A new species of Homola Leach, 1816 (Crustacea: Brachyura: Homolidae) from Palau, Western Pacific, with notes on H. mieensis Sakai, 1979

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Abstract.— A new species of deep water homolid crab, Homola milkolk, new species, is described from a specimen obtained from a Nautilus (Mollusca: Cephalopoda: Nautilidae) trap in Palau. The new taxon is closest to H. mieensis Sakai, 1979, known from Japan to New Caledonia, but can easily be separated by its proportionately longer carapace, more elongate ambulatory legs, and armature of the carapace and legs. The taxonomy of H. mieensis is also discussed.

Key words: Taxonomy, Homolidae, Homola, new species, Palau

Introduction

The genus Homola Leach, 1816, currently contains 11 species from the Atlantic and Pacific Oceans: H. barbata (Fabricius, 1793), H. vigil A. Milne-Edwards, 1880, H. orientalis Henderson, 1888, H. ikedai Sakai, 1979, H. mieensis Sakai, 1979, H. dickinsoni Eldredge, 1980, H. coriolisi Guinot & Richer de Forges, 1995, H. eldredgei Guinot & Richer de Forges, 1995, H. minima Guinot & Richer de Forges, 1995, H. ranunculus Guinot & Richer de Forges, 1995, and H. poupin Richer de Forges & Ng, 2007 (cf. Guinot & Richer de Forges, 1995; Richer de Forges & Ng, 2007a; Ng et al., 2008; Tavares & Lemaitre, 2014).

Of these species, H. mieensis and H. ranunculus are distinct in having the sides of their carapaces gently diverging toward the posterior carapace margin, and their major subhepatic spine distinctly larger than the anterolateral spine. All other congeners have a carapace that is distinctly quadrate or have the lateral margins converge towards the posterior carapace margin, and the major subhepatic spine is distinctly smaller than the anterolateral spine. In this paper, we describe a third member of this species group collected from a Nautilus (Mollusca: Cephalopoda: Nautilidae) trap in Palau, Micronesia, western Pacific.

The measurements for the carapace (in millimetres) are of the maximum carapace length and width (including spines), respectively. The terminology used follows that by Guinot & Richer de Forges (1995). The abbreviations P1–P5 are used for the chelipeds and first to fourth ambulatory legs, respectively. The spines along the ventral margin of the merus of P2–P4 are sometimes arranged in approximately two rows proximally but merge distally. As such, the number of spines on the ventral margin is a total count. Specimens examined are deposited in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (formerly the Raffles Museum of Biodiversity Research), National University of Singapore.

Taxonomy

Family Homolidae De Haan, 1839

Homola Leach, 1816

Homola mieensis Sakai, 1979

(Figs. 1–3)
Homola mieensis Sakai, 1979: 3, fig. 1c, 3b, pl. frontispiece, fig. 2. — Guinot & Richer de Forges 1981: 531, 534, fig. 2 D, pl. 2, fig. 3, 3a–b, pl. 8, fig. 2, 2a. — Guinot & Richer de Forges 1995: 335, fig. 9h, 11 a–b, 13c. – Ng et al. 2001: 6, fig. 1A. — Ng et al. 2008: 40. — Richer de Forges & Ng 2008: 5, fig. 1A, C. – Ahyong et al. 2009: 77, figs. 46, 47.

Material examined
1 male (31.7 × 24.6 mm) (ZRC 2012.56), Tashi port, Ilan County, northeastern Taiwan, coll. Hwang, 19 September 2011; 1 male (24.2 × 18.7 mm) (ZRC 2014.180), stn CP4095, 57–573 m, very hard bottom, Taiwan, 21°13.21′N 121°32.67′E–21°12.41′N 121°32.62′E, coll. ORJ 1 Cruise, 29 May 2013; 1 male (28.4 × 21.4 mm) (ZRC 2008.978), stn DW2997, Grand Passage, New Caledonia, 18°02′S 163°02′E, 430–438 m, coll. NO Alis, Concalis cruise, 6 May 2008.

Diagnosis
Medium-size homolid species (carapace length 30 mm). Carapace quadrangular, slightly wider posteriorly, length to width ratio 1.29–1.33; distances from gastric fossa to base of rostrum and posterior carapace margin subequal (Figs. 1A, B, 3). Rostrum relatively short, gently curved upwards from lateral view, tip sharp (Fig. 1B–D). Pseudorostral spine short; supraorbital spine distinct, sharp; anterolateral spine gently curved, with sharp tubercle posterior to it; subhepatic region with 1 strong, gently curved anterior spine, distinctly longer than anterolateral spine, with 1 shorter spine posterior to it, arc of 8–10 small spines around region below; row of 13–18 prominent small sharp granules posterior to anterolateral tubercle and spine, marking homolian linea (Figs. 1A–C, 3). Gastric area divided into 3 regions; epigastric region with 1 sharp tubercle; protogastric region with 3 distinct sharp tubercles, largest anterior, followed by lateral and mesial ones (Fig. 1B). Third maxilliped pediform; merus with posterior half of outer part dilated, appears lamellate, demarcated from rest of margin by broad cleft (Fig. 2A). Pereopods long: P4 longest; basis-ischium of P1–P5 with 1 sharp tubercle (occasionally low) on dorsal margin, 1 or 2 sharp tubercles on ventral margin, with distal one always larger; P1 (cheliped) merus: dorsal margin with 6 or 7 spines and 1–4 tubercles in adults (with only 4 tubercles in smaller specimen), distal margin with 3 spines, 2 on dorsal part, 1 on outer surface (only 2 spines in smaller specimen), ventral margin with 5–7 spines and 3–9 tubercles in adults (only 2 or 3 tubercles in smaller specimen); P2 merus: dorsal margin with 10–12 spines and 0 or 1 tubercle in adults (with 7 spines and 5 tubercles in smaller specimen), distal margin with 1 low spine on dorsal part, ventral margin with 14–17 spines and 8–28 tubercles in adults (only 14 or 15 tubercles in smaller specimen); P3 merus: dorsal margin with 8–12 spines and 0–2 tubercles in adults (with 9 spines and 2–4 tubercles in smaller specimen), distal margin with 1 low spine on dorsal part, ventral margin with 18–25 spines and 3–19 tubercles in adults (only 17–35 tubercles in smaller specimen); P4 merus: dorsal margin with 9 or 10 spines and no tubercles in adults (with 9 or 10 spines and 1 tubercle in smaller specimen), distal margin with 1 low spine on dorsal part, ventral margin with 18–21 spines and 7–12 tubercles in adults (only 2 spines and 17–21 tubercles in smaller specimen); P5 merus: dorsal margin unarmed except for long sharp spine on distal part; ventral margin with 5 spines in adults (6 short spines in smaller specimen), distal edge of merus reaching gastric groove when folded anteriorly; P5 propodus with 6 stout spines on proximal edge and 1 submedian spine; P5 dactylus with 6 or 7 relatively short, pectinate mobile spines behind pectinate tip on ventral margin, progressively longer towards tip (Figs. 1, 2B–H, 3).
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Fig. 1. *Homola mieensis* Sakai, 1979, male (31.7×24.6 mm) (ZRC 2012.56), Taiwan. A, overall habitus; B, dorsal view of cephalothorax; C, lateral view of cephalothorax; D, lateral view of frontal area of cephalothorax highlighting rostrum.
Remarks

_Homola mieensis_ was described from Sagami Bay in Japan (Sakai 1979) and has been reported from Taiwan (Ng _et al._, 2001; Ahyong _et al._, 2009) and New Caledonia (Guinot & Richer de Forges, 1981, 1995). The specimens from these locations resemble each other closely with regards to their carapace shape and arma-
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The structure as well as ambulatory leg proportions so we have little doubt they are conspecific (cf. Guinot & Richer de Forges, 1995. All also share the same distinctive mottled colour pattern (cf. Ng *et al.*, 2001: fig. 1A; Ahyong *et al.*, 2009: fig. 46).

Richer de Forges & Ng (2008) suggest that the apparent rarity of this species could be cause of their preference for rocky steep habitats.

**Homola milkolk, new species**

(Figs. 4–6)

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**Material examined**

Holotype: female (42.3 x 32.5 mm) (ZRC 2015.301), off Palau, in *Nautilus* trap, coll. P. Colin & L.B. Colin, 6 March 1997.
Fig. 4. *Homola milkoik*, new species, holotype female (42.3 × 32.5 mm) (ZRC 2015.301), Palau. A, overall habitus; B, dorsal view of carapace; C, D, frontal view of cephalothorax.
Diagnosis

Medium-size homolid species (carapace length 42 mm). Carapace quadrangular, slightly wider posteriorly; length to width ratio 1.30; distance from gastric fossa to base of rostrum shorter than that to posterior carapace margin (Fig. 4A, B). Rostrum short, almost straight from lateral view, tip blunt (Figs. 4B, 5A, B). Pseudorostral spine short; supraorbital spine distinct, sharp; anterolateral spine gently curved, with sharp tubercle posterior to it; subhepatic region with 1 strong, gently curved anterior spine, distinctly longer than anterolateral spine, with 1 shorter spine posterior to it, arc of 9 or 10 small spines around region below; row of 18–20 relatively smaller sharp granules posterior to anterolateral tubercle and spine, marking homolian linea (Figs. 4A–D, 5A). Gastric area divided in 3 regions; epigastric region with 1 sharp tubercle; protogastric region with 2 distinct sharp and 1 low tubercle, largest anterior, followed by lateral one, mesial one low (Fig. 4B, C). Third maxilliped pediform; merus with posterior two-thirds of outer part dilated, appears lamellate, demarcated from rest of margin by broad cleft (Fig. 5C). Pereopods proportionately longer: P4 longest; basis-ischiium of P1–P5 with 1 sharp tubercle on dorsal margin, 2 sharp tubercles on ventral margin, with distal one always larger, and 6–10 low granules; P1 (cheliped) merus: dorsal margin with 8 or 9 spines, distal margin with 1 spine on dorsal part, ventral margin with 7–10 tubercles, outer surface with scattered low granules; P2 merus: dorsal margin with 15 spines, distal margin with 1 low spine on dorsal part, ventral margin with 4 spines and 25 tubercles, outer surface with scattered low granules; P3 merus: dorsal margin with 12–14 spines, 6 tubercles, distal margin with 1 low spine on dorsal part, ventral margin with 8–12 spines and 32–36 tubercles; outer surface with scattered low granules; P4 merus: dorsal margin with 11 spines and 0 or 1 tubercle, distal margin with 1 low spine on dorsal part, ventral margin with 8 or 9 spines and 24–30 tubercles; outer surface with 20–25 rounded granules; P5 merus: dorsal margin unarmed except for long sharp spine on distal margin, distal margin with 1 spine on outer, ventral margin with 8 spines, outer surface with 12–14 rounded granules, distal edge of merus reaching gastric groove when folded anteriorly; P5 propodus with 5 stout spines on proximal edge and 1 submedian spine; P5 dactylus with 6 relatively long, pectinate mobile spines behind pectinate tip on ventral margin, progressively longer towards tip (Figs. 4A, 6A–G).

Description

Carapace quadrangular, longer than wide; lateral margins gently convex, gently diverging towards sinuous posterior carapace margin, wider posteriorly; length to width ratio 1.30 (Fig. 4A, B). Dorsal surface with regions well demarcated; generally smooth, with low rounded granules and shallow pits, glabrous; gastric with 3 regions: epigastric region with 1 sharp tubercle, protogastric region with 2 distinct sharp and 1 low tubercle, largest anterior, followed by lateral one, mesial one low; cardiac region clearly defined; gastro-cardiac and branchio-cardiac grooves deep, demarcating prominent broadly ovate regions; distance from gastric fossa to base of rostrum shorter than distance from fossa to posterior carapace margin (Fig. 4A, B). Ocular peduncle long; cornea large, spherical, cornea surface appears chequered (Figs. 4B–D, 5A, B). Rostrum short, almost straight, tip barely bifurcated distally, appearing blunt; ventral surface prominently carinate; lateral margins subcristate (Figs. 4A, B, 5A, B). Pseudorostral spine short, sharp, shorter than rostrum; supraorbital spine distinct, sharp, longer than pseudorostral spine, covering base of ocular peduncle (Fig. 4A, B). Anterolateral spine prominent, gently curved anteriorly, with sharp tubercle posterior to it; subhepatic region swollen, with 1 strong, gently curved anterior spine, prominently longer.
Fig. 5. *Homola milkolk*, new species, holotype female (42.3 × 32.5 mm) (ZRC 2015.301), Palau. A, lateral view of cephalothorax; B, lateral view of frontal area of cephalothorax highlighting rostrum; C, left third maxilliped; D, ventral surface of cephalothorax and pleon; E, telson and pleonal somites 5 and 6; F, sternopleonal cavity.
than anterolateral spine, with 1 shorter spine posterior to it, arc of 9 or 10 small spines around region below these; row of 18–20 relatively smaller sharp granules posterior to anterolateral tubercle and spine, marking homolian linea (Figs. 4A, B, 5A, B). Basal antennal article with long setae at base of prominent urinary article, proepistomial tooth triangular, sharp (Fig. 4C, D). Pterygostomian region rugose, glabrous (Fig. 5C, D). Sub-branchial region with low granules (Fig. 5A, D).

Third maxilliped pediform, not entirely closing buccal cavity; ischium subrectangular, distal part wider, inner surface more swollen, lined with longitudinal row of low tubercles, mesial margin lined with long stiff setae which obscure margin, margin uneven but no distinct crista dentata present; merus with posterior
two-thirds of outer surface dilated, appears lamellate, demarcated from rest of margin by broad cleft, inner surface swollen, mesial margin lined with long stiff setae which obscure margin; carpus, propodus and dactylus elongated, inner margins with long stiff setae, tip of dactylus reaching to proximal part of ischium when appressed; exopod relatively slender, distal part reaching to two-thirds length of merus, with long flagellum (Fig. 5C, D).

Chelipeds (P1) slender, symmetrical (Fig. 4A). Basis-ischium with 1 sharp tubercle on dorsal margin, 2 sharp tubercles on ventral margin, distal one larger, and several low granules; merus long, subcylindrical, dorsal margin with 8 or 9 spines and scattered short setae, distal margin with 1 spine on dorsal part, ventral margin with 7–10 tubercles and scattered long setae, outer surface with scattered low granules; carpus elongate, surfaces almost smooth, margins with scattered short setae, unarmed; chela slender, elongate, outer surfaces almost smooth, margins with scattered low setae; fingers shorter than palm, straight, cutting edges smooth (Fig. 6A, B).

Ambulatory legs long: P4 longest; basis-ischium of P2–P5 with 1 sharp tubercle on dorsal margin, 2 sharp tubercles on ventral margin, with distal one always larger, and 6–10 low granules; P2 merus: dorsal margin with 15 spines, distal margin with 1 low spine on dorsal part, ventral margin with 4 spines and 25 tubercles as well as scattered short setae, outer surface with scattered low granules; P3 merus: dorsal margin with 12–14 spines, 6 tubercles, distal margin with 1 low spine on dorsal part, ventral margin with 8–12 spines and 32–36 tubercles as well as scattered short setae; outer surface with scattered low granules; P4 merus: dorsal margin with 11 spines and 0 or 1 tubercle, distal margin with 1 low spine on dorsal part, ventral margin with 8 or 9 spines and 24–30 tubercles as well as scattered short setae; outer surface with 20–25 rounded granules; P5 merus: dorsal margin unarmed except for long sharp spine on distal margin, distal margin with 1 spine on outer surface, ventral margin with 8 spines, outer surface with 12–14 rounded granules, distal edge of merus reaching gastric groove when folded anteriorly against dorsal surface of carapace; P5 propodus with 5 stout spines on proximal edge, 1 submedian spine, with scattered long and short setae; P5 dactylus with 6 relatively long, pectinate, mobile spines behind pectinate tip on ventral margin, progressively longer towards tip (Figs. 4A, 6C–G).

Thoracic sternum entirely covered by ovate pleon; vulva small, adjacent to condyle of coxa of P3 (Fig. 5F). Pleon longitudinally ovate, domed, with all somites and telson free; telson triangular, lateral margins sinuous, tip rounded; lateral margins of somites covering bases of coxae of P2–P5; somite 6 subtrapezoidal, lateral margin distinctly sinuous, with median part concave; coxae of third maxilliped forming pleonal lock when closed, no other locking mechanism present (Fig. 5D–F).

**Etymology**

According to the mythology of Palau, “milkolk” is the name given to an era of darkness when only gods prevailed (Aoyama, 1996). The name is used here (as a noun in apposition) to allude to the dark realm where the new species lives.

**Remarks**

The new species from Palau is closest to *H. mieensis* Sakai, 1979, and *H. ranunculus* Guinot and Richer de Forges, 1995. *Homola mieensis* and *H. milkolk*, new species, are perhaps the most similar. However, the carapace of *H. milkolk*, new species, is relatively longer than in *H. mieensis*, with the distance from the gastric fossa to posterior carapace margin distinctively longer than that from the gastric fossa to the base of the rostrum (Fig. 4B) (distances subequal in *H. mieensis*, Fig. 1B); the mesial tubercle on each protogastric region is low
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(Fig. 4A, B, D) (distinct and sharp in *H. mieensis*, Figs. 1A, B, 3); the granules along the lateral margin posterior to the anterolateral spine are relatively lower and less distinct (Fig. 4B) (granules more prominent and sharper in *H. mieensis*, Fig. 1B); the hepatic spine is proportionately smaller (Fig. 4A, B) (proportionately larger in *H. mieensis*, Fig. 1A, B); the rostrum relatively straight from lateral view (Fig. 5B) (distinctly upcurved in *H. mieensis*, Fig. 1D); the lamellate part of the outer border of the merus of the third maxilliped is about two-thirds the overall length (Fig. 5C) (the lamellate part is only about half the overall length in *H. mieensis*, Fig. 2A); the P2–P4 meri are relatively longer (Fig. 6C–D) (meri relatively shorter in *H. mieensis*, Fig. 2D–F); the spines on the ventral margins of P2–P4 are relatively shorter (Fig. 6C–E) (distinctly longer in *H. mieensis*, Fig. 2D–F); the distal margin of the P1 merus has only one spine (Fig. 6A) (with 2 or 3 spines in *H. mieensis*, Fig. 2C); the proximal part of the ventral margin of P5 propodus has five spines (Fig. 6G) (with 6 spines in *H. mieensis*, Fig. 2H); and the mobile pectinate spines on the ventral margin of the P5 dactylus are relatively longer (Fig. 6G) (mobile pectinate spines relatively short in *H. mieensis*, Fig. 2H). In the specimens of *H. mieensis* on hand, the ventral margin of the P5 merus always has five spines (Fig. 2G) (with 8 spines in *H. milkolk*, new species, Fig. 6F), but this may vary. In the figure of *H. mieensis* by Ahyong *et al.* (2009: fig. 46), the ventral margin of the right P5 merus has eight spines while the left structure has six.

*Homola ranunculus* (known only from New Caledonia) has the same general silhouette with hepatic spine strongest, carapace enlarged posteriorly and long legs with thick meri. However, *H. ranunculus* is easily distinguished from of *H. mieensis* and *H. milkolk*, new species, in having a distinctly bifid rostrum (cf. Guinot & Richer de Forges, 1995: fig. 15A) and the spine behind the largest subhepatic spine is low and directed laterally (cf. Guinot & Richer de Forges, 1995: fig. 15A). *Homola milkolk*, new species, is similar to *H. ranunculus* in having the spines on the ventral margin of the meri of P2–P4 relatively short (Fig. 6C–E; Guinot & Richer de Forges, 1995: fig. 16a). However, it differs markedly from *H. ranunculus* in having a greater distance between the gastric fossa to posterior carapace margin than that to the base of the rostrum (Fig. 4A, B versus Guinot & Richer de Forges, 1995: fig. 16a, b); the ventral surface of the subhepatic region are covered only with tubercles and no spines (Figs. 4C, 5A versus Guinot & Richer de Forges, 1995: fig. 15B); and possessing relatively longer and more slender P2–P4 meri (Fig. 6C–E versus Guinot & Richer de Forges, 1995: fig. 16a, b).

Considering the wide distribution of *H. mieensis* (from Japan to New Caledonia), it is surprising to discover an allied new species in Palau Islands that is within this geographical range. The islands of Micronesia nevertheless appear to have a number of deep-water species known only from and around the area, for example, the homolid *Homola dickinsoni* Eldredge, 1980 (see Eldredge, 1980; Guinot & Richer de Forges, 1995), the oregoniid *Bothromia* Williams & Moffitt, 1991 (see Williams & Moffitt, 1991), and the inachid *Cyrtomaia micronesica* Richer de Forges & Ng, 2007 (see Richer de Forges & Ng, 2007b; Komai & Tsuchida, 2014) (see also Paulay *et al.*, 2003).

The type specimen of *H. milkolk*, new species, was collected from a trap used to collect *Nautilus* (Mollusca: Cephalopoda: Nautilidae) specimens for study. The label with the specimen says “short drop off Palau”, suggesting that the traps were positioned in deeper waters.

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