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DESCRIPTION OF A NEW SPECIES OF BLACKWATER PRAWN, *MACROBRACHIUM PURPUREAMANUS* (CRUSTACEA: DECAPODA: CARIDEA: PALAEMONIDAE), FROM KUNDUR ISLAND, INDONESIA

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ABSTRACT. - *Macrobrachium purpureamanus*, new species, is described from highly acidic blackwaters in Kundur island, Riau Archipelago, Indonesia. The species appears to be closest to *M. callirrhoe* (De Man, 1898), but can be separated by being a more robust species and having proportionately shorter second pereiopods which do not have a longitudinal elevated ridge on their fingers, the first ventral tooth of the rostrum positioned at about the distal third, the sixth abdominal somite being proportionately longer, and the telson being broader. The number of rostral tooth is generally fewer in number (2-3 + 5-8/1-2) and the tip of the rostrum usually does not reach the end of the antennular peduncle. This new species also appears to reach maturity at a smaller size (5.5 to 7.0 mm carapace length) and lives in a quite different habitat with a pH of 3.6.

KEY WORDS. - Crustacea, Palaemonidae, new species, *Macrobrachium purpureamanus*, peat swamps, Riau Archipelago.

INTRODUCTION

A freshwater prawn of the genus *Macrobrachium* Bate, 1868, was recently obtained by the author from highly acidic blackwaters of Kundur island, Riau Archipelago, Indonesia. There are not many decapod crustaceans living in this harsh environment (Johnson, 1967, 1968; Ng, 1992; Ng et al., 1992). In blackwaters with a pH of between 3.5 to 3.8 in the north Selangor peat swamp forest (Peninsular Malaysia), Ng (1992) and Ng et al. (1992) reported only three decapod species, a parathelphusid crab *Parathelphusa maindroni* (Rathbun, 1902), an undescribed atyid shrimp of the genus *Caridina*, and a palaemonid shrimp *Macrobrachium oxyphilus* Ng, 1992. No decapod crustacean, however, has been formally reported from peat swamps in Indonesia thus far. *Parathelphusa maindroni*, however, was originally described from Bengkalis, Riau Archipelago (without any ecological data), and from what

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is known about its ecology, it is an obligate peat swamp species (Ng, 1993). So far, only a few species of *Macrobrachium* are known to live in such acidic waters, namely *M. oxyphilus* Ng, 1992 (pH of between 3.3 and 3.8) (Ng, 1992), *M. trompii* (De Man, 1898) (pH below 4.5) (Johnson, 1967, 1968), both from Peninsular Malaysia, and *M. clymene* (De Man, 1898) (pH of between 3.4 and 4.1) (unpublished data) from Sarawak. The morphology of the recently collected *Macrobrachium* from Kundur island is quite different from these three species as well as all congeners, and is described here as new. The new species appears to be very close to *M. callirrhoe* (De Man, 1898) previously described from inland waters of Borneo, and recently found in Bako National Park, Sarawak, by Ng (1995). Both species are found from lowland rainforest.

The abbreviations used are cl for the carapace length, measured from the postorbital margin to the posterior margin of the carapace; tl for total length, measured from the tip of rostrum to the end of the telson. All measurements are in millimetres. Specimens are deposited in Balitbang Zoologi, Puslitbang Biologi - LIPI [formerly Museum Zoologicum Bogoriense (MZB)], Bogor, Indonesia; Zoological Reference Collection (ZRC), Raffles Museum, Department of Biological Sciences, National University of Singapore, Singapore; and Nationaal Natuurhistorisch Museum [formerly Rijksmuseum van Natuurlijke Historie (RMNH)], Leiden, The Netherlands.

TAXONOMY

FAMILY PALAEMONIDAE RAFINESQUE, 1815
Genus *Macrobrachium* Bate, 1868
Macrobrachium purpureamanus, new species
(Figs. 1A, B; 2A, C, E, F; 3A, C, E; 4)

Material examined. - Holotype: 1 male (8.1 mm cl) (MZB Cru 1421), Sungai Nibong B, nearby Kampung Baru, Kundur island, Riau Province, Indonesia (0°46'46.8"N 103°28'05.4"E), coll. D. Wowor, 13 Oct.1998.

Paratypes: 6 males (5.4-6.3 mm cl), 5 females (4.8-6.4 mm cl), 3 ovigerous females (5.5-5.7 mm cl), 6 juveniles (3.6-4.4 mm cl) (MZB Cru 1422), same data as holotype. — 2 males (6.7-7.7 mm cl), 2 ovigerous females (5.7-5.8 mm cl) (ZRC 1999.0003), same data as holotype. — 5 males (4.7-7.9 mm cl), 4 ovigerous females (5.7-7.0 mm cl) (MZB Cru 1423), Parit Gantung Sei Ungar, Tanjung Batu district, Kundur island, Riau Province, 0°44'06.8"N 103°27'32.8"E, coll. D. Wowor, 13 Oct.1998. — 2 males (4.5-6.6 mm cl), 1 female (5.1 mm cl), 1 ovigerous female (5.6 mm cl) (RMNH), Parit Gantung Sei Ungar, Tanjung Batu district, Kundur island, Riau Province, 0°44'06.8"N 103°27'32.8°E, coll. D. Wowor, 13 Oct.1998. — 7 males (5.5-7.9 mm cl), 1 female (6.3 mm cl) (MZB Cru 1424), Tanjung Batu area, Kundur island, Riau Province, coll. Patrick Yap, Apr.1998. — 3 males (6.0-9.2 mm cl), 2 females (5.9-6.0 mm cl), 2 juveniles (4.9-5.0 mm cl) (ZRC 1999.0004), Tanjung Batu area, Kundur island, Riau Province, coll. Patrick Yap, Apr.1998. — 2 males (6.8-7.1 mm cl), 2 ovigerous females (6.4-6.7 mm cl) (RMNH), Tanjung Batu area, Kundur island, Riau Province, coll. Patrick Yap, Apr.1998.

Description. - A small sized palaemonid with robust, similar but unequal-sized second pereiopods, body form subcylindrical.

The rostrum is rather short, about 0.58 of the carapace length, the tip is usually not reaching the end of the antennular peduncle nor the scaphocerite (Fig. 1A, B); only 15 out of 45 specimens observed had the tip reaching the distal end of the antennular peduncle. The rostrum is slightly bent downwards and the teeth on the dorsal margin are subequally

distributed. There are 7 to 10 dorsal teeth (mode 8 to 9), 2 or 3 of which are placed behind the orbit in the anterior 0.26 of the carapace. The teeth are strong and sharp, non-articulate, with setose interspaces. The upper margin is almost straight or slightly convex. The lower margin is convex with 1 or 2 teeth (mode 2), except for two males of 6.3 and 7.8 mm cl which have 3 ventral teeth. The first tooth stands at about the distal third of the rostrum.

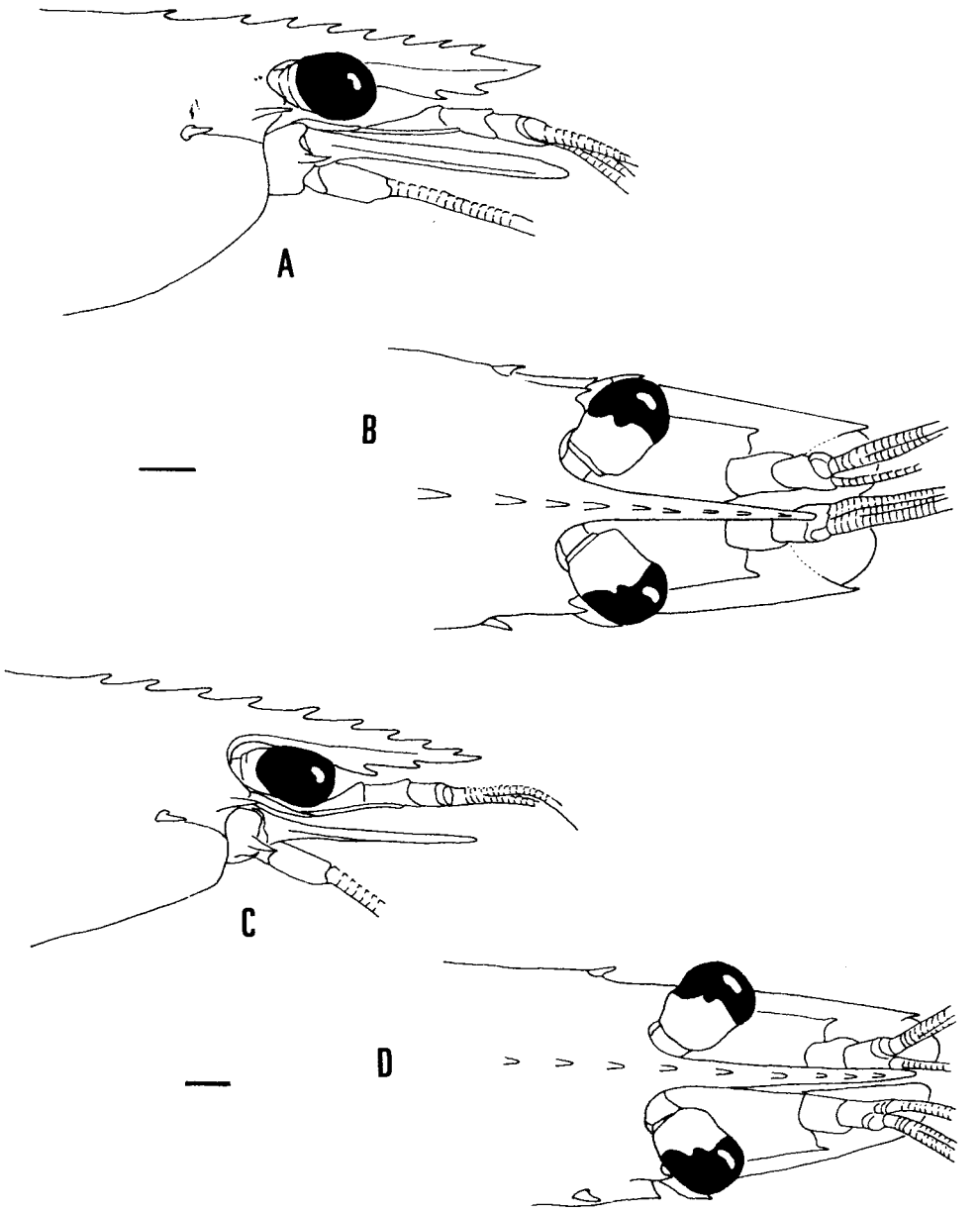

Fig. 1. A, B, *Macrobrachium purpureamanus*, new species, holotype, MZB Cru 1421, male, 8.1 mm cl, Kundur island. C, D, *M. callirrhoe* (De Man, 1898), male, 8.7 mm cl, Bako National Park, Sarawak (ZRC 1995.248). A, C, lateral views of carapace; B, D, dorsal views of carapace. Scales: 1.0 mm.

The inferior orbital angle is distinctly produced and broadly rounded (Fig. 1A). The antennal spine is sharp and slender, continuing posteriorly as a ridge, and is placed slightly below the lower orbital angle. The hepatic spine is similar, lies behind and below the antennal spine and has a short branchiostegal suture anteriorly. The two spines are not placed in one line. The carapace is slightly pubescent with scattered minute setae.

The abdomen is smooth and glabrous. The pleura of the first four somites are broadly rounded, while the fifth is triangular with a rounded tip. The sixth somite is about 1.45 times as long as the fifth. The posterolateral angle of the sixth somite is strongly produced to form a broad triangular angle with a sharp point and the lower margin is provided with a small, blunt lobe; the posteroventral angle is also triangular and sharply pointed.

The first male abdominal sternite has a triangular projection medially, the lateral margins of which slope gently (ca. 30° from horizontal) (Fig.3C). The second male abdominal sternite has the same projection form as that of the first abdominal sternite but is slightly smaller and shorter although the lateral margins slope has the same angle. The third male abdominal sternite is also similar to the first abdominal sternite, but the lateral margins are steeper (ca. 40° from horizontal).

The telson is 1.5 times as long as the sixth somite, and is about 2.3 times longer than the median width. The lateral margins are straight, convergent with 2 pairs of dorsal spines. The spines are at about 0.45 and 0.70 length of the telson respectively (measured from proximal margin). A transverse row of setae at proximal and longitudinal row of setae present between the first and the second dorsal spines (Fig. 3E). The posterior subventral margin is sinuous to almost rounded and is provided with a small acute median point; it is overreached by the inner pair of posterior spines, the outer pair is about a quarter as long as the inner ones; the posterior subventral margin has about 7 pairs of long plumose setae.

The eyes are normal with well developed pigmented corneas, about 0.2 times as long as the carapace length (Fig. 1A, B).

The epistome has a distinct groove medially which is much broader anteriorly and gradually narrowing posteriorly (Fig. 3A). This groove forms the epistome into 2 lobes, i.e. right and left. The 2 lobes are separated for three quarters of length of the epistome. The inner edges of these lobes have distinct slopes. The lobes are well developed.

The basal segment of the antennular peduncle has the stylocerite sharply pointed, reaching to about the middle of the segment; the anterolateral margin is strongly produced, with a stout distolateral tooth extending to about 0.7 of intermediate peduncular segment length (Fig. 1B).

The scaphocerite reaches somewhat beyond the rostrum (Fig. 1B). It is 2.7 times as long as wide (Fig. 4G). The lateral margin is straight, with a stout distolateral tooth which does not reach the end of the lamella.

The third maxilliped is slender, with the joint of its ultimate and penultimate segments reaching the distal part of the antennal peduncle. The ultimate segment is as long as the penultimate and about 0.7 as long as the antepenultimate segment.

The first pereiopod is very slender and overreaches by chela and half to two third of carpus beyond the scaphocerite. The fingers are about as long as the palm and very slender. The carpus is about 1.7 times as long as the chela and about 1.2 times longer than the merus (Fig. 4A).

The second pereiopods are similar but unequal in size; reaching with the tips of the chela beyond the scaphocerite. The major chela is about 1.3 as long as the carapace and about 4.8 as long as wide, the palm is about 2.8 as long as wide. The palm is slightly compressed with a width to depth ratio of 1.4, the outer and inner surfaces are slightly transversely convex, the upper and under margins are likewise rounded (Fig. 2A, C). The outer and upper surfaces are covered with small spinules, the lower surface is covered with somewhat larger spinules which are positioned some distance apart; the inner margin is covered by two longitudinal, parallel rows of large spines, between which the surface is smooth with sparsely scattered long setae on the outer margin and short setae on the other margins. The fingers are about 0.8 as long as the palm length with stout, feebly hooked tips. The movable finger is smooth and glabrous, except for the proximal third of its outer margin which has spines, and is provided with tufts of sparsely scattered long setae; about the distal half of the cutting edge is entire and sharp, with a strong and big conical tooth just behind the middle of the finger, the second tooth is situated at the middle, between the first tooth and the articulation of the fingers, and is slightly smaller than the first one. The fixed finger is similar to the dactylus, with the distal 0.7 of the cutting edge entire; a big conical tooth, which is the largest among the teeth present on the fingers, and 2 to 3 small denticles are present between the big tooth and the articulation of the fingers. The carpus is somewhat conical and spinous, with the spines on the inner margin more prominent than those on the other margins which are of the same size as those on the inner margin of the palm. The carpus is also provided with sparsely scattered short setae, it is about 2.6 times as long as its distal width, about 0.4 of the chela length and 0.7 of the palm length. It widens distally, but is narrower than the palm. The merus is subcylindrical, about as long as the carpal length, spinous and covered with sparsely scattered short setae as on the carpus; the spines are smaller than those on the palm and the carpus, the outer margin is feebly spinous while the inner margin has stronger spines which are about the same size as those found on outer margin of the palm and the carpus. The ischium is compressed, slightly shorter than the merus, smooth and glabrous except for the inner edge which is spinous and provided with a longitudinal row of setae.

The minor second pereiopod resembles the major one; the chela being about 0.7 the length of the major chela and the palm being about as long as the finger (Fig. 2E, F). The movable finger has 2 teeth, the proximal tooth being slightly smaller than the distal one; with the distal tooth on the distal 0.6 and the proximal one on the proximal 0.2. The fixed finger has also 2 teeth as on the movable finger; with the distal tooth placed on the distal 0.7 and the proximal one on the proximal 0.2, and may or may not have a small denticle behind it. The carpus is about 0.9 as long as the palm. The merus is about as long as the carpus.

The chelae of female and young specimens are smaller and not as robust as those of the males. In females, the dentition of both fingers takes the form of minute denticles. Young specimens also show the same denticle formation as the females or do not have any denticles at all. Other characters of the female and young specimens are similar to the male in most respects.

The ambulatory pereiopods are very slender and similar (Fig. 4B, C). The third pereiopod reaches with the distal third of propodus beyond the edge of the scaphocerite. The dactylus

is stout, compressed and feebly curved, with numerous setae dorsally. The propodus is 3 times as long as the dactylus, 10 times as long as wide, with 1 distoventral pair of spines, 1 single ventral spine with 8 further spines off-set medially. The carpus is about 0.6 as long as the propodus. The merus is longer than the propodus and about 1.8 as long as the ischium. The fourth pereiopod reaches with the joint of dactylus and propodus beyond the edge of the scaphocerite, resembles the third, except that the merus is about 2.0 times as long as ischium. The fifth pereiopod exceeds the scaphocerite by the distal third of the propodus, with 3 single ventral spines and 11 further spines off-set medially. The merus is about as

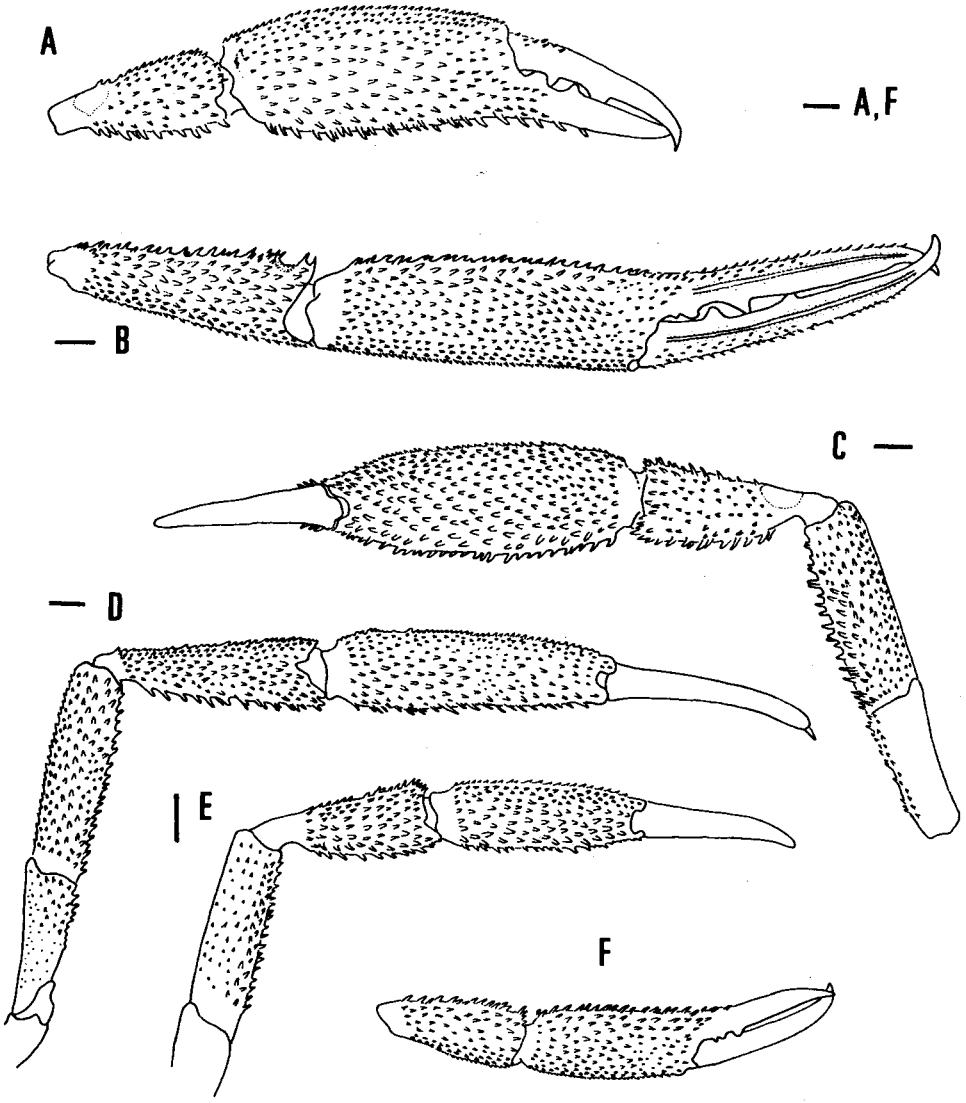

Fig. 2. A, C, E, F, *Macrobrachium purpureamanus*, new species, holotype, MZB Cru 1421, male, 8.1 mm cl, Kundur island. B, D, *M. callirrhoe* (De Man, 1898), male, 8.7 mm cl, Bako National Park, Sarawak (ZRC 1995.248). A, B, upper margin views of major chelae; C, D, outer margin views of major chelae; E, outer views of minor chela; F, upper views of minor chela. Setae omitted. Scales: 1.0 mm.

long as the propodus, and 1.9 times as long as the ischium, otherwise it is very similar to the fourth.

The first pleopod of the male has a kidney-shaped endopod, with the inner margin concave, the outer margin convex, and the top rounded (Fig. 4D). Second pleopod with appendices at 0.4 of medial margin length. The appendix masculina with corpus 7.5 times longer than proximal width, is 1.5 times longer and stronger than the appendix interna and has numerous spiniform setae (Fig. 4E).

The uropods are of the normal shape and distinctly exceed the tip of the telson; the lateral margin of the exopod is straight, with an acute distolateral tooth and smaller mobile spine mesially, with the diaresis distinct (Fig. 4F). The exopod is about 1.8 times as long as broad, with the endopod smaller than the exopod.

Etymology. - The specific name *purpureamanus* is derived from the Latin words *purpura* (adj.) for purple and *manus* (noun) for hand, alluding to the bright purple colour chelipeds of the species. Used as a noun in apposition.

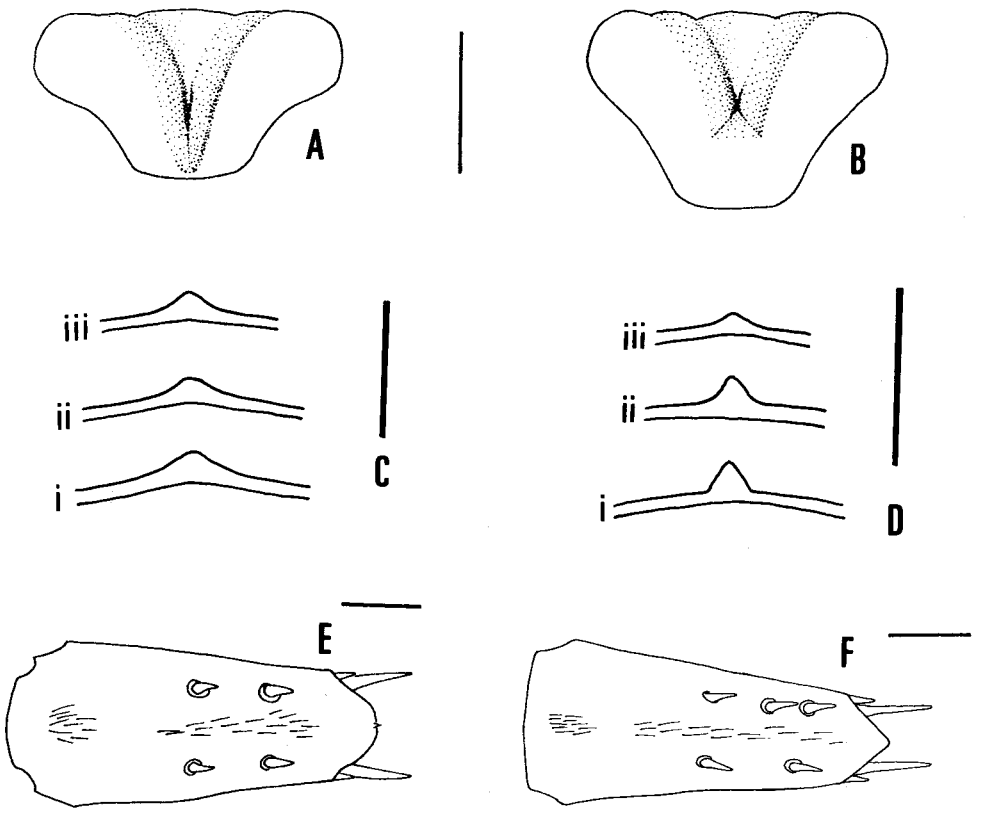

Fig. 3. A, C, E, *Macrobrachium purpureamanus*, new species, paratype, MZB Cru 1422, male, 7.4 mm cl, Kundur island. B, D, F, *M. callirrhoe* (De Man, 1898), male, 8.7 mm cl, Bako National Park, Sarawak (ZRC 1995.248). A, B, epistome; C, D, abdominal sternite, i=first, ii=second, iii=third; E, F, telson. Setae omitted. Scales: A-B=0.5 mm; C-F=1.0 mm.

Size. - The largest male has a carapace length of 9.2 mm (ZRC 1999.0004) but the rostrum and a small part of its carapace are broken.

Colour. - The living specimens are reddish-brown with bright purple colour chelipeds, which are most likely correlated with their habitat. Prawns kept in the aquarium became yellowish-green but the chelipeds retained their colour. Even after seven months in preservative (70% ethanol) the chelipeds remained purple, although generally slightly paler.

Distribution and habitat. - The species is only known from Kundur island, Riau Archipelago, thus far. The habitat in which *M. purpureamanus* was collected is a blackwater creek at the edge of a peat swamp forest. The water comes from undisturbed forest. The prawn has been found in slowly flowing waters among roots along the banks which are partly open or well shaded, with leaf litter substrate and shallow water (depth less than a metre). The water is dark tea-coloured to almost black on reflected light with a pH of 3.6. The water is clear and clean. *Macrobrachium oxyphilus* from Peninsular Malaysia has similar habits (Ng, 1992).

Remarks. - The new species is probably closest to *Macrobrachium callirrhoe* (De Man, 1898), a species so far only found in Borneo, viz. the Kapuas basin, Kalimantan, Indonesia

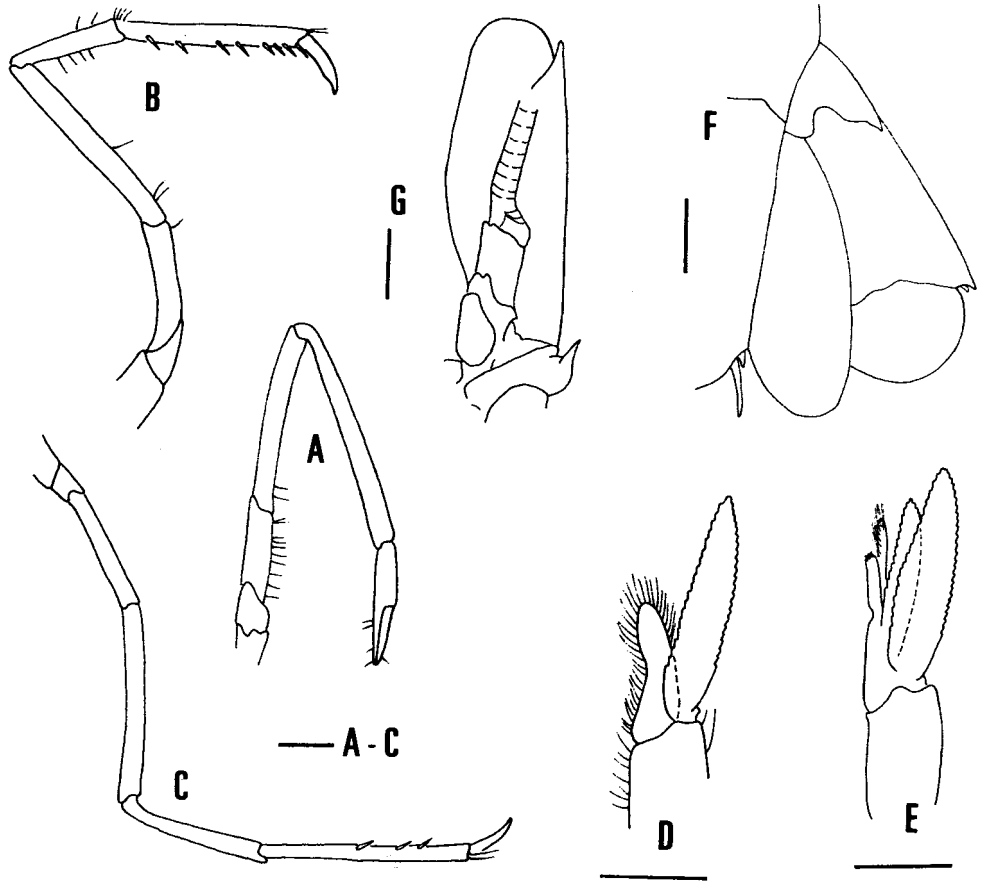

Fig. 4. *Macrobrachium purpureamanus*, new species, paratype, MZB Cru 1422, male, 7.4 mm cl, Kundur island. A, first pereiopod; B, third pereiopod; C, fifth pereiopod; D, first pleopod; E, second pleopod; F, uropod; G, antennal scale. Setae omitted. Scales: 1.0 mm.

(De Man, 1898; Holthuis, 1950; Chace & Bruce, 1993) and Bako National Park, Sarawak, Malaysia (Ng, 1995). The author has examined the Sarawakian specimens referred to *M. callirrhoe* by Ng (1995). They agree very well with the original description and figures of De Man (1898) and there is no reason to doubt their conspecificity.

The adult male second pereiopod of large male specimens of *M. purpureamanus* closely resembles those of *M. callirrhoe*, but that of *M. purpureamanus* is relatively more robust (Fig. 2), with the chela broader (ratio of length to width 4.3-5.1 (mean 4.8) versus 5.0-6.4 (mean 5.6)) and shorter (ratio of chela to carapace length 1.2-1.5 (mean 1.3) versus 1.6-1.7 (mean 1.6)). The palm is more compressed (ratio of palm width to depth 1.2-1.8 (mean 1.4) versus 1.2-1.4 (mean 1.3)), and the carpus is shorter (ratio of carpus length and distal carpus width 2.3-2.7 (mean 2.6) versus 2.6-2.9 (mean 2.7)).

Comparisons of adult specimens of equivalent sizes is not possible as *M. purpureamanus* appears to be a smaller species. Male specimens of *M. callirrhoe* the size of the holotype of *M. purpureamanus* still do not have well developed second pereiopods. The holotype of *M. purpureamanus* (31 mm tl, 8.1 mm cl) has a chela length to width ratio of 3.9 while for *M. callirrhoe*, the ratios for the largest syntype (4.3 mm tl, carapace length is not available, fide De Man, 1898) and largest Sarawakian specimen (44 mm tl, 12.9 mm cl, ZRC 1995.245) are 5.5 and 5.5 respectively. With regards to the palm itself, that of *M. purpureamanus* is distinctly broader (ratios of palm length to width for the above mentioned three specimens are 2.1, 2.6 and 2.6 respectively). The carpus of the holotype of *M. purpureamanus* is also shorter and more conical in shape than that of the two *M. callirrhoe* specimens mentioned (ratios of the carpus length to distal carpus width 2.3 versus 2.5 and 2.7).

In overall length, the second pereiopods of *M. purpureamanus* (measured from tip of fingers to proximal margin of merus) are distinctly shorter than those of *M. callirrhoe*; with the average ratio of the major pereiopod to carapace length being 2.4 versus 2.9; and the average ratio of the minor pereiopod to carapace length being 1.9 versus 2.0. In addition, in *M. purpureamanus*, there is no longitudinal elevated ridge present on each finger of both second pereiopods (ridge present in *M. callirrhoe*). The first ventral tooth of the rostrum is also positioned at about the distal third (versus medially in *M. callirrhoe*); the sixth abdominal somite is proportionately longer (average ratio of the sixth to fifth abdominal somite length is 1.5 versus 1.3); and the telson is relatively broader (average ratio of length to mid-width 2.3 versus 2.7). The telson of the holotype of *M. purpureamanus* is also broader than that of the largest syntype of *M. callirrhoe* (ratio of length to mid-width 2.5 versus 3.0).

The epistome of *M. purpureamanus* is proportionately slightly broader than that of *M. callirrhoe*. In both species, there is a deep median longitudinal groove, but that of *M. purpureamanus* is broader anteriorly and extends 0.75 down the length of the structure (Fig. 3A) whereas in *M. callirrhoe*, the anterior part is narrower and the groove only reaches to the median part (Fig. 3B).

The median projections on male abdominal sternites 1 to 3 of the two species are similar, but their shapes and sizes are quite different (Fig. 3C, D). The projection on the first sternite of *M. purpureamanus* is relatively lower and more obtuse (lateral margin is sloping at ca. 30° from the horizontal versus ca. 60° in *M. callirrhoe*). This is also the case for the second sternite. The lateral margin slopes at ca. 30° from the horizontal versus ca. 50° in *M. callirrhoe*, and the median projection is slightly shorter than the first median projection (versus subequal to the first median projection in *M. callirrhoe*). On the third sternite, however, the projection

on *M. purpureamanus* is relatively higher, with steeper lateral margins (ca. 40° from horizontal versus ca. 30° in *M. callirrhoe*). Generally, the median projections on male abdominal sternites 1-3 of *M. purpureamanus* are similar, with the third having a slightly steeper slope; while those of *M. callirrhoe* the slope is gradually less, especially the size of the third one, which is only half as high as the first median projection.

There are several other useful characters that can also usually be used to distinguish *M. purpureamanus* from *M. callirrhoe* most of the time. The tip of the rostrum usually does not reach the end of the antennular peduncle (67% of the observed sample) while that of *M. callirrhoe* usually overreaches the end of the antennular peduncle (72% of the observed sample). All the syntypes of *M. callirrhoe* (fide description and figures of De Man, 1898) and present specimens of Sarawak have the tip of their rostrums overreaching or just reaching the end of the antennular peduncle. The number of rostral teeth is generally fewer, with the dorsal teeth varying from 7 to 10 (mode 8 to 9) (versus 8 to 11, mode 10); and the ventral teeth from 1 to 2 (mode 2) (versus 2 to 3, mode 3). Only one specimen of *M. callirrhoe* at 7.1 mm cl (ZRC 1995.248) has 4 ventral teeth. Usually, two dorsal teeth (57% of the population studies) are behind the orbit, while in *M. callirrhoe* there are almost always three dorsal teeth (92% of the population) instead. The rostral formula of all the syntypes of *M. callirrhoe* (fide De Man, 1898) is same as those from Sarawak. The scaphocerite of *M. purpureamanus* is also slightly proportionately broader (average ratio of length to width 2.7 versus 2.8).

As mentioned earlier, *M. purpureamanus* appears to be a smaller species than *M. callirrhoe*. The largest male found so far is only 9.2 mm cl (ZRC 1999.0004), while the largest male of *M. callirrhoe* from Sarawak measures 12.9 mm cl (ZRC 1995.245) (Ng, 1995). The ovigerous females of *M. purpureamanus* are also smaller, being between 5.5 to 7.0 mm cl (n=15) versus 7.3 to 9.3 mm cl (n=14). It is clear that the new species does not grow as large as *M. callirrhoe*, and the females reach reproductive maturity at a smaller size. The eggs are 2.1 by 1.3 mm, ovoid and quite large for such a small species. The brood is also small, with one of the females (MZB Cru 1423) having only 19 eggs.

Although *M. purpureamanus* and *M. callirrhoe* are both found in lowlands and close to each other, they live in quite different habitats. The new species is known only from highly acidic blackwaters with a pH of 3.6, while *M. callirrhoe* is not known to inhabit such habitats. According to Ng (1995), *M. callirrhoe* appears to prefer waters with a pH of ca. 5.5-6.5.

Comparative material examined. - *Macrobrachium callirrhoe*: 3 males, 2 ovigerous females (ZRC 1995.249), Ulu Assam trail, Bako National Park, Sarawak, coll. D. Chung et al., 29 Jun.1994. 2 ovigerous females, 13 specimens (ZRC 1995.248), Ulu Assam trail, Bako National Park, Sarawak, coll. D. Chung et al., 29 Jun.1994. 1 male, 10 ovigerous females, 32 specimens (ZRC 1995.245), Ulu Assam trail, Bako National Park, Sarawak, first two streams, coll. P. K. L. Ng et al., 30 Jun.1994. 30 specimens (ZRC 1995.246), middle stretches of Sungai Serait, Bako National Park, Sarawak, coll. N. Sivasothi et al., 1 Jul.1994.

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