The species of Anisops and Micronecta described below were studied within the framework of preparing an identification guide to the Heteroptera of Thailand and adjacent areas (ed. P. Chen). In addition, a second species of Aphelocheirus from the island of Java, Indonesia is described.

**MATERIAL AND METHODS**

Part of the material was collected while preparing a survey of aquatic and semiaquatic bugs of North Thailand, supported by the University of Chiang Mai, Thailand, and a grant from the Uyttenboogaart-Eliasen Stichting, Amsterdam, The Netherlands.

Measurements are in mm and based on five specimens, if available, of each sex taken from the sample containing the holotype. Measurements are presented as the mean ‘x’ followed by the standard deviation based on sample ‘s’. For some measurements the actual value for the holotype is added between brackets {}. If only two or three specimens are available the measurements are presented as range, in case of three specimens with the mean between <>. The mean values of measurements of leg segments are presented in table 1. If there is no significant difference in length of leg segments between the sexes of a species, the measurements are united. Length and width refer to body length and maximum width, with the body in a horizontal plane. Body length is measured from the anterior point of head to the posterior point of hemielytra in dorsal view. The width of an eye in Micronecta is measured along its posterior margin. In Aphelocheirus the head is measured with its own longitudinal axis horizontal; the width of an eye is here the maximum width perpendicular on the longitudinal axis of the head. A special ratio, used in Micronecta, is the ocular index, which is calculated as two times the synthlipsis (S) divided by the width of the head across the eyes (D) minus the synthlipsis: 2S/(D-S). The synthlipsis is the smallest distance between the eyes posteriorly. In Anisops, where the synthlipsis is often very narrow, the ocular index based on vertex (Nieser 1975) is used. This index is defined as two times the anterior width of vertex (V) divided by the width of head (D) minus anterior width of vertex: 2V/(D-V). These ocular indexes eliminate to certain extent the errors in comparing measurements of D, S and V due to not perfect orientation of the head when measuring. Leg segments are measured in ventral view with the segment under consideration in a horizontal plane.

**Abbreviations & depositories**

- LvV: fifth instar larva.
- CMCT: Chiang Mai University, Department of Biology Collection, Chiang Mai, Thailand.
- NHMW: Naturhistorisches Museum, Wien, Austria.
FAMILY MICRONECTIDAE JACZEWSKI, 1924

Genus *Micronecta* Kirkaldy, 1897

The family Micronectidae has alternately been considered a subfamily of Corixidae and a separate family (Nieser & Chen 1999, Nieser 2002b).

Species of *Micronecta* are small Nepomorpha with a length from less than 1 to 4 mm, but only very few species reach a length of 3 mm. They live in stagnant or nearly stagnant waters. Some species are very widespread in tropical areas, these species are either always macropterous or have an important fraction of macropterous specimens. They occur in habitats in agricultural fields as well as in more natural habitats e. g. marshes or stagnant ponds in stream beds. Examples are *M. ludibunda* Breddin which occurs both in the brachypterous and macropterous form and is distributed from India through southeast Asia and Indonesia, to New Guinea and the Solomon Islands; and *M. quadristrigata* Breddin which is always macropterous and distributed from Iran through India, southeast Asia, Indonesia and the Philippines to N. Australia. Both species are common and often abundant in Thailand. Other species have a restricted distribution. They are often restricted to more or less stagnant waters associated with streams, and are often predominantly brachypterous. A key to the Micronectidae of Thailand and adjacent countries is given by Nieser (2000). However, Nieser (2002a) described four more species from the neighbouring Malay Peninsula, of which one already has been found in Thailand. In addition, Chen et al. (2002) described one more species from Thailand. We estimate that, especially in waters associated with streams in hilly and mountainous areas in Thailand, some more new records and undescribed species could be found. In other parts of continental southeast Asia, especially Laos and Cambodia, collection has been distinctly less intensive than in West Malaysia and Thailand.

Stridulation in *Micronecta* has been explained by Jansson (1989). We use his terminology: the pars stridens is an area of fine ribs on the ventral lobe on the right paramere, the plectrum is an area with at least one sclerotized ridge about halfway near the inner margin of the left lobe of segment 8, however, with normal optics this is usually difficult to observe and will be ignored in the present descriptions. Especially the term plectrum has been used differently by other authors e. g. Wróblewski (1972) and Nieser (2000).

*Micronecta spaniotricha* sp. n.  
(figs. 1, 4-11)

Type locality. – THAILAND: Chiang Mai Prov., Chom Thong Dist., Doi Inthanon National Park.

Type material. – Holotype, macropterous male (RMNH): THAILAND, Chiang Mai Prov., Chom Thong Dist., Doi Inthanon National Park, Wang Khway
waterfall, 72 Km SW Chiang Mai City, 31 Jan. 2002, leg. N. Nieser, C. Duangsupa & A. Thanyakan (waterfall near the road). – Paratypes 13♂ 13♀ same data as holotype (NCTN, 1♂ 2♀ CMCT); Doi Inthanon NP, 68 Km SW Chiang Mai city, Baan Num Tok Mae Kleng, Mae Kleng waterfall, 31.1.2002, leg. N. Nieser, C. Duangsupa & A. Thanyakan (stagnant pools in stream bed, 300 m downstream of the waterfall), 3♂ 2♀, paratypes. All macropterous.

Distribution. – Only known from the type locality.

Description
Macropterous form, based on alcohol material. A medium sized, light brown, oval species (fig. 1). Dimensions. Length ♂ x 2.25, s 0.089 [2.15], ♀ x 2.23, s 0.020; width ♂ x 1.17, s 0.0151 [1.17], ♀ x 1.24, s 0.021; width of head ♂ x 0.82, s 0.012 [0.81], ♀ x 0.86 s 0.015; synthelipsis ♂ x 0.39, s 0.023 [0.38], ♀ x 0.42 s 0.015; width of an eye ♂ x 0.22, s 0.012, [0.21], ♀ x 0.24, s 0.006; width of pronotum ♂ x 0.86, s 0.038 [0.83], ♀ x 0.92, s 0.006; ocular index ♂ x 1.84, s 0.19; [1.77], ♀ x 1.93, s 0.188.

Colour. Dorsally medium brown, head yellowish, posterior margin of interoculus infuscated; in frontal view a brown spot midway between eyes (absent in one male), eyes castaneous to grey. Pronotum unicolorous brown except an indistinct small spot medioanteriorly, a narrow stripe along posterior margin and humeral angles yellowish with a dark patch. Basal hyaline patch on clavus opaque, only slightly more translucent than remainder of hemelytra. Costal margin yellowish, most of embolar groove from base on brown dorsal; clavus and corium with very vague irregular dark patches, not or hardly visible with hemelytra closed over abdomen, sometimes forming a transverse band on corium, just caudally of the caudal tip of clavus; right membrane with a rather broad dark brown margin laterally and caudally. Thoracic venter yellowish, abdominal venter yellowish brown to medium grey. Legs yellowish.

Structural characteristics. Pronotum smooth but dull, hemelytra shiny, densely beset with well visible spines. Ratio width/length body male 1.9, female 1.8. Head very slightly narrower than pronotum, synthelipsis 1.8 times the width of an eye. Pronotum dorsally nearly flat with lateral angles curving ventrad, 3.2 times as wide as long. Spines laterally on abdominal segments: v 2 short, 1 long; vi 2 short, 2 long; vii 2 short, 2 long, 1 intermediate bristle-like; viii 4-5 short, 2 very long hair-like.

Male. Fore femur with two spines proximally of midway near ventral margin (fig. 9); one, rather long, in distal one third and two apically. Fore tibia with one bristle-like spine apicoventrally and two smaller spines in ventral half of apical margin; pala with three long hairs dorsally, dorsal palmar row with about 15 short bristles and two apical ones longer, ventral palmar row with about 18 long bristles becoming gradually more strongly developed towards apex (fig. 10). Claw narrowly clavate. Prestrigilar lobe (fig. 6) with an apically rounded, rather long, mediocaudal tongue-like process, base not sutured off from tergite; strigil elongate, similar in shape to the strigil of M. tuwanoni sp. n. (figs. 14, 15), with its teeth in one row so densely packed that they cannot be counted at a magnification of 400x. Abdominal sternite vii with four long bristles, its submedial caudal lobe well developed with a narrowly rounded apex (fig. 8). Free lobe on left part of tergite viii more or less parallel-sided, with median margin somewhat sinuate, caudal angles rounded; lateral margin with one to four large bristles (fig. 7), caudal process not developed. Shaft of right paramere apically strongly curved, nearly hooked (fig. 4); pars stridens with about 27 ribs. Left paramere large and broad with a flap-like projection in apical third (fig. 5).

Female. Spines on foreleg as in male. Receptaculum seminis with a short stalk (fig. 11).
Brachypterous form unknown.

Etymology
Spaniotrichos (Greek adjective, composed of spanios ‘scarce’ and trichos ‘with hairs’) refers to the free lobe of left part of tergite viii in the male with only one to four large setae.

Comparative notes
In size and shape similar to M. drepani Nieser with which it was found together. M. drepani, is darker, lacks the brown spot between eyes, has the pronotum slightly stronger developed and is slightly more elongate; males have the prestrigilar lobe with an acute tip, free lobe on left part of tergite viii with about 20 bristles on left margin, the right paramere evenly curved, sickle-shaped, and the left paramere comparatively narrower and without flap on the shaft. M. transversa Chen et al. from Thailand is smaller, length 1.8-1.9 and has a much more distinct transverse band on corium. With the key to species from Thailand and adjacent regions by Nieser (2000) M. spaniotricha runs to M. anatolica Lindberg, which is smaller, length up to 2.0 and males have the left paramere narrower with a small apical tooth.

Micronecta tuwanoni sp. n.
(figs. 2, 12-21)

Type locality. – THAILAND: Chiang Rai Prov., Muang Distr., Mae Khon subdistrict, Baan Khun Khon.

31

Distribution. – Only known from the type locality.

Description
Brachypterous form, based on alcohol material. A medium sized, light brown with dark brown to blackish spots, somewhat narrowly oval species (fig. 2).

Dimensions. Length ♂ x 1.92, s 0.073 {1.89}, ♀ x 1.92, s 0.032; width ♂ x 1.10, s 0.011 {1.11}, ♀ x 1.11, s 0.013; width of head ♂ x 0.73, s 0.011 {0.75}, ♀ x 0.76, s 0.008; synthlipsis ♂ x 0.36, s 0.016 {0.37}, ♀ x 0.38, s 0.011; width of an eye ♂ x 0.22, s 0.012 {0.21}, ♀ x 0.23, s 0.008; width of pronotum ♂ x 0.74, s 0.011, {0.76}, ♀ x 0.78, s 0.011; ocular index ♂ x 1.85, s 0.15, {1.94}, ♀ x 1.99, s 0.12.

Colour. Dorsally medium to pale brown, head yellowish with in most specimens an orange to orange-brown spot anteriorly on vertex which continues as a median stripe frontally between eyes; eyes castaneous becoming grey in dry specimens. Pronotum brown with a dark patch, which may be vague, on each side of the median line. Basal hyaline patch on clavus opaque, only slightly more translucent than remainder of hemelytra, usually dark coloured when hemelytra in closed position due to colour of underlying
mesothorax. Costal margin yellowish, most of embolar groove from base on dark brown; corium with an irregular dark brown transverse band, which may be reduced to a median and a lateral patch, just caudally of the caudal tip of clavus; right membrane with a broad dark brown margin interrupted medio-basally. Venter light brown to yellowish, thorax often with an orange tinge, abdomen in males usually with vague lateral dark marks and the median margins of the lobes of sternite VIII dark brown to blackish. Legs yellowish.

Structural characteristics. Dorsal surface shiny, hemielytra densely pitted, with very small spines in the pits. Ratio length/width body 1.7. Head very slightly narrower than pronotum, synthlipsis 1.6 times the width of an eye. Pronotum dorsally nearly flat with lateral angles curving ventrad, 3.9-4.3 times as wide as long. Spines laterally on abdominal segments: v 1 or 2 short, 1 long; vi 2 short, 1 long, bristle-like (fig. 15); vii 2 short, 2 long; viii 5 short, 2 very long hair-like.

Male. Fore femur (fig. 16) with two spines proximally of midway near ventral margin; two in distal one third and two apicodorsally. Fore tibia with one spine proximally and two apical spines ventrally; pala with three long hairs dorsally, dorsal palmar row with 12-15 short bristles, ventral palmar row with about 15-17 long bristles of which the distal three are more strongly developed (fig. 17). Claw a rather small, nearly parallel-sided strap (fig. 17). Prestrigilar lobe (fig. 18) with an acute and rather long mediocaudal

Figs. 12-17. Micronecta tuwanoni sp. n., paratype male. – 12, Right paramere; 13, left paramere; 14, strigil; 15, right part of abdominal tergite 6; 16, fore leg; 17, apex of pala. Scales 0.1 mm.
apex; strigil (figs. 14, 15) elongate with 80-100 teeth in one densely packed row. Abdominal sternite VII (fig. 19) with four long bristles, its submedial caudal lobe well developed with a rather acute apex. Free lobe (fig. 20) on left part of tergite VIII divergent caudally, with median margin slightly sinuate, medio-caudal angle rounded; caudal margin slightly sinuate; lateral margin with about 35 bristles, caudal process not developed. Shaft of right paramere apically hooked (fig. 12); pars stridens with about 25 ribs. Left paramere with a thorn-like projection halfway the shaft (fig. 13).

Female. Spines on foreleg as in male. Receptaculum seminis mushroom-shaped (fig. 21).

Macropterus form unknown.

Etymology

Dedicated to Dr. N. Tuwanon, President of Chiang Mai University for his support to entomological research in North Thailand.

Comparative notes

This species is at first sight very similar to M. melanopardala melanopardala Nieser & Chen (2003) from Luzon in the Philippines, which has a similar, though more distinct, transverse band on corium. However, the parameres of the male are different, notably the left paramere of M. m. melanopardala being distinctly narrower apically, the free lobe of tergite VIII of the male in M. m. melanopardala has about 15 bristles, and the fore femur has four spines in basal row. M. transversa Chen et al. from Thailand is somewhat smaller (length 1.8-1.9), and has a much more distinct transverse band on corium; the male has only about 10 bristles on lateral margin of free lobe on left part of tergite VIII; and different parameres, the right paramere with its shaft slightly narrowed at its base, and apically less hooked, the left paramere without the thornlike projection on the shaft. With the key to species from Thailand and adjacent regions by Nieser (2000) M. tuwanoni runs to couplet three of which both choices do not really fit. If one chooses the second choice of couplet three this species runs to M. anatolica Lindberg, which has the tooth on left paramere apically and the hemielytral pattern, which is usually pale and indistinct, consisting of irregular longitudinal stripes, not a transverse band as in M. tuwanoni.

Micronecta poikila sp. n.
(figs. 3, 22-23)

Type locality. – LAOS: Kammouan Prov., Ban Khoun Ngeun.

Type material. – Holotype, macropterus female (NHMW): LAOS: Kammouan Prov., 4-30.XI.2000, Ban Khoun Ngeun env., 18°7’N, 104°29’E, alt. 250m, leg. E. Jendek & P. Patcholatko. Paratype, same data as holotype, 1♀ macr. (NCTN).

Remark. – The claws of the middle legs of both specimens are lacking.

Distribution. – Only known from the type locality.

Description

Based on two macropterus females (glued on carton). A medium sized, rather dark parallel-sided species (fig. 3). Dimensions (the holotype is the larger specimen). Length 2.15-2.18, width 1.08-1.15, width of head 0.79-0.81, synthlipsis 0.38-0.39, width of an eye 0.23-0.24, width of pronotum 0.80-0.85, ocular index 1.85-1.86.

Colour. Dorsally yellowish with extensive dark brown to blackish markings. Eyes castaneous, interoculus yellow with a poorly contrasting light brown median longitudinal stripe posteriorly and a pair of sublateral light brown patches at anterior margin of vertex. Posterior margin of head in holotype with a small transverse black marking medially. Pronotum
brownish with poorly contrasting dark dots arranged in ill-defined transverse lines in holotype, yellowish with well contrasting dots in paratype. Hemelytra yellowish with dark brown to blackish spots; hyaline transverse stripe at base of clavus and hyaline longitudinal stripe at base of membrane of right hemelytron lacking. Embolium with three subquadrate solid dark markings, corium along embolar suture with a solid blackish stripe, remainder of hemelytra with numerous blackish roundish dots which tend to fuse into large blotches (fig. 3). Connexival segments yellow with blackish dots in anterolateral angle both dorsally and ventrally. Venter sordid yellow in paratype; in holotype thoracic venter grey, abdominal venter sordid yellow to pale greyish. Legs yellowish.

Structural characteristics. Dorsal surface shiny with a fine rugulose structure, hemelytra with few hair-like bristles. Ratio length/width body 2.0. Head slightly narrower than pronotum, synthlipsis 1.6-1.7 times the width of an eye. Pronotum dorsally convex, 2.6-2.8 times as wide as long. Laterocaudal angles of connexiva of segments 4-8 mucronate. Spines laterally on abdominal segments V 2 short, 1 broken off; VI 3 short of which 1 bristle-like, 2 long, bristle-like; VII 2 short, 2 long bristle-like; VIII 3 short plus 1 probably short, broken, 2 long broken. Fore leg (fig. 23); tibia with a row of five spines near ventral margin, dorsally two bristles in proximal third, a spine halfway and a spine distally; tibiapala with three long dorsal bristles; palm with about 10 rather large bristles in ventral row and about 10 distinctly smaller bristles in dorsal row; claw of same size as ventral bristles. Receptaculum seminis; in the place where the receptaculum seminis is located we saw the elongate structure of fig. 22. We are not sure if it is really the receptaculum seminis as we were unable to detect the opening which this structure has in other Micronecta.

Etymology
Poikilos (Greek adjective, meaning spotted) refers to the variegated appearance of this species.

Comparative notes
Although there are only two females available, these specimens are sufficiently different from known species to describe them as a separate species. The only other species with punctate pronotum is *M. punctinotum* Chen which has been recorded from Laos (see below); it is of about the same size. It differs in having the dots on the hemelytra smaller and not confluent and with numerous hair-like bristles on their dorsal surface. *M. haliploides* Horváth has dots of similar size on the hemelytra which are, however, not confluent. Moreover, *M. haliploides* lacks punctuation of the pronotum and has the hyaline transverse stripe at base of clavus present. *M. maculata* Nieser from West Malaysia has very large spots and blotches on its corium and *M. transversa* Chen et al. from Thailand has the base of corium solid dark. With the key to Thai species by Nieser (2000) this species runs to *M. haliploides*, for differences see above.

Micronecta punctinotum Chen


*Micronecta punctinotum* was described by Chen (1960) on the basis of a single female. Her comment that the species is close to *M. haliploides* Horváth is somewhat misleading, as the species are not really similar. When describing *M. crinita* the first author of the present paper overlooked the publication by Wróblewski (1963), which gave a description of the male sex of *M. punctinotum* and already indicated that *M. punctinotum* and *M. haliploides* have little in common.

Micronecta poikila sp. n.

Figs. 22-23. Micronecta poikila sp. n., paratype female. – 22, Receptaculum seminis ? (see text); 23 fore leg. Scale 0.1 mm.
Distribution. – *M. punctinotum* is now recorded from NE India (Assam), Sri Lanka, Northern Thailand and Laos.

**Family Notonectidae Latreille, 1802**

**Genus Anisops Spinola, 1837.**

Species of *Anisops* are small to medium sized Notonectidae which, in the southeastern Asian fauna, can be recognized by having a hair-lined pit at the anterior end of the hemielytral commissure and the coxal plates of the hind legs bare (Chen et al. 2002). The genus has been revised by Brooks (1951) who gives a key to species for males. Since then many species have been added including one described from the state of Melaka in Malaysia (Leong 1963). Definite identification is usually only possible for males, which have several distinguishing secondary sexual characteristics. Apart from the secondary sexual characteristics of the males, females and males can be separated by the front tarsi which are two-segmented in females and one-segmented in males. There are 15 species known from Thailand and adjacent areas, including the one described below.

Species of *Anisops* and their New World counterpart *Buenoa* Kirkaldy are remarkable for having haemoglobin cells at the base of their abdomen (Bare 1928). Here they store the reserve oxygen during a dive (Miller 1964). The amount of air they take with them under water can be regulated, in this way they can obtain neutral buoyancy which makes them belong to the few really planktonic insects. They live usually in ponds or pools, including virtually stagnant parts of streams with little or no fish. An exception are fish ponds with fry which may be occasionally infested with *Anisops* and other Notonectidae, preying on the fry.

**Anisops brooksianus** sp. n.
(figs. 24-26)

Type locality. – LAOS: Champasak Prov., Bolavena Plateau, Paksong.

Type material. – Holotype, macropterous male (NHMW): LAOS: Champasak Prov., Bolavena Plateau, Paksong, 1260m, 27.XII.1996, leg. P. Schwendinger. – Paratypes, same data as holotype, 1♂ 3♀ all macropterous (NHMW, 1♂ 1♀ NCTN).

Distribution. – Only known from the type locality.

**Description**

A small, blackish, rather parallel-sided species with its greatest width at the humeral angles of the pronotum. Dimensions (measurements taken from dry specimens glued to carton points), the holotype is the larger male. Length ♂ 4.90-4.91 ♀ 5.20-5.79-6.08; width of head ♂ 1.14-1.18 ♀ 1.23-1.32-1.43; humeral width of pronotum ♂ 1.29-1.30 ♀ 1.40-1.49-1.60; anterior width of vertex ♂ 0.19-0.20 ♀ 0.22-0.24-0.26; synthlipsis ♂ 0.059-0.063 ♀ 0.081-0.096-0.113; ocular index based on vertex ♂ 0.40-0.41 ♀ 0.40-0.45-0.54.

Colour. Dorsally blackish with variable yellowish to pale brownish patches, due to the underlying structures shining through the hyaline pronotum, scutellum and wings. Interoculus yellowish, posteriorly infuscated, eyes greyish brown; frons yellowish, in some specimens with a pair of short black stripes at lower angles of eyes; rostrum yellowish, segments 3 and 4 in frontal view blackish. Thoracic venter yellowish with variable darker patches. Abdominal venter black, margins of connexival segments and median carina yellowish to pale brownish.

Structural characteristics. Labrum only slightly wider at base than long (0.19/0.17), at base beset with semi-erect bristles in both sexes, apex obtuse. Eyes one fifth of their length longer than median length pronotum (0.77/0.62). Surface of pronotum smooth without impressions or carinae, its lateral margins diverging posteriorly, half as long as median length (0.32/0.62); posterior margin distinctly sinuate. Length of leg segments as in table 1.

Male structural characteristics. In dorsal view the outline of the head is rounded to parallel-sided with anterior margin nearly straight and vertex not or only very slightly indented, width of head 0.9 times the humeral width of pronotum, 6 times the anterior width of vertex (5.9-6.0); synthlipsis one third the anterior width of vertex (0.31-0.32). Along median axis, length of head subequal to median length of pronotum (0.60/0.65). Humeral width of pronotum twice its median length (1.29/0.65). Tylus smooth, flat, sparsely beset with hairs. Rostral prong (fig. 24) about half the length of third rostral segment, with base originating near proximal end and apex rounded. Stridulatory comb on fore tibia (figs. 25, 26) consisting of 11 teeth of roughly the same size. Fore tarsus without small pegs on its inner surface.

Female structural characteristics. Head parallel sided to slightly converging anteriorly, anteriorly truncate with anterior margin virtually straight and vertex not indented, width of head five to six times as wide as anterior width of vertex (4.7-6.0), its median length slightly shorter than median length of pronotum (0.58-0.65), synthlipsis slightly over one third the anterior width of vertex (0.096/0.24). Humeral width of pronotum over twice its median length (1.49/0.65).

**Etymology**

Named in honour of George T. Brooks, whose 1951 revision laid the foundation for the modern
study of the genus *Anisops*. We use *brooksianus* instead of the more usual *brooksi* as the latter is preoccupied by *Anisops apicalis brooksi* Poisson, 1954 from the Democratic Republic of Congo.

**Comparative notes**

*A. brooksianus* is similar to *A. crinitus* Brooks which is recorded from New Caledonia through India to the Mediterranean (Nieser 1996), *A. exigus* Horváth from New Guinea through southeast Asia to India, *A. lansburyi* Leong from southeast Asia and *A. waltairensis* Brooks from India. These all have the synthlipsis relatively narrower, one sixth or less the anterior width of vertex in males, one fourth or less in females. In addition, males of *A. lansburyi* have the rostral prong longer than third rostral segment, the rostral prongs of the other three species are very similar to that of *A. brooksianus*. However, males of *A. crinitus*, *A. exigus* and *A. waltairensis* have three to five short spines on the inner side of fore tarsus, whereas in males of *A. brooksianus* males there is only one spine basally, which is somewhat larger, and somewhat closer to the anterior margin on fore tarsus (fig. 25). The maximum width of *A. crinitus* and, according to Brooks (1951) also of *A. waltairensis*, is at the level of the apex of the scutellum, not at the humeral width of pronotum. Females of *A. exigus*, *A. brooksianus* and *A. lansburyi* can be separated by the number of spines in the ventral row posteriorly on hind femur which is 13-20 (25 in one leg of one specimen) in *A. exigus*, about 30 in *A. brooksianus*, and 40 or more in *A. lansburyi*. In *A. crinitus* the number of spines in the ventral row posteriorly on hind femur is 24-28, so in some cases approximately the same as in *A. brooksianus*.

**FAMILY APHELOCHEIRIDAE FIEBER, 1851**

**Genus Aphelocheirus** Westwood, 1833

*Aphelocheirus* is the only genus in the family Aphelocheiridae. The species of tropical Asia have been revised by Polhemus & Polhemus (1988). The genus is especially rich in continental southeast Asia with 15 species. Only one species was known from Java, we add a second species from that island.

Generally species of *Aphelocheirus* live at the bottom of streams although there are a few records from lakes. They have pleuston respiration (Thorpe & Crisp 1947a, b), which enables them to complete their life cycle under water. These insects were considered quite rare by most authors until the work by Polhemus & Polhemus (1989) showed that *Aphelocheirus* species are in fact very common in many of the rocky streams of tropical Asia. They also noted that densities tend to be higher in stretches of unshaded water.

*Aphelocheirus kedirius* sp. n. (figs. 27-29)

**Type locality.** – INDONESIA: Java, Kediri.

**Type material.** – Holotype (ZMAN, unique specimen) macropterous male, INDONESIA, Java, Kediri, (19)17, leg. W. Roepke.

**Remark.** – Legs on right side lacking except for coxa to tibia of middle leg, rostrum damaged, second rostral segment lacking.

**Distribution.** – Only known from Java.
Description

Based on the dry, pinned, unique macropterous male holotype.

A medium sized, rather uniformly medium brown, elongate species. Dimensions: length 8.15, maximum width (across abdomen) 4.98, width across embolia 4.61.

Colour. Dorsally medium brown, scutellum and hemielytra slightly darker than connexiva and head; pronotum with a lighter patch centrally; eyes blackish. Venter dark brown with medium brown lateral areas, antennae, rostrum and legs yellowish to light brownish.

Structural characteristics. Head alveolate, shining, about as long as wide (L/W = 1.70/1.66), produced ahead of eyes slightly less than one third the length of an eye (0.30/1.06); eyes shining, width/length = 0.40/1.06, outer margin only faintly sinuate, anterior/posterior interocular = 0.98/0.80. Rostrum short, length 3.20, just reaching the bases of the middle trochanters. Pronotum rugose to alveolate, lateral margins narrowly glabrous, bordered by an, on average 0.4 wide area of dense appressed hairs; central part glabrous with very few, scattered, golden hairs; width/length (along midline) 4.17/1.20. Scutellum rugose to alveolate, bare, width/length 2.00/1.50, transversely sulcate basally, lateral margins not sinuate. Hemielytra fully developed, reaching to apex of abdomen, leaving laterally an, about 0.5 wide, strip of abdomen uncovered. Clavus and corium distinctly delimited, coriaceous, alveolar; membrane membranaceous, smooth. Embolar margin anteriorly slightly convex, posterolateral angle smoothly rounded. Exposed part of abdominal dorsum smooth, covered with appressed hairs, distinctly less dense than the lateral hair patches on pronotum; posterolateral angles of tergites 3-7 strongly spinose. Prosternum with a poorly developed carina, inner propleural projections with relatively slender points (fig. 28). Mesosternum with a poorly developed carina, posteromedially swollen with scattered golden setae on anterior two third, posterior one third bare, glabrous. Venter of abdomen pruinose except for the lighter brown lateral areas which on ventrites 3-5 are about 0.5 wide. Posterior margin of ventrites 4-6 with small groups of stout short pegs medially. Fore leg, trochanter distally and femur, tibia and tarsus on inner surface with thick hair pads. Middle leg, femur, tibia and tarsus with thick hair pads ventroposteriorly, femur posteriorly with a row of seven to eight slender erect setae, anteriorly with some short stout semiappressed bristles; tibia anteriorly with long and short, stout semiereect bristles. Hind leg, femur with some short stout bristles anteriorly and some hairs posteriorly; tibia anteriorly with stout spines along anterior margin and a transverse row of spines distally; tibia and tarsus with a thick fringe of long swimming hairs; tarsal segments apparently fused. All tarsi are three-segmented but as the first segment is small and rather difficult to measure in table 1 tarsal segments 1+2 are measured together under ‘tars1’ and the third segment under ‘tars2’.

Male. Abdominal ventrite 5 with an asymmetrical posterior margin and an elongate impression of the right side which extends onto ventrite 6 (fig. 27). Genitalia (fig. 29), right paramere broad with a lateral
fringe of long hairs. Left paramere with apex slightly expanded.

Brachypterous form and macropteral female unknown.

Etymology
Kedirius (Latin adjective meaning 'from Kediri') refers to the type locality.

Comparative notes
With the key for macropterous specimens by Polhemus & Polhemus (1989) this species runs, due to the rounded embolar margin and short rostrum, to couplet 7: A. australicus Usinger from Australia and celebensis Polhemus & Polhemus from Sulawesi. Both have different male genitalia with the apical part of the right paramere more slender. A. bengkulu Polhemus (1994) from southern Sumatra, which is related to A. australicus and A. celebensis has also the right paramere with apical part distinctly more slender. In addition the lateral margin of embolium of the macropterous form is much more angular. The only other species known from Java, A. javanicus Polhemus & Polhemus, is known from an unique brachypterous male. It is somewhat longer and distinctly wider (width 6.3); the fifth abdominal segment has the entire right margin concave and the parameres are different (figs. 30, 31).

Acknowledgements
The field trip in which most of the material was collected was supported by grants for 2002 from the Uyttenboogaart-Elisien Foundation, The Netherlands to Chen and Nieser. We thank Dr. N. Tuwanon (president of Chiang Mai University) and Dr. C. Kasemset (director of the Institute for Science and Technology Research and Development, Chiang Mai University) for supporting the inventarisation of water bugs of northern Thailand. Finally we thank Mr. W. Hogenes (ZMAN) and Dr. H. Zettel (NHMW) for the loan of material under their care.

References


Received: 2 April 2003
Accepted: 27 May 2003
Table 1. Leg measurements of Nepomorpha described in this paper. The measurement of the fore tibia in female *Micronecta* refers to the joint tibia and tarsus. If claws are of unequal length the largest one is measured. In *Aphelocheirus* tars1 represents the actual segments 1+2 and tars2 is segment 3, see text.

<table>
<thead>
<tr>
<th></th>
<th>femur</th>
<th>tibia</th>
<th>tars1</th>
<th>tars2</th>
<th>claw</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anisops brooksianus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♂</td>
<td>0.71</td>
<td>0.84</td>
<td>0.66</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Middle leg ♂</td>
<td>1.09</td>
<td>0.93</td>
<td>0.51</td>
<td>0.35</td>
<td>0.17</td>
</tr>
<tr>
<td>Hind leg ♂</td>
<td>1.62</td>
<td>1.36</td>
<td>0.51</td>
<td>0.54</td>
<td>0.10</td>
</tr>
<tr>
<td>Fore leg ♀</td>
<td>0.73</td>
<td>1.10</td>
<td>0.52</td>
<td>0.39</td>
<td>0.20</td>
</tr>
<tr>
<td>Middle leg ♀</td>
<td>1.42</td>
<td>1.10</td>
<td>0.59</td>
<td>0.39</td>
<td>0.40</td>
</tr>
<tr>
<td>Hind leg ♀</td>
<td>1.92</td>
<td>1.52</td>
<td>0.56</td>
<td>0.60</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>Aphelocheirus kediri</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♂</td>
<td>1.88</td>
<td>1.50</td>
<td>0.31</td>
<td>0.30</td>
<td>0.25</td>
</tr>
<tr>
<td>Middle leg ♂</td>
<td>1.90</td>
<td>1.52</td>
<td>0.40</td>
<td>0.43</td>
<td>0.26</td>
</tr>
<tr>
<td>Hind leg ♂</td>
<td>2.31</td>
<td>2.80</td>
<td>1.40</td>
<td>0.82</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Micronecta spaniotricha</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♂</td>
<td>0.35</td>
<td>0.18</td>
<td>0.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♀</td>
<td>0.33</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle leg ♂ &amp; ♀</td>
<td>0.76</td>
<td>0.25</td>
<td>0.41</td>
<td></td>
<td>0.23</td>
</tr>
<tr>
<td>Hind leg ♂ &amp; ♀</td>
<td>0.50</td>
<td>0.38</td>
<td>0.41</td>
<td>0.20</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Micronecta tuwanoni</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♂</td>
<td>0.24</td>
<td>0.14</td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♀</td>
<td>0.25</td>
<td>0.26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle leg ♂ &amp; ♀</td>
<td>0.63</td>
<td>0.21</td>
<td>0.33</td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>Hind leg ♂ &amp; ♀</td>
<td>0.47</td>
<td>0.35</td>
<td>0.38</td>
<td>0.17</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>Micronecta poikila</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore leg ♂</td>
<td>0.26</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle leg ♀</td>
<td>0.67</td>
<td>0.25</td>
<td>0.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hind leg ♀</td>
<td>0.51</td>
<td>0.33</td>
<td>0.42</td>
<td>0.22</td>
<td>0.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>femur</th>
<th>tibia</th>
<th>tars1</th>
<th>tars2</th>
<th>claw</th>
</tr>
</thead>
</table>