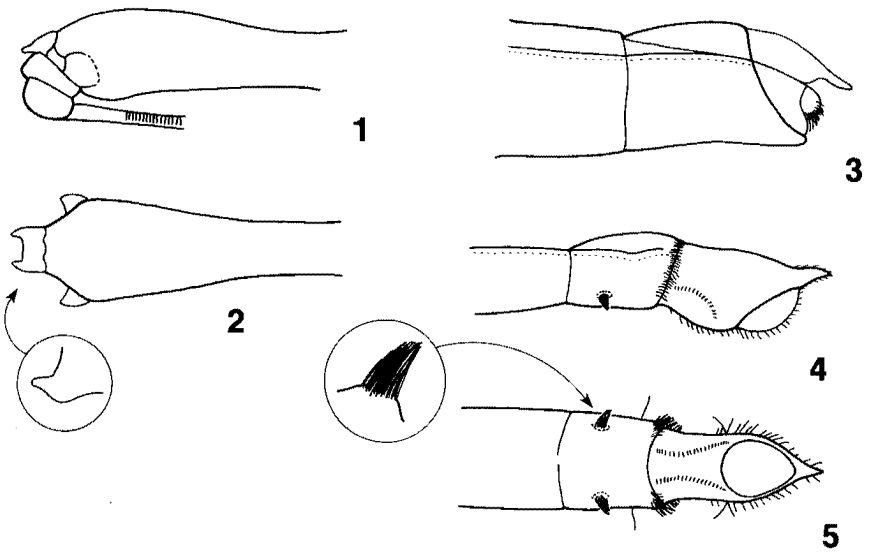

Figs. 1–5. *Hydrometra seychellensis* n. sp. **1.** Apex of head, lateral view. **2.** Apex of head, dorsal view. **3.** Female terminal abdomen, lateral view. **4.** Male terminal abdomen, lateral view. **5.** Male terminal abdomen, ventral view.

REVISION OF THE GENUS *HYDROMETRA* LATREILLE IN INDOCHINA AND THE WESTERN MALAY ARCHIPELAGO (HETEROPTERA: HYDROMETRIDAE)

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ABSTRACT. A revision is presented of the water measurers in the genus *Hydrometra* occurring in Southeast Asia, including Indochina, the Greater Sunda Islands, the Lesser Sunda Islands, Celebes, the Moluccas and the Philippines. A key to species is provided, followed by a taxonomic treatment and distributional information. The following new taxa are proposed: *H. carinata* n.sp. from peninsular Malaysia and Borneo, *H. cracens* n.sp. from peninsular Malaysia and Borneo, *H. gilloglyi* n.sp. from Indochina and Borneo, *H. julienoidea* n.sp. from the Lesser Sunda Islands, *H. kelantan* n.sp. from peninsular Malaysia, and *H. lombok* n.sp. from the Lesser Sunda Islands.

INTRODUCTION

The last revisions dealing with the *Hydrometra* of Southeast Asia were undertaken by Lundblad (1933) and Hungerford and Evans (1934). Since then a number of additional new species have been discovered and the distributions of others extended. The *H. longicapitis* group was recently revised by Andersen (1992) who added one new species from Thailand. All known species occurring in Indochina, the Greater and Lesser Sunda Islands, Celebes, the Moluccas and the Philippines are redescribed here, with synonymy and distribution data provided. A complementary revision is currently in preparation by the senior author and Ivor Lansbury that will revise the Melanesian *Hydrometra* fauna occurring in Australia, New Guinea and the Solomons. The faunas of Melanesia and Southeast Asia are mainly separate, although the distributions of four species, *H. lineata* Eschscholtz, *H. mindoroensis* Polhemus, *H. orientalis* Lundblad and *H. papuensis* Kirkaldy, overlap across the two regions. A final contribution to this series will present a cladistic and zoogeographical analysis of both regional faunas.

METHODS

The geographical scope of this monograph includes three large, faunistically similar regions: Indochina, the Malay Archipelago, and the Philippines. Indochina is defined as the portion of continental Southeast Asia lying east of the Irrawaddy River and south of

the Red River fault zone, including Burma, Thailand, Laos, Cambodia, Vietnam and peninsular Malaysia. The Malay Archipelago is defined as the islands lying between Southeast Asia and Australia. This includes the Greater and Lesser Sunda Islands, Celebes, and the Moluccas. This definition deliberately excludes New Guinea, its satellite islands lying on the Australian continental shelf, and the archipelagos to the east, which comprise a separate and faunally distinctive region that we refer to as Melanesia.

Most of the material upon which this revision is based was collected by the authors during a series of expeditions to the Malay Archipelago supported by the National Geographic Society and the National Science Foundation. This material is held in the J. T. Polhemus collection, Englewood, Colorado, and the Bishop Museum, Honolulu, Hawaii. Acronyms for these and other collections consulted in the course of this research are given in the acknowledgments. The CL numbers following localities in the material examined sections refer to a coding system used to cross reference collecting sites and ecological data in journal books. All measurements are given in mm.

ECOLOGY

Hydrometrids are surface dwelling insects typically found on still or slowly flowing waters, generally near the margins of ponds or stream pools. Excellent reviews of the overall biology of the family may be found in Polhemus and Chapman (1979), and Andersen (1982). Although certain tropical Malagasy species have invaded terrestrial habitats (Polhemus and Polhemus 1987), all of the *Hydrometra* occurring in Southeast Asia are uniformly aquatic in their habits as far as is known. Even the typically stream-inhabiting Asian forms, however, will run into shallow waters and up onto muddy banks if pursued, a behaviour particularly evident in *H. longicapitis*.

Some of the *Hydrometra* species of occurring in the Malay Archipelago appear to be capable dispersalists, since they are widely distributed across the region. Their occurrence thus appears to be dictated by local ecological conditions as well as historical factors. In many cases several species may be present at the same locality, and the extensive collections now available from throughout the region reveal that certain predictable assemblages, or guilds, of species may be found in particular habitats, with closely allied species replacing each other within such guilds in different parts of the archipelago.

Along the slow, mud-banked streams of the swamp forests in the Malay Peninsula, for example, *H. longicapitis* and *H. cracens* form a characteristic guild, with the former species predominating in abundance; in certain cases this guild may also be locally augmented by the presence of *H. gilloglyi*, usually in low numbers. In the lowland forests of Borneo, by contrast, one sees a reversal of the Malaysian pattern, with *H. cracens* generally occurring in tandem with *H. gilloglyi*, while *H. longicapitis* is only occasionally encountered as a rare member of the guild. Along rocky hill streams in northern Thailand *H. longicapitis* is also encountered, but in these situations it is associated with *H. annamana* and *H. greeni*, a species pair that typifies such upland habitats in Indochina, replacing the swamp forest species of the lowlands.

In the Philippines one sees an entirely different species guild, with *H. lineata* and *H. minodoroensis* forming a commonly encountered species pair on many islands and across a wide elevational range. These species are also found along rocky upland streams in northern Celebes, while along similar streams in southern Celebes *H. mindoroensis* is still

present, but *H. lineata* is replaced by *H. maidli*. The latter species is also present in the Lesser Sunda Islands, on Sumbawa, Timor and Sumba, but on these islands it occurs sympatrically with *H. lombok*, the sister species to *H. mindoroensis*. Along the spring fed streams of upland Sumba still another species guild is encountered, consisting of *H. lombok* plus *H. orientalis* and *H. julienoidea*.

These observations suggest that certain *Hydrometra* species are functional ecological equivalents, and replace or exclude each other in different parts of the archipelago. In most cases these species have mutually exclusive ranges, yet associate within their ranges with similar sympatric taxa. Such ecologically equivalent pairs include *H. lombok* versus *H. mindoroensis*, *H. longicapitis* versus *H. gilloglyi*, and *H. maidli* versus *H. lineata*. We have not yet determined whether these species pairs represent sister species, and the question provides an interesting subject for future cladistic analysis.

MORPHOLOGY

The purpose of this section is to establish a consistent set of terms for the descriptions that follow, and for a character analysis to be used in a cladistic study of the Hydrometridae of the world. The morphology of *Hydrometra* was studied in varying detail by Ekblom (1926), Hungerford & Evans (1933), and Sprague (1956), and summarized by Andersen (1982). These studies and others are reviewed, conflicting or redundant terminology discussed, and a consistent set of terms is adopted or proposed and related to classification. The interpretation and terminology follows the definitive study of Sprague (1956) unless otherwise noted. The current review is based on examination of all taxa of Hydrometridae of the world held in the Polhemus collection, which lacks only a few species of *Hydrometra* and *Heterocleptes*, plus the two annectant monotypic Marquesan genera *Chaetometra* Hungerford and *Dolichocephalometra* Hungerford. The emphasis throughout is on the genus *Hydrometra* Latreille, which contains most of the descibed and undescribed taxa in the family.

Head: A definitive study of the heteropteran head capsule was provided by Parsons (1962). Her study included a well supported definition of homologies and terms that are accepted here, and illustrated in figure 2. The long slender head is characteristic of the family, and an apomorphy for the genera most closely related to *Hydrometra* (see Andersen 1982: 126–127). The anteclypeus (clypeus of authors) is quite variable in shape, from conical to transverse and truncate (Figs. 3, 17, 22, 27), but the shape is quite constant for a given species and often useful in separating species and species groups. The structure identified by Ekblom (1926; 120, figure 155, as the lamina maxillaris) and Andersen (1982: 110, figure 174) as the maxillary plate is actually the mandibular plate (= lorum of Sprague 1956: 583, figure 7; see discussion, p. 586). Anteroventral to the mandibular plate and separated from it by the genal suture is the maxillary plate which is variably sclerotized, quite variable in the degree of development (Figs. 2, 6, 11, 16, 21, 26) and very useful in species differentiation. The maxillary plate has not been previously employed in classification, but is useful in separating species in some groups. Adjoining the maxillary plate anteroventrally is the gular lobe (=buccala of Sprague), for which Andersen needlessly coined the equivalent new term "ventral lobe" (see footnote in Parsons 1962: 100). The shape of the gular lobe is variable among the species of *Hydrometra* (Figs. 2, 6, 11, 16, 21, 26), and sometimes useful in species separation, but

apparently does not define groups. The labium, or beak, is very long and slender, usually reaching at least to the eyes, and its length is sometimes useful in separating species.

Thorax: The morphological terminology of the thorax is relatively stable and not controversial. A number of thoracic features are useful in classification. Among these are: punctation of the pronotal dorsum and pleura; complement of acetabular pits (which often vary by one plus or minus on each acetabula); presence or absence of longitudinal pruinose dorsal or lateral stripes; and relative distances between acetabulae. The mesothoracic wings or hemelytra vary somewhat in length according to species. In most species only two morphs are found, one of them being macropterous; among these morphs there is usually one that is predominant, and another that is encountered only occasionally. The morph types recognized in this work are: micropterous (tiny wing pads); brachypterous (slender straps reaching onto the base of the abdomen); and macropterous (broad, fully developed forewings, reaching at least the middle of the abdomen, with metathoracic hind wings in addition). The nature of the light colored longitudinal markings (stripes) on the hemelytra is constant within species and useful for separating closely related forms; in some species it is continuous (except for veins), whereas in others it has definite gaps, the number and width of which are also constant for a given species.

Pregenital Abdomen: The first abdominal segment is clearly present as tergite I in a few species of *Hydrometra*, particularly those possessing other plesiomorphic characters, but is usually fused with tergite II, and never visible ventrally. The fused tergites I and II possessed by most species were interpreted as tergite I by Hungerford and Evans (1934) (who studied *Hydrometra aculeata* Montrouzier but did not notice the plainly separated basal tergites of this species), thus they give the last pregenital segment as VI instead of VII. Andersen also misinterpreted the line of fusion of the basal tergites, in spite of a clearly retained transverse suture in Danish populations of *H. gracilenta* Horvath. Sprague (1956: 602) noted that the first and second tergites are separated by a faint line, but in many species there is none. The division between tergites I and II is demarcated by two (1+1) lateral depressions whether or not any vestige of the transverse suture remains. The mediotergites are narrow, and the width to length ratio is useful in separating some closely allied species. The laterotergites (connexiva in our descriptions, paratergites of authors) are usually monotonous in structure, however the pruinose pattern is helpful at the species level.

Each abdominal sternite bears a pair of widely separated ventrally directed trichobothria or trichobothria-like setae. These have not been previously noticed as far as we can determine. They are variable in development among the species studied, and much longer and more prominent in males than in females. In species with hirsute sternites they are often difficult to see amid the other dense setae, but are usually longer than these other setae. They are apparently present in all genera of Hydrometridae and Macroveliidae (at least in the genus *Oravelia* of the latter), and deserve further study as a possible synapomorphy allying these two families, as they do not seem to be present in Hebridae or Mesoveliidae.

The sixth sternite of some *Hydrometra* species bears mammilose processes or tufts of setae near the posterior margin, but spinose processes are not yet known. The seventh sternite, by contrast, exhibits a large variety of modifications including distinctive patterns of setiferation, spine-like setae arranged in transverse rows, clumps or tufts resembling stout spines, and large mammilose structures. These are very useful at the species level

and occasionally at the species group level.

Genital segments: The male genital segments offer a wealth of characters at the species level, and are occasionally useful in separating species groups. The eighth (first genital) sternite exhibits almost the same range of modifications given for sternite VII, which are very useful for species discrimination. The ninth segment, or pygophore, may or may not be expanded posterodorsally into lateral wings, a species specific character, and may be sculptured in various ways, particularly in African species. The shape of the eighth female sternite is also a useful character for species separation.

MEASUREMENTS

Measurements: The measurements defined below are intended to avoid the effects of pterygomorphism, and permit standardized measurements to be made whether or not all wing morphs are available. Where the measurements or terminology differ from that used by Hungerford and Evans (1934), the last revisors of *Hydrometra*, those differences are noted.

Head: The anteocular part is usually abbreviated as AO and the postocular part as PO, following Torre-Bueno (1926), and both are measured from the eye margin, AO to the tip of the anteclypeus, PO to the anterior margin of the pronotum (Fig. 2).

Thorax: The pronotum is measured on the dorsal midline. The remainder of the thorax is measured from the posterior margin of the pronotum to the posterior margin of the metathoracic acetabula. The width of the insect is measured just behind the curvature of the anterior acetabulae. Hungerford and Evans (1934) did not state their method of measurement, but apparently the metanotum length (remainder of the thorax above) was measured from the posterior margin of the pronotum to the anterior margin of the abdomen on the dorsal midline, meaning that the wing straps of brachypters must be moved aside, and in macropters the hemelytra must be removed in order to see this feature.

Abdomen: The abdomen is measured in lateral view, with length defined as the distance from the posterior margin of the metathoracic acetabula to the apex of segment VIII. The dorsal anterior margin of tergite I is actually forward of this, but hidden in alate specimens, thus the measurement used will normalize the relative length for all morphs. Either method of measurement provides the same information content for species discrimination, which is its primary purpose.

SYSTEMATICS

KEY TO THE *HYDOMETRA* OF INDOCHINA AND THE WESTERN MALAY ARCHIPELAGO

Note: This key is primarily applicable to males; characters peculiar to females are noted as such; m = male, f = female.

1. Anteclypeus not conical, anterior margin broadly angulate (Fig. 63), broadly rounded (Fig. 12), or truncate (Figs. 3, 22, 32, 35, 83), sometimes medially concave. 2

–. Anteclypeus angulate, conical, or narrow and narrowly rounded distally (Figs. 7, 17, 27, 40, 48, 53, 58, 69, 74, 78). 8

2. Anteclypeus widening anteriorly, as broad or broader than long, anterior margin truncate, usually medially concave (Figs. 3, 22, 32, 35). 3
–. Anteclypeus longer than broad, anterior margin broadly angulate, broadly rounded, or truncate, not medially concave (Figs. 12, 63, 83). 6
3. Seventh abdominal sternite with a pair of large prominent pad-like lateral projections covered with stiff black hairs (Fig. 5). . . . . ***papuana*** Kirkaldy
–. Seventh abdominal sternite without a pair of prominent pad–like lateral projections covered with stiff black hairs. 4
4. Anteclypeus quadrate, essentially as wide anteriorly as long (Fig. 22); eighth sternite longitudinally carinate, with a fringe of laterally directed setae on each side (Figs. 23, 24). . . . . ***gilloglyi*** n.sp.
–. Anteclypeus transverse, wider anteriorly than long (Figs. 32, 35, 83); eighth sternite not longitudinally carinate, without a fringe of laterally directed setae on each side. 5
5. Seventh abdominal sternite with two (1+1) lateral clusters of setae, each with length about 1/6 of the sternite (Figs. 33, 34) . . . . . ***julienoidea*** n. sp.
–. Seventh abdominal sternite with two (1+1) lateral clusters of setae, each with length about 1/3 of the sternite (Figs. 37, 38). . . . . ***julieni*** Hungerford & Evans
6. Body extremely long (males 14.5 mm, females 15.5 mm minimum) and slender (width/length mediotergite V about 0.10; body length/width across tergite IV, males 40/1, females 25/1); maxillary plate extremely large, covering entire gular lobe except anterior margin (Fig. 11); female abdomen with ventral carina (Fig. 15). . . . . ***carinata*** n. sp.
–. Body shorter (males 13.0 mm, females 14.0 mm maximum), less slender (width/length mediotergite V = 0.29–0.33; body length/width across tergite IV, males 23/1, females 17/1); maxillary plate elongate, not covering gular lobe (Figs. 62, 82); female abdomen without ventral carina. 7
7. Anterior margin of anteclypeus broadly rounded to broadly angled, set with a small denticle or sharp knob at apex (Fig. 63); male abdominal sternite VII with two (1+1) large fleshy tubercles near anterior margin, excavate behind (Fig. 64); female often with long hairy tubercle arising from posterior margin of pronotum (Figs. 87–89). . . . . ***longicapitis*** Bueno
–. Anterior margin of anteclypeus broadly rounded to almost straight, without denticle or knob at apex (Fig. 83); male abdominal sternite VII with two (1+1) smaller tubercles near anterior margin, each set with short dark setae, not excavate behind (Figs. 84, 85); female without tubercle on posterior margin of pronotum. . . . . ***ripicola*** Andersen
8. Seventh abdominal sternite with a deep, broad transverse sulcus, laterally pilose (Figs. 28, 29, 41, 42). 9
–. Seventh abdominal sternite without a deep, broad transverse sulcus (may be weakly depressed in *H. lineata*), variably pilose (Figs. 70, 75, 79). 10
9. General coloration dark brown to black; body long (males 13.0 mm, females 14.0 mm), slender (width/length mediotergite V, males about 0.20, females about 0.14; body length/width across tergite IV; males 30.4/1, females 19/1); anterior part of head with AO/PO about 2.51; middle tarsi long (length segments II/III, males 2.3/1, females 2.4/1) . . . . . ***kelantan*** n. sp.

–. General coloration brown to light brown; body shorter (males 10.44 mm, females 11.37 mm), less slender (width/length mediotergite V, males and females both about 0.23; body length/width across tergite IV; males 25.5/1, females 17/1); anterior part of head shorter, AO/PO about 2.40–2.47; middle tarsi shorter (length segments II/III, males 1.8/1, females 2.0/1). . . . . ***greeni*** Kirkaldy

10. Seventh abdominal sternite with two prominent proximal peg fields. 11

–. Seventh abdominal sternite smooth or with patches of setae beyond middle, may be hirsute, but without prominent proximal peg fields. 14

11. Anteclypeus small, button-like, not projecting anteriorly, almost hidden by normal size maxillary plate (Fig. 58); seventh sternite proximally with two (1+1) groups of stout setae (Figs. 59, 60), distally without fields of pegs or stiff setae on either side of ventral midline, sparsely pilose ventrally, setae short; eighth abdominal segment proximally pilose and depressed ventrally, caudal margin transversely carinate. . . . . ***jaczewskii*** Lundblad

–. Anteclypeus larger, projecting anteriorly, not hidden by normal size maxillary plate (Figs. 7, 17, 48, 53, 69, 74, 78); seventh abdominal sternite proximally often bearing two (1+1) groups of stout setae superficially resembling spines, each set on a weak tumescence (Figs. 9, 19, 50, 60, 76), distally with two (1+1) small fields of pegs, very short setae, or stiff setae on either side of ventral midline; eighth abdominal segment not proximally pilose or depressed ventrally, caudal margin not transversely carinate 12

12. Body slender, width/length mediotergite V less than 0.20; distance between middle coxal cavities/width of middle coxa about 0.25. . . . . ***cracens*** n. sp.

–. Body less slender, width/length mediotergite V about 0.33; distance between middle coxal cavities/width of middle coxa at least 0.50. 13

13. Anterior part of head longer, AO/PO about 2.24; distance between middle coxal cavities/width of middle coxa about 0.50 (about 0.75 in some females); length of abdominal sternite VII about equal to VIII on ventral midline; abdominal sternite VIII behind lateral depression on each side with distinct tuft of laterally directed setae (rarely weakly developed) (Figs. 75, 76); female connexiva with erect setae along entire length of segment VI and basal half of segment VII (Fig. 45). . . . . ***mindoroensis*** Polhemus

–. Anterior part of head shorter, AO/PO about 2.13; distance between middle coxal cavities/width of middle coxa subequal; length of abdominal sternite VII shorter than VIII on ventral midline; abdominal sternite VIII behind lateral depression on each side with scattered laterally directed setae, not organized into distinct tufts (Figs. 49, 50); female connexiva with erect setae on posterior half of segment VI, basal half of segment VII (Fig. 51). . . . . ***lombok*** n. sp.

14. Abdominal sternite VII set with distinct patches of dark setae (Figs. 8, 9, 54, 55); abdominal venter not hirsute; posterior femur set with long brown erect setae over entire length 15

–. Abdominal sternite VII without distinct patches of dark setae (Figs. 70, 71, 79, 80); abdominal venter hirsute; posterior femur without long erect setae. 16

15. Abdominal sternite VII with two (1+1) widely separated patches of posteriorly directed, tightly clustered short dark setae on either side just behind middle (Figs. 8, 9). . . . . ***annamana*** Hungerford & Evans

–. Abdominal sternite VII with two (1+1) widely separated patches of brown setae on either side near posterior margin, flanked by longer setae (Figs. 54, 55). . . . . ***maidli*** Hungerford & Evans

16. Anteclypeus obtusely angled to broadly rounded anteriorly (Fig. 69); maxillary plate extending anteriorly to apex of anteclypeus (Fig. 68); abdominal ventrite VII essentially bare medially on caudal half, pilose laterally with numerous closely set long brown setae forming two distinct divergent brushes, one on each side of midline, best seen in posterior view (Fig. 71); abdominal segment VIII flared posteriorly in dorsal or ventral view (Fig. 71); lateral wings of segment IX spinose; median stripe on hemelytra bright white in both males and females, usually continuous except narrowly interrupted at cross veins; female connexiva usually acuminate distally (Fig. 72). . . . . ***lineata*** Eschscholtz

–. Anteclypeus sharply triangular to obtusely angled anteriorly (Fig. 78); maxillary plate not extending anteriorly to apex of anteclypeus (Fig. 77); abdominal ventrite VII pilose medially and laterally on caudal half, but without two distinct divergent brushes (Fig. 80); abdominal ventrite VIII with straight lateral margins in dorsal view, or nearly so (Fig. 80); lateral wings of abdominal segment IX moderately developed, not spinose, median stripe on hemelytra sordid to bright white, usually weak or effaced in females, with 2 to 4 wide gaps, at least 2 near cross veins; female connexiva truncate distally. . . . . ***orientalis*** Lundblad

Hydrometra annamana Hungerford & Evans Figs. 6–10, 90

Hydrometra annamana Hungerford, H. B. & N. E. Evans, 1934. Annls. Mus. Natn. Hung. 28: 68. Holotype, male, Annam, Laos (Hungarian Natural History Museum).

Hydrometra taipehana Drake, C. J., 1951. Bull. So. Calif. Acad. Sci. 50: 102. Holotype, male, Formosa (California Academy of Sciences). Syn. by Miyamoto, S., 1964, Sieboldia 3: 212.

Description

MACROPTEROUS MALE. Length 11.01–11.42, width 0.61.

Color. Ground color brown; abdominal tergite VI orange brown, faintly shining, faintly rastrate medially; VII–VIII mostly mat and clothed with fine pubescence; VII with basal median area faintly shining, pruinose laterally; VIII pruinose. Head tinged with blackish except basally and anteriorly, darker laterally and ventrally, very lightly pruinose ventrally and on median longitudinal light stripe dorsally behind eyes. Thorax dorsally with prominent median longitudinal pruinose stripe, wider on posterior lobe, pronotum laterally with narrow arched pruinose longitudinal stripe; most of remainder of thorax and abdomen at least lightly pruinose except broad abdominal stripe along junction of medio- and laterotergites, visible in oblique light. Head ventrally beneath base and anterior margin, broad irregular longitudinal regions on either side of dorsal thoracic midline of posterior lobe, venter of thorax and abdomen, light brown. Connexiva brown, pruinose; pruinosity more pronounced at segmental sutures on connexiva and adjacent laterosternites. Legs, antennae light brown to brown, darker distally; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head long (3.17), widest at antennal tubercles (0.38); almost devoid of setae, with a few scattered very short decumbent setae, anteroventrally with a few bristly setae; maxillary plate of moderate size, covering base of gular lobe, not extending to tip of anteclypeus anteriorly (Fig. 6); gular lobe of moderate size, elongate; rostrum reaching well caudad of eyes, about halfway to prosternum; ratio anteocular/postocular portions: 2.36/0.87; interocular space/width of an eye: 0.10/0.15; anteclypeus broadly rounded to obtusely angled anteriorly (Fig. 7). Antennal formula I:II:III:IV; 0.56: 1.23: 2.43: 1.28. Prothorax with row of deep encircling pits on anterior lobe setting

off collar, plus 6–8 along lateral margin, posterior lobe with numerous pits including on midline, each pit appearing pruinose in oblique light. Pronotum length 1.69; remainder of thorax 1.48; abdomen length 4.71. Hemelytra reaching base to middle of tergite VI; basal white stripe mesad of R + M evanescent beyond basal fourth; median stripe bright white, commencing near base, extending almost to apex, interrupted only by cross veins. Abdominal sternites very sparsely set with short slender setae. Posterior femur set with a row of very slender long brown setae. Distance between anterior and middle coxae (measured between closest margins) 0.77; between middle and hind coxae 1.38. Anterior, middle acetabulae with two or three pits each on anterior and posterior parts; posterior acetabula with one pit dorsally on anterior part. Entire venter set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.12: 3.99: 0.10: 0.31: 0.20; of middle leg, 3.43: 3.94: 0.10: 0.41: 0.20; of hind leg, 3.79: 5.32: 0.10: 0.36: 0.26.

Abdominal terminalia as shown in figures 8 and 9. Male sternite VII with two (1+1) large black flattened widely separated posteriorly directed processes just caudad of middle, each set on a weak tumescence, each composed of tightly clustered dark stiff setae. Eighth sternite unmodified. Segment IX with moderately developed lateral wings.

MACROPTEROUS FEMALE. Length 12.85–13.98, width 0.61. Most structures and coloration as in male, except posterior femur not set with setae. Hemelytra reaching onto basal part of tergite V; bright white markings similar to male. Abdominal terminalia as shown in figure 10; caudal process of tergite VIII prominent, slightly curved.

BRACHYPTEROUS FORM. Hemelytra reaching onto tergite II, each with a narrow white stripe on inner margin which together form a continuation of the light pronotal pruinose stripe. Pronotum narrower posteriorly than in macropter, usually with fewer pits.

MICROPTEROUS FORM. Unknown.

Diagnosis. This is a moderate sized, brown to yellowish brown species that is most closely related to *H. maidli* Hungerford and Evans, a species widespread in the Malay Archipelago. The two are difficult to separate at first glance, but have several distinguishing characters as given in the key, including the relatively longer tarsal segment II in *annamana* (about twice as long as III, at most 1.6 times as long as III in *maidli*), the slightly larger AO/PO ratio in *annamana*, and the very slightly different shape of female tergite VIII. The males may be easily separated by the modification of the seventh sternite in *annamana*, and relatively hairy venter in *maidli* (compare Figs. 8, 9, 54, 55).

One of us (JTP) has studied the types of both *annamana* and *taipehana*, and determined that they are synonymous.

Distribution. China, Formosa, Indochina, Japan (Fig. 90).

Material examined. THAILAND: **Chiang Mai Prov.**: 2 males, 1 female, ponds at Fang Horticultural Res. Sta., CL 2201, 15 Nov. 1985, J.T. & D.A. Polhemus; 1 female, Huay Hia Creek, Fang Horticultural Res. Sta., CL 2198, 500 m, 15 Nov. 1985, J.T. & D.A. Polhemus. **Prov. uncertain**: 1 male, Bangkok, 10 May 1974, E.Heiss (JTPC). HONG KONG: 1 male, 1 female, Pokfulan, 150 m., 30–31 May 1964, J.L. Gressitt (BPBM). VIETNAM: 2 males, 3 females, S. of Nha Trang, 20–26 Nov. 1960, C.M. Yoshimoto (BPBM); 4 males, 1 female, Nha Trang, 17–26 Nov. 1960, C.M. Yoshimoto (BPBM).

Hydrometra carinata Polhemus & Polhemus, **new species** Figs. 11–15, 91

Description

BRACHYPTEROUS MALE. Length 14.72–15.00, width 0.51.

Color Ground color brown, dorsally mostly light brown to orange brown; abdominal tergites dark orange brown, shining, faintly rastrate except VII–VIII clothed with fine pubescence, all but

median part frosted. Head dorsally tinged with black near eyes, laterally mostly darker, ventrally heavily tinged with black between and ahead of eyes except anterior extreme, entirely lightly pruinose. Pronotum dorsally with narrow median longitudinal pruinose stripe, laterally with an arched pruinose longitudinal stripe, continuing linearly along remainder of thorax and abdomen onto segment VIII, more heavily pruinose at segmental sutures, visible in oblique light; entire venter more lightly pruinose, separated from pruinose stripe described above by dark stripe which, in completely different oblique light (by 90°), is also pruinose. Connexiva except narrow margins, brown, pruinose. Lateral margins and collar of pronotum, acetabulae, dark. Legs orange brown to brown, darker distally; antennae deep brown, segment IV light distally; coxae, trochanters mostly luteous tinged with fuscous, similar to bases of femora.

Structure. Head extremely long (4.76), widest at antennal tubercles (0.41); sparsely set with short erect setae, more numerous beneath eyes, antero-ventrally longest; maxillary plate extremely large, covering most of gular lobe, extending ventrally beneath antennal tubercles (Fig. 11); gular lobe large, rounded ventrally, barely covering base of rostrum; rostrum reaching between eyes; ratio anteocular/postocular portions: 3.43/0.92; interocular space/width of an eye: 0.10/0.15; anteclypeus large, tapering, rounded anteriorly, lateral margins curved (Fig. 12). Antennal formula I:II:III:IV; 0.67: 2.40: 5.48: 2.21. Prothorax with a pronounced row of encircling pits on anterior lobe setting off collar, posterior lobe with scattered shallow pits, plus a row on midline. Pronotum length 2.05; remainder of thorax 2.20; abdomen length 6.25. Hemelytra reaching posterior margin of metasternum. Abdominal, thoracic sternites sparsely set with scattered short semi-erect setae. Distance between anterior and middle coxae (measured between closest margins) 1.18; between middle and hind coxae 1.95. Anterior, middle acetabulae with one to three (usually two) pits each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally. Head, thoracic venter set with scattered minute black denticles.

Proportions of legs as follows: Measurements of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 5.39: 7.02: 0.10: 0.36: 0.26; of middle leg, 6.45: 7.98: 0.10: 0.36: 0.26; of hind leg, 7.22: 9.91: 0.10: 0.31: 0.26.

Abdominal terminalia as shown in figures 13 and 14. Male sternite VII with two (1+1) black widely separated spine-like processes, each set on a broad weak tumescence, each composed of tightly clustered dark stiff setae, located about 2/5 from anterior margin, curved at base, tips pointed almost ventrally and slightly caudad. Eighth male sternite weakly depressed on sides; distal process of tergite VIII of moderate length.

BRACHYPTEROUS FEMALE. Length 15.49–17.02, width 0.56. Similar in many respects to male, except coloration somewhat lighter, especially the abdomen. Abdominal terminalia as shown in figure 15; abdomen slightly curved upward distally; ventrally with weakly developed median carina, extending from basal 1/4 of sternite II onto base of sternite VII where it broadens and disappears; distal half of sternite VI, base of VII laterally slightly compressed accentuating carina which is more pronounced caudally; sternite VII caudally with a brush of stiff dark setae directed postero-ventrally; connexival segments VI–VII set with scattered erect slender setae; terminal process of tergite VIII short, straight.

MICROPTEROUS, MACROPTEROUS FORMS. Unknown.

Etymology. The name *carinata* refers to the prominent carina on the abdominal venter of the female.

Diagnosis. This large, elongate, dark colored species could be considered to belong to a group containing *H. ripicola* Andersen and *H. longicapitis* Hungerford & Matsuda, as it shares with them an extremely long head, which is longer than the thorax. The long, slender body of *carinata* is much narrower than that seen in either of the above species, however, and this plus other peculiarities place *carinata* as an annectant form. The modifications of male abdominal sternite VII (Fig. 14), the ventral abdominal carina of the female (Fig. 15), and the unique expanded maxillary plate (Fig. 11) immediately separate *H. car-*

inata from any other congenor. The species may be further recognized by the characters given in the key.

Ecological notes. The type series from East Kalimantan was taken along the margins of a blackwater stream at a road crossing in disturbed lowland peat swamp forest.

Distribution. Malay Peninsula, Borneo (East Kalimantan) (Fig. 91).

Material examined. Holotype, brachypterous male: INDONESIA, *BORNEO*, **Kalimantan Timur Prov.**, stream 8 km NE Kota Bangun on Samarinda Rd, CL 2098, 29 Aug. 1985, J.T. & D.A. Polhemus (USNM). *Paratypes* (all brachypterous): INDONESIA, *BORNEO*, **Kalimantan Timur Prov.**: 16 males, 22 females, 1 nymph, same data as holotype (JTPC). WEST MALAYSIA, **Malacca**: 2 males, Pottery Pond, 3 Dec. 1973, collector unknown; 2 males, 1 female, Batu Batendan, 1973, ANG & CHF. **Pahang**: 3 females, forest stream nr. Rd. 4 mls. from Fort Iskandar, 29 March 1963 (JTPC, USNM). **Selangor**: 1 male, Kampond Pond, nr. Kuala Selangor, 20 Aug. 1973, collector unknown (JTPC).

Hydrometra cracens Polhemus & Polhemus, **new species** Figs. 16–20, 92

Description

MICROPTEROUS MALE. Length 8.95–9.91, width 0.31.

Color. Ground color blackish brown, most of body faintly pruinose (in oblique light), dorsally mostly blackish brown; abdominal tergites black-brown, shining, faintly rastrate except VII–VIII mat and clothed with fine pubescence. Head mostly blackish, brown anteriorly and postero-dorsally, with yellowish median longitudinal stripe dorsally behind eyes. Thorax dorsally with weakly developed narrow median longitudinal pruinose stripe, pronotum laterally with an arched pruinose longitudinal stripe; much brighter large pruinose spots on basal 1/4 of each connexival segment and shorter spots on adjacent lateral sternites. Thoracic dorsum, pleura, abdominal sternites laterally tinged with brown. Legs, antennae light brown to brown, darker distally; coxae, trochanters mostly luteous to light brown, similar to bases of femora.

Structure. Head long (3.07), widest at antennal tubercles (0.36); almost bare, anteroventrally with erect brown setae; maxillary plate of moderate size, not reaching past anteclypeus anteriorly (Fig. 16); gular lobe of moderate size, truncate ventrally, covering base of rostrum; rostrum reaching well caudad of eyes, 2/3 toward pronotal margin; ratio anteocular/postocular portions: 2.10/0.87; interocular space/width of an eye: 0.08/0.15; anteclypeus small, parallel sided, broadly rounded anteriorly (Fig. 17). Antennal formula I:II:III:IV; 0.36 : 1.13: 2.75 : 1.18. Prothorax with a row of encircling pits on anterior lobe setting off collar, weakly formed dorsally, posterior lobe with a row of pits on midline. Pronotum length 1.23; remainder of thorax 1.33; abdomen length 3.84. Abdominal sternites not pilose, set with scattered short erect setae, increasing in length posteriorly, longest, densest on tergite VI. Distance between anterior and middle coxae (measured between closest margins) 0.56; between middle and hind coxae 1.18. Anterior, middle acetabulae with two pits each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of fore leg; 3.08: 3.37: 0.07: 0.31: 0.20; of middle leg, 3.46: 3.66: 0.10: 0.36: 0.26; of hind leg 4.23: 5.19: 0.10: 0.36: 0.20.

Abdominal terminalia as shown in figures 18 and 19. Male sternite VII with two (1+1) small black widely separated posteriorly directed spine-like processes along anterior margin, each composed of tightly clustered dark stiff setae plus a fringe of longer golden setae; posteriorly with two (1+1) weak tumescences lateral to midline each set with a fringe of laterally directed golden setae. Eighth sternite very weakly laterally compressed on each side of middle along most of length, with a row of laterally directed golden setae on each side clearly visible only in oblique light, without distinct tufts of laterally directed setae.

MICROPTEROUS FEMALE. Length 10.85, width 0.41. Similar in most respects to male,

except connexiva lighter in color. Abdominal terminalia as shown in figure 20; lateral margins of abdominal tergite VI, base of VII set with long erect setae; tergite VIII set with stiff laterally directed setae, caudal process long, sharp, fully 1/2 of tergite length.

APTEROUS and MACROPTEROUS FORMS. Unknown.

Etymology. The name *cracens* L. means slender, graceful.

Diagnosis. This small, dark colored species is the most diminutive *Hydrometra* occuring in Southeast Asia, and appears closely related to *H. mindoroensis* Polhemus and *H. lombok* n. sp. It differs from these latter two species in its dark coloration, smaller size, more weakly developed and lighter colored posterolateral hair tufts on male sternite VII (Figs. 18–20), and narrower body, particularly the abdomen (W/L of mediotergite V less than 1/5, versus about 1/3 in the other two species). The color is somewhat variable on the dorsum of the thorax and abdomen, ranging from uniformly brown to blackish brown.

Ecological notes. The specimens from Johor were taken along the margins of smoothly flowing streams in lowland swamp forests. They occurred sympatrically here with *H. longicapitis* Torre-Bueno, but in smaller numbers.

Distribution. Malay Peninsula, Borneo (Sabah, Sarawak) (Fig. 92).

Material examined. Holotype, micropterous male: WEST MALAYSIA, **Johor**, swamp forest stream 15 km W. of Sedili Besar, 20 m, CL 2218, 16 Oct. 1986, J.T. & D.A. Polhemus (JTPC). *Paratypes* (all micropterous): WEST MALAYSIA, **Johor**: 1 male, swamp forest stream 61 km NE of Johor Bharu on Mersing Road, CL 2220, 16 Oct. 1986, J.T. & D.A. Polhemus. **Kelantan**: 1 male, waterfall 10 km NW of Pasir Puteh, CL 2084, 21 Aug. 1985, J.T. & D.A. Polhemus. EAST MALAYSIA, *BORNEO*, **Sabah**: 1 female, trib. to Moyog River nr. km 12 on Keningau Hwy., CL 2039, 6 Aug. 1985, J.T. & D.A. Polhemus (JTPC); 1 male, Forest Camp, 19 km. N. of Kalabakan, 13 Nov. 1962, Y. Hirashima (BPBM); 1 male, 1 female, Tawau Residency, Kalabakan River, 48 km. W. of Tawau, 9–18 Nov. 1958, primary forest, T.C. Maa (BPBM). **Sarawak**: 3 males, 1 female, Tapah River, 16 km NW of Bau, CL 2052, 10 Aug. 1985, J.T. & D.A. Polhemus (JTPC); 3 males, small stream disappearing into limestone cave, 8 km S of Tebakang, CL 2046, 9 Aug. 1985, J.T. & D.A. Polhemus (JTPC).

Hydrometra gilloglyi Polhemus & Polhemus, **new species** Figs. 21–25, 93

Description

BRACHYPTEROUS MALE. Length 12.31–12.70, width 0.48–0.58.

Color. Ground color orange brown; abdominal tergites light brown, shining, faintly transversely striate except VII–VIII mat and clothed with fine pubescence. Head black ventrally, lightly pruinose ventrally and often on narrow median longitudinal stripe dorsally behind eyes. Thorax dorsally with narrow median longitudinal weakly pruinose stripe, laterally and ventrally mostly pruinose, weakly continuing on abdomen onto segment VIII, visible in oblique light; much brighter large pruinose spots on basal 1/4 of each connexival segment and adjacent lateral sternites. Legs, antennae light brown, darker distally; coxae, trochanters mostly luteous.

Structure. Head long (3.69), widest at antennal tubercles (0.46); set beneath with bristly decumbent setae behind eyes, longer, straighter, more numerous anteriorly; maxillary plate long, exceeding anteclypeus anteriorly (Fig. 21); gular lobe of moderate size, rounded; rostrum reaching caudad of eyes, halfway to pronotum; ratio anteocular/postocular portions: 2.20/1.18; interocular space/width of an eye: 0.15/0.15; anteclypeus broad, expanded anteriorly, truncate, anterior margin straight but depressed medially (Fig. 22). Antennal formula I:II:III:IV; 0.82 : 1.43: 4.10: 1.74. Prothorax with a distinct row of encircling pits on anterior lobe setting off collar, posterior lobe with numerous large

shallow pits especially on midline. Pronotum length 1.84; remainder of thorax 1.74; abdomen length 5.48. All abdominal sternites at least weakly pilose, setae increasing in length and density to caudal margin of sternite VII. Distance between anterior and middle coxae (measured between closest margins) 0.77; between middle and hind coxae 1.54. Anterior and middle acetabulae with one or two weak pits each on anterior and posterior parts; posterior acetabula with one or two weak pits dorsally. Entire venter, head except basally, anterior lobe of pronotum, connexiva set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.99: 4.20: 0.10: 0.36: 0.26; of middle leg, 4.76: 4.66: 0.10: 0.67: 0.36; of hind leg, 5.84: 5.99: 0.10: 0.61: 0.26.

Abdominal terminalia as shown in figures 23 and 24. Male sternite VII weakly transversely depressed on caudal half; sternite VIII tumid on either side of the ventral midline on caudal half, each tumescence set with numerous ventro-laterally directed brown setae; segment IX without lateral angles.

BRACHYPTEROUS FEMALE. Length 14.24–15.10, width 0.58. Similar in most respects to male; abdominal terminalia as in Fig. 25.

APTEROUS and MACROPTEROUS FORMS. Unknown.

Etymology. This species is named for our colleague Alan Gillogly, an assiduous collector who has done much over the years to add to our knowledge of the aquatic Heteroptera of remote tropical regions.

Diagnosis. Hydrometra gilloglyi is a moderate sized species that seems most closely related to *H. poissoni* Hungerford from Africa. The peculiar modification of male sternite VIII, which is broadly carinate medially and bears paired longitudinal hair tufts, is completely different from that seen in any other Asian species. *H. gilloglyi* is also quite variable in regard to coloration, with the ground color of the Vietnamese specimens being the lightest, the Malayan specimens intermediate, and the Sarawak specimens the darkest. These latter specimens are almost entirely black except for light areas dorsally on the base of the head and on the thorax, along the entirity of the connexiva, and in an adjacent stripe on the abdominal laterosternites. The Sarawak specimens also have the female abdomen strongly upturned distally, in contrast to specimens from mainland Asia in which this curvature is incipient or lacking; a similar polymorphism in abdominal curvature was discussed by Polhemus and Polhemus (1987) for *H. longicapitis* (as *H. aberrans*). The longitudinal bright pruinose spots on the connexiva are not evident in most specimens from peninsular Malaysia, perhaps because they were long stored in alcohol. The maxillary plate is variable in the degree of extension beyond the anteclypeus, but always exceeds the latter (Fig. 21).

Ecological notes. Hydrometra gilloglyi seems to prefer dark and sheltered spots along the margins of lowand rain forest and swamp forest streams.

Distribution. Indochina, Malay Peninsula, Borneo (Sabah, Sarawak) (Fig. 93).

Material examined. Holotype, brachypterous male: VIET NAM, **Quang Tri Prov.**: 1 mi N Quang Tri, 23 June 1970, A.R. Gillogly (USNM). *Paratypes* (all brachypterous unless noted): VIET NAM, **Quang Tri Prov.**: 6 males, 4 females, 1 macropterous female, all same data as holotype except 1 male, 9 June 1970 (JTPC). EAST MALAYSIA, *BORNEO*, **Sabah**: 1 male, stream, 5 km S of Poring Hot Springs, CL 2024, 2 Aug. 1985, J.T. & D.A. Polhemus (JTPC); 3 males, 2 females, Tawau Dist., Kalabakan, primary forest, 8–15 Nov. 1958, L.W. Quate (BPBM). **Sarawak**: 2 males, 2 females, 8 km S of Tebakang, CL 2045, 9 Aug. 1985, J.T. & D.A. Polhemus; 3 males, 1 female, 8 km S of Tebakang, stream disappearing into limestone cave, CL 2046, 9 Aug. 1985, J.T. & D.A. Polhemus;

5 males, 4 females, 1 macropterous female, Sameran River, 2 km. W. of Tubeh, CL 2047, 9 Aug. 1985, J.T. & D.A. Polhemus; 1 female, Tapah River, 16 km. NW of Bau, CL 2052, 10 Aug. 1985, J.T. & D.A. Polhemus. WEST MALAYSIA, **Johor**: 1 male, swamp forest stream, 15 km W of Sedili Besar, 20 m, CL 2218, 16 Oct. 1986, J.T. & D.A. Polhemus; 2 males, 27 km S. of Mersing, slow shaded stream, CL 2058, 14 Aug. 1985, J.T. & D.A. Polhemus; 1 female, Sungai Sedili Ulu, 3 April 1965, P.W.; 1 male, 16.5 mi. W. of Mersing on Kluang Rd., 4 Aug. 1963; 1 male, Sungai Mupah, Mawai Rd., 16 April 1963. **Perak**: 2 males, 2 females, Kerunai River, 9 km. N. of Grik at bridge, CL 2078, 19 Aug. 1985, J.T. & D.A. Polhemus (all JTPC). **Selangor**: 1 male, 1 female, Sungai Sleh, old waterworks, Ulu Klang, F. 63/30, 2 April 1963, J.I. Furtado; 1 female, Subang, Sungai Pelumut, 14 March 1964 (all USNM).

Hydrometra greeni Kirkaldy

Figs. 26–30, 94

Hydrometra greeni Kirkaldy, 1898. Entomol. 21: 2. Type, female, Pundaloya, Sri Lanka (USNM).

Description

MACROPTEROUS MALE. Length 10.44–11.57, width 0.51.

Color (specimens from Thailand, Chiang Mai Prov.): Ground color blackish brown, most of body pruinose (in oblique light), dorsally mostly brown tinged with black; abdominal tergites black-brown, shining, faintly rastrate except VII–VIII mat and clothed with fine pubescence. Head mostly blackish brown, lighter dorsally, brown postero-dorsally, with faint median longitudinal pruinose stripe dorsally behind eyes. Thorax dorsally with narrow median longitudinal pruinose stripe, broader on posterior lobe, pronotum laterally with an arched pruinose longitudinal stripe; brighter pruinose spots on lateral sternites at sutures. Thoracic dorsum, pleura tinged with brown. Hemelytra reaching basal third of tergite VI, brown; basal white stripe mesad of R + M weaker distally; median stripe sordid white, broken into five or six short to moderate length widely interrupted longitudinal streaks. Legs orange brown to brown, legs darker distally; coxae, trochanters mostly luteous to light brown, similar to bases of femora. Antennal segment I piceous, light basally; II brown, dark distally; III–IV brown to piceous, IV light distally.

Structure. Head long (3.33), widest at antennal tubercles (0.41); almost bare, anteroventrally and beneath eyes with a few short erect setae; maxillary plate of moderate size, not expanded, gular lobe of moderate size, rounded ventrally, covering base of rostrum (Fig. 26); rostrum reaching well caudad of eyes, halfway to pronotal margin; ratio anteocular/postocular portions: 2.20/0.92; interocular space/width of an eye: 0.13/0.17; anteclypeus conical, triangular, sharply angled anteriorly (Fig. 27). Antennal formula I:II:III:IV; 0.51: 1.33: 2.66: 1.43. Prothorax with a row of encircling pits on anterior lobe setting off collar, plus a few weak pits laterally, posterior lobe with numerous pits plus a row on midline, all appearing pruinose. Pronotum length 1.74; remainder of thorax 1.74; abdomen length 4.71. Abdominal sternites set with scattered short recumbent setae, plus a few longer setae on basal segments; pilose on caudal third of tergite V, all of VI–VII, setae long, slender, erect. Distance between anterior and middle coxae (measured between closest margins) 0.87; between middle and hind coxae 1.53. Anterior, middle acetabulae with two to four pits each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.28: 3.69: 0.10: 0.36: 0.20; of middle leg, 3.74: 4.25: 0.10: 0.61: 0.26; of hind leg, 4.51: 5.43: 0.10: 0.56: 0.26.

Abdominal terminalia as shown in figures 28 and 29. Male sternite VII transversely depressed medially, set with long setae laterally, much shorter medially, otherwise unmodified. Eighth sternite set with scattered short setae, unmodified, distal process prominent. Ninth segment with small lateral wings.

MACROPTEROUS FEMALE. Length 11.67–12.29, width 0.56. Similar in most respects to male, except connexiva lighter in color. Abdominal terminalia as shown in figure 30. Tergite VII raised posteriorly, set with short dark setae; tergite VIII short, distal process long, angled somewhat ventrally. Hemelytra reaching base of tergite VI; sordid white basally between veins, light markings

effaced elsewhere, consisting of scattered longitudinal streaks.

BRACHYPTEROUS MALE (Ceylon). Length 10.55, width 0.46. Similar to macropterous male in general structure and coloration.

BRACHYPTEROUS FEMALE (Ceylon). Length 11.67, width 0.51.Similar to macropterous female in general structure and coloration. Wing straps reaching onto tergite II, brown, with white stripe on mesal margin.

Diagnosis. This moderate sized, light brown species is widespread across southern Asia, and appears most closely related to *H. kelantan* n. sp., a species known only from peninsular Malaysia. Both species possess numerous long erect setae along the ventrolateral margins of male abdominal segments VI and VII, but *greeni* differs from *kelantan* in having a lighter coloration, a shorter and broader body, and shorter appendages. In other respects these two species are very similar.

Gunawardane and Kaunaratne (1965) discussed and illustrated the morphological variablility in the male abdominal terminalia of *greeni* from Ceylon, and we have also seen considerable variability in our series from Ceylon, India and Thailand. We have been unable to reconcile this variability with the status of a closely related species, *H. maindroni* Hungerford and Evans from the southern Arabian Peninsula, and the two may well be synonymous. Material is needed from Pakistan, southern Iran and the Arabian Peninsula to settle this question.

Ecological notes. Hydrometra greeni occurs across a broader elevational range than most other Asian *Hydrometra* species, being found from near sea level to over 1000 meters. Gunawardane and Kaunaratne (1965), for instance, noted that on Ceylon they had taken this species from sea level to 6000 feet. The habitats it occupies are also diverse, including ponds, swampy areas, and rocky upland streams.

Distribution. Sumatra, Bangladesh, India, Nepal, Ceylon, China, Thailand, Vietnam, Nias Is. (nr. Sumatra) (Fig. 94).

Material examined (all macropterous). BANGLADESH [as EAST PAKISTAN]: 2 females, Lawa Chera Forest, Srimangai, 110 m, 27 Nov. 1961, E.S. Ross, D.Q. Cavagnaro (JTPC). INDIA: 1 female, 1 nymph, South India, Coimbatore, 6 Feb. 1950, P.S. Nathan; 1 male, South India, Anamali Hills, Cinchona, 3500 ft (~1200 m), 1959, P.S. Nathan (JTPC). NEPAL: 2 males, 1 female, Bhairawa, 3 Dec. 1953, G.T. Brooks (JTPC). SRI LANKA: 1 male, 3 females, Ratnapura, 7 Nov. 1966, K.L.A. Perera; 2 males, 1 female, Dambuwa Est., 17 June 1965, K.L.A. Perera; 8 males, 7 females, Veinna, 4 Oct. 1964, K.L.A. Perera; 1 male, Hinguragoda, 10 Feb. 1964, K.L.A. Perera (JTPC). VIETNAM: 1 male, 2 females, 20 km. N. of Pleiku, 650 m., 9 May 1960, L.W. Quate (BPBM). THAILAND, **Chiang Mai Prov.**: 2 females, Mt. Doi Sutep, stream, 26 March 1952, M.E. Griffith; 3 males, 2 females, Huay Yang Creek, nr. Ban Yang, CL 2199, 16 Nov. 1985, J.T. & D.A. Polhemus; 7 males, 6 females, pond at Fang Horticultural Res. Sta., CL 2201, 15 Nov. 1985, J.T. & D.A. Polhemus; 11 males, 12 females, Nam Chai River, above hydro. station intake, Fang Horticultural Res. Sta., CL 2197, 15 Nov. 1985, J.T. & D.A. Polhemus; 11 males, 13 females, Huay Hia Creek, Fang Horticultural Res. Sta., CL 2198, 15 Nov. 1985, J.T. & D.A. Polhemus; 3 males, 5 females, trib. to Nam Chai River, Fang Horticultural Res. Sta., CL 2202, 500 m., 15 Nov. 1985, J.T. & D.A. Polhemus; 5 males, 7 females, Mae Sa Waterfall, 7 km. W. of Mae Rim, CL 2203, 18 Nov. 1985, J.T. & D.A. Polhemus; 20 males, 16 females, 10 km. NW of Mae Rim, CL 2204, 18 Nov. 1985, J.T. & D.A. Polhemus (all above JTPC); 4 males, 3 females, Chiangdao, 450 m., 5–11 April 1958, in standing stagnant water, T.C. Maa (BPBM). **Prov. uncertain**: 2 females, km. 124.5 on Bangkok–Prabuddhaht Rd., Botanic Garden, stream, 23 Feb. 1967, J.I.F. (USNM). WEST MALAYSIA, **Pahang**: 1 male, Kuala Terenggan, 220 m., 15 Dec. 1958, J.L. Gressitt (BPBM).

Hydrometra jaczewskii Lundblad Figs. 57–61, 95

Hydrometra jaczewskii Lundblad, 1933. Arch. Hydrobiol. Suppl. Bd. 12, Trop. Binnengewass. 4: 433. Holotype, male, Ranau [Lake Ranau], Sumatra (Swedish Natural History Museum).

Description

BRACHYPTEROUS MALE. Length 9.01–9.22, width 0.51.

Color. Ground color orange brown, abdominal tergites orange brown tinged with blackish, mat, VII–VIII clothed with fine pubescence. Head tinged with black dorsally between and anterad of eyes, laterally, ventrally black and lightly pruinose. Pronotum laterally with a faint arched pruinose longitudinal stripe, remainder of thorax and abdomen faintly pruinose in oblique light; entire venter solid black, more strongly pruinose. Legs brown to piceous, darker distally; antennae piceous on basal segments, III brown, IV yellow brown; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head long (2.76), widest at antennal tubercles (0.38); set with very short inconspicuous recumbent setae, with a few longer curved setae beneath anterior extreme; maxillary plate prominent, leucine, expanded anterodorsally, exceeding anteclypeus (Fig. 57); gular lobe large, truncate ventrally, covering base of rostrum; rostrum reaching well caudad of eyes, about 1/2 toward prosternum; ratio anteocular/postocular portions: 1.59/0.87; interocular space/width of an eye: 0.08/0.15; anteclypeus small, short, broadly triangular, set with small sharp tubercle at apex (Fig. 58). Antennal formula I:II:III:IV; 0.61: 0.87: 2.25: 1.59. Prothorax with a row of encircling small pits on anterior lobe setting off collar, posterior lobe with scattered shallow pits, including ragged row of deep pits on midline. Pronotum length 1.28; remainder of thorax 1.33; abdomen length 3.89. Abdominal, thoracic sternites set with scattered short semi-erect setae, plus longer erect setae increasing in length posteriorly, longest, most numerous on tergites VII–VIII; sutures between abdomonal sternites deeply impressed. Distance between anterior and middle coxae (measured between closest margins) 0.41; between middle and hind coxae 1.13. Anterior acetabulae with one to three pits on anterior part, four to five on and posterior part; middle acetabulae with three to five pits each on anterior and posterior parts; posterior acetabula with six to nine pits on anterior part. Entire body set with minute black denticles, dense on most parts, scattered on posterior pronotal lobe.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 2.97: 3.38: 0.10: 0.20: 0.20; of middle leg, 3.43: 3.64: 0.10: 0.46: 0.26; of hind leg, 4.35: 4.71: 0.10: 0.38: 0.26.

Abdominal terminalia as shown in figures 59 and 60. Male sternite VII with two (1+1) small black widely separated posteriorly directed processes along anterior margin, each set on a large moderately raised tumescence, each composed of tightly clustered dark stiff setae forming a small brush; weakly transversely depressed on middle. Male sternite VIII flattened medially, otherwise unmodified; distal process long slightly curved.

BRACHYPTEROUS FEMALE. Length 9.22–9.63, width 0.61. Similar in most respects to male, but slightly larger and broader across abdomen; color lighter, more uniform light to orange brown dorsally, tinged with black between eyes. Abdominal terminalia as shown in figure 61; abdomen curved upward caudally; set with stiff upright setae along connexival margin on distal part of tergite VI; distal process of tergite VIII prominent, straight; ventrally set with short to moderate length erect setae; first gonocoxae each with a tuft of stiff dark setae on lateral margin.

MICROPTEROUS and MACROPTEROUS FORMS. Unknown.

Diagnosis. Within the Southeast Asian fauna, *H. jaczewskii* forms a monotypic group not closely related to any other in the region. It is similar in many respects to *H. cyprina* Bueno from Mexico, having a short, button-like anteclypeus, a relatively short head, a female body that is relatively stout and upcurved distally, and male abdominal processes of similar shape and location. *H. jaczewskii* is also similar to *H. mindoroensis* and *H. lombok*, sharing with them same general size and body shape, the placement of the male anterior processes, and the morphology of the female abdominal terminalia, including the

presence of upright setae on abdominal segment VI, but there are significant differences in body shape, anteclypeal morphology, and the morphology of male abdominal segments VII and VIII.

Lundblad (1933) described this species from Java and Sumatra. The single female seen from Myanmar has lighter colored legs and lacks distinct tufts of dark setae on the first gonocoxae, but otherwise seems to be this species as it agrees in all remaining characters.

Ecological notes. Hydrometra jaczewskii appears to be a species of upland habitats. In northern Sumatra individuals were found along the margins of pools in rocky upland streams in areas of pine forest and disturbed montane rain forest.

Distribution. Java, Sumatra, Burma (Fig. 95).

Material examined (all brachypterous). INDONESIA, *SUMATRA*, **Sumatera Utara Prov.**: 2 males, 1 female, river 18 km E. of Prapat, 1000 m, CL 2189, 8 Nov. 1985, J.T. & D.A. Polhemus; 4 males, 4 females, small stream 3 km. E. of Parlilitan, 900 m, CL 2191, 10 Nov. 1985, J.T. & D.A. Polhemus; 1 male, 4 females, river 14 km. NE of Prapat, 1000 m, CL 2196, 12 Nov. 1985, J.T. & D.A. Polhemus (all above JTPC). MYANMAR [as BURMA]: 1 female, Tinghawk, 5 May 1944, L.C. Kuitert (SEMC).

Hydrometra julieni Hungerford & Evans — Figs. 35–38, 96

Hydrometra julieni Hungerford, H. B. & N. E. Evans, 1934. Annls. Mus. Natn. Hung. 28: 55. Holotype, male, Cochinchine [Vietnam] (National Natural History Museum, Paris).

Description

BRACHYPTEROUS MALE. Length 12.03–12.29, width 0.56.

Color. Ground color brown, tinged with blackish; abdominal tergites dark orange brown, shining, faintly transversely striate except VII–VIII mat and clothed with fine pubescence. Head dark ventrally, lightly pruinose ventrally as is entire body, with weak pruinose longitudinal stripe behind eyes. Thorax dorsally with median longitudinal pruinose stripe, narrower on anterior lobe, pronounced and broad on posterior lobe; laterally and ventrally mostly pruinose, more pronounced on propleura, weakly continuing on abdomen onto segment VIII, visible in oblique light; much brighter large pruinose spots on basal 1/4 of each connexival segment and adjacent lateral sternites. Head dorsally, large longitudinal areas laterally on pronotum, pleura tinged with orange brown. Wing pads brown, reaching base of tergite III, mostly deeply wrinkled except blackish veins. Legs brown to piceous; anterior, middle femora blaxkish brown, posterior lfemora lighter, all with subdistal light annulus and piceous distally, all tibia narrowly piceous basally; coxae, trochanters mostly luteous, tinged with fuscous. Antennae piceous on basal two segments, distal segments blackish brown, tips of IV light.

Structure. Head long (3.48), widest at antennal tubercles (0.41); set with many bristly decumbent setae ventro-basally and beneath eyes, sparser elsewhere on head; maxillary plate large, extending anteriorly well beyond anteclypeus, covering about half of gular lobe; gular lobe small, rounded; rostrum reaching caudad of eyes, about 2/3 toward pronotum; ratio anteocular/postocular portions: 2.20/1.02; interocular space/width of an eye: 0.10/0.15; anteclypeus broad, rugulose, almost parallel sided, truncate, anterior margin straight but deeply depressed medially (Fig. 35). Antennal formula I:II:III:IV; 0.72: 1.43: 4.20: 2.00. Prothorax with a distinct row of encircling pits on anterior lobe setting off collar, posterior lobe with a few faint shallow pits, more numerous posteriorly. Pronotum length 1.69; remainder of thorax 1.74; abdomen length 5.02. All abdominal sternites sparsely set with short appressed golden setae; tergite VII dorsally with a posteriorly directed fringe of stiff golden setae extending over base of tergite VIII. Distance between anterior and middle coxae (measured

between closest margins) 0.72; between middle and hind coxae 1.54. Anterior and middle acetabulae with two or three weak pits each on anterior and posterior parts; posterior acetabula with one pit dorsally. Entire venter, head except basally, anterior lobe of pronotum, connexiva (very sparse) set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.74: 4.20: 0.10: 0.36: 0.26; of middle leg, 4.20: 4.25: 0.10: 0.56: 0.26; of hind leg, 5.12: 5.38: 0.10: 0.46: 0.26.

Male abdominal terminalia as shown in figures 37–38. Male sternite VII weakly transversely depressed on middle, set with 2 (1+1) tufts of dark ventrally directed setae on either side far removed from midline near posterior margin, each tuft about 1/3 as long as sternite; sternite VIII slightly depressed on either side of the ventral midline medially, posterolaterally with a small inconspicuous patch of very short appressed golden setae visible in oblique light, plus a single long erect slender antero-laterally directed setae; segment IX without lateral angles.

MACROPTEROUS MALE: See Hungerford and Evans (1934: 55).

MICROPTEROUS FORMS and FEMALES. Unknown.

Diagnosis. One of us (JTP) has studied the type of *H. julieni* in the Paris Museum. It does not resemble any other species except *H. julienoidea* n.sp., with which it forms a distinctive subgroup characterized by the possession of a broad, apically truncate anteclypeus (Figs. 32, 35). The two species may be separated by the structure and setiferation of the male terminal abdominal segments (compare Figs. 33, 34, 37, 38, and see comparative notes under *H. julienoidea*), and by geographic provenence, with *julieni* occurring on Borneo, the Philippines and mainland Southeast Asia, while *julienoidea* is confined to the Lesser Sunda Islands.

Ecological notes. *Hydrometra julieni* is a lowland species found on ponds and slow streams, and is quite uncommon in collections. The male specimen from Pahang, Malaysia was taken in deep shade under vegetation and logs bordering a shallow roadside pond.

Distribution. Borneo (East Kalimantan), Philippines (Mindoro), Malay Peninsula, Vietnam (Fig. 96).

Material examined. INDONESIA, *BORNEO*, **Kalimantan Timur Prov.**: 1 brachypterous male, 1 macropterous male, waterfall 4 km. S. of Kota Bangun, CL 2095, 29 Aug. 1985, J.T. & D.A. Polhemus (JTPC). PHILIPPINES, *MINDORO*, **Mindoro Oriental Prov.**: 1 brachypterous male, 10 km. W. of Calapan, CL 1976, 13 July 1985, J.T. & D.A. Polhemus (JTPC). VIETNAM: 1 male [holotype], Cochinchine (MNHN). WEST MALAYSIA, **Pahang**: 1 male, pond 54 km. SW of Kuantan, CL 2085, 22 Aug. 1985, J.T. & D.A. Polhemus (JTPC).

Hydrometra julienoidea Polhemus & Polhemus, **new species** Figs. 31–34, 44, 97

Description

MACROPTEROUS MALE. Length 12.18–12.29, width 0.68.

Color. Ground color blackish brown; abdominal tergites blackish brown, shining, faintly transversely striate except VII–VIII mat and clothed with fine pubescence. Head black ventrally, lightly pruinose ventrally as is entire body. Thorax dorsally with median longitudinal pruinose stripe, narrow and weak on anterior lobe, pronounced and broad on posterior lobe; laterally and ventrally mostly pruinose, weakly continuing on abdomen onto segment VIII, visible in oblique light; much brighter large pruinose spots on basal 1/4 of each connexival segment and adjacent lateral sternites. Head antero-ventrally, dorsally, large longitudinal areas laterally on pronotum, pleura tinged with orange brown. Hemelytra long, reaching middle of tergite VI, brown, set with 5 pairs of white elon-

gate streaks of equal length except short distal pair, each separated by about the length of a streak. Legs, antennae orange brown, piceous distally, all tibia narrowly piceous basally; coxae, trochanters mostly luteous, tinged with fuscous.

Structure. Head long (3.48), widest at antennal tubercles (0.46); set with many bristly decumbent setae behind eyes ventrally, sparser elsewhere on head; setae more numerous, longer, straighter, antero-ventrally; maxillary plate large, extending anteriorly well beyond anteclypeus (Fig. 31); gular lobe of moderate size, rounded; rostrum reaching caudad of eyes, about 2/3 toward pronotum; ratio anteocular/postocular portions: 2.25/0.92; interocular space/width of an eye: 0.15/0.18; anteclypeus broad, almost parallel sided, truncate, anterior margin straight but slightly depressed medially (Fig. 32). Antennal formula I:II:III:IV; 0.77: 1.48: 4.40: 1.84. Prothorax with a distinct row of encircling pits on anterior lobe setting off collar, posterior lobe with numerous large shallow pits including on midline. Pronotum length 1.89; remainder of thorax 1.84; abdomen length 4.92. All abdominal sternites sparsely set with short erect setae; tergite VII dorsally with a posteriorly directed fringe of stiff golden setae extending over base of tergite VIII. Distance between anterior and middle coxae (measured between closest margins) 0.82; between middle and hind coxae 1.09. Anterior and middle acetabulae with two weak pits each on anterior and posterior parts; posterior acetabula with one pit dorsally. Entire venter, head except basally, anterior lobe of pronotum, connexiva set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.99: 4.40: 0.10: 0.41: 0.26; of middle leg, 4.76: 4.86: 0.10: 0.77: 0.31; of hind leg, 5.22: 5.89: 0.10: 0.61: 0.26.

Male abdominal terminalia as shown in figures 33–34. Seventh male sternite weakly transversely depressed on middle, set with 2 (1+1) tufts of dark ventrally directed setae on either side far removed from midline near posterior margin; sternite VIII slightly depressed on either side of the ventral midline medially, posterolaterally with a patch of short appressed golden setae visible in oblique light, plus a single long erect slender laterally directed setae; segment IX without lateral angles.

BRACHYPTEROUS FEMALE. Length 12.60, width 0.67. Similar to male in general structure and coloration, but more robust, with abdomen broader and curved upward distally. Abdominal terminalia as shown in Fig. 44.

APTEROUS FORM. Unknown.

Etymology. The species name alludes to the close resemblence to *H. julieni* Hungerford & Evans from Vietnam and Malaya.

Diagnosis. This moderate sized, brownish species has a truncate anteclypeus of the same shape as seen in *H. julieni* (compare Figs. 32, 35), but the male abdominal terminalia of the two species are different. In *H. julienoidea* a brush of stiff setae is present on the posterior margin of tergite VIII, the apical process on tergite VIII is shorter; and the brush of setae on sternite VII is smaller, being about 1/6 the length of the segment, or about one half as long as seen in *julieni* (compare Figs. 33, 37, and see Hungerford & Evans 1934, plate III). *H. julienoidea* is also darker in coloration that *H. julieni*, and is apparently confined to the Lesser Sunda Islands, while *julieni* occurs in Vietnam, Malaysia, Borneo, and Mindoro.

Ecological notes. On Sumba *H. julienoidea* was found along the margins of large spring pools in limestone areas, usually in sheltered spots under overhanging vegetation, or near small seeps.

Distribution. Sumba, Sumbawa (Fig. 97).

Material examined. Holotype, brachypterous male: INDONESIA, *SUMBA*, **Nusa Tenggara Timur Prov.**: Omang Spring and outflow stream nr. Makamenggit, CL 2600, 14 Sept. 1991, 460 m, J.T. & D.A. Polhemus (USNM). *Paratypes*: INDONESIA, *SUMBA*, **Nusa Tenggara Timur Prov.**:

1 brachypterous male, Kambahapang Riv., 59 km. SW of Waingapu, CL 2599, 14 Sept. 1991, 530 m, J.T. & D.A. Polhemus; 13 brachypterous males, 1 micropterous male, 1 brachypterous female, same data as holotype. *SUMBAWA*, **Nusa Tenggara Barat Prov.**: 3 macropterous males, Bela River, 28 km. SW of Bima, CL 2712, 19 Oct. 1985, 100 m, J.T. & D.A. Polhemus (all JTPC).

Hydrometra kelantan Polhemus & Polhemus, **new species** Figs. 39–40, 46, 105

Description

BRACHYPTEROUS MALE. Length 11.72, width 0.38.

Color. Ground color blackish brown, most of body faintly pruinose (in oblique light), dorsally mostly brown tinged with black; abdominal tergites black-brown, shining, faintly rastrate except VII–VIII mat and clothed with fine pubescence. Head mostly blackish, brown anteriorly and posterodorsally, with yellowish median longitudinal stripe dorsally behind eyes. Thorax dorsally with narrow median longitudinal pruinose stripe, pronotum laterally with an arched pruinose longitudinal stripe; brighter pruinose spots on base of each connexival segment and larger spots on adjacent lateral sternites. Thoracic dorsum, pleura tinged with brown. Legs, antennae orange brown to brown, legs darker distally; coxae, trochanters mostly luteous to light brown, similar to bases of femora.

Structure. Head long (3.48), widest at antennal tubercles (0.41); almost bare, anteroventrally with a few erect setae; maxillary plate of moderate size, not expanded (Fig. 39); gular lobe of moderate size, rounded ventrally, covering base of rostrum; rostrum reaching well caudad of eyes, halfway to pronotal margin; ratio anteocular/postocular portions: 2.30/0.90; interocular space/width of an eye: 0.10/0.15; anteclypeus conical, triangular, sharply angled anteriorly (Fig. 40). Antennal formula I:II:III:IV; 0.56: 1.38: 3.07: 1.38. Prothorax with a row of encircling pits on anterior lobe setting off collar, plus a few weak pits laterally, posterior lobe with numerous pits plus a row on midline, all appearing pruinose. Pronotum length 1.13; remainder of thorax 1.74; abdomen length 4.92. Abdominal sternites set with scattered short erect setae; pilose on caudal third of tergite V, all of VI–VII, setae long, slender, erect. Distance between anterior and middle coxae (measured between closest margins) 0.77; between middle and hind coxae 1.54. Anterior, middle acetabulae with two pits (rarely three) each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.53: 3.79: 0.10: 0.41: 0.20; of middle leg, 4.15: 4.45: 0.10: 0.69: 0.26; of hind leg, 4.93: 5.89: 0.10: 0.51: 0.31.

Abdominal terminalia as shown in figures 41 and 42. Male sternite VII transversely depressed medially, set with long setae laterally, much shorter medially, otherwise unmodified. Sternite VIII set with scattered short setae, unmodified, distal process prominent.

BRACHYPTEROUS FEMALE. Length 12.85, width 0.56. Similar in most respects to male, except connexiva lighter in color. Abdominal terminalia as shown in figure 46; tergite VII raised posteriorly, set with short dark setae; tergite VIII short, distal process long, angled somewhat ventrally.

MACROPTEROUS FEMALE. Length 12.34, width 0.61. Similar to brachypterous female. Hemelytra reaching base of tergite VI; sordid white basally between veins, light markings effaced elsewhere, consisting of scattered longitudinal streaks.

Etymology. The species name, a noun in apposition, alludes to the type locality, Kelantan, Malaya.

Diagnosis. Hydrometra kelantan n.sp. is a moderate sized, dark brownish species that appears most closely related to *H. greeni* Kirkaldy, a widespread taxon occurring from Ceylon to Sumatra. It differs from the latter in having darker coloration, longer appendages, and a longer and narrower body (particularly the abdomen; see key), giving the males in particular a rather delicate appearance. In most other respects these two species are very similar.

Ecological notes. The type series was taken from a rocky stream in low hills covered with disturbed lowland rain forest. Most individuals were found in dark pockets amid streamside boulders.

Distribution. Malay Peninsula (Fig. 105).

Material examined. Holotype, brachypterous male: WEST MALAYSIA, **Kelantan**: waterfall 10 km. NW of Pasir Puteh, CL 2084, 21 Aug. 1985, J.T. & D.A. Polhemus (JTPC). *Paratypes*: WEST MALAYSIA, **Kelantan**: 1 brachypterous female, 1 macropterous female, same data as holotype (JTPC); 1 brachypterous male, Sungai Rok , trib. [to] S.[ungai] Kelantan, Ulu Kelantan, paddy along road, 12 July 1972, LKS (USNM).

Hydrometra lineata Eschscholtz Figs. 1, 68–72, 98

Hydrometra lineata Eschscholtz 1822. Entomographien, Berlin, Leif 1, p.110. (Type-locality, Philippines, Luzon, near Manila; repository unknown)

Hydrometra vittata Stål 1870. Öfv. Kongl. Vet.-Akad. Forh. 27: 705. (Type-locality, Philippines; Stockholm Museum). Syn by Lundblad 1933: 429.

Description

MACROPTEROUS MALE. Length 11.68–13.12, width 0.61.

Color. Ground color brown; abdominal tergite VI orange brown, faintly shining, faintly rastrate medially; VII–VIII mostly mat and clothed with fine pubescence; VII with basal median area faintly shining, pruinose laterally; VIII pruinose. Head tinged with blackish dorsally between and ahead of eyes, ventrally except basally and anteriorly, very lightly pruinose ventrally and on median longitudinal light stripe dorsally behind eyes. Thorax dorsally with prominent median longitudinal pruinose stripe, wider on posterior lobe, pronotum laterally with narrow arched pruinose longitudinal stripe; most of remainder of thorax and abdomen at least lightly pruinose except broad abdominal stripe along junction of medio- and laterotergites, visible in oblique light. Head ventrally beneath base and anterior margin, broad irregular longitudinal regions on either side of dorsal thoracic midline of posterior lobe, venter of thorax and abdomen, yellowish brown. Connexiva brown, inner margin pruinose, lighter medially; pruinosity more pronounced at segmental sutures on laterosternites. Legs, antennae yellowish brown to brown, darker distally; coxae, trochanters mostly light yellowish brown, similar to bases of femora.

Structure. Head long (3.33), widest at antennal tubercles (0.39); almost devoid of setae, with a few scattered very short decumbent setae, anteroventrally with a few bristly setae; maxillary plate of moderate size, covering base of gular lobe, not extending to tip of anteclypeus anteriorly (Fig. 68); gular lobe of moderate size, elongate; rostrum reaching well caudad of eyes, about halfway to prosternum; ratio anteocular/postocular portions: 2.11/0.89; interocular space/width of an eye: 0.11/0.14; anteclypeus broadly rounded to obtusely angled anteriorly (Fig. 69). Antennal formula I:II:III:IV; 0.61: 1.33: 2.94: 1.50. Prothorax with row of deep encircling pits on anterior lobe setting off collar, plus 6–8 along lateral margin, posterior lobe with numerous pits including on midline, each pit appearing pruinose in oblique light. Pronotum length 1.78; remainder of thorax 1.50; abdomen length 4.66. Hemelytra reaching middle of tergite VI; basal white stripe mesad of R + M evanescent beyond basal fourth; median stripe bright white, commencing near base, extending almost to apex, interrupted only by cross veins. Abdominal sternites sparsely set with short slender setae, more numerous on V–VII. Posterior femur without long setae. Distance between anterior and middle coxae (measured between closest margins) 0.83; between middle and hind coxae 1.50. Anterior, middle acetabulae with two or three pits each on anterior and posterior parts; posterior acetabula with one pit dorsally on anterior part. Entire venter set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.33: 3.55: 0.10: 0.33: 0.22; of middle leg, 3.94: 3.94: 0.10: 0.61: 0.33; of hind leg, 4.77: 5.38: 0.10: 0.50: 0.28.

Abdominal terminalia as shown in figures 70 and 71. Male sternite VII slightly depressed and bare medially, setose laterally, with many long setae, most dense near posterior margin. Eighth sternite unmodified, weakly raised medially, caudal process of moderate length, directed slightly dorsad, slightly curved. Segment nine with well developed lateral wings.

MACROPTEROUS FEMALE. Length 11.34–14.88, width 0.67. Most structures and coloration as in male. Hemelytra reaching middle to distal part of tergite V; bright white markings similar to male. Abdominal terminalia as shown in figure 72. Caudal process of tergite VIII prominent, slightly curved. Connexiva of tergite VII posteriorly directed inward, usually set with short dark setae.

BRACHYPTEROUS FORM. Hemelytra reaching onto tergite II, each with a narrow white stripe on inner margin which together form a continuation of the light prontal pruinose stripe. Pronotum narrower posteriorly than in macropter, usually with fewer pits.

MICROPTEROUS FORM. Unknown.

Diagnosis. Hydrometra lineata is a moderate sized, yellowish brown species that is widespread throughout the Philippines, and ranges westward to the Moluccas, Celebes, and northern Borneo. It is similar in many respects to *Hydrometra orientalis*, and the distributions of the two species overlap, but they may be separated by the characters given in the key. Two useful spot characters that will quickly distinguish these species are the posteriorly convergent connexiva seen in *lineata* females (Fig. 72), and the continuous pruinose stripe on the dorsum of the connexiva in *lineata*, which is lacking in *orientalis*.

Ecological notes. Hydrometra lineata occurs on both streams and ponds throughout a wide elevational range, and does not seem to have any distinct habitat preferences.

Distribution. China, Borneo (Sabah), Ambon, Celebes, New Guinea (Irian Jaya, Papua New Guinea), Philippines (Leyte, Luzon, Mindanao, Palawan) (Fig. 98).

Material examined (all brachypterous, unless noted). EAST MALAYSIA, *BORNEO*, **Sabah**: 2 macropterous males, Bukit Luaki, Kota Belud, buffalo wallow, 10 March 1965, V.F. Wong; 1 macropterous female, 10 mls. Telupid-Ranan Rd., marsh, 4 April 1974, collector unknown (all above USNM); 1 male, 6 females, Forest Camp, 19 km. N. of Kalabakan, 19 Nov. 1962, Y. Hirashima; 1 female, Liawan, 14–19 Jan. 1959, T.C. Maa (all above BPBM). INDONESIA, *AMBON*, **Maluku Prov.**: 4 macropterous males, 4 macropterous females, Amaori River, NW of Ambon, CL 2150, 2 Oct. 1985, J.T. & D.A. Polhemus; 4 macropterous males, 3 macropterous females, Wairea River, 50 m, CL 2150, 4 Oct. 1985, J.T. & D.A. Polhemus. *CELEBES*, **Sulawesi Utara Prov.**: 1 male, rice paddies nr. Lolak, 0° 54'N, 124° 00'E, CL 2104, 6 Sept. 1985, J.T. & D.A. Polhemus; 2 macropterous males, 1 macropterous female, stream 4 km. S. of Inobonto, CL 2106, 6 Sept. 1985, J.T. & D.A. Polhemus; 2 males, 1 female, spring and pools, E. end of Lake Mala, 1050 m, CL 2115, 10 Sept. 1985, J.T. & D.A. Polhemus; 1 male, 1 macropterous female, ponds at Project Wallace Base Camp, Toraut, CL 2119, 12 Sept. 1985, J.T. & D.A. Polhemus (all JTPC). PHILIPPINES, *BOHOL*, **Bohol Prov.**: 1 male, Bohol, 23 March 1957, Y. Kondo (BPBM). *BUSUANGA*, **Palawan Prov.**: 1 male, 4 km. N. of San Nicolas, 20–21 May 1962, H. Holtmann (BPBM). *LEYTE*, **Leyte Prov.**: 2 macropterous males, 2 macropterous females, Lusig River at Hilusig, CL 1979, 15 July 1985, J.T. & D.A. Polhemus; 1 male, 1 female, pond 23 km. SE of Baybay, CL 1981, 16 July 1985, J.T. & D.A. Polhemus; 1 macropterous male, 1 female, coastal stream S of Ormoc, CL 1987, 17 Aug. 1985, J.T. & D.A. Polhemus. *LUZON*, **Pangasinan Prov.**: 3 males, 1 female, Pangasinan River, 1 km. W. of Sual, CL 1956, 6 July 1985, J.T. & D.A. Polhemus ; 1 macropterous female, 6 km. W. of Sual, CL 1955, 6 July 1985, J.T. & D.A. Polhemus. *MINDANAO*, **South Cotabato Prov.**: 1 male, 1 macropterous female, Seven Falls, below Lake Sebu, CL 1992, 19 July 1985, J.T. & D.A. Polhemus. **Zamboanga del Sur Prov.**: 1 macropterous male, Bituti River, 7 km. NW of Zamboanga City, 100 m, CL 1998, 22 July 1985, J.T. & D.A. Polhemus; 4 macropterous males, 3 macropterous females, 2 females, Milwau Creek at Patalon, 27 km. NW of Zamboanga City, CL 2000, 23 July 1985, J.T. &

D.A. Polhemus; 1 macropterous male, Migasa River at Sinonok, NW of Zamboanga City, CL 2001, 23 July 1985, J.T. & D.A. Polhemus. **Zamboanga del Norte Prov.**: 1 female, 8 km. S. of Manucan, 420 m., 12 Oct. 1959, L.W. Quate (BPBM). **Misamis Occidental Prov.**: 1 male, 2 females, Ozamis City, 22 Oct. 1959, C.M. Yoshimoto (BPBM). *NEGROS*, **Negros Oriental Prov.**: 1 male, 1 female, Dumaguete, 16 March 1957, Y. Kondo (BPBM). *PALAWAN*, **Palawan Prov.**: 1 macropterous male, Togadang River, 27 km NW of Puerto Princesa, CL 2016, 28 July 1985, J.T. & D.A. Polhemus (all above in JTPC unless otherwise noted).

Hydrometra lombok Polhemus & Polhemus, **new species** Figs. 47–51, 99

Description

MICROPTEROUS MALE. Length 8.47–9.81, width 0.34 (versus 0.48 in macropterous form).

Color. Ground color brown, dorsally mostly brown to orange brown; abdominal tergites orange brown, shining except VII–VIII mat, clothed with fine pubescence, all but median part pruinose. Head tinged with black dorsally, laterally, entirely lightly pruinose, more noticeable on median longitudinal stripe dorsally behind eyes. Pronotum dorsally with median longitudinal pruinose stripe, on posterior lobe broader, bordered with brown on each side; laterally with an arched pruinose longitudinal stripe, weakly continuing linearly along remainder of thorax and abdomen onto segment VIII, visible in oblique light; entire venter more lightly pruinose, separated from pruinose stripe described above by dark stripe which, in completely different oblique light (by 90°), is also pruinose. Connexiva except narrow margins, brown, basal third of each segment and adjacent spot on each laterosternite heavily pruinose. Legs, antennae light brown to brown, darker distally; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head long (2.66), widest at antennal tubercles (0.36); set with very short inconspicuous recumbent setae, longest beneath anterior extreme; maxillary plate not prominent (Fig. 47); gular lobe large, truncate ventrally, covering base of rostrum; rostrum reaching well caudad of eyes, about 3/4 toward prosternum; ratio anteocular/postocular portions: 1.64/0.77; interocular space/width of an eye: 0.08/0.15; anteclypeus small, tapering anteriorly, lateral margins straight, conical anteriorly (Fig. 48). Antennal formula I:II:III:IV; 0.36: 0.92: 2.87: 1.64. Prothorax with a row of encircling small pits on anterior lobe setting off collar, posterior lobe with scattered shallow pits, without row of deep pits on midline. Pronotum length 1.23; remainder of thorax 1.33; abdomen length 3.74. Abdominal sternites set with scattered short semi-erect setae, plus a few long erect setae increasing in length posteriorly, longest, most numerous on tergite VI. Distance between anterior and middle coxae (measured between closest margins) 0.56; between middle and hind coxae 1.18. Anterior, middle acetabulae with one or two pits each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally. Entire venter, head except base, anterior lobe of pronotum set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 2.82: 3.23: 0.10: 0.20: 0.20; of middle leg, 3.17: 3.58: 0.10: 0.36: 0.20; of hind leg, 3.69: 4.92: 0.10: 0.23: 0.18.

Abdominal terminalia as shown in figures 49 and 50. Male sternite VII with two (1+1) small black widely separated posteriorly directed processes along anterior margin, each set on a weak tumescence, each composed of tightly clustered dark stiff setae, similar to *mindoroensis*; also set with two (1+1) patches of short dark stiff setae near posterior margin, less widely spaced than the previous structures, very similar to *mindoroensis* but slightly closer together. Eighth male sternite broadly laterally compressed basally, forming a weak excavation on each side, ventral margin almost straight.

MICROPTEROUS FEMALE. Length 10.20–10.77, width 0.38 (versus 0.58 in macropterous form). Similar in most respects to male, but slightly larger and broader across abdomen; color lighter, more uniform light to orange brown dorsally. Abdominal terminalia as shown in figure 51; abdomen curved upward caudally; set with stiff upright setae along connexival margin on distal part of tergite VI, basal part of VII; distal process of tergite VIII prominent, straight; ventrally set with short erect setae, longwer caudally, densest on stenites V–VII.

MACROPTEROUS FORM. Most characteristics as in micropterous form. Hemelytra brown, reaching middle of tergite VI; male with long basal light streak mesad of M + Cu, plus long medial white stripe reaching from near base almost to apex, interrupted only by dark cross veins; light markings effaced in female.

Etymology. The species name, a noun in apposition, alludes to the type locality, the island of Lombok.

Diagnosis. This small, dark brown species is more closely related to *H. mindoroensis* than to any other. The great similarity in the modifications of the male abdominal terminalia (see key and compare figures 49, 50, 75, 76), body markings, similarity of structure of the female abdominal terminalia (compare Figs. 45, 51), and many other resemblances strongly suggest a sister species relationship. The two taxa may be separated, however, by the characters given in the key. In addition, sternite VII in *lombok* is shorter than VIII on the ventral midline, whereas they are about equal in *mindoroensis*, thus the clumps of setae are closer together in *lombok*. Other slight differences between the two species include the distal two antennal segments, which are relatively longer in *lombok*, and generally darker the coloration of *lombok*. *H. risbeci* also belongs to the same group, but the male structures on sternite VII are smaller, although similar in form.

H. mindoroensis and *H. lombok* are so far not known to be sympatric, but their ranges are separated by only 300 km., with *mindoroensis* occurring in southwestern Sulawesi, and *lombok* on Flores and Sumbawa.

Ecological notes. Hydrometra lombok was found commonly along the margins of large springs and outflow creeks in the limestone uplands of Sumba and Timor. It was also taken from sheltered pools along swift rocky upland streams with basaltic beds on Sumbawa and Flores.

Distribution. Bali, Flores, Lombok, Sumba, Sumbawa, Timor (Fig. 99).

Material examined. Holotype, micropterous male: INDONESIA, *LOMBOK*, **Nusa Tenggara Barat Prov.**: springs at Suranadi, 22 km. NE of Mataram, CL 2177, 23 Oct. 1985, 350 m, J.T. & D.A. Polhemus (USNM). *Paratypes* (all micropterous unless noted; all collected by J.T. & D.A. Polhemus): INDONESIA, *BALI*, **Bali Prov.**: 1 male, Melangit River, E. of Bangli, 400 m, CL 2170, 17 Oct. 1985 (JTPC). *LOMBOK*, **Nusa Tenggara Barat Prov.**: 5 macropterous males, 1 female, 4 macropterous females, same data as holotype (JTPC). *SUMBAWA*, **Nusa Tenggara Barat Prov.**: 2 males, 2 macropterous males, 8 females, 1 macropterous female, Bela River, 28 km SW of Bima, 100 m, CL 2172, 19 Oct. 1985 (JTPC). *FLORES*, **Nusa Tenggara Timur Prov.**: 9 males, 6 macropterous males, 6 females, 9 macropterous females, Wae Garit River, 6 km. W. of Ruteng, CL 2179, 24 Oct. 1985 (JTPC). *SUMBA*, **Nusa Tenggara Timur Prov.**: 6 males, 4 females, 2 nymphs, springs and rocky stream 10 km. S. of Waingapu, 180 m, CL 2597, 13 Sept. 1991; 2 males, 1 female, Mataiyang spring and outflow stream at Lewa Paku, 500 m, CL 2598, 14 Sept. 1991; 1 female, Kambahapang River, 59 km. SW of Waingapu, 530 m, CL 2599, 14 Sept. 1991; 1 female, Omang spring and outflow stream, nr. Makemenggit, 460 m, CL 2600, 14 Sept. 1991 (all JTPC). *TIMOR*, **Nusa Tenggara Timur Prov.**: 9 males, spring and streams at Baumata, 17 km. E. of Kupang, 215 m, CL 2590, 10 Sept. 1991; 1 male, Lili River at Lili, nr. Camplong, 40 km. E. of Kupang, 60 m, CL 2592, 11 Sept. 1991; 2 males, 4 macropterous males, 5 females, 2 macropterous females, spring and stream at Oe Hala, 10 km. N. of Soe, 685 m, CL 2593, 11 Sept. 1991; 12 males, 9 macropterous males, 9 females, 14 macropterous females, spring and stream at Oe Noah, 24 km. NE of Soe, 840 m, CL 2594, 12 Sept. 1991; 2 macropterous males, marsh at Oelki, 5 km. W. of Niki Niki, 825 m, CL 2595, 12 Sept. 1991; 1 male, 3 macropterous males, 1 female, 2 macropterous females, spring and stream at Oe Noulle, 9 km. N. of Soe, 685 m, CL 2596, 12 September 1991 (all JTPC).

Hydrometra longicapitis Torre-Bueno Figs. 62–66, 87-89, 100

Hydrometra longicapitis Torre-Bueno, 1927. Bull. Brooklyn Entomol. Soc. 22: 31. Holotype, brachypterous male, Ft. de Kock [nr. Padang], Sumatra (USNM, No. 40208).

Hydrometra aberrans Hungerford & Matsuda, 1961. J. Kans. Ent. Soc. 34: 61. Holotype, brachypterous female, Selangor, West Malaysia (SEMK). Synonymized by Andersen 1992: 4.

Description

BRACHYPTEROUS MALE. Length 13.06–14.18, width 0.61.

Color. Ground color orange brown, dorsally mostly light brown to orange brown; abdominal tergites dark orange brown, mat, each slightly darker near posterior margin. Head dorsally lighter anteriorly and basally, ventrally brownish yellow, entirely lightly pruinose. Thoracic dorsum not pruinose; pruinose stripe on abdominal laterosternites adjacent to connexival margin interrupted near each suture, continuing onto segment VIII, visible in oblique light; entire venter and region of laterotergites near each suture more lightly pruinose, visible in completely different oblique light (by 90°). Connexiva except narrow margins, light brown. Thoracic, abdominal venter, acetabulae yellowish brown. Legs orange brown to brown, darker distally; antennae deep brown, basal two segments lighter; coxae, trochanters mostly luteous.

Structure. Head very long (4.81), widest at antennal tubercles (0.46); essentially bare, with only a few short setae antero-ventrally; maxillary plate of moderate size, not extending anteriorly (Fig. 62); gular lobe large, truncate ventrally, covering base of rostrum; rostrum reaching behind eyes; ratio anteocular/postocular portions: 3.28/1.18; interocular space/width of an eye: 0.13/0.17; anteclypeus large, truncate, lateral margins almost straight, widening slightly anteriorly, anterior margin obtusely angled to weakly convex, set with small tubercle on apex (Fig. 63). Antennal formula I:II:III:IV; 0.87: 1.64: 5.27: 2.71. Prothorax with a pronounced row of encircling pits on anterior lobe setting off collar, posterior lobe with numerous deep pits, without distinct separate row on midline. Pronotum length 1.74; remainder of thorax 1.74; abdomen length 5.89. Hemelytra short narrow straps, reaching base of abdomen. Abdominal, thoracic sternites essentially bare, with a few scattered semi-erect setae on sternites VI–VIII. Distance between anterior and middle coxae (measured between closest margins) 0.67; between middle and hind coxae 1.54. Anterior, middle acetabulae with two to four deep pits on anterior part, six or seven on posterior part; posterior acetabula with six or seven pits on anterior part dorsally. Entire body set with scattered minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 5.68: 6.55: 0.10: 0.36: 0.26; of middle leg, 6.35: 7.17: 0.10: 0.41: 0.26; of hind leg, 7.32: 9.88: 0.10: 0.36: 0.26.

Abdominal terminalia as shown in figures 64 and 65. Male sternite VII with two (1+1) short black widely separated fleshy processes, often bilobed, each set on a tumescence near anterior margin, excavate and tranversely rugose medially behind processes, with a fringe of dark short setae near posterior margin. Male sternite VIII unmodified except slightly curved ventrad posteriorly; distal process of tergite VIII short; segment IX without lateral wings.

BRACHYPTEROUS FEMALE. Length 13.57–14.44, width 0.67. Similar in many respects to male, except coloration somewhat lighter, especially the abdomen. Pronotum polymorphic, with three distinct states, normal, with incipient tubercle, or with long finger-like tubercle medially on posterior margin directed posterodorsally and set with long soft setae distally (Figs. 87-89). Abdominal terminalia as shown in figure 66; abdomen curved upward distally; sternite VII caudally with a few stiff dark setae directed postero-ventrally; connexival segments VI–VII set with scattered erect slender setae; tergite VIII with terminal process of moderate length, slightly curved, directed ventrally from plane of segment VII, but slightly upward from plane of thorax because of abdominal curvature.

MACROPTEROUS FORM. Hemelytra reaching base to middle of tergite VI in males, middle to caudal part of tergite V in females; color soft brown in both sexes, without longitudinal white stripe, but with longitudinal light streak along costal margin on distal 1/3 just beyond region where Sc forms costal margin, and sometimes small light basal markings.

MICROPTEROUS FORMS. Unknown.

Diagnosis. *Hydrometra longicapitis* belongs to a distinctive species group containing *H. zeylanica* Gunawardane and Karunaratne from Ceylon and *H. ripicola* Andersen from Thailand. All of these species possess a very long head, which is longer than the thorax, and were considered by Andersen (1992) to form a monphyletic "*longicapitis* group". *H. longicapitis* is apparently the sister species of *H. ripicola*, and is very close to the latter in most characteristics, although the two species may be separated by the structure of the male abdominal terminalia, and other characters given in the key. *H. carinata* n.sp. from Borneo and Malaysia may also belong to the *longicapitis* group, but differs from the preceding species in possessing an enlarged gular lobe (Fig. 11), very narrow abdominal mediotergites, and a carinate female abdominal verter (Fig. 15), and thus appears to be somewhat removed phylogenetically.

We have studied the types of both *H. longicapitis* and *H. aberrans*, and while the former is a male and the latter a female, the morphology of the anteclypeus is the same. In addition, we have a series from Johor, Malaysia that includes both sexes and all of the known forms, thus supporting the synonymy proposed by Andersen (1992).

The remarkable polymorphism of the female pronotum, which in certain individuals possesses a large backwardly angling tubercle, and the variability of the female abdominal curvature were discussed by Polhemus and Polhemus (1987, as *H. aberrans*). The distribution records listed in that paper, and in Andersen (1992) are not repeated here, but are included on the distribution map (Fig. 100).

Ecological notes. *Hydrometra longicapitis* has been taken in a variety of both upland and lowland habitats. In Johor, peninsular Malaysia, it was most commonly encountered along the margins of smoothly flowing swamp forest streams, while in northern Thailand it has been taken along rocky upland streams. Individuals were observed to retreat onto shallow waters along stream margins when pursued, and in some cases would actually leave the water and run across the damp earth adjacent to the stream itself. Additional information on the ecology of this species in Johor is provided by Polhemus and Polhemus (1987).

Distribution. Sumatra, Borneo (Sarawak), Malay Peninsula, Thailand (Fig. 100).

Material examined. WEST MALAYSIA, **Selangor**: 1 brachypterous male, Sungai Pelumut, 4 March 1964, collector unknown (USNM). **Prov. uncertain**: 2 brachypterous males, 1 brachypterous female, Sungai Wang, Tanga, 1 Nov. 1968, J.I.F. (USNM). EAST MALAYSIA, *BORNEO*, **Sarawak**: 4 females, Bau Dist., Pangkalan Tebang, 300–450 m., 5–8 Sept. 1958, T.C. Maa (BPBM). INDONESIA, *SUMATRA*, **Sumatera Barat Prov.**: 1 brachypterous male [holotype, *H. longicapitis*] Ft. de Kock [Padang], E. Jacobson (USNM). THAILAND, **Chiang Mai Prov.**: 4 macropterous females, Nam Chai River above hydro station intake, Fang Horticultural Res. Sta., CL 2197, 550 m, 15 Nov. 1985, J.T. & D.A. Polhemus; 2 macropterous males, 13 macropterous females, Huay Hia Creek, Fang Horticultural Res. Sta., CL 2198, 15 Nov. 1985, J.T. & D.A. Polhemus; 1 macropterous male, trib. to Nam Chai River, Fang Horticultural Res. Sta., CL 2197, 500 m, 15 Nov. 1985, J.T. & D.A. Polhemus; 1 macropterous female, Mae Sa waterfall, 7 km. W. of Mae Rim, CL 2203, 18 Nov. 1985, J.T. & D.A. Polhemus (all above JTPC); 1 male, 2 females, Chiangdao, 450 m., 5–11 April 1958, T.C. Maa (BPBM).

Hydrometra maidli Hungerford & Evans Figs. 52–56, 101

Hydrometra maidli Hungerford, H. B. & N. E. Evans, 1934. Annls. Mus. Natn. Hung. 28: 73. Holotype, male, West Sumatra (Vienna Museum).

Description

MACROPTEROUS MALE. Length 11.11–11.68, width 0.56.

Color. Ground color light brown; abdominal tergite 6 orange brown, faintly shining, faintly rastrate medially; VII–VIII mostly mat and clothed with fine pubescence; VII with basal median area faintly shining, pruinose laterally; VIII pruinose. Head tinged with blackish dorsally between eyes, ventrally except basally and anteriorly, very lightly pruinose ventrally and on median longitudinal light stripe dorsally behind eyes. Thorax dorsally with prominent median longitudinal pruinose stripe, wider on posterior lobe, pronotum laterally with narrow arched pruinose longitudinal stripe; most of remainder of thorax and abdomen at least lightly pruinose except broad abdominal stripe along junction of medio- and laterotergites, visible in oblique light. Head ventrally beneath base and anterior margin, broad irregular longitudinal regions on either side of dorsal thoracic midline of posterior lobe, venter of thorax and abdomen, yellowish brown. Connexiva brown, pruinose, lighter medially; pruinosity more pronounced at segmental sutures on connexiva and adjacent laterosternites. Legs, antennae yellowish brown to brown, darker distally; coxae, trochanters mostly light yellowish brown, similar to bases of femora.

Structure. Head long (3.43), widest at antennal tubercles (0.38); almost devoid of setae, with a few scattered very short decumbent setae, anteroventrally with a few bristly setae; maxillary plate of moderate size, covering base of gular lobe, not extending to tip of anteclypeus anteriorly (Fig. 52); gular lobe of moderate size, elongate; rostrum reaching well caudad of eyes, about halfway to prosternum; ratio anteocular/postocular portions: 2.30/0.87; interocular space/width of an eye: 0.10/0.15; anteclypeus broadly rounded to obtusely angled anteriorly (Fig. 53). Antennal formula I:II:III:IV; 0.51: 1.38: 2.92: 1.54. Prothorax with row of deep encircling pits on anterior lobe setting off collar, plus 6–8 along lateral margin, posterior lobe with numerous pits including on midline, each pit appearing pruinose in oblique light. Pronotum length 1.69; remainder of thorax 1.54; abdomen length 4.71. Hemelytra reaching base of tergite VI; basal white stripe mesad of R + M evanescent beyond basal fourth; median stripe bright white, commencing near base, extending almost to apex, interrupted only by cross veins. Abdominal sternites sparsely set with short slender setae, more numerous on V–VII. Posterior femur set with a row of very slender long brown setae. Distance between anterior and middle coxae (measured between closest margins) 0.72; between middle and hind coxae 1.48. Anterior, middle acetabulae with two or three pits each on anterior and posterior parts; posterior acetabula with one pit dorsally on anterior part. Entire venter set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 3.43: 3.89: 0.10: 0.36: 0.26; of middle leg, 3.89: 4.40: 0.10: 0.38: 0.26; of hind leg, 4.71: 5.89: 0.10: 0.38: 0.26.

Abdominal terminalia as shown in figures 54 and 55. Male sternite VII slightly depressed medially, with two (1+1) large patches of short dark setae arising just caudad of middle and extending to posterior margin, each flanked laterally by a fringe of long curved setae. Sternite VIII unmodified, caudal process of moderate length, slightly curved. Segment IX with moderately developed lateral wings.

MACROPTEROUS FEMALE. Length 11.67–12.13, width 0.61. Most structures and coloration as in male, except posterior femur not set with setae. Hemelytra reaching base of tergite VI; bright white markings similar to male. Abdominal terminalia as shown in figure 56; caudal process of tergite VIII prominent, directed slightly dorsad, slightly curved.

BRACHYPTEROUS FORM. Hemelytra reaching onto tergite II, each with a narrow white stripe on inner margin which together form a continuation of the light prontal pruinose stripe. Pronotum narrower posteriorly than in macropter, usually with fewer pits.

MICROPTEROUS FORM. Unknown.

Diagnosis. Hydrometra maidli is a moderately small species that is widespread across Indochina and the Malay Archipelago, and appears most closely related to *H. annamana* Hungerford and Evans, a species that is also widespread in Indochina and eastern Asia. Males of both of these taxa have a fringe of long setae along the entire length of the hind

femur, which separates them from all other known *Hydrometra* species. The two species are difficult to separate at first glance, but possess several distinguishing characters, as given in the key, plus others discussed in detail under *H. annamana.*

In addition to the Timorese records given herein, *H. maidli* was also reported from eastern Timor (Pantai Macassar, Oe-Cusse, Timor Português) by Hungerford and Matsuda (1963).

Ecological notes. Hydrometra maidli occurs at low to intermediate elevations, and appears to prefer the margins of ponds and slow stream pools.

Distribution. Borneo, Celebes, Java, Lombok, Sumatra, Sumba, Sumbawa, Timor, Malay Peninsula, Thailand, Laos, Hong Kong (Fig. 101).

Material examined (all macropterous unless noted; all collected by J.T. & D.A. Polhemus, in JTPC unless noted). INDONESIA, *BORNEO*, **Kalimantan Timur Prov.**: 1 male, 4 females, spring with waterfall and ponds, 3 km. NE of Kota Bangun, CL 2092, 27 Aug. 1985; 1 female, imponded streams NW of Kota Bangun, CL 2094, 28 Aug. 1985; 2 females, stream 4 km. NE of Kota Bangun on Samarinda rd., CL 2097, 29 Aug. 1985; 1 male, 7 brachypterous males, 1 female, 5 brachypterous females, stream 8 km. NE of Kota Bangun on Samarinda rd., CL 2098, 29 Aug. 1985. *JAVA*, **Jawa Barat Prov.**: 2 males, 1 female, Bogor, April–May 1965, J. Winkler (BPBM). *CELEBES*, **Sulawesi Selatan Prov.**: 1 male, Marana River, 50 km. E. of Maros, 450 m, CL 2167, 14 Oct. 1985. *LOMBOK*, **Nusa Tenggara Barat Prov.**: 2 males, 3 brachypterous males, 2 females, 2 brachypterous females, Aik Jut River, 30 km NE of Mataram, 350 m, CL 2178, 23 Oct. 1985. *SUMBAWA*, **Nusa Tenggara Barat Prov.**: 1 male, 3 females, Bela River, 28 km. SW of Bima, 100 m, CL 2172, 19 Oct. 1985. *SUMBA*, **Nusa Tenggara Timur Prov.**: 2 males, 2 brachypterous males, 3 females, Kambahapang River, 59 km. SW of Waingapu, 530 m, CL 2599, 14 Sept. 1991 *TIMOR*, **Nusa Tenggara Timur Prov.**: 1 male, Lili River at Lili, nr. Camplong, 40 km. E. of Kupang, 60 m, CL 2592, 11 Sept. 1991; 1 male, 4 brachypterous males, 2 females, 4 brachypterous females, marsh at Oelki, 5 km. W. of Niki Niki, 825 m, CL 2595, 12 Sept. 1991. WEST MALAYSIA, **Selangor**; 8 males, 10 females, pond along Old Gombok Rd., 23 km. E. of Kuala Lumpur, CL 2069, 16 Aug. 1985; 1 female, Kampond pond, nr. Kuala Selangor, 20 Aug. 1973, collector unknown (USNM). THAILAND, **Chiang Mai Prov.**: 1 male, Pangmakamphon (Pankampawng), nr. Fang, 450 m., 15–16 Nov. 1957, T.C. Maa (BPBM). LAOS, **Vientiane Prov.**: 1 male, 1 female, Vientiane, 9 May 1965, at light, P.D. Ashlock (BPBM); 1 male, Muong Sing, NW of Luang Prabang, 650 m., 6–10 June 1960, S. and L. Quate (BPBM). HONG KONG: 1 male, Sai Kung Station, 7 Dec. 1964, light trap, W.J. Voss and H. W. Ming (BPBM).

Hydrometra mindoroensis Polhemus — Figs. 45, 73–76, 102

Hydrometra mindoroensis Polhemus, J. T., 1976. *In* Polhemus, J. T. & W. K. Reisen, Kalikasan, Philipp. J. Biol. 5: 283. Holotype, male, San Jose, Mindoro, Philippines (California Academy of Sciences).

Description

MICROPTEROUS MALE. Length 9.92–10.56, width 0.39 (versus 0.50 in macropterous form).

Color. Ground color brown, dorsally mostly brown to orange brown; abdominal tergites orange brown, shining except VII–VIII mat, clothed with fine pubescence, all but median part pruinose. Head tinged with black dorsally, laterally, entirely lightly pruinose, more noticeable on median longitudinal stripe dorsally behind eyes. Pronotum dorsally with median longitudinal pruinose stripe, on posterior lobe broader, bordered with brown on each side; laterally with an arched pruinose longitudinal stripe, weakly continuing linearly along remainder of thorax and abdomen onto segment VIII,

visible in oblique light; entire venter more lightly pruinose, separated from pruinose stripe described above by dark stripe which, in completely different oblique light (by 90°), is also pruinose. Connexiva except narrow margins, brown, basal third of each segment and adjacent spot on each laterosternite heavily pruinose. Legs, antennae light brown to brown, darker distally; coxae, trochanters mostly light brown, similar to bases of femora.

Structure. Head long (2.89), widest at antennal tubercles (0.36); set with very short inconspicuous recumbent setae, longest beneath anterior extreme; maxillary plate not prominent (Fig. 73); gular lobe large, truncate ventrally, covering base of rostrum (Fig. 73); rostrum reaching well caudad of eyes, about 3/4 toward prosternum; ratio anteocular/postocular portions: 1.83/0.83; interocular space/width of an eye: 0.08/0.15; anteclypeus small, tapering anteriorly, lateral margins straight, rounded to conical anteriorly (Fig. 74). Antennal formula I:II:III:IV; 0.39: 0.92: 2.83: 1.50. Prothorax with a row of encircling small pits on anterior lobe setting off collar, posterior lobe with scattered shallow pits, with row of shallow pits on midline. Pronotum length 1.28; remainder of thorax 1.17; abdomen length 3.77. Abdominal sternites set with scattered short semi-erect setae, plus a few long erect setae increasing in length posteriorly, longest, most numerous on tergite VI. Distance between anterior and middle coxae (measured between closest margins) 0.50; between middle and hind coxae 1.05. Anterior, middle acetabulae with one or two pits each on anterior and posterior parts; posterior acetabula with one pit on anterior part dorsally. Entire venter, head except base, anterior lobe of pronotum set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 2.83: 3.22: 0.10: 0.25: 0.22; of middle leg, 3.16: 3.55: 0.10: 0.33: 0.22; of hind leg, 3.77: 4.72: 0.10: 0.28: 0.122.

Abdominal terminalia as shown in figures 75 and 76. Male sternite VII with two (1+1) small black widely separated posteriorly directed processes along anterior margin, each set on a weak tumescence, each composed of tightly clustered dark stiff setae, similar to *lombok*; also set with two (1+1) patches of short dark stiff setae near posterior margin, less widely spaced than the previous structures, very similar to *lombok* but slightly closer together. Eighth male sternite broadly laterally compressed basally, forming a weak excavation on each side, ventral margin slightly curved.

MICROPTEROUS FEMALE. Length 10.40–12.48, width 0.44 (versus 0.61 in macropterous form). Similar in most respects to male, but slightly larger and broader across abdomen; color lighter, more uniform light to orange brown dorsally. Abdominal terminalia as shown in figure 45; abdomen curved upward caudally; set with stiff upright setae along connexival margin of tergite VI (and sometimes part of V), basal part of VII; ventrally set with short erect setae, longer caudally, densest on sternites V–VII; ventrite VIII laterally with numerous dark curved setae forming a brush plainly visible from above; distal process of tergite VIII prominent, straight.

MACROPTEROUS FORM. Most characteristics as in micropterous form. Hemelytra brown, reaching base of tergite VII in males, middle of tergite VI in females; male with long basal light streak mesad of M + Cu, plus long medial sordid white stripe (sometomes partly effaced) reaching from near base almost to apex, interrupted only by dark cross veins; light markings effaced in female.

Diagnosis. Hydrometra mindoroensis is a small, brownish to blackish species that is widespread in the Philippine Islands and Celebes, and locally distributed in northern Borneo. It is very closely related to *H. lombok*, both species sharing a distinctive pattern of setiferation on the venter of male abdominal segments VII and VIII (compare Figs. 49, 50, 75, 76, and see discussion under *H. lombok*).

The Philippine records from Polhemus and Reisen (1976) are not repeated here but are plotted on the map (Fig. 102).

Ecological notes. Hydrometra mindoroensis generally occurs in upland habitats, often on headwater streamlets with a large amount of submerged leaf litter overlain by a shallow film of water.

Distribution. Borneo, Celebes, Philippines (Leyte, Luzon, Mindanao, Mindoro, Palawan), New Guinea (Papua New Guinea) (Fig. 102).

Material examined (all micropterous unless noted; all collected by J.T. and D.A. Polhemus, in JTPC unless noted). EAST MALAYSIA, *BORNEO*, **Sabah**: 2 males, 2 females, bog nr. km 56 on Keningau Hwy., E. of Kota Kinabalu, montane rain forest, CL 2037, 6 Aug. 1985. INDONESIA, *CELEBES*, **Sulawesi Selatan Prov.**: 1 female, Marana River, nr. Camba, 50 km. E. of Maros, 450 m, CL 2167, 14 Oct. 1985. **Sulawesi Tengah Prov.**: 9 males, 4 females, stream at Lore Lindu Nat. Pk., 830 m, CL 2155, 15 Oct. 1985. **Sulawesi Utara Prov.**: 1 male, 2 females, Tumpah River, Dumoga-Bone Nat. Park, 0° 34' N, 123° 54' E, 222 m, CL 2100, 4 Sept. 1985; 1 female, upper Metalanga River, 10 km. S. of Doloduo, CL 2108, 7 Sept. 1985; 1 male, seeps 7 km. S. of Doloduo, CL 2109, 7 Sept. 1985; 10 males, 18 females, forest streamlet above Lake Mala, 0° 44' N, 124° 27' E, 1100 m, CL 2114, 9 Sept. 1985; 4 males, 7 females, springs and pools, E. end of Lake Mala, 1050 m, CL 2115, 10 Sept. 1985; 7 males, 1 female, swift clear stream nr. S. end of Lake Mala, 1000 m, CL 2117, 10 Sept. 1985; 2 males, 3 females, forest stream, S. of Lake Mala, 1200 m, CL 2118, 11 Sept. 1985; 1 male, 1 female, spring and stream , 2 km. S. of Mokabang, N. of Lake Mala, 950 m, CL 2123, 17 Sept. 1985. PHILIPPINES, *LEYTE*, **Leyte Prov.**: 5 males, 8 females, Lusig River at Hilusig, CL 1979, 15 July 1985; 1 male, Higualan, 15 km SE of Baybay, CL 1982, 16 July 1985. *LUZON*, **Cavite Prov.**: 2 females, Tapat River, 2 km. S. of Alfonso, CL 2003, 24 July 1985. **Quezon Prov.**: 1 female, rocky stream at Lucena, CL 1972, 10 July 1985. *MINDANAO*, **South Cotabato Prov.**: 1 male, Sepa River, SE of Koronadal, 550 m, CL 1994, 20 July 1985; 3 males, 1 female, Cacob River, SE of Koronadal, 550 m, CL 1995, 20 July 1985. **Zamboanga del Sur Prov.**: 6 males, 5 females, Bituti River, 7 km. NW of Zamboanga City, 100 m, CL 1998, 22 July 1985. *PALAWAN*, **Palawan Prov.**: 4 males, 2 females, 2 nymphs, Mainit Falls, 18 km NW of Brooks Point, 50 m, CL 2006, 26 July 1985; 1 female, Bacungan Creek, 18 km. NW of Puerto Princesa, CL 2019, 28 July 1985; 4 males, 1 macropterous male, 1 macropterous female, Togading River, 79 km. NW of Puerto Princesa, CL 2016, 28 July 1985 (all JTPC).

Hydrometra orientalis Lundblad — Figs. 67, 77–81, 103

Hydrometra orientalis Lundblad, O., 1933. Arch. Hydrobiol., Suppl. Bd. 12, Trop. Binnengewass. 4: 430. Holotype, male, Sumatra (Stockholm Museum).

Hydrometra insularis Hungerford, H. B. & N. E. Evans, 1934. Ann. Mus.Nat. Hungar. 28: 76. Holotype, male, Sumatra (Vienna Musuem). Syn. by Polhemus, J. T. & W. K. Reisen, Kalikasan, Philipp. J. Biol. 5: 284. Preoccupied by *Hydrometra insularis* Motschulsky 1886.

Hydrometra sumatrana Ruhoff, F. A. 1964. Proc. Entomol. Soc. Wash. 66: 32. Syn. by Polhemus, J. T. & W. K. Reisen, Kalikasan, Philipp. J. Biol. 5: 284. Unnecessary new name for *H. insularis* Hungerford & Evans 1934.

Description

MACROPTEROUS MALE. Length 10.72–12.16, width 0.55

Color. Ground color light brown tinged with dark brown; abdominal tergite VI orange brown, faintly shining, faintly rastrate; VII–VIII mostly mat and clothed with fine pubescence; VII with small basal median area faintly shining, faintly pruinose laterally; VIII pruinose laterally. Head tinged with brown dorsally between eyes, ventrally except basally, beneath eyes and anteriorly, very lightly pruinose ventrally and on median longitudinal light stripe dorsally behind eyes. Thorax dorsally with prominent median longitudinal pruinose stripe, wider on posterior lobe, pronotum laterally with narrow arched pruinose longitudinal stripe; most of remainder of thorax and abdomen at least lightly pruinose except broad abdominal stripe along junction of medio- and laterotergites, visible in oblique light. Head ventrally beneath base and anterior margin, broad irregular longitudinal regions on either side of dorsal thoracic midline of posterior lobe, venter of thorax and abdomen, yellowish brown. Connexiva brown, weakly pruinose; pruinosity more pronounced at segmental sutures on laterosternites. Legs, antennae yellowish brown to brown, darker distally; coxae, trochanters mostly light yellowish brown, similar to bases of femora.

Structure. Head long (2.83), widest at antennal tubercles (0.39); almost devoid of setae, with a few scattered very short decumbent setae, anteroventrally with a few bristly setae; maxillary plate of moderate size, covering base of gular lobe, not extending to tip of anteclypeus anteriorly (Fig. 77); gular lobe of moderate size, elongate; rostrum reaching well caudad of eyes, about halfway to prosternum; ratio anteocular/postocular portions: 1.83/0.72; interocular space/width of an eye: 0.08/0.12; anteclypeus broadly to sharply angled anteriorly (Fig. 78). Antennal formula I:II:III:IV; 0.39: 0.94: 2.16: 1.11. Prothorax with row of deep encircling pits on anterior lobe setting off collar, plus 6–8 along lateral margin, posterior lobe with numerous pits including on midline, each pit appearing pruinose in oblique light. Pronotum length 1.39; remainder of thorax 1.39; abdomen length 4.11. Hemelytra reaching base of tergite VI; basal white stripe mesad of R + M continuing to beyond middle, weak beyond; median stripe sordid white, commencing near base, extending to distal 7/8, broadly interrupted at least three times, usually more (Fig. 67). Abdominal sternites sparsely set with very short slender setae, numerous long erect setae on at least distal half of VI (sometimes all), all of VII. Posterior femur without long setae. Distance between anterior and middle coxae (measured between closest margins) 0.72; between middle and hind coxae 1.28. Anterior, middle acetabulae with two or three pits each on anterior and posterior parts; posterior acetabula with one pit dorsally on anterior part. Entire venter set with minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 2.61: 3.00: 0.10: 0.33: 0.17; of middle leg, 3.11: 3.22: 0.10: 0.40: 0.17; of hind leg, 3.55: 4.61: 0.10: 0.40: 0.19.

Abdominal terminalia as shown in figures 79 and 80. Male sternite VII flattened or slightly depressed medially, covered with long slender erect setae. Sternite VIII unmodified, broadly carinate medially, caudal process of moderate length, straight. Segment IX with weakly developed lateral wings.

MACROPTEROUS FEMALE. Length 11.68–13.44, width 0.58. Most structures and coloration as in male. Hemelytra reaching distal part of tergite V or base of tergite VI; broken median light stripe similar to male. Abdominal terminalia as shown in figure 81; caudal process of tergite VIII prominent, directed very slightly dorsad, straight.

MICROPTEROUS and BRACHYPTEROUS FORMS. Unknown.

Diagnosis. This moderate sized, brown species is widespread in Southeast Asia and locally common, but the distribution is spotty. It is closely related to *H. lineata*, but lacks convergent connexiva in the females, and may be further separated by the characters given in the key (for detailed comparison see discussion under *H. lineata*). The size and color of *H. orientalis* are highly variable across its geographic range, but the populations involved are otherwise identical structurally.

The Philippine records given by Polhemus and Reisen (1976) are not repeated here but are plotted on the distribution map (Fig. 103).

Ecological notes. Hydrometra orientalis generally occurs along pools on rocky upland streams, and has been taken across a wide elevational range, from 100 to over 800 meters above sea level. It occurs sympatrically with *H. lombok* n.sp. in large springs on Sumba, and with the closely related *H. mindoroensis* on rocky upland streams in central Celebes.

Distribution. Philippines (Luzon, Lubang, Mindanao), Celebes, Java, Sumatra, Sumba, New Guinea, Malay Peninsula, Thailand, Burma, Vietnam, Australia (Fig. 103).

Material examined (all macropterous; all collected by J.T. and D.A. Polhemus and in JTPC unless noted). INDONESIA, *CELEBES*, **Sulawesi Selatan Prov.**: 10 males, 15 females, Patanuang River, 7 km. SW of Maros, 100 m, CL 2165, 13 Oct. 1985; 9 males, 6 females, Marana River, nr. Camba, 50 km. E. of Maros, 450 m, CL 2167, 14 Oct. 1985. **Sulawesi Tengah Prov.**: 1 female, swift rocky stream along Lindu Footpath, Lore Lindu Nat. Pk., 42 km. SE of Palu, 830 m, CL 2155, 15 Oct. 1985. *JAVA*, **Jawa Barat Prov.**: 1 female, Soukaboemi [Sukabumi], T. Barbour (JTPC). *SUMBA*, **Nusa**

Tenggara Timur Prov.: 2 males, 6 females, 1 micropterous female, Mataiyang spring and outflow stream at Lewa Paku, 500 m, CL 2598, 14 Sept. 1991; 31 males, 18 females, Kambahapang River, 59 km. SW of Waingapu, 530 m, CL 2599, 14 Sept. 1991; 3 males, 1 female, 2 nymphs, Omang spring and outflow stream, nr. Makemenggit, 460 m, CL 2600, 14 Sept. 1991 (all JTPC). PHILIPPINES, *MINDANAO*, **South Cotabato Prov.**: 1 female, Luhib River, 13 km. W. of Surilah, 600 m, CL 1993, 19 July 1985. **Zamboanga del Sur Prov.**: 3 males, 2 females, Milwau Cr. at Patalon, 27 km. NW of Zamboanga City, 100 m, CL 2000, 23 July 1985. MALAYSIA, **Penang**: 2 males, Penang, Univ. Sains Malaysia, 29 Jan. 1983, H.C. Chapman (JTPC); 1 male, 1 female, Penang, Dec. 1959, at light, H.T. Pagden (JTPC). VIETNAM: 1 male, Nui Ba Den, 8 Aug. 1970, A.R. Gillogly (JTPC); 20 males, 20 females, Quang Tri, 28 March to 14 Aug. 1970, A.R. Gillogly (JTPC). THAILAND, **Chiang Mai Prov.**: 1 female, Nam Chai River above hydro station intake, Fang Horticultural Res. Sta., CL 2197, 550 m, 15 Nov. 1985, J.T. & D.A. Polhemus (all JTPC). **Prov. uncertain**: 2 males, Lepburi, Huey Sablek, 20 March 1952, M.E. Griffith (JTPC); 1 male, 1 female, Saraburi, Forestry Sta., 21 March 1952, M.E. Griffith (JTPC); 6 males, 3 females, km 124.5 on Bangkok-Prabuddhaht Rd., Botanic Garden, stream, 23 Feb. 1967, J.I.F. (USNM). MYANMAR (as BURMA): 2 males, 2 females, Myitkyina, 10 Sept. 1945, L.C. Kuitert (JTPC); 1 female, Muse, 26 Feb. 1945, L.C. Kuitert (JTPC).

Hydrometra papuana Kirkaldy — Figs. 2–5, 43, 104

Hydrometra papuana Kirkaldy 1901. Ann. Mus. Civ. Storia Nat. Genova (2) 20: 807 (Type-locality, Fly River, New Guinea; type lost, supposed to be in Mus. Civ. Storia Nat., Genova).

Description

MICROPTEROUS MALE. Length 13.44–17.12, width 0.50 (versus 0.55 in macropterous form).

Color. Ground color brown, dorsally mostly light brown to orange brown; abdominal tergites dark orange brown, shining, faintly rastrate except VII–VIII clothed with fine pubescence, VIII frosted laterally. Head dorsally tinged with black near eyes, laterally mostly darker, ventrally lighter, entirely lightly pruinose. Pronotum dorsally without median pruinose stripe, laterally with an arched pruinose longitudinal stripe, continuing linearly along remainder of thorax and abdomen onto segment VIII, more heavily pruinose at segmental sutures, visible in oblique light; entire venter more lightly pruinose. Connexiva except narrow margins, light brown, weakly pruinose. Collar of pronotum dark dorsally. Legs orange brown to brown, darker distally; antennae deep brown, segment IV light distally; coxae, trochanters mostly luteous tinged with fuscous.

Structure. Head extremely long (4.05), widest at antennal tubercles (0.42); sparsely set with short erect setae, more numerous beneath eyes, antero-ventrally longest; maxillary plate elongate, widened anteriorly, barely covering base of gular lobe (Fig. 2); gular lobe large, rounded ventrally, barely covering base of rostrum; rostrum reaching just beyond eyes; ratio anteocular/postocular portions: 2.89/0.94; interocular space/width of an eye: 0.11/0.17; anteclypeus large, broad, truncate and slightly concave anteriorly, lateral margins almost straight, slightly divergent anteriorly (Fig. 3). Antennal formula I:II:III:IV; 0.78: 1.89: 4.50: 1.78. Prothorax with a very weak row of encircling pits on anterior lobe setting off collar (sometime not visible), posterior lobe with scattered shallow pits, plus a row on midline. Pronotum length 1.83; remainder of thorax 1.89; abdomen length 5.11. Hemelytral wing pads either hidden or barely visible. Abdominal, thoracic sternites sparsely set with scattered short semi-erect setae. Distance between anterior and middle coxae (measured between closest margins) 0.89; between middle and hind coxae 1.83. Anterior, middle acetabulae without pits; posterior acetabula with one pit on anterior part dorsally. Head, thoracic venter without black denticles.

Proportions of legs as follows: Measurements of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 4.66: 5.16: 0.10: 0.33: 0.22; of middle leg, 5.33: 5.99: 0.10: 0.44: 0.22; of hind leg, 6.10: 7.66: 0.10: 0.42: 0.28.

Abdominal terminalia as shown in figures 4, 5. Male sternite VII with two (1+1) black widely separated setose pads, each posteriorly raised, each composed of tightly clustered dark stiff setae, occupying about 1/2 the length of the segment. Male sternite VIII weakly depressed on sides, forming a weak median carina in the form of 2 V's with their points touching; distal process of tergite VIII short, straight.

MICROPTEROUS FEMALE. Length 16.48–18.56, width 0.67 (versus 0.78 in macropterous form). Similar in many respects to male, except coloration somewhat darker, especially the abdomen medially. Abdominal terminalia as shown in figure 43; abdomen slightly curved upward distally; sternite VII caudally produced, caudal extreme exceeding segment VIII; connexival segments V–VII set with a row of erect slender setae on posterior 1/2 to 2/3; terminal process of tergite VIII absent.

MACROPTEROUS FORM. Most characteristics as in micropterous form, except pronotum larger, longer. Hemelytra brown, reaching onto base of tergite V in males, middle of tergite V in females; male with short basal light streak mesad of M + Cu, plus long medial white stripe reaching from near base almost to apex, interrupted only by dark cross veins; light markings effaced in female.

Diagnosis. Hydrometra papuana is a large, elongate species that is not closely allied to any other species of *Hydrometra* species occurring in the region treated here. The clypeus is blunt anteriorly (Fig. 3), but much narrower than in all other Asian species with a blunt clypeus. The pad-like processes on male abdominal sternite VII are unique (Fig. 5), and the lack of a female distal process on tergite VIII is shared only with *H. aculeata* Montrusier from New Caledonia, a much shorter and smaller species, and with several South American taxa.

The distribution shown on the map (Fig. 104) is only for the area considered in this paper; the distribution of this species in Australia and New Guinea, where it is common and widespread, will be given in separate paper currently in preparation dealing with the Melanesian fauna.

Ecological notes. In Southeast Asia *H. papuana* has been taken only in lowland swamp forests.

Distribution. Borneo (East Kalimantan), Malay Peninsula (Pahang), New Guinea, Australia (Fig. 104).

Material examined. INDONESIA, *BORNEO*, **Kalimantan Timur Prov.**: 1 micropterous female, 1 macropterous female, stream 8 km. NE of Kota Bangun on Samarinda rd., CL 2098, 29 Aug. 1985, J.T. & D.A. Polhemus; 5 micropterous males, 9 micro-pterous females, spring 3 km. NE of Kota Bangun, CL 2092, 28 Aug. 1985, J.T. & D.A. Polhemus; 1 micropterous female, waterfall 4 km. S. of Kota Bangun, CL 2095, 29 Aug. 1985, J.T. & D.A. Polhemus (JTPC). WEST MALAYSIA, **Pahang**: 1 apterous male, Tasek Berah, S. of Fort Iskander, 29 March 1963, collector unknown (USNM); 1 apterous female, Tg. [Tanjung] Kuin, Tasek Bera, 17 March 1970, L.K.S. (USNM).

Hydrometra ripicola Andersen — Figs. 82–86, 105

Hydrometra ripicola Andersen, N. M., 1992. Steenstrupia 18: 2. Holotype, micropterous male, Doi Sutep, Thailand (Zoological Museum, University of Copenhagen).

Description

MICROPTEROUS MALE. Length 11.93–12.29, width 0.56.

Color. Ground color brown, dorsally mostly light brown to orange brown; abdominal tergites dark orange brown, mat, each lighter colored and faintly shining posteriorly. Head dorsally lighter anteriorly and basally, ventrally brownish yellow, entirely lightly frosted. Thoracic dorsum not pru-

inose; pruinose stripe on abdominal laterosternites adjacent to connexival margin continuing linearly onto segment VIII, visible in oblique light; entire venter more lightly pruinose, separated from pruinose stripe described above by dark stripe which, in completely different oblique light (by 90°), is also pruinose. Connexiva except narrow margins, brown. Thoracic, abdominal venter, acetabulae yellowish brown. Legs orange brown to brown, darker distally; antennae deep brown, basal two segments lighter; coxae, trochanters mostly luteous.

Structure. Head very long (4.10), widest at antennal tubercles (0.46); essentially bare, with only a few short setae antero-ventrally; maxillary plate small, not extending anteriorly (Fig. 82); gular lobe large, truncate ventrally, covering base of rostrum; rostrum reaching behind eyes; ratio anteocular/postocular portions: 2.68/1.18; interocular space/width of an eye: 0.10/0.15; anteclypeus large, truncate, lateral margins almost straight, widening slightly anteriorly, anterior margin weakly convex, without tubercle (Fig. 83). Antennal formula I:II:III:IV; 0.67: 1.43: 4.76: 2.41. Prothorax with a pronounced row of encircling pits on anterior lobe setting off collar, posterior lobe with numerous deep pits, without row on midline. Pronotum length 1.48; remainder of thorax 1.64; abdomen length 4.71. Hemelytra short narrow straps. Abdominal, thoracic sternites essentially bare, with a few scattered short semi-erect setae on sternites VI–VIII. Distance between anterior and middle coxae (measured between closest margins) 0.67; between middle and hind coxae 1.38. Anterior, middle acetabulae with two to four deep pits on anterior part, four or five on posterior part; posterior acetabula with six or seven pits on anterior part dorsally. Entire body set with scattered minute black denticles.

Proportions of legs as follows: femur, tibia, tarsal I, tarsal II, tarsal III of foreleg, 4.40: 5.17: 0.10: 0.20: 0.20; of middle leg, 4.86: 5.38: 0.10: 0.26: 0.20; of hind leg, 5.99: 7.48: 0.10: 0.20: 0.20.

Abdominal terminalia as shown in figures 84and 85. Male sternite VII with two (1+1) short black widely separated spine-like processes, each set on a broad weak tumescence near anterior margin, each composed of tightly clustered dark stiff setae, tips pointed almost caudad. Male sternite VIII unmodified; distal process of tergite VIII short; segment IX without lateral wings.

MICROPTEROUS FEMALE. Length 12.95–13.77, width 0.61. Similar in many respects to male, except coloration somewhat lighter, especially the abdomen. Abdominal terminalia as shown in figure 86; abdomen curved upward distally; sternite VII caudally with a few stiff dark setae directed postero-ventrally; connexival segments VI–VII set with scattered erect slender setae; tergite VIII set with erect brown setae, terminal process of moderate length, slightly curved, directed ventrally from plane of segment VII, but slightly upward from plane of thorax because of abdominal curvature (Fig. 86).

BRACHYPTEROUS and MACROPTEROUS FORMS. Unknown.

Diagnosis. This moderate-sized, yellowish brown species belongs to the long-headed *longicapitis* group, containing *H. zeylanica* Gunawardane & Karunaratne and *H. longicapitis* Bueno. *H. ripicola* is apparently the sister species of *H. longicapitis*, and is very close to the latter in many characteristics, although the two species may be separated by the structure of the male abdominal terminalia and other characters given in the key. Andersen (1992) also provided comparative notes, and a key to the *longicapitis* group species.

A description of this species was already prepared when the authors discovered that Dr. Andersen was completing his manuscript on the *H. longicapitis* group. We thus sent our material to Dr. Andersen, who kindly included it in his type series (Andersen, 1992).

Ecological notes. Hydrometra ripicola occurs along the margins of pools on rocky upland streams in the hill country of northern Thailand.

Distribution. Thailand (Fig. 105).

Material examined (all micropterous). THAILAND, **Chiang Mai Prov.**: 2 males, 12 females, trib-

utary to Nam Chai River, Fang Horticultural Res. Sta., CL 2202, 15 Nov. 1985, J.T. & D.A. Polhemus; 3 males, 2 females, Huay Hia Creek, Fang Horticultural Res. Sta., CL 2198, 15 Nov. 1985, J.T. & D.A. Polhemus (JTPC; all paratypes); 1 female, Chiangmai, 1 March 1952, Lot #275, D. C. & E. R. Thurman (JTPC); 1 male [head missing], Chaingdao, 450 m, 5–11 April 1958, T.C. Maa (BPBM).

ACKNOWLEDGMENTS

We are pleased to acknowledge the invaluable assistance of the following persons who helped us with permits, guidance, transportation and logistics, and without whose help and patience our field surveys in Southeast Asia could not have been accomplished: Drs. Rosichon Ubaidillah, Dr. Soetikno Wiroatmodjo, Dr. Mohammed Amir, and other personnel from the Indonesian Institute of Sciences (LIPI), Bogor; Mrs. Moertini, Mr. Sanchoyo, and the other staff members of the LIPI office in Jakarta; Dr. D. H. (Paddy) Murphy, National University of Singapore; Mikkel Christensen, TAD Corp., Samarinda, Kalimantan Timur; Meke Meikdely, Ambon, Maluku; Mr. Hamdjah, Palu, Sulawesi Tengah; Dr. Victor Gapud, University of the Philippines, Los Banos; Burt Barrion, International Rice Research Institute, Los Banos; and P. B. Karunaratne, Nugegoda, Sri Lanka.

The following curators kindly provided loans of specimens held under their care (collection abbreviations are those used in the text): Dr. Robert Brooks, Snow Entomological Museum, Lawrence (SEMC); Drs. Richard Froeschner and Karl Krombein, National Museum of Natural History, Smithsonian Institution, Washington, D. C. (USNM), and Dr. N. M. Andersen, Universitets Zoologisk Museum Copenhagen (ZMUC). Holotypes of all new species described herein are deposited in the Bishop Museum, Honolulu (BPBM), or the U. S. National Museum of Natural History; paratypes are held in the J. T. Polhemus collection, Englewood, Colorado (JTPC), and where numbers permit will be distributed to the institutions noted above as well as the Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB), and the Universitets Zoologisk Museum (Copenhagen).

This research was based in part on material collected during the authors' participation in Project Wallace, a joint scientific under-taking sponsored by the Royal Entomological Society of London and the Indonesian Institute of Sciences (LIPI). Further support was provided by a series of grants (3053-85, 3398-86, 4537-91) from the National Geographic Society, Washington, D. C., and by grant BSR-9020442 from the National Science Foundation, Washington, D. C. We thank all these organizations for their continued support on research into the systematics and zoogeography of aquatic Heteroptera.

CHECKLIST OF *HYDROMETRA* OF THE WESTERN MALAY ARCHIPELAGO AND INDOCHINA
(including Burma, Malaya, Thailand, Viet Nam, Laos, Cambodia).

SPECIES	DISTRIBUTION
annamana H & E	SE Asia, China, Taiwan (= *taipehana* Drake), Thailand
carinata n. sp.	Borneo (East Kalimantan), Malaya
cracens n. sp.	Borneo (Sabah, Sarawak), Malay Peninsula
gilloglyi n. sp.	Malay Peninsula, Viet Nam, Borneo (Sabah, Sarawak)
greeni Kirkaldy	Bangladesh, India, Nepal, China, Ceylon, Sumatra, Thailand
jaczewskii Lundblad	Burma, Java, Sumatra
julieni H & E	Borneo, Philippines (Mindoro), Malay Peninsula, Vietnam
julienoidea n. sp.	Sumba, Sumbawa
kelantan n. sp.	Malay Peninsula
lineata Eschscholtz*	Ambon, Celebes, New Guinea (Irian Jaya, Papua New Guinea), Borneo (Sabah), Philippines (Bohol, Leyte, Luzon, Mindanao, Negros, Palawan), China
lombok n. sp.	Bali, Flores, Lombok, Sumba, Sumbawa, Timor
longicapitis Torre Bueno	Malay Peninsula, Sumatra (= *aberrans* H & E), Thailand
maidli H & E	Thailand, Malay Peninsula, Java, Borneo, Celebes, Lombok, Sumba, Sumbawa, Timor
mindoroensis J. Polhemus*	Celebes, New Guinea (Irian Jaya, Papua New Guinea), Philippines (Leyte, Luzon, Mindanao, Mindoro, Palawan), Borneo (Sabah)
orientalis Lundblad*	SE Asia to Australia
papuensis Kirkaldy*	Borneo, Malay Peninsula, New Guinea (Papua New Guinea), Australia
ripicola Andersen	Thailand

* = species common to both the Malay Archipelago and Melanesia.

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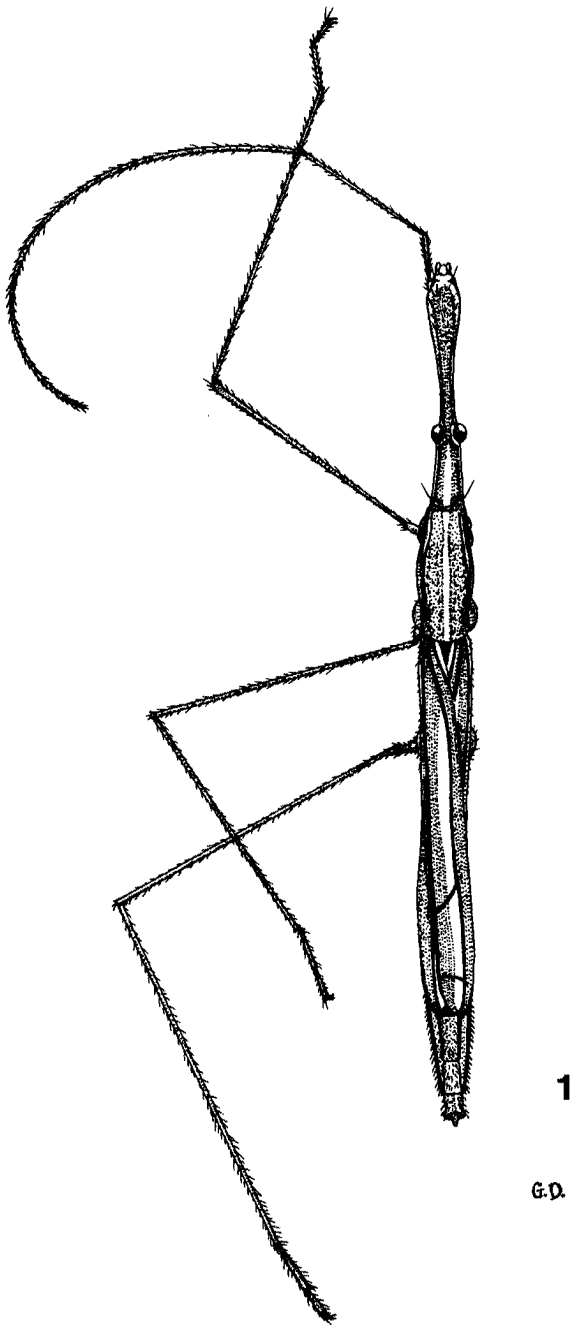
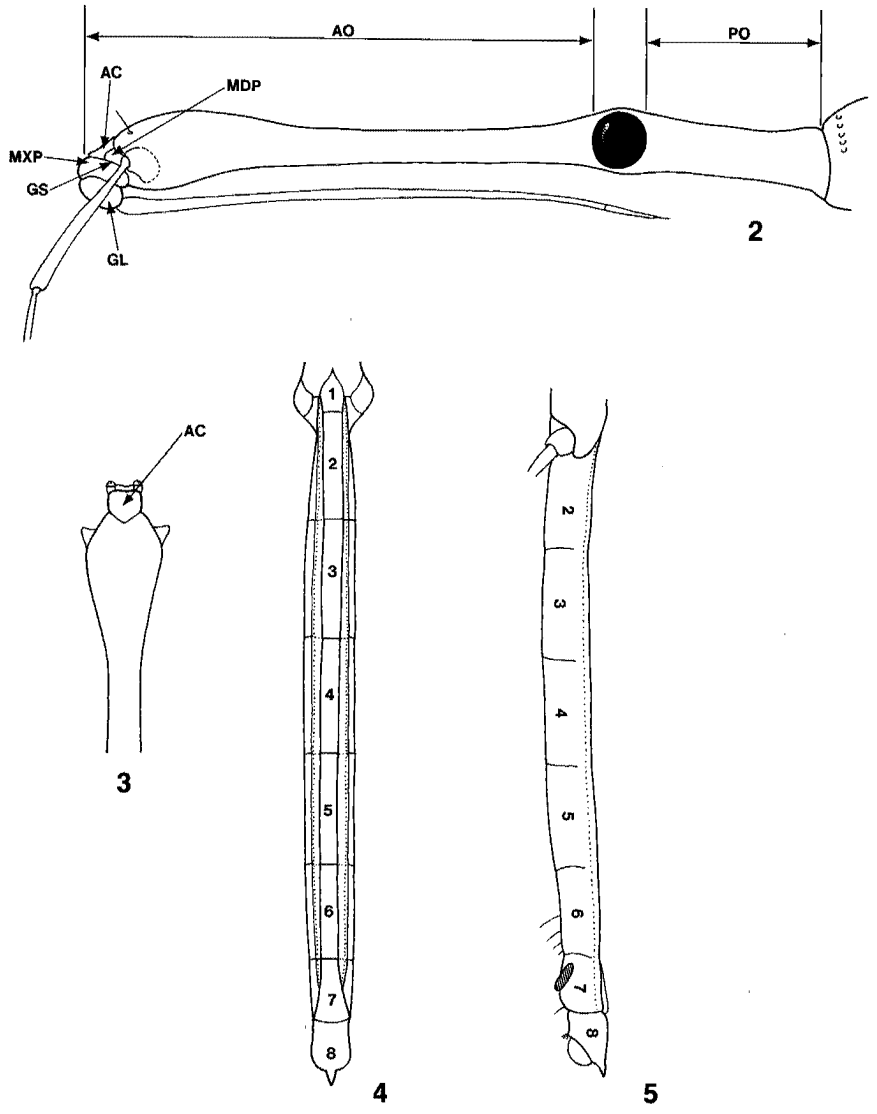
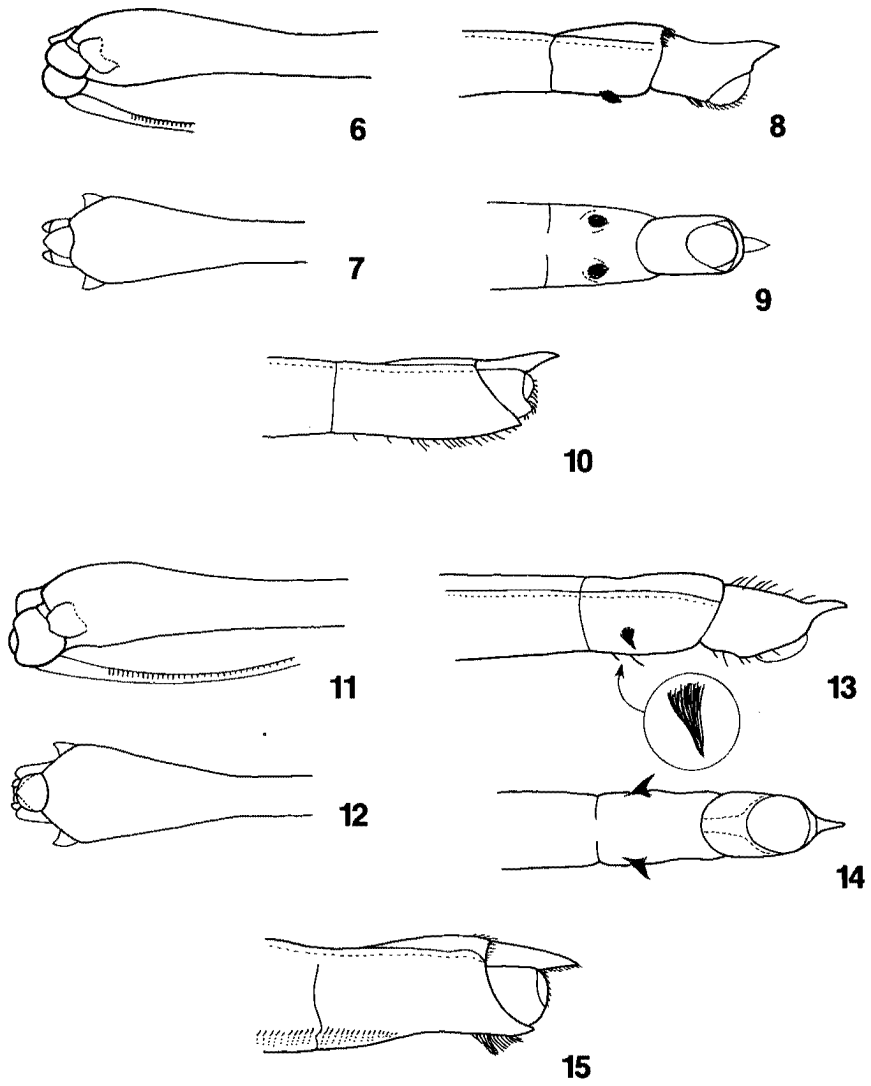


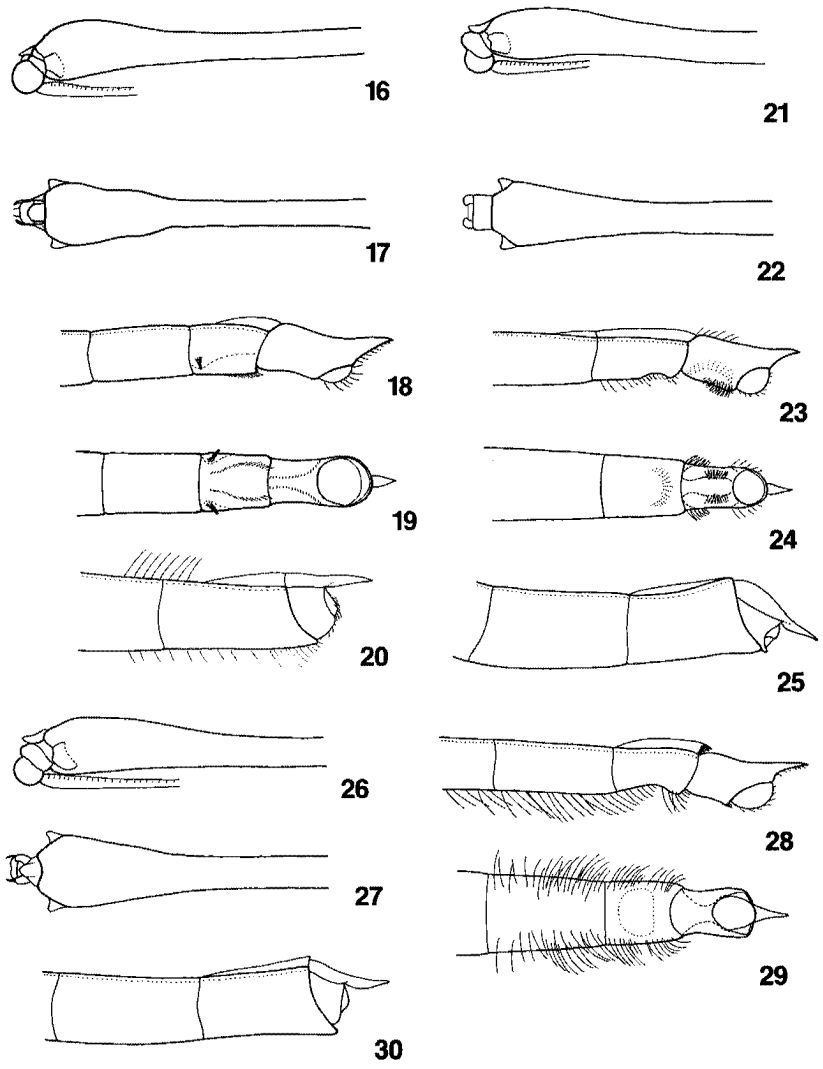
Figure 1. *Hydrometra lineata* Eschscholtz, male, dorsal habitus.



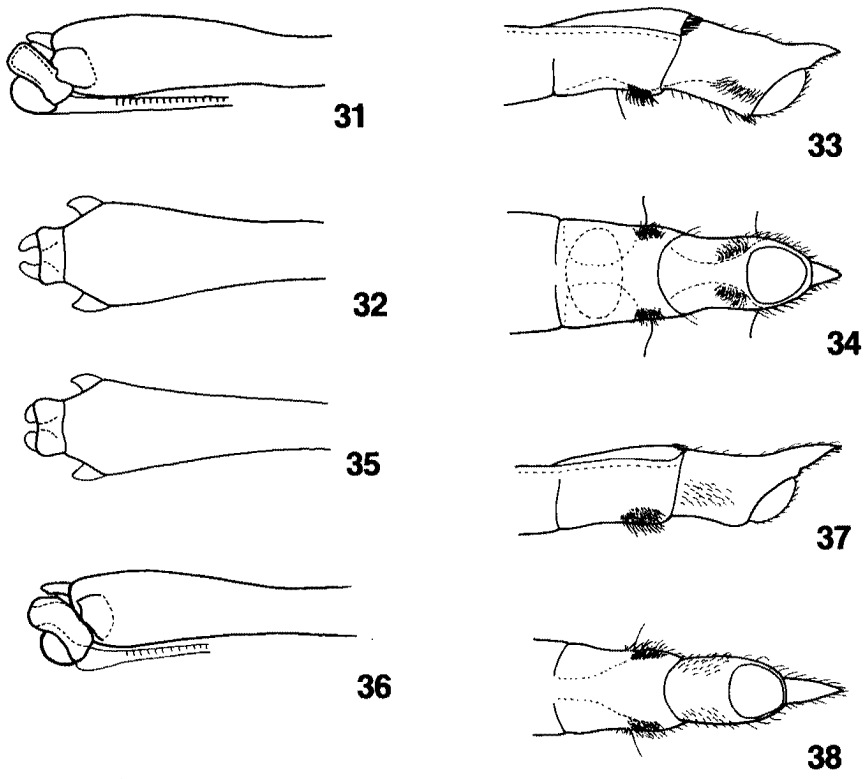
Figs. 2–5. *Hydrometra papuana* Kirkaldy, showing locations of structures discussed in text. **2.** Head, lateral view. Abbreviations are as follows: AO = anteocular distance, PO = postocular distance, AC = anteclypeus, MXP = maxillary plate, GS = gular suture, GL = gular lobe, MDP = mandibular plate. **3.** Head apex, dorsal view. AC = anteclypeus. **4.** Male abdomen, dorsal view. Abdominal tergites I–VIII numbered. **5.** Male abdomen, lateral view. Abdominal segments II–VIII numbered.



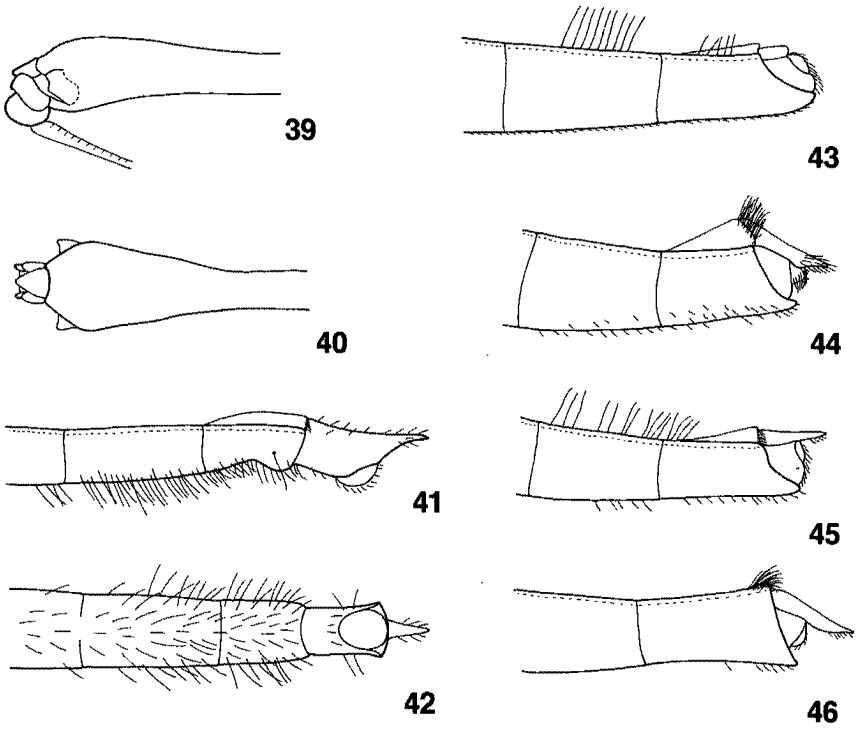
Figs. 6–10. *Hydrometra annamana* Hungerford and Evans. **6.** Apex of head, lateral view. **7.** Apex of head, dorsal view. **8.** Male terminal abdomen, lateral view. **9.** Male terminal abdomen, ventral view. **10.** Female terminal abdomen, lateral view. **11–15.** *Hydrometra carinata* n.sp. **11.** Apex of head, lateral view. **12.** Apex of head, dorsal view. **13.** Male terminal abdomen, lateral view. **14.** Male terminal abdomen, ventral view. **15.** Female terminal abdomen, lateral view



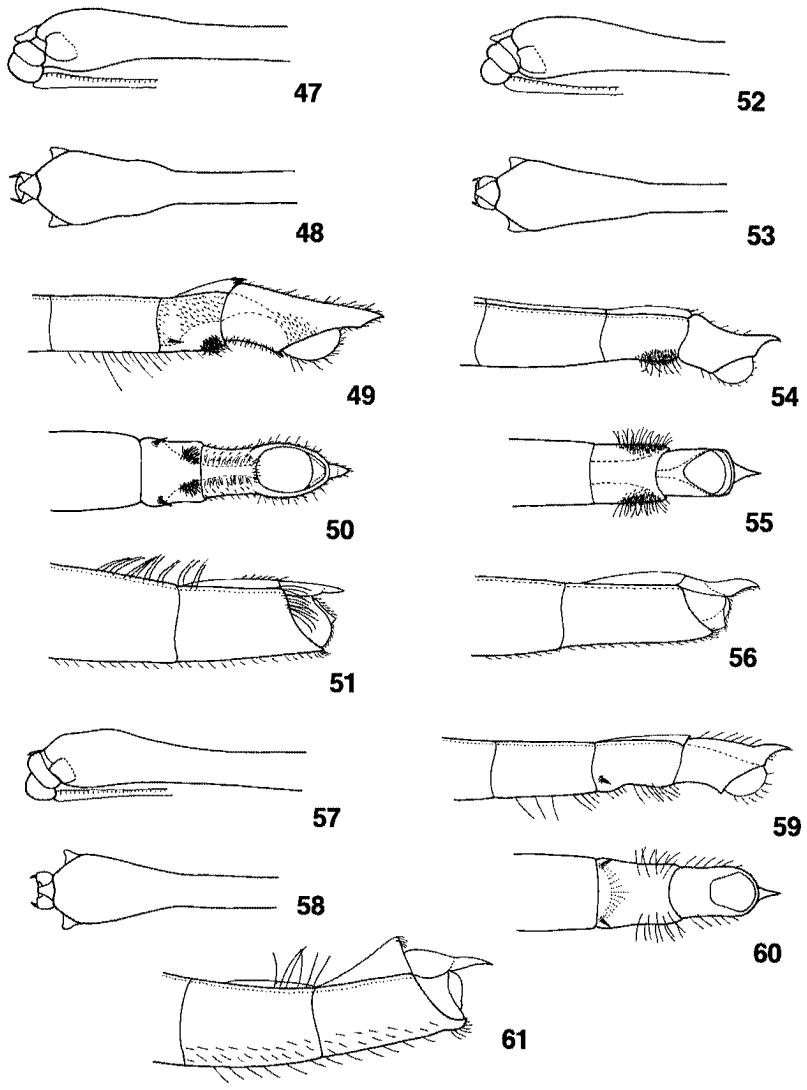
Figs. 16–20. *Hydrometra cracens* n.sp. **16.** Apex of head, lateral view. **17.** Apex of head, dorsal view. **18.** Male terminal abdomen, lateral view. **19.** Male terminal abdomen, ventral view. **20.** Female terminal abdomen, lateral view. **21–25.** *Hydrometra gilloglyi* n.sp. **21.** Apex of head, lateral view. **22.** Apex of head, dorsal view. **23.** Male terminal abdomen, lateral view. **24.** Male terminal abdomen, ventral view. **25.** Female terminal abdomen, lateral view. **26–30.** *Hydrometra greeni* Kirkaldy. **26.** Apex of head, lateral view. **27.** Apex of head, dorsal view. **28.** Male terminal abdomen, lateral view. **29.** Male terminal abdomen, ventral view. **30.** Female terminal abdomen, lateral view.



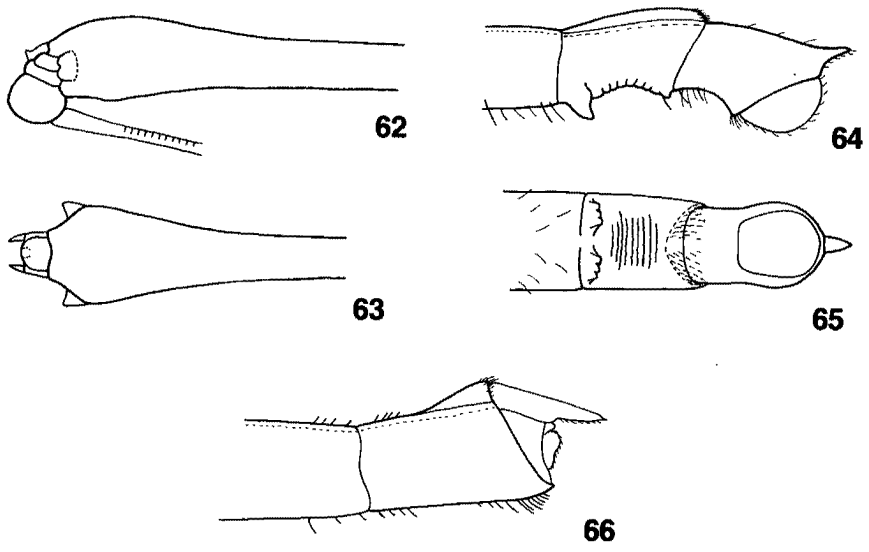
Figs. 31–34. *Hydrometra julienoidea* n.sp. **31.** Apex of head, lateral view. **32.** Apex of head, dorsal view. **33.** Male terminal abdomen, lateral view. **34.** Male terminal abdomen, ventral view. **35–38.** *Hydrometra julieni* Hungerford and Evans. **35.** Apex of head, dorsal view. **36.** Apex of head, lateral view. **37.** Male terminal abdomen, lateral view. **38** . Male terminal abdomen, ventral view.



Figs. 39–42. *Hydrometra kelantan* n.sp. **39.** Apex of head, lateral view. **40.** Apex of head, dorsal view. **41.** Male terminal abdomen, lateral view. **42.** Male terminal abdomen, ventral view. **43–46.** *Hydrometra* species, female terminal abdomen, lateral view. **43.** *H. papuana* Kirkaldy. **44.** *H. julienoidea* n.sp. **45.** *H. mindoroensis* Polhemus. **46.** *H. kelantan* n.sp.



Figs. 47–51. *Hydrometra lombok* n.sp. **47.** Apex of head, lateral view. **48.** Apex of head, dorsal view. **49.** Male terminal abdomen, lateral view. **50.** Male terminal abdomen, ventral view. **51.** Female terminal abdomen, lateral view. **52–56.** *Hydrometra maidli* Hungerford and Evans. **52.** Apex of head, lateral view. **53.** Apex of head, dorsal view. **54.** Male terminal abdomen, lateral view. **55.** Male terminal abdomen, ventral view. **56.** Female terminal abdomen, lateral view. **57–61.** *Hydrometra jaczewskii* Lundblad. **57.** Apex of head, lateral view. **58.** Apex of head, dorsal view. **59.** Male terminal abdomen, lateral view. **60.** Male terminal abdomen, ventral view. **61.** Female terminal abdomen, lateral view.



Figs. 62–66. *Hydrometra longicapitis* Bueno. **62.** Apex of head, lateral view. **63.** Apex of head, dorsal view. **64.** Male terminal abdomen, lateral view. **65.** Male terminal abdomen, ventral view. **66.** Female terminal abdomen, lateral view.

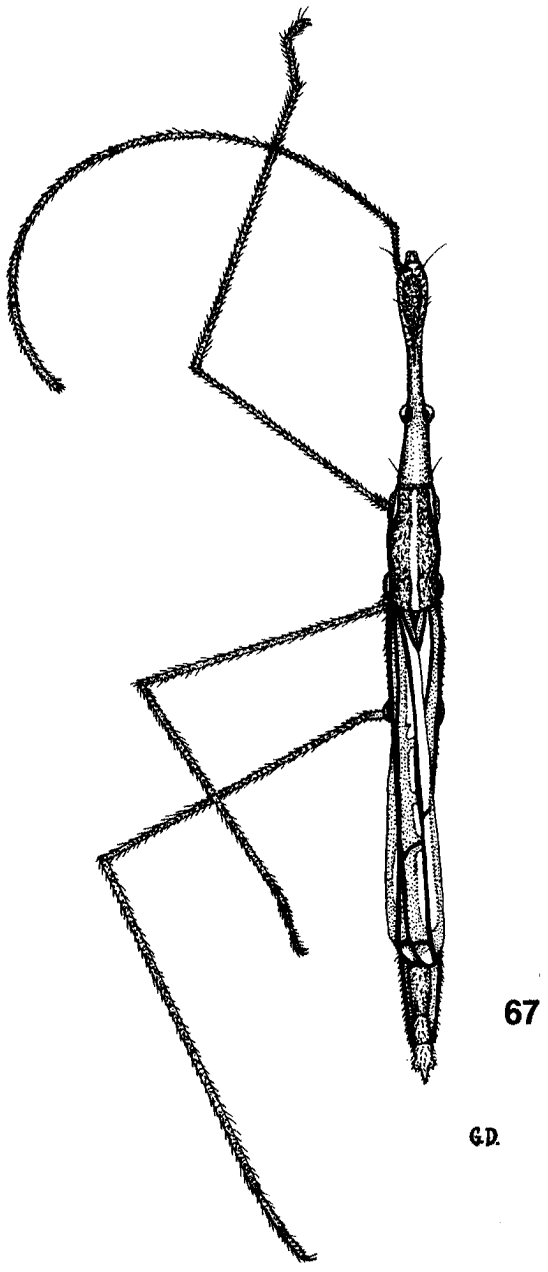
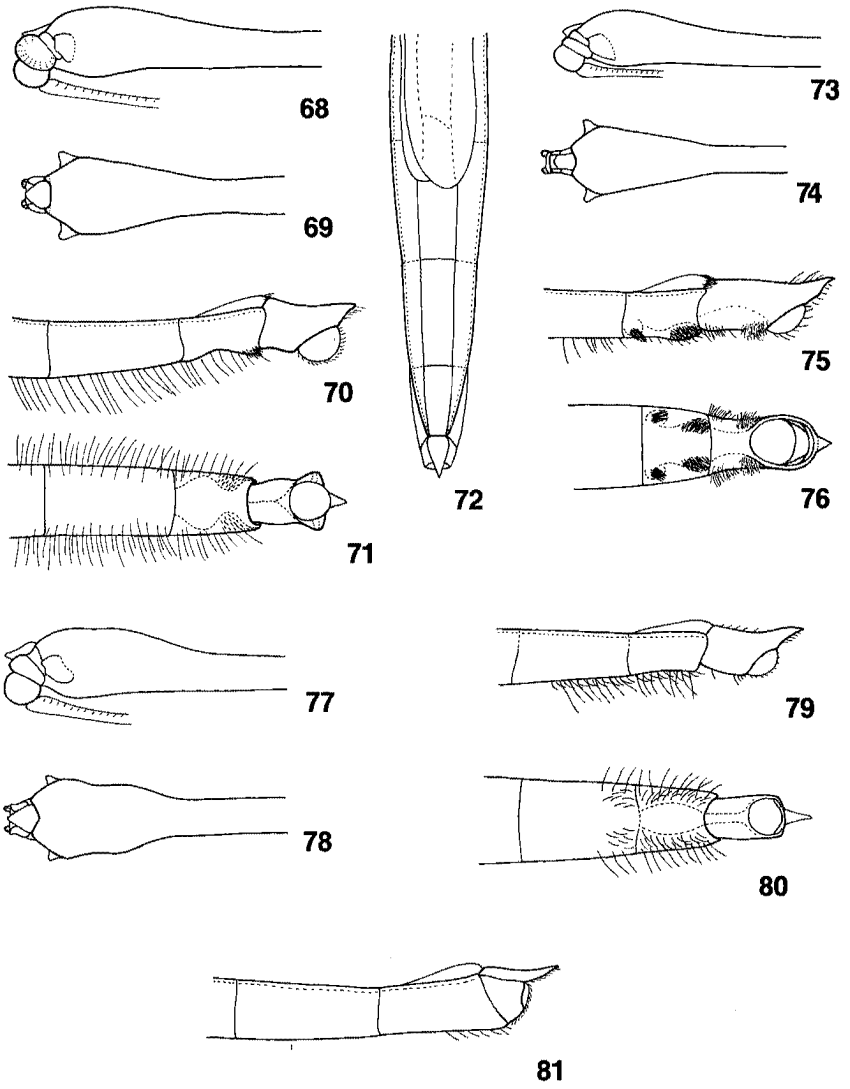
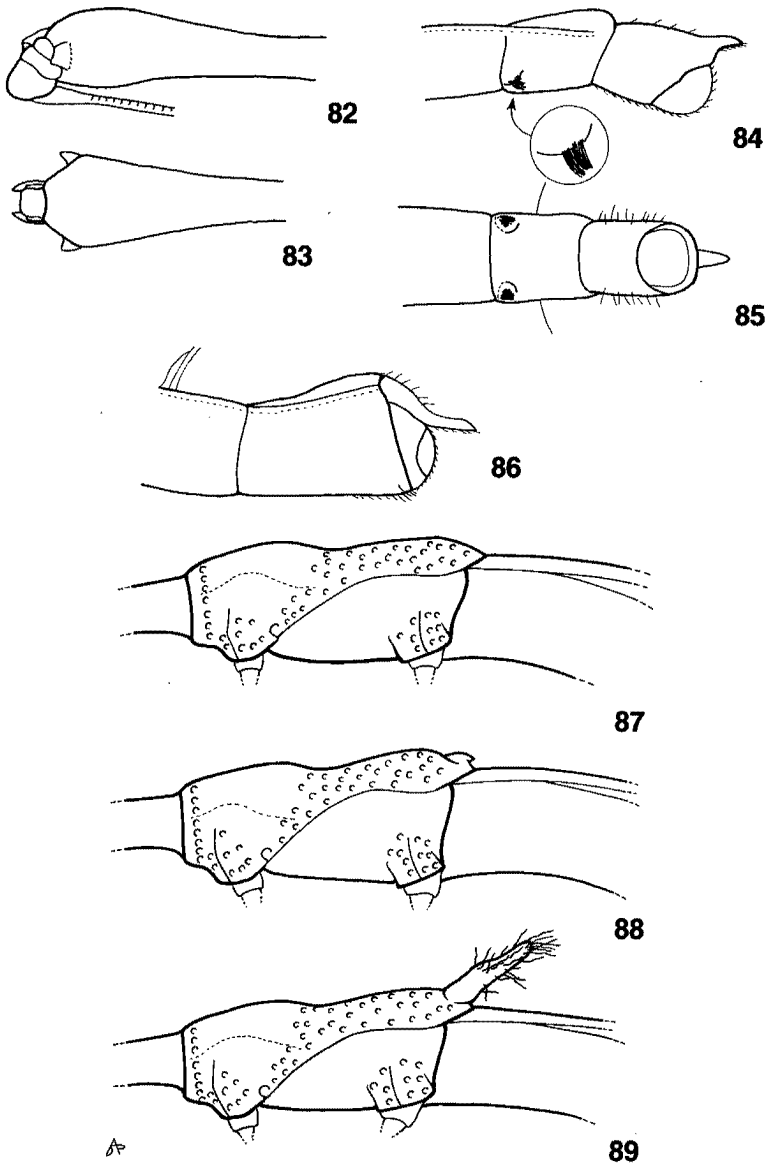


Fig. 67. *Hydrometra orientalis* Lundblad. Male, dorsal habitus.



Figs. 68–72. *Hydrometra lineata* Eschscholtz. **68.** Apex of head, lateral view. **69.** Apex of head, dorsal view. **70.** Male terminal abdomen, lateral view. **71.** Male terminal abdomen, ventral view. **72.** Female abdomen, dorsal view. Note convergent connexiva posteriorly. **73–76.** *Hydrometra mindoroensis* Polhemus. **73.** Apex of head, lateral view. **74.** Apex of head, dorsal view. **75.** Male terminal abdomen, lateral view. **76.** Male terminal abdomen, ventral view. **77–81.** *Hydrometra orientalis* Lundblad. **77.** Apex of head, lateral view. **78.** Apex of head, dorsal view. **79.** Male terminal abdomen, lateral view. **80.** Male terminal abdomen, ventral view. **81.** Female terminal abdomen, lateral view.



Figs. 82–86. *Hydrometra ripicola* Andersen. **82.** Apex of head, lateral view. **83.** Apex of head, dorsal view. **84.** Male terminal abdomen, lateral view. **85.** Male terminal abdomen, ventral view. **86.** Female terminal abdomen, lateral view. **87–89.** *Hydrometra longicapitis* Torre-Bueno, female thorax, lateral view, showing polymorphism in development of tubercle on pronotum. **87.** Normal form. **88.** Pronotal lobe with incipient tubercle. **89.** Pronotal lobe with well developed tubercle

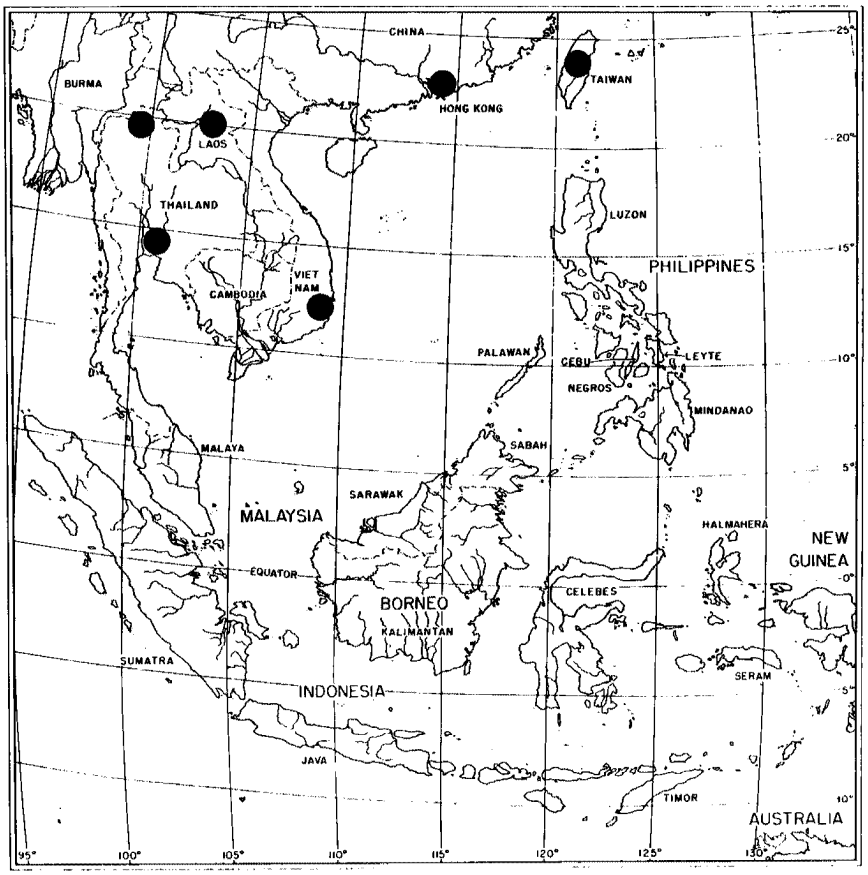


Fig. 90. Distribution of *H. annamana* Hungerford and Evans in Southeast Asia.

Fig. 91. Distribution of *H. carinata* n.sp. in Southeast Asia.

Fig. 92. Distribution of *H. cracens* n.sp. in Southeast Asia.

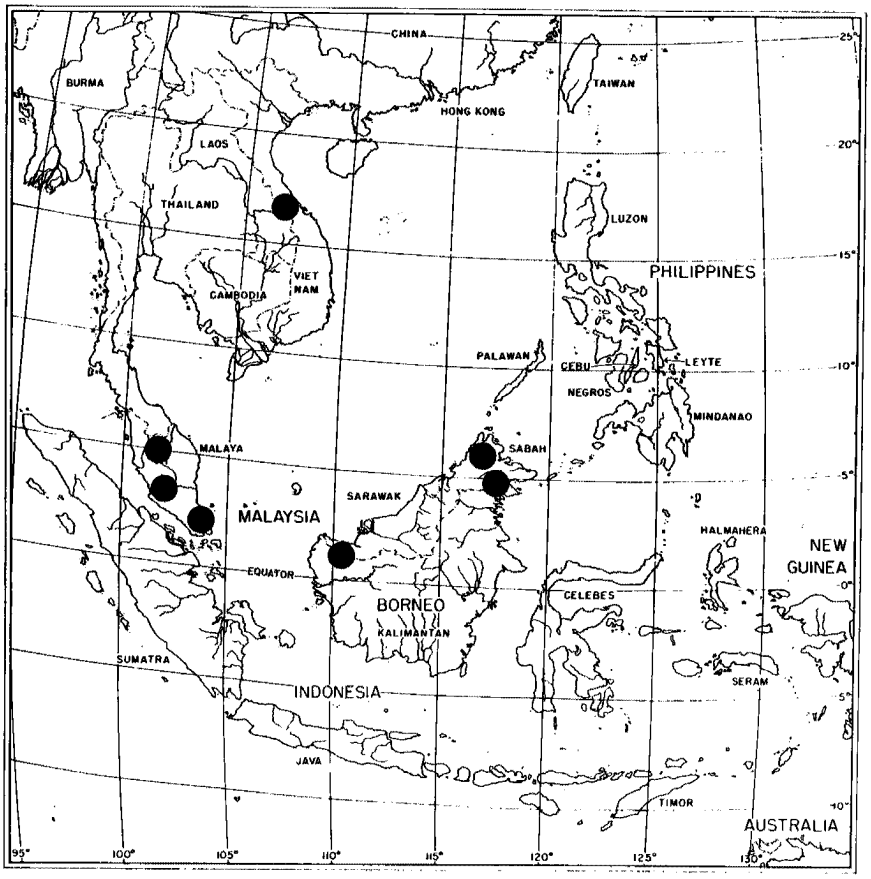


Fig. 93. Distribution of *H. gilloglyi* n.sp. in Southeast Asia.

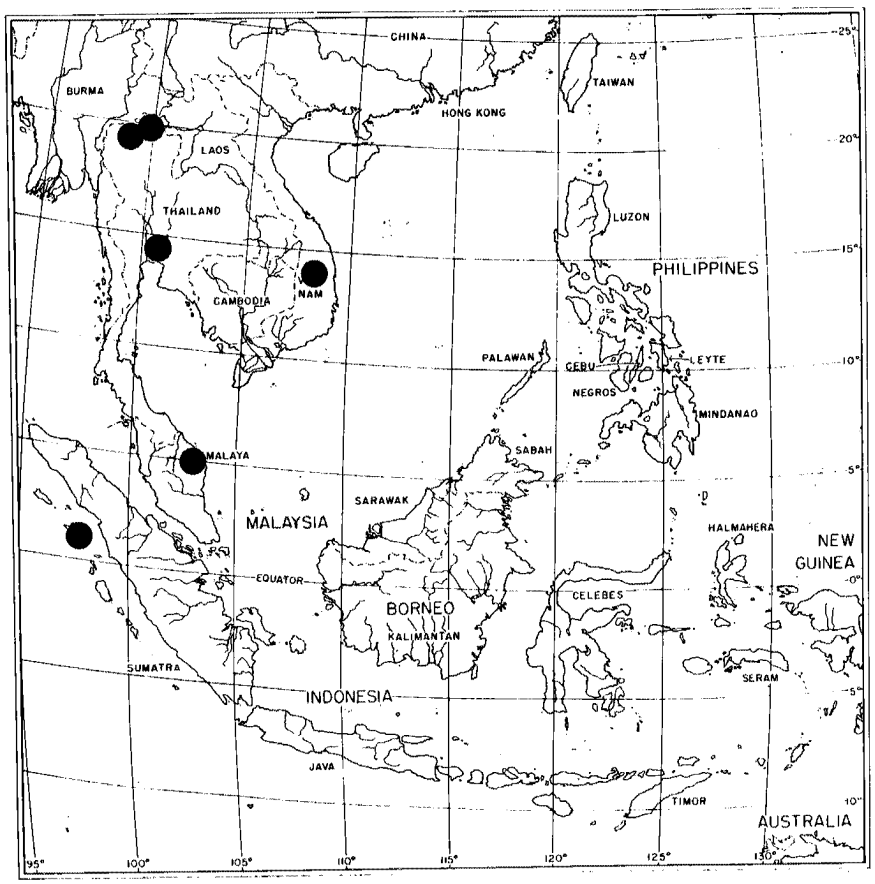


Fig. 94. Distribution of *H. greeni* Kirkaldy in Southeast Asia.

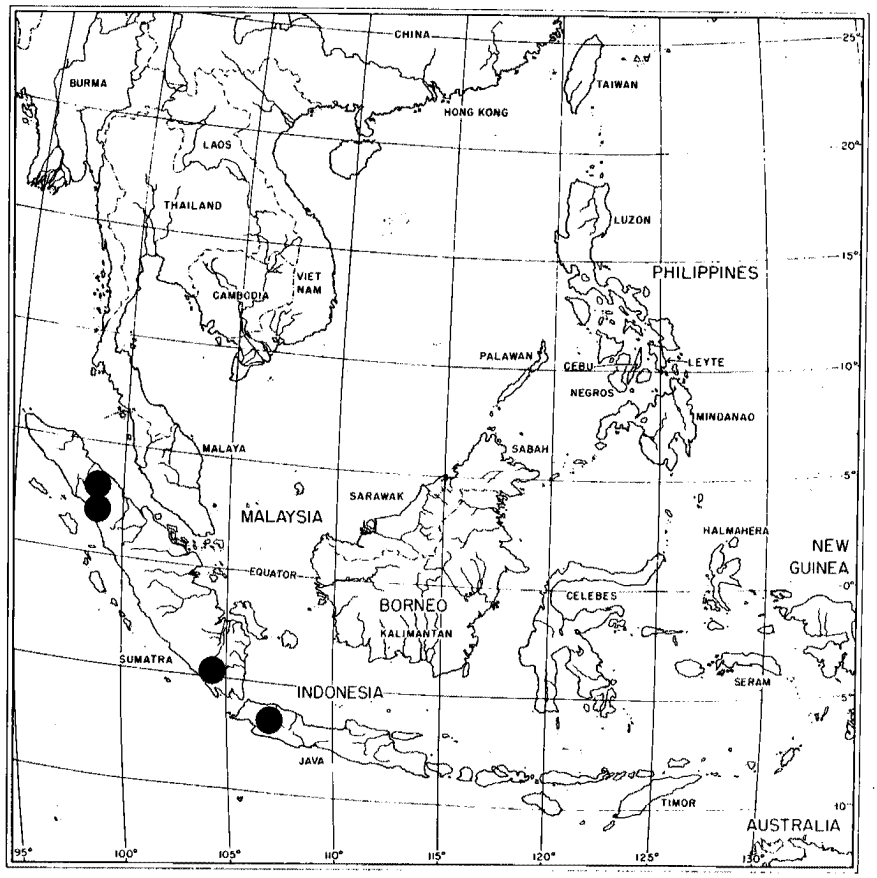


Fig. 95. Distribution of *H. jackzewskii* Lundblad in Southeast Asia.

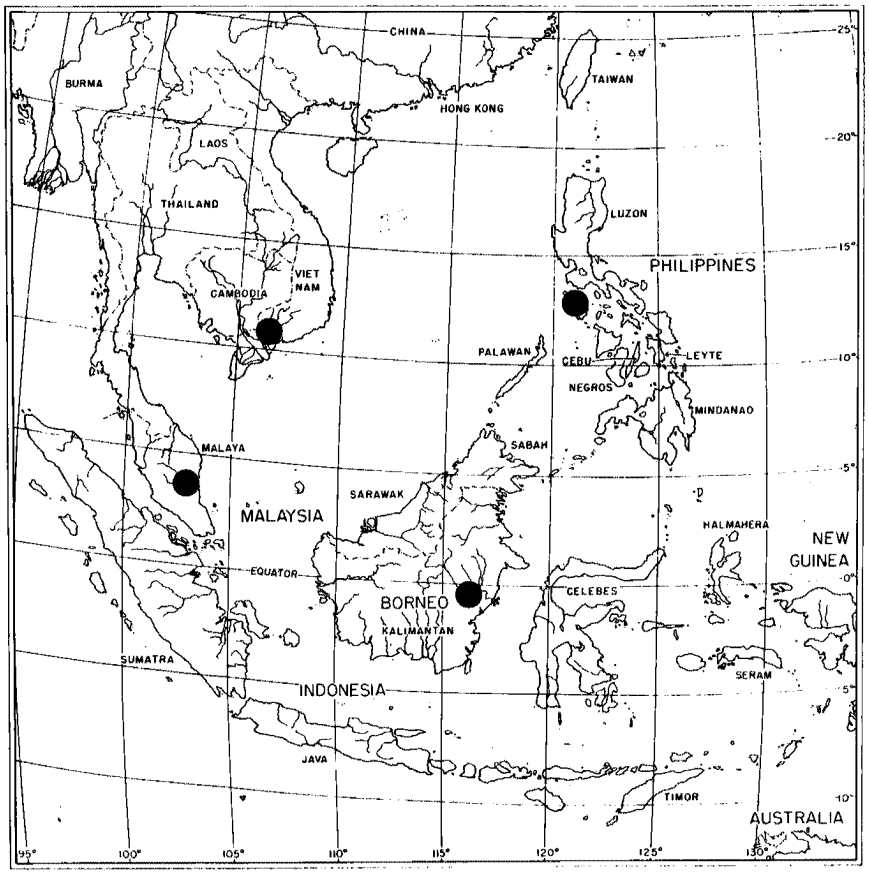


Fig. 96. Distribution of *H. julieni* Hungerford and Evans in Southeast Asia.

Fig. 97. Distribution of *H. julienoidea* n.sp. in Southeast Asia.

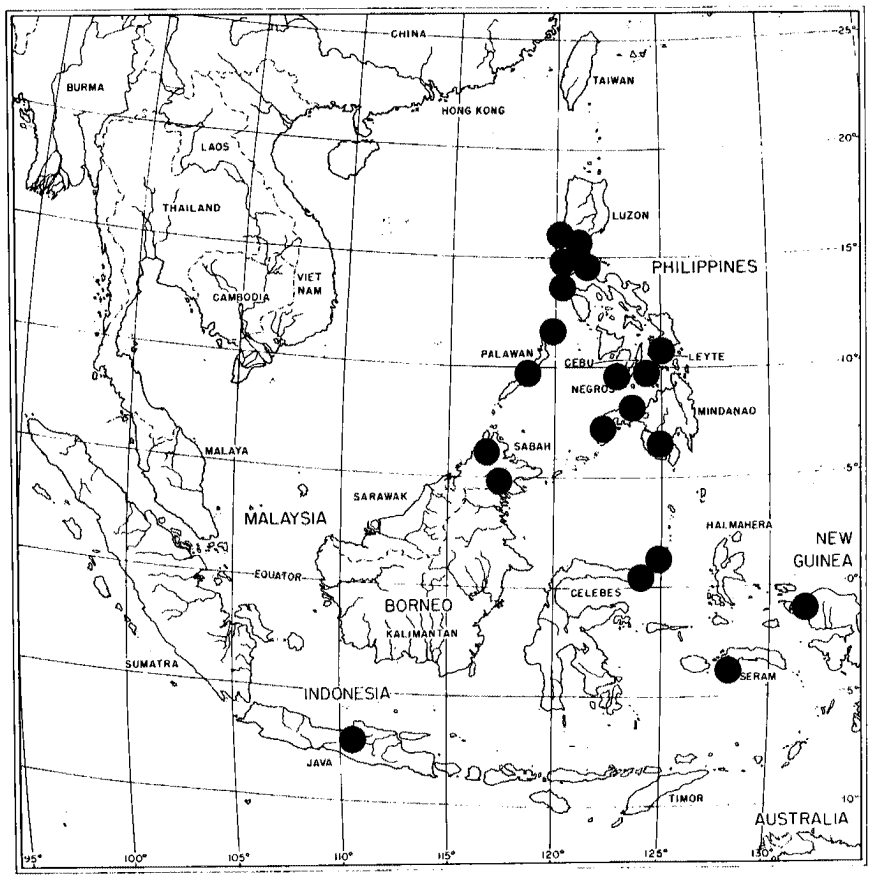


Fig. 98. Distribution of *H. lineata* Eschscholtz in Southeast Asia.

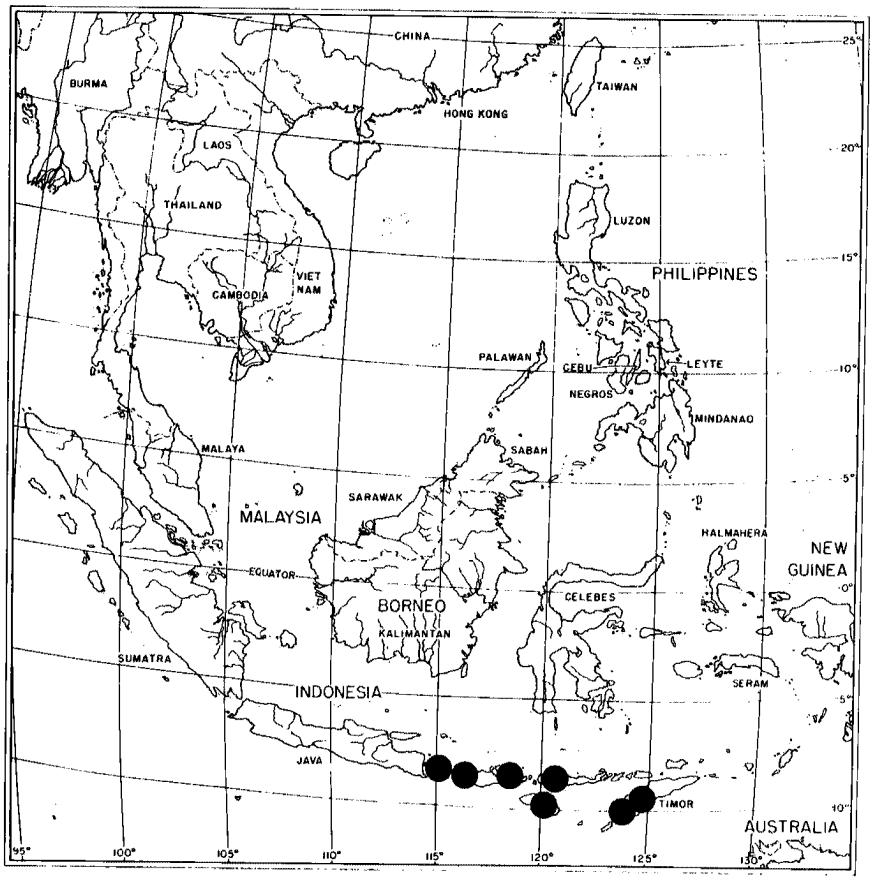


Fig. 99. Distribution of *H. lombok* n.sp. in Southeast Asia.

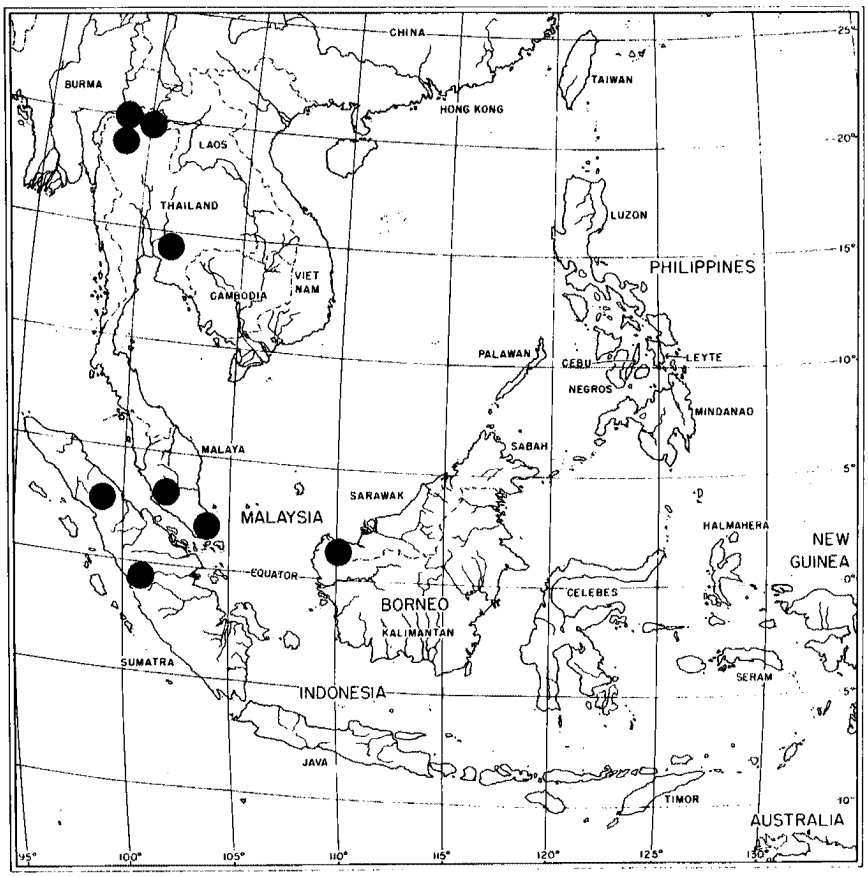


Fig. 100. Distribution of *H. longicapitis* Torre-Bueno in Southeast Asia.

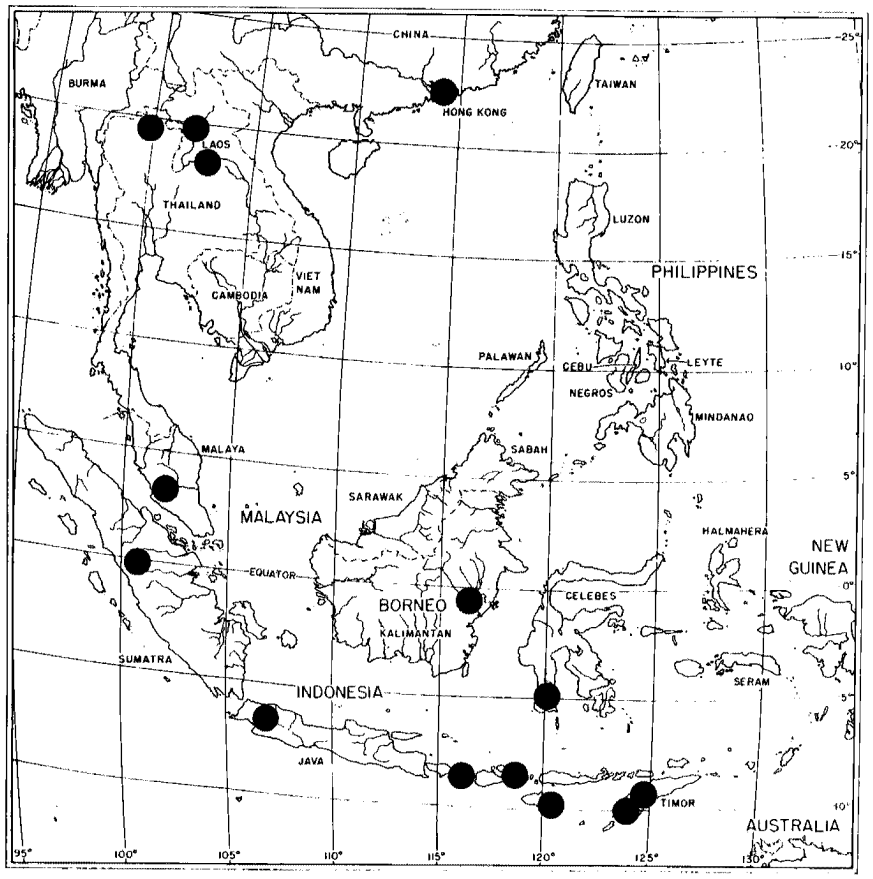


Fig. 101. Distribution of *H. maidli* Hungerford and Evans in Southeast Asia.

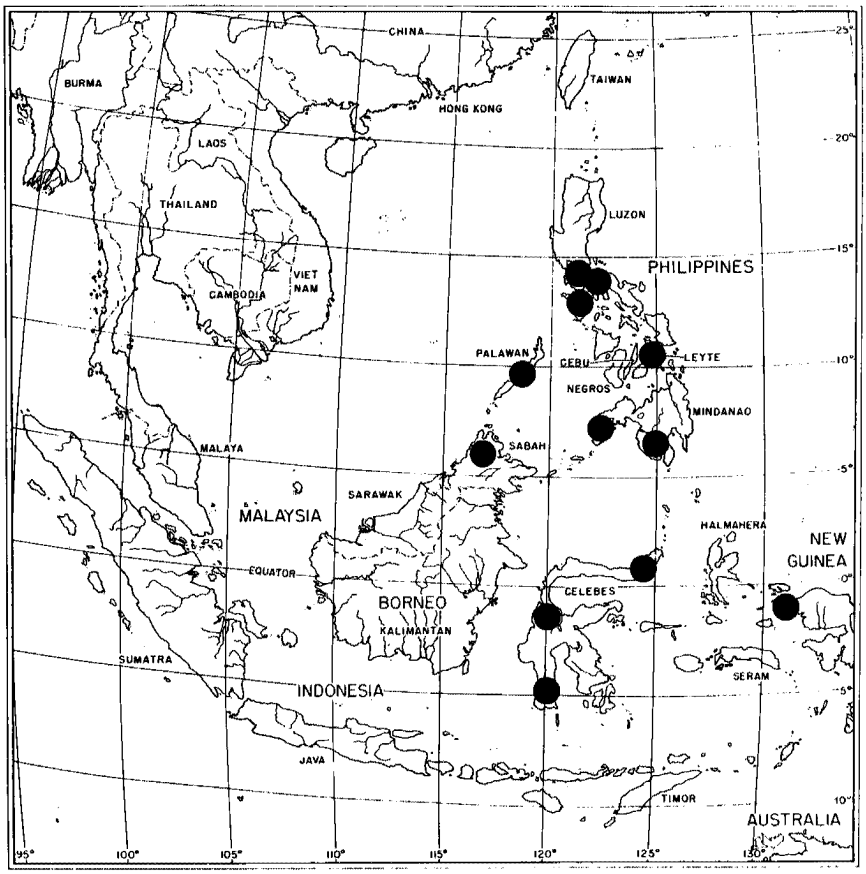


Fig. 102. Distribution of *H. mindoroensis* Polhemus in Southeast Asia.

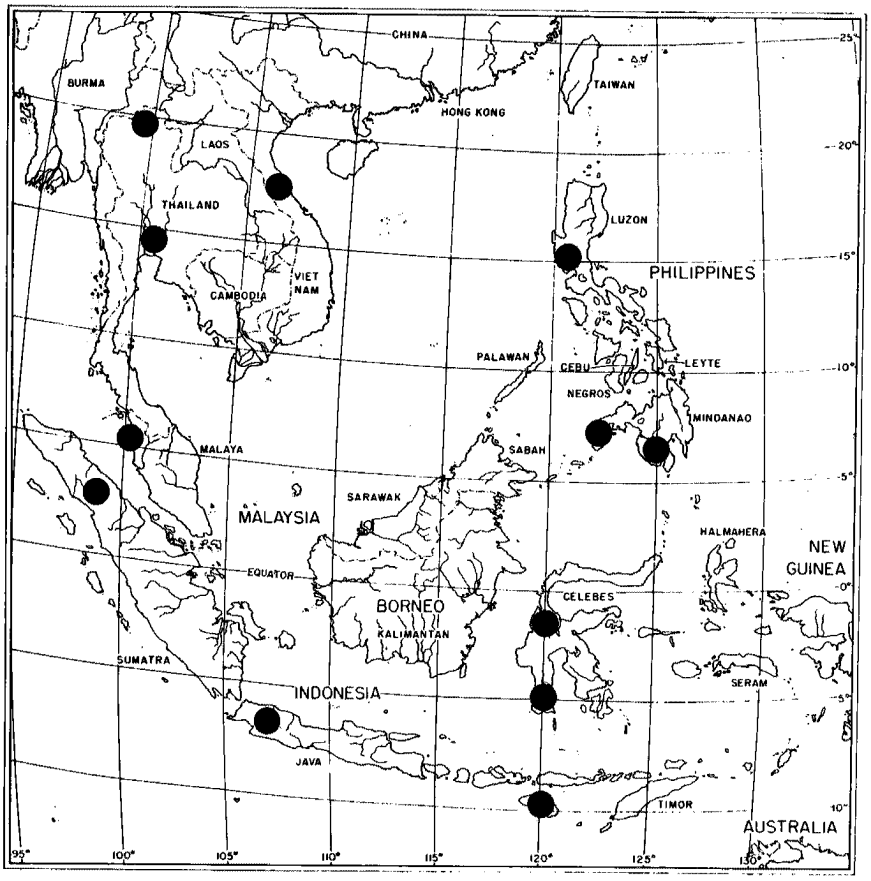


Fig. 103. Distribution of *H. orientalis* Lundblad in Southeast Asia.

Fig. 104. Distribution of *H. papuana* Kirkaldy in Southeast Asia.

Fig. 105. Distribution of *Hydrometra* species in Southeast Asia.
Square = *H. ripicola* Andersen. Triangle = *H. kelantan* n.sp.