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# Two new hermit crab species of the genus *Diogenes* Dana, 1851 from Lombok Island, Indonesia (Crustacea: Decapoda: Anomura: Diogenidae)

Dwi Listyo **Rahayu**

**Abstract.** Two new hermit crab species of the genus *Diogenes* Dana, 1851 from the northern coast of Lombok Island, Indonesia are described and illustrated. *Diogenes luteus*, new species, is characterised by the stout antennal peduncles with a cast-net like setae structure flagella, short antennal acicles, and a black band on each ocular peduncle that separate the areas of yellow distally and white proximally. *Diogenes kombalensis*, new species, is recognisable in having a broad longitudinal crest on the outer surface of the left cheliped palm and stout ocular peduncles each with a large longitudinal brown band on the dorsal surface. These new species are members of the *edwardsii* group of the genus *Diogenes*, that are listed in this paper with their geographical distributions.

**Key words.** hermit crab, *Diogenes*, new species, Diogenidae, Indonesia

## INTRODUCTION

*Diogenes* Dana, 1851, the species-rich genus in the family Diogenidae, is a significant component of Indonesian hermit crabs. Rahayu (2012) documented the species of the genus known from Indonesian waters at that time, and later on with new records and new species being reported, a total of 25 species were listed as part of the Indonesian marine fauna (Asakura, 2020; Rahayu, 2021; Rahayu & Pratiwi, 2022). Recently, two unidentified species of the genus *Diogenes* were collected from a vast area of sandy mud flat, near river mouth in the northern coast of Lombok Island, Indonesia. These two species belong to the *edwardsii* group of *Diogenes* as defined by Asakura & Tachikawa (2010), but differ markedly from 52 known species of this group with regards to the form of the ocular peduncle, armament of the chelipeds and pereopods, and live colouration. In this study, the two species are described and illustrated as new to science. A list of species in the genus *Diogenes* assigned to the *edwardsii* group with the geographical distribution is also presented (Table 1).

## MATERIAL AND METHODS

The holotypes of the new species are deposited in the Museum Zoologi Bogor (MZB), National Research and Innovation Agency (BRIN), Indonesia. Paratypes and other specimens examined are deposited in MZB and the Lee Kong Chian Natural History Museum (ZRC), National University of Singapore. The measurement provided of specimens is shield length (sl) in millimetres (mm), measured from the tip of the rostral lobe to the midpoint of the posterior margin of the shield. The descriptive terminology follows McLaughlin et al. (2007) and Komai & Yoshida (2020). All the specimens examined from Indonesia were collected by D.L. Rahayu, during low tide from tide pools or among rubble and rotten wood brought to the beach by rivers in the northern coast of Lombok Island. Some additional specimens came from Bedukang beach, Brunei Darussalam.

## TAXONOMY

### Family Diogenidae Ortmann, 1892

### Genus *Diogenes* Dana, 1851

### *Diogenes luteus*, new species
(Figs. 1B–D, 2, 3)

**Type material.** Holotype, male, 2.2 mm (MZB Cru 5754), 8° 24′ 02.8″N 1116° 05′ 07.4″E, Teluk [= Bay] Kombal, Lombok Utara [= North], 4 June 2023. Paratypes, 4 males, 1.5–2.5 mm, 1 female, 1.8 mm, 2 ovigerous females, 1.5, 1.6 mm (MZB Cru 5755); 5 males, 1.3–2.5 mm, 1 ovigerous female, 1.6 mm (ZRC 2023.0671), same locality as holotype.

*Accepted by: Lee Bee Yan*

Research Centre for Marine and Land Bioindustry, National Research and Innovation Agency, Dusun Teluk Kodek, Pemenang, Lombok Utara 83756, NTB, Indonesia; Email: dwi.listyo.rahayu@brin.go.id; https://orcid.org/0000-0003-4342-9045


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Table 1. List of species of *Diogenes* Dana, 1851 assigned to the *edwardsii* group, with summary of geographic ranges.

| Species | Geographical range | References |
|---|---|---|
| *Diogenes acanthochela* Komai, Liang & Yang, 2012 | Leizou Bay, Guangdong, China | Komai et al., 2012 |
| *Diogenes albimanus* Landschoff & Rahayu, 2018 | South Africa | Landschoff & Rahayu, 2018 |
| *Diogenes arguinensis* Almón, Cuesta & García Raso, 2022 | Mauritania, Spain, Morocco | Almón et al., 2022 |
| *Diogenes armatus* Almón, Cuesta, Schubart & García Raso, 2021 | Spain, Portugal, French Mediterranean and Atlantic, Tunisia | Almón et al., 2021 |
| *Diogenes avarus* Heller, 1865 | Red Sea, Persian Gulf, northern Arabian Sea, Indian Ocean from east Africa to Thailand, Indonesia, Singapore, Malaysia, northern and western Australia | Rahayu, 2021; Siddiqui et al., 2004 |
| *Diogenes berduri* Rahayu, 2021 | South of Java, Indonesia | Rahayu, 2021 |
| *Diogenes bicristimanus* Alcock, 1905 | Indian Ocean | Alcock, 1905 |
| *Diogenes bispinatus* Xiao, Wang & Sha, 2015 | Buhai, Guangxi, South China Sea | Xiao et al., 2015 |
| *Diogenes brevirostris* Stimpson, 1858 | Durban Bay, West Coast of Africa | Barnard, 1950 |
| *Diogenes canaliculatus* Komai, Reshmi & Kumar, 2013 | Kerala, India | Komai et al., 2013 |
| *Diogenes chhapgari* Trivedi, Osawa & Vachhrajani, 2016 | Gujarat, India | Trivedi et al., 2016 |
| *Diogenes costatus* Henderson, 1893 | Mozambique, South Africa, Red Sea, Seychelles, Arabian Sea, Gulf of Mannar, Andaman Sea, Thailand. | McLaughlin, 2002 |
| *Diogenes crassus* Asakura, 2020 | Pelabuhan Ratu, Java, Indonesia | Asakura, 2020 |
| *Diogenes curvimanus* Almón, Cuesta, Schubart & García Raso, 2021 | Mediterranean Sea, Atlantic coast of Europe, North Sea. | Almón et al., 2021 |
| *Diogenes deflectomanus* Wang & Tung, 1980 | Coast of China, from Bohai to Hainan | Komai et al., 2012 |
| *Diogenes denticulatus* Chevreux & Bouvier, 1892 | West coast of Africa from Senegal to Angola, Red Sea | Forest, 1956 |
| *Diogenes dorotheae* Morgan & Forest, 1991 | Papua, Indonesia; Northwestern Australia | Morgan & Forest, 1991; Rahayu & Hortle, 2002 |
| *Diogenes edwardsii* De Haan, 1849 | Japan, Korea, East China Sea, Taiwan | Asakura, 2006; McLaughlin et al., 2007 |
| *Diogenes erythromanus* Almón, Cuesta & García Raso, 2022 | Atlantic coast of Spain, Morocco | Almón et al., 2022 |
| *Diogenes extricatus* Stebbing, 1910 | Western South Africa, East Atlantic | Barnard, 1950 |
| *Diogenes fasciatus* Rahayu & Forest, 1995 | Pakistan, Thailand, Indonesia, Singapore | Rahayu, 2022 |
| *Diogenes foresti* Rahayu & Hortle, 2002 | Papua, Indonesia | Rahayu & Hortle, 2002 |
| *Diogenes goniochirus* Forest, 1956 | Indonesia, Singapore, Vietnam. | Forest, 1956; McLaughlin & Clark, 1997 |
| *Diogenes guttatus* Henderson, 1888 | Andaman Sea, Thailand; Torres Strait, Northern Australia | Siddiqui & McLaughlin, 2003 |
| *Diogenes haigae* Asakura, 2020 | Arafura Sea, Philippines | Asakura, 2020 |
| *Diogenes heteropsammicola* Igawa & Kato, 2017 | Oshima Strait, Japan | Igawa & Kato, 2017 |

| Species | Geographical range | References |
|---|---|---|
| *Diogenes holthuisi* Asakura & Tachikawa, 2010 | Ogasawara, Japan | Asakura & Tachikawa, 2010 |
| *Diogenes inglei* McLaughlin & Clark, 1997 | Singapore | Rahayu, 2022 |
| *Diogenes investigatoris* Alcock, 1905 | Indian Ocean | Alcock, 1905 |
| *Diogenes karwarensis* Nayak & Neelakantan, 1989 | West coast of India | Nayak & Neelakantan, 1989 |
| *Diogenes klaasi* Rahayu & Forest, 1995 | Persian Gulf, Pakistan, western Thailand, Singapore, Indonesia | Rahayu, 2022 |
| *Diogenes kombalensis*, new species | Lombok Island, Indonesia | This study |
| *Diogenes laevicarpus* Rahayu, 1996 | Singapore | Rahayu, 2022 |
| *Diogenes lophochir* Morgan, 1989 | Rottnest Island, Australia; Singapore | Rahayu, 1996 |
| *Diogenes luteus*, new species | Lombok Island, Indonesia | This study |
| *Diogenes maclaughlinae* Nayak & Neelakantan, 1985 | Karwar, India | Nayak & Neelakantan, 1985 |
| *Diogenes minimus* Komai & Yoshida, 2020 | Chiba Prefecture, Japan | Komai & Yoshida, 2020 |
| *Diogenes moosai* Rahayu & Forest, 1995 | Indonesia, Singapore | Rahayu, 2022 |
| *Diogenes nitidimanus* Terao, 1913 | Northeast coast of Russia, Japan, Korea, Taiwan | Asakura, 2006; McLaughlin et al., 2007 |
| *Diogenes ortholepis* Forest, 1961 | Guinea, East Atlantic | Forest, 1961 |
| *Diogenes ovatus* Miers, 1881 | Senegal, Congo | Forest, 1956 |
| *Diogenes paracristimanus* Wong & Dong, 1977 | Coast of China, from Bohai to Zhejiang | Komai et al., 2012 |
| *Diogenes penicillatus* Stimpson, 1858 | Japan; Ussuri Bay, Russia; Taiwan | Asakura, 2006; McLaughlin et al., 2007 |
| *Diogenes pisinnus* Rahayu, 2022 | Singapore | Rahayu, 2022 |
| *Diogenes pugilator* Roux, 1828 | Mediterranean Sea, Spain, Tunisia | Almón et al., 2021 |
| *Diogenes rectimanus* Miers, 1884 | Gulf of Aden, India, Sri Lanka, Thailand, Indonesia, Singapore, Torres Strait, Australia, China, Taiwan | Komai et al., 2012; Rahayu, 2022 |
| *Diogenes senex* Heller, 1865 | East coast of Australia, from Sydney to Port Essington, Northern Australia | McLaughlin & Dworschak, 2001 |
| *Diogenes singaporensis* Rahayu, 2014 | Singapore | Rahayu, 2014 |
| *Diogenes spinifrons* (De Haan, 1849) | Japan, Taiwan | Asakura, 2006; McLaughlin et al., 2007 |
| *Diogenes spongicola* Komai, Ravinesh & Kumar, 2018 | Kerala, Tamil Nadu, India | Komai et al., 2018 |
| *Diogenes takedai* Rahayu, 2012 | Lombok Island, Indonesia | Rahayu, 2012 |
| Diogenes *tirmiziae* Siddiqui & McLaughlin, 2003 | Sindh coast of Pakistan | Siddiqui et al., 2004 |
| *Diogenes tomentosus* Wang & Tung, 1980 | Chengsan, Zhejiang, China | Wang & Tung, 1980 |
| *Diogenes waltairensis* Kamalaveni, 1950 | Waltair, India | Kamalaveni, 1950 |

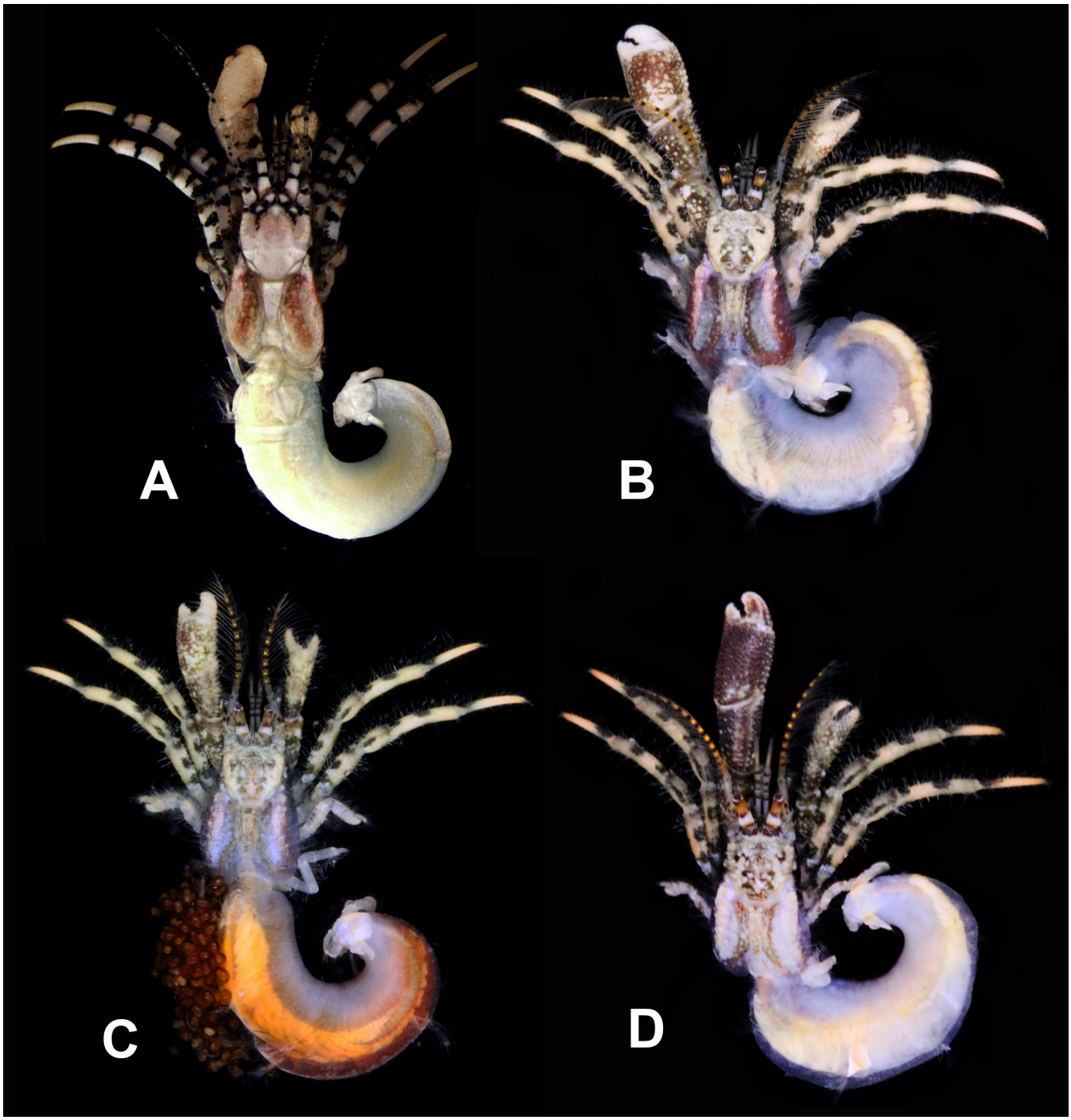


Fig. 1. A, *Diogenes takedai* Rahayu, 2012 (not measured and sexed); B, *Diogenes luteus,* new species, holotype, male 2.2 mm (MZB Cru 5754); C, *Diogenes luteus,* new species, paratype, ovigerous female, 1.6 mm (ZRC 2023.0671); D, *Diogenes luteus,* new species, paratype, male, 2.5 mm (MZB Cru 5755).

**Other material**. 2 males, 2.0, 2.4 mm, 2 females, 1.1, 1.5 mm, 1 ovigerous female, 1.6 mm (MZB Cru 5756); 3 males, 1.3–2.5 mm, 2 females, 1.5, 1.6 mm, 1 ovigerous female, 2.2 mm (ZRC 2023.0672), same locality as holotype, 17 June 2023; 8 males, 2.0–2.4 mm, Bedukang beach, Brunei Darussalam, 11 July 2020.

**Comparative material**. *Diogenes takedai* Rahayu, 2012, 1 male, 1.9 mm, Pandanan, Lombok, 25 October 2009 (MZB Cru 3263).

**Description**. Shield (Figs. 1B–D, 2A) approximately as long as broad; anterolateral margins sloping, each lined with minute spinulose granules, anterolateral angles each with small spine; dorsal surface slightly rugose, with some short, transverse, marginally spinulose ridges laterally and few tufts of short setae; posterior margin roundly truncate. Rostral lobe broadly rounded, weakly produced. Lateral projections triangular, not exceeding tip of rostral lobe, each with small terminal spine. Branchiostegite unarmed on dorsal margin; anterior margin rounded, unarmed.

Ocular peduncles (Fig. 2A) stout, left slightly longer than right, 0.6–0.7 length of shield, inflated proximally, narrowing distally to rounded cornea; surfaces almost glabrous. Corneas slightly dilated, diameter about 0.2 of peduncular length. Ocular acicles subtriangular, each with row of 4 or 5 spines on distolateral margin, distalmost spine strongest. Intercalary rostriform process simply acuminate at tip, not reaching tips of ocular acicles.

Antennular peduncles (Fig. 2A) unarmed, when fully extended, overreaching distal corneal margins by 0.7 length of ultimate article. Ultimate article 1.2 times as long as penultimate article, slightly widened in lateral view, with few moderately long setae on dorsal surface. Dorsal flagellum with short aesthetasc-bearing portion consisting of 5 or 6 articles.

Antennal peduncles stout (Figs. 1B–D, 2A) overreaching distal corneal margins by half-length of article 5. Article 5 subcylindrical, unarmed, with row of long setae laterally. Article 4 with triangular dorsodistal margin, otherwise unarmed. Article 3 short, with few setae ventrally, unarmed. Article 2 stout, with dorsolateral distal angle produced into prominent spine, dorsomesial distal angle with small spine; ventral surface convex, with 4 marginal spines. Article 1 unarmed, with scattered short setae laterally. Antennal acicle short (Fig. 2A, B), stout, triangular, not reaching half-length of article 4, with row of 4 to 5 strong spines and short setae on oblique mesial margin. Antennal flagellum (Fig. 1B–D) about 1.8 times as long as shield, not reaching and overreaching tip of left cheliped in males and females, respectively; each article distally with long lateral and mesial setae forming cast net-like structure, and sometimes with additional short seta dorsally.

Maxilliped 3 (Fig. 2C) moderately slender. Dactylus to merus unarmed; dactylus approximately as long as propodus; ischium with crista dentata composed of 4 small corneous spines, of which distalmost one strongest and slightly recurved; basis with 2 minutes spiniform denticles on mesial margin (Fig. 2D). Exopod overreaching midlength of carpus, with well-developed flagellum.

Chelipeds (Fig. 1B–D) unequal and dissimilar, left much larger than right, but not particularly elongate even in males. Left cheliped (Figs. 1B–D, 2E–G) generally similar between male and female, but male with stronger spines on upper margin of palm; very narrow hiatus between dactylus and fixed finger; setation on chela and carpus quite sparse. Dactylus gently curving, slightly shorter than palm measured along upper margin; outer surface with row of moderately large spinulose tubercles adjacent to upper margin, and irregular rows of small spinulose tubercles on remaining portion; upper margin with row of small spines diminishing in size distally; inner surface with drop-like tubercles, larger proximally; cutting edge with 1 large, submedian blunt calcareous tooth followed by row of much smaller calcareous teeth, terminating in strong calcareous claw. Palm somewhat convex laterally on outer surface, approximately as broad as long measured along upper margin; outer surface covered with small and large tubercles, some tubercles drop-like, proximal and median tubercles larger; upper margin with row of small, forwardly directed spines; inner surface gently concave, smooth, nearly glabrous; fixed finger short, stout, with tufts of short setae on outer and inner surfaces; cutting edge with 1 large, blunt calcareous tooth medially and row of smaller teeth, terminating in strong calcareous claw. Carpus noticeably becoming wider distally; upper margin with row of strong spines; outer surface elevated in midline, with irregular rows of strong spines, and remaining portion with scattered spines and tubercles; lower margin with row of tubercles. Merus slightly shorter than carpus, longer than broad, with very low tubercles or protuberances on dorsal surface accompanied by sparse short setae; lateral surface with small, low tubercles; mesial surface nearly flat, with few small, low tubercles; ventral surface with small, low tubercles and scattered short setae. Ischium without conspicuous armature, with sparse short setae.

Right cheliped (Figs. 1B–D, 2H) when fully extended, reaching to midlength of palm of left cheliped, covered with long and dense setae not obscuring armature. Dactylus gently curving, 1.3 times as long as palm measured along upper margin; upper margin with 2 rows of strong spines; outer surface with scattered spinules; cutting edge with row of very small, blunt calcareous teeth, terminating in small corneous claw. Palm covered with sparse small spines on entire surfaces, upper surface with row of large spines; outer surface sloping without distinct delimitation of upper margin; lower to inner surfaces glabrous, with few setae; fixed finger with row of minute blunt calcareous teeth on cutting edge, terminating in small corneous claw, crossing claw of dactylus; narrow hiatus between fingers. Carpus widened distally, with scattered tufts of long setae on outer surface; upper margin with row of spines increasing in size distally and followed by few low protuberances; outer surface with longitudinal row of small spines medially, few small, low protuberances on remaining portion; inner surfaces almost glabrous. Merus somewhat compressed laterally; dorsal margin with row of well-spaced small spines and tufts of short setae; lateral surface with few small, low protuberances, ventrolateral margin with 1 small subdistal spine; mesial surface almost glabrous, ventromesial margin with small distal spine followed by low protuberances; ventral surface narrow, with scattered long setae. Ischium unarmed, with sparse setae.

Pereopods 2 and 3 (Fig. 3) generally similar, relatively slender. Dactyli subequal in length to propodi, slightly curved ventrally, but not twisted, each terminating in long corneous claw; dorsal margins each with row of sparse moderately long setae; lateral and mesial faces with few short setae, devoid of median sulci; ventral margins each with row of sparse moderately long setae. Propodi distinctly longer than carpi; dorsal margins without conspicuous armature, each with row of sparse, moderately long setae; lateral and mesial faces with tufts of short setae adjacent to dorsal and ventral margins; ventral surfaces each with row of widely spaced, moderately long setae. Carpi each with small dorsodistal spine and row of moderately long setae; lateral and mesial faces almost glabrous; ventral margins each with few moderately

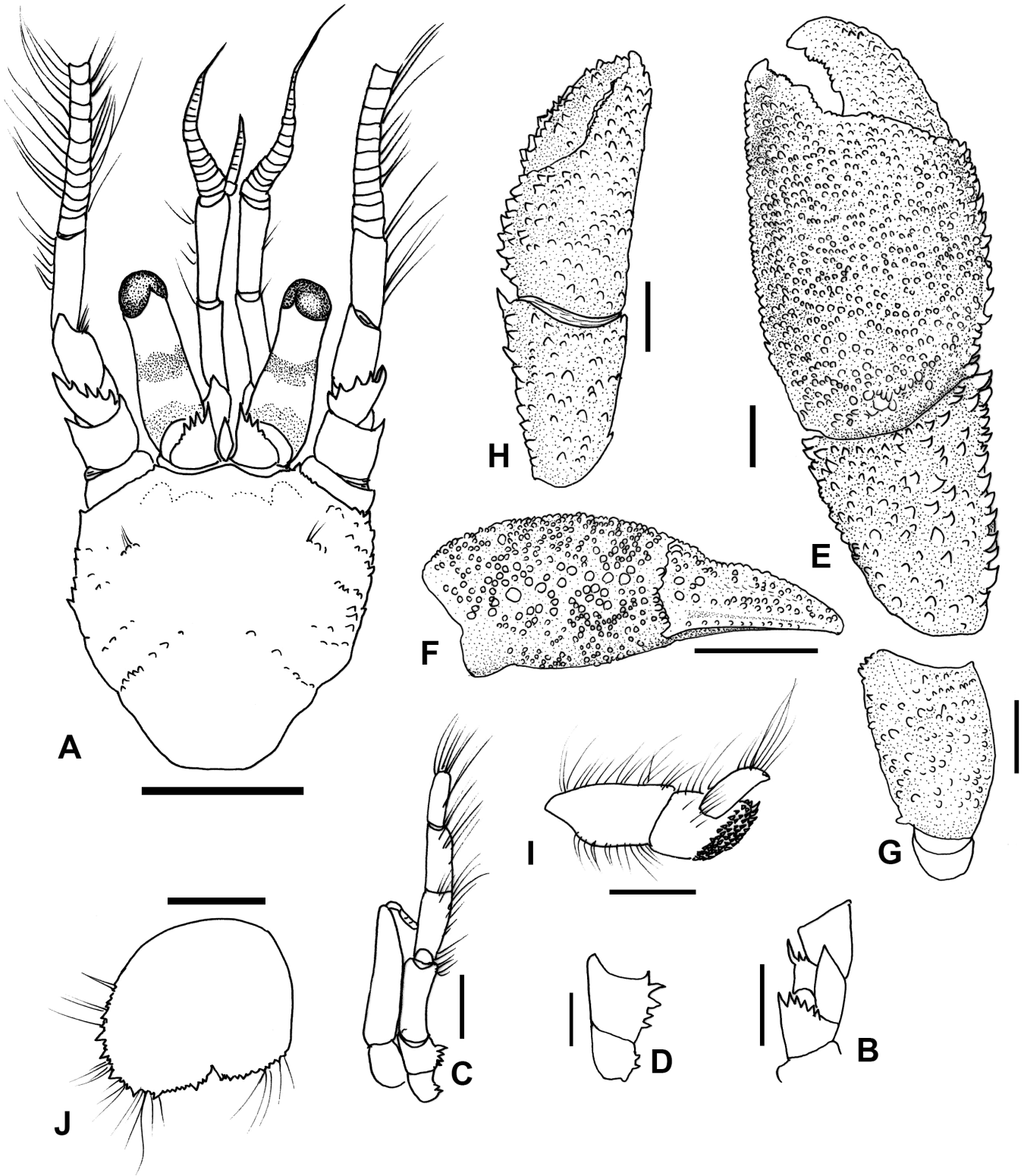


Fig. 2. *Diogenes luteus,* new species, holotype, male, 2.2 mm (MZB Cru 5754). A, shield and cephalic appendages; B, left antennal peduncle (articles 1–4), ventral view; C, right maxilliped 3, lateral view; D, right maxilliped 3, ischium and basis, lateral view; E, left cheliped, chela and carpus outer view; F, same, chela, mesial view; G, same, merus, lateral view; H, right cheliped, chela and carpus, outer view; I, right pereopod 4, lateral view; J, telson, dorsal view. Scales, A, E–H = 1 mm; B, C, D, I, J = 0.5 mm. Setae partially omitted.

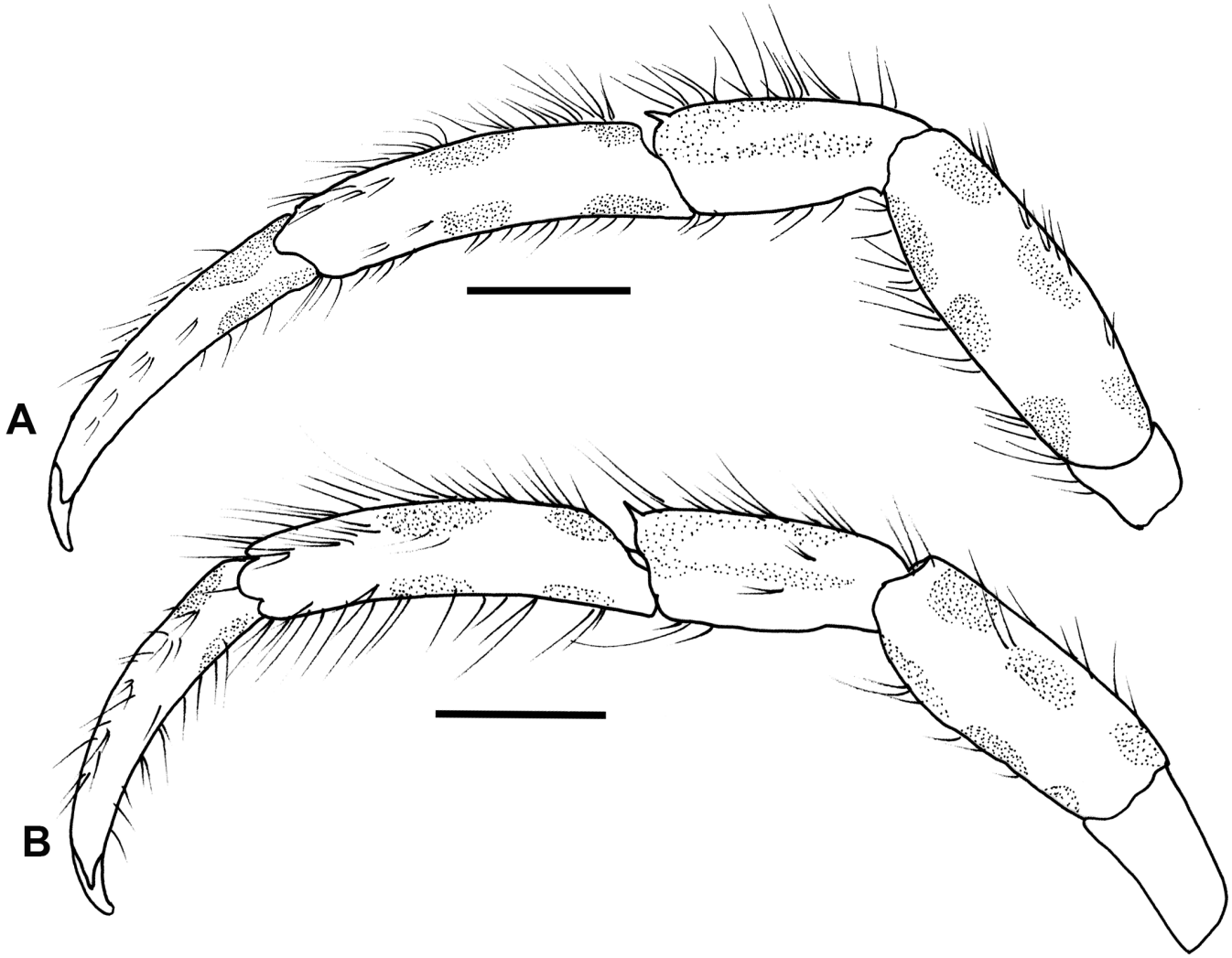


Fig. 3. *Diogenes luteus,* new species, holotype, male, 2.2 mm (MZB Cru 5754). A, left pereopod 2, lateral view; B, left pereopod 3, lateral view. Scales = 1 mm. Setae partially omitted.

short setae. Meri each with row of sparse, moderately long setae on dorsal and ventral margins; lateral and mesial faces almost glabrous; ventral margins unarmed. Ischia each with row of sparse setae on dorsal and ventral margins. Female with paired gonopores on coxae of pereopods 3.

Pereopods 4 semichelate (Fig. 2I). Dactylus slightly curved distally, dorsodistally with long, dense setae. Propodi unarmed; propodal rasp occupying lateral face of fixed finger and extending onto ventral one-third of palm, consisting of numerous rows of small oval corneous scales. Carpi unarmed at dorsodistal angles.

Male with 4 well-developed, unpaired, uniramous left pleopods; pleopod 3 largest. Female also with 4 unpaired, biramous left pleopods.

Telson (Fig. 2J) with distinct median cleft and row of small spines on terminal margin, left lobe larger but not longer than right, lateral margin with row of large spines interspersed by smaller spines; right lobe unarmed on lateral margin; row of long setae on terminal margin extending onto lateral margins.

**Colour in life**. See Fig. 1B–D. Shield whitish cream, with brown patches on posteromedian part; branchial regions pinkish. Ocular peduncles dark brown proximally, followed by whitish cream area, dark brown band medially, followed by golden yellow distally, narrow dark brown band adjacent to cornea; cornea silvery black; ocular acicles dark brown, terminal spines white; intercalary rostral process dark brown. Antennular peduncle white in general; ultimate article with dark brown band distally and proximally, large dark brown spot medially; penultimate article with dark brown band distally; flagellum alternately translucent white and light brown. Antennal peduncle translucent white or cream, articles 4 and 5 each with large dark brown spot distally; flagellum alternately dark brown and golden yellow. Left cheliped palm dark brown, speckled with white; dactylus and fixed finger whitish cream; carpus and merus dark brown, tubercles white. Right cheliped palm whitish cream, speckled with light brown proximally; dactylus and fixed finger as in those of left cheliped; carpus and merus light brown, with whitish cream tubercles. Pereopods 2 and 3 generally cream; dactyli yellowish cream or orangish cream, with dark brown or black broad streak on each dorsolateral and ventrolateral

margins proximally; propodi each with dark brown or black broad streak on each dorsolateral and ventrolateral margins medially and proximally; carpi each with dark brown or black broad longitudinal band on each lateral and dorsal faces not reaching distal area, smear of light brown distally on dorsolateral face; meri each with dark brown spot on distal, median, and proximal areas, respectively (Fig. 1B). In some paratypes, left cheliped whitish cream, with faint light brown speckles (Fig. 1C), or uniformly dark brown, only tips of dactylus and fixed finger white (Fig. 1D).

**Etymology**. The specific name is derived from the Latin 'luteus' (= yellow), in reference to the colouration of the ocular peduncle adjacent to the cornea.

**Remarks**. The short, truncate antennal acicle in the new species is a character shared with eight other species included in the *edwardsi* group: *D. albimaculatus* Landschoff & Rahayu, 2018; *D. berduri* Rahayu, 2021; *D. dorotheae* Morgan & Forest, 1991; *D. guttatus* Henderson, 1888; *D. heteropsammicola* Igawa & Kato, 2017; *D. hothuisi* Asakura & Tachikawa, 2010; *D. takedai* Rahayu, 2012; and *D. tirmiziae* Siddiqui & McLaughlin, 2003. *Diogenes luteus,* new species, can be separated from these congeners by the stout and distally narrowing ocular peduncles with only slightly dilated corneas, the short and stout antennal peduncles reaching the tip of the left cheliped and with long and thick flagella and dense setae forming cast-net like structure, and the unarmed branchiostegite.

Other differences with the closely related species mentioned above are armaments of the palm of the left cheliped. It is covered with: small and large tubercles, some tubercles are drop-like in *D. luteus*, new species (Fig. 2E–G); minutely crenulate tubercles, with larger tubercles or spines on slightly elevated median ridge in *D. albimaculatus* (Landschoff & Rahayu, 2018: 270, fig. 1B); irregular longitudinal row of moderately small, broad tubercles on midline, with additional row of smaller tubercles between it and upper margin in *D. berduri* (Rahayu, 2021: 163, fig. 1C); short to long, acute to blunt tubercles in *D. dorotheae* (Morgan & Forest, 1991: 663, fig. 6a); circular, mushroom-shape, flattened tubercles in *D. guttatus* (McLaughlin, 2004: 5, fig. 2A); small tubercles and double rows of blunt spines on midline in *D. heteropsammicola* (Igawa & Kato, 2017: 7, fig. 2A); more or less granular or tubercular, sometime with row of strong spines on midline in *D. holthuisi* (Asakura & Tachikawa, 2010: 138, fig. 4A, B); small and large drop-like tubercles, with longitudinal row of moderately larger tubercles on midline in *D. takedai* (Rahayu, 2012: 266, fig. 1C); small, drop-like, spinulose tubercles, sometimes just ovate tubercles in *D. tirmiziae* (Siddiqui & McLaughlin, 2003: 960, fig. 2)

The colouration in life is also different among these species. Both *D. luteus,* new species and *D. tirmiziae* have a yellow distal area and median dark brown band of the ocular peduncle, but the shield is whitish cream, with brown patches in *D. luteus*, new species (Fig. 1B–D), instead of having a brown transverse band as in *D. tirmiziae* (Siddiqui & McLaughlin, 2003). The ambulatory pereopods each have orange and red longitudinal stripes in *D. albimaculatus* and *D. berduri* (Landschoff & Rahayu, 2018: fig. 3; Rahayu, 2021: fig. 2), proximal dark brown or greenish brown bands in *D. takedai* (Fig. 1A), and alternately transparent and brown colours in *D. holthuisi* (Rahayu & Osawa, 2012: fig. 1B), respectively. However, in *D. luteus*, new species, the ambulatory pereopods are cream or yellowish cream, with dark brown or black streaks on the dorsolateral and ventrolateral margins of each article (Fig. 1B–D).

No colouration was reported for *D. guttatus* and *D. dorotheae*, but morphological differences mentioned above separate them from the new species.

**Distribution**. Lombok Island, Indonesia, and Pulau Bedukang, Brunei Darussalam; intertidal.

### *Diogenes kombalensis,* new species

(Figs. 4–6)

**Type material.** Holotype, male, 3.3 mm (MZB Cru 5757), 8° 24′ 02.8″N 1116° 05′ 07.4″E, Teluk (=Bay) Kombal, Lombok Utara (=North), 20 May 2023. Paratypes, 6 males, 2.0–3.1 mm, 2 females, 2.0, 2.2 mm, 4 ovigerous females, 2.2–2.7 mm (MZB Cru 5758), 1 ovigerous female, 2.8 mm (MZB Cru 5759); 6 males, 2.0–3.6 mm, 2 females, 1.7, 2.7 mm, 4 ovigerous females, 1.8–2.0 mm (ZRC 2023.0673) same locality as holotype.

**Other material.** 7 males, 1.7–3.1 mm, 3 females, 1.6–2.2 mm, 3 ovigerous females, 2.2–2.4 mm (MZB Cru 5760), 8 males, 1.8–3.3 mm, 3 females, 1.6–2.4 mm, 3 ovigerous females, 2.2–2.7 mm (ZRC 2023.0674), same locality as holotype, 4 June 2023.

**Description**. Shield (Figs. 4, 5A) approximately as long as broad; anterolateral margins sloping, lined with minute spinulose granules, anterolateral angles each with small spine; dorsal surface rugose, with short, transverse, marginally spinulose ridges laterally and few tufts of short setae. Rostral lobe broadly rounded, weakly produced. Lateral projections triangular, exceeding tip of rostral lobe. Branchiostegite with row of 6–9 strong spines on dorsal margin; anterior margin rounded, unarmed, but with long setae.

Ocular peduncles (Fig. 5A) stout, left and right equal in length, 0.7–0.8 length of shield, not inflated basally, with sparse setae dorsally and mesially. Corneas very slightly dilated, diameter about 0.3 of peduncular length. Ocular acicles slightly concave on mesial margin; anterolateral margin with row of spines, decreasing in size proximally. Intercalary rostriform process simply acuminate at tip, barely reaching tips of ocular acicles.

Antennular peduncles (Fig. 5A) unarmed, when fully extended, overreaching distal corneal margins by half length of ultimate article. Ultimate article 1.4 times as long as penultimate article, slightly widened distally in lateral view, with sparse moderately short setae on dorsal surface; basal article with long setae on dorsodistal mesial angle

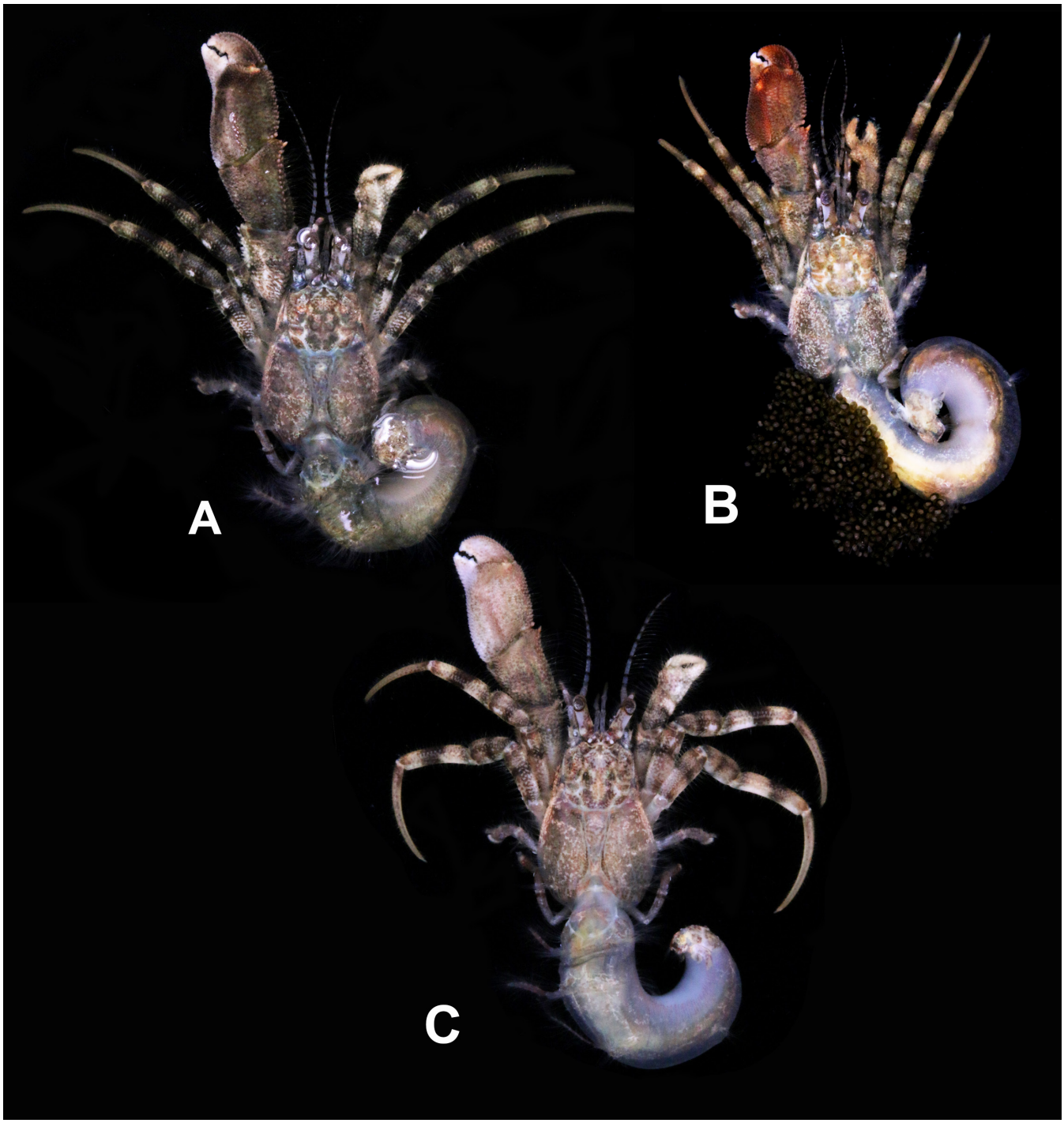


Fig. 4. *Diogenes kombalensis*, new species. A, holotype, male 3.3 mm (MZB Cru 5757); B, paratype, ovigerous female, 2.8 mm (MZB Cru 5759); C, paratype, male, 3.6 mm (ZRC 2023.0673).

and on proximal mesial margin. Dorsal flagellum with short aesthetasc-bearing portion consisting of 6 articles.

Antennal peduncles slender (Fig. 5A), when fully extended, overreaching distal corneal margins by 0.7 length of article 5. Article 5 subcylindrical, unarmed, with row of long setae laterally and sparse short setae dorsally. Article 4 with triangular dorsodistal margin, otherwise unarmed. Article 3 short, unarmed, with few setae ventrally. Article 2 stout, with dorsolateral distal angle produced into prominent spine; dorsomesial distal angle with small spine; ventral surface convex, unarmed. Article 1 unarmed, with scattered short setae laterally. Antennal acicle reaching distal margin of article 4, terminating in strong spine, bearing row of 4 or 5 spines and long setae on mesial margin. Antennal flagellum (Fig. 4) about 2 times as long as shield, reaching half-length of palm of left cheliped; each article distally with long lateral setae and sometimes with additional short seta.

Maxilliped 3 (Fig. 5B) moderately slender. Ischium with crista dentata composed of 2 small corneous spines, distal spine slightly recurved (Fig. 5C). Merus to dactylus unarmed; dactylus approximately as long as propodus. Exopod reaching proximal third of carpus, with well-developed flagellum.

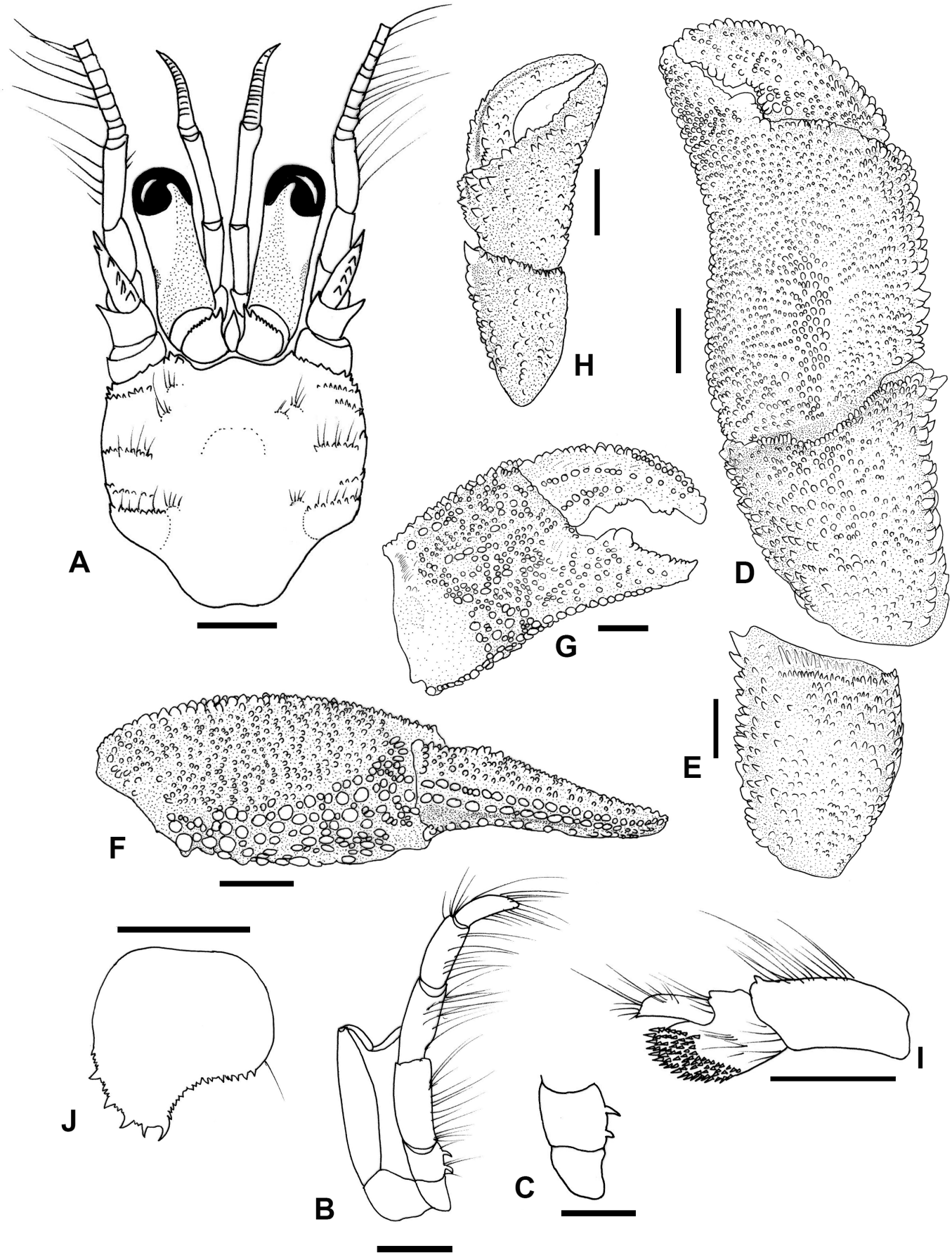


Fig. 5. *Diogenes kombalensis*, new species, holotype, male, 3.5 mm (MZB Cru 5757). A, shield and cephalic appendages; B, right maxilliped 3, lateral view; C, right maxilliped 3, ischium and basis, lateral view; D, left cheliped, chela and carpus, outer view; E, same, merus, lateral view; F, same, chela, mesial view; G, same, inner view; H, right cheliped, chela and carpus, outer view; I, left pereopod 4, lateral view; J, telson, dorsal view. Scales, A, B, D–J = 1 mm; C = 0.5 mm. Setae partially omitted.

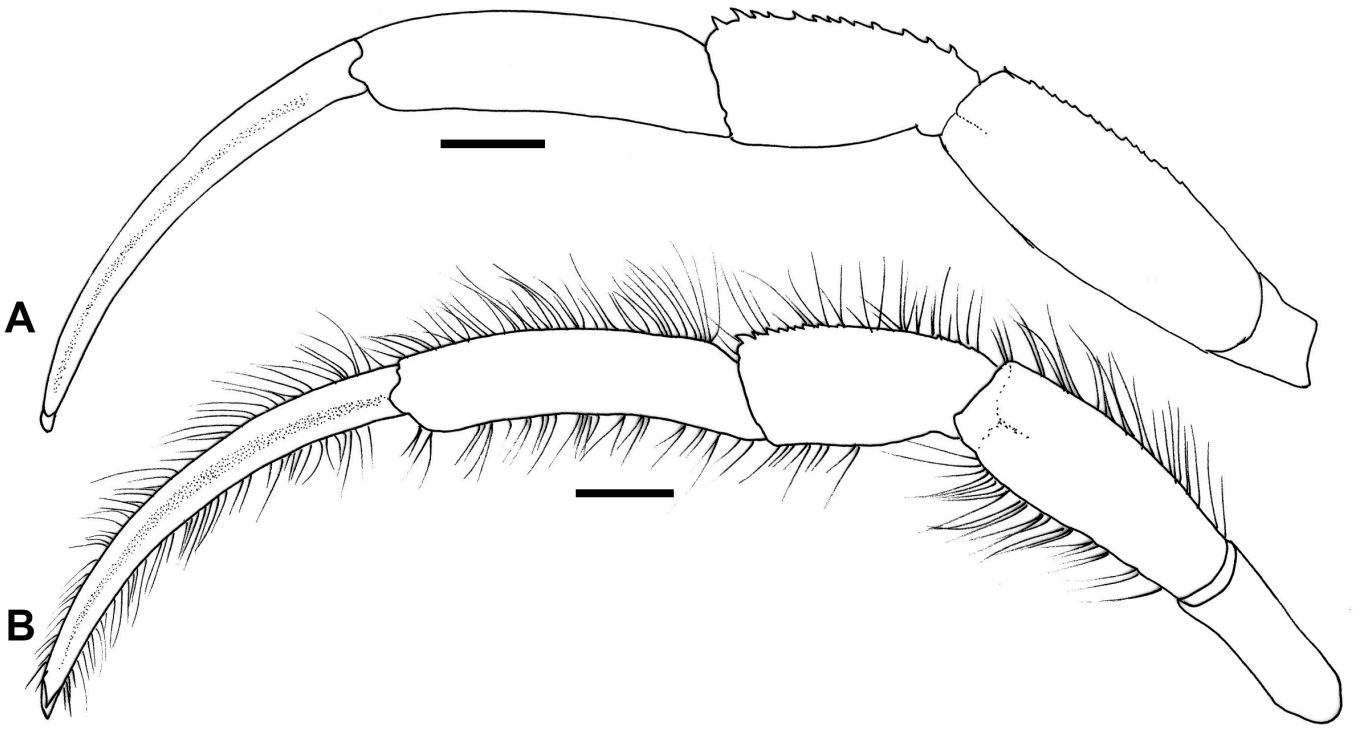


Fig. 6. *Diogenes kombalensis*, new species, holotype, male, 3.5 mm (MZB Cru 5757). A, left pereopod 2, lateral view; B, left pereopod 3, lateral view. Scales = 1 mm. Setae partially omitted.

Chelipeds (Figs. 4, 5D–H) unequal and dissimilar, left much larger than right, elongate in large males. Left cheliped of male (Figs. 4, 5D–G) with narrow hiatus between dactylus and fixed finger; setation on chela and carpus quite sparse. Dactylus relatively broad, flattened, gently curving, approximately as long as palm measured along upper margin; upper margin with double rows of large spinulose tubercles decreasing in size distally; outer surface with row of small spinulose tubercles adjacent to upper margin, narrow sulcus between this row and upper margin, remaining portion with scattered tubercles, larger, flattened tubercles adjacent to cutting margin proximally; cutting edge with 1 large, blunt calcareous tooth submedially and row of smaller calcareous teeth, terminating in strong calcareous claw; inner surface with median longitudinal row of tubercles becoming larger proximally, moderately deep sulcus between this row and upper margin, scattered flattened tubercles adjacent to cutting edge. Palm about as broad as long measured along upper margin; outer surface somewhat convex, covered with small tubercles, median longitudinal broad crest composed of rows of larger tubercles starting from median proximal margin and reaching midlength of palm; upper margin with row of large spinulose tubercles; inner surface gently convex, covered with flattened tubercles, larger tubercles along lower margin, sparse long setae near upper margin; fixed finger short, gently deflexed, covered with small tubercles denser adjacent to lower margin; cutting edge with 1 large, blunt calcareous tooth submedially following by row of smaller teeth, terminating in strong calcareous claw. Carpus slightly becoming wider distally; upper margin with double row of strong spines; outer surface convex, covered with moderately large tubercles. Merus slightly shorter than carpus, longer than broad, with row of small spines on dorsal margin accompanied by sparse short setae; lateral surface with short transverse rows of low tubercles; mesial surface nearly flat, with few small, low tubercles; ventral surface with transverse rows of small tubercles and scattered short setae. Ischium without conspicuous armature, only with sparse short setae. Left cheliped of female generally similar to that of male, but with weaker spines on upper margin of palm.

Right cheliped (Figs. 4, 5H) reaching to distal margin of carpus of left cheliped when fully extended, covered with long setae not obscuring armature; broad hiatus between dactylus and fixed finger. Dactylus gently curving, 2.1 times as long as palm measured along upper margin; upper margin with 2 rows of strong spines, coalescent and becoming very small distally; outer surface with short row of spinules in proximal midline, longitudinal furrow adjacent to upper margin, remaining portion with scattered spinules; cutting edge with row of very small, blunt calcareous teeth, terminating in small corneous claw. Palm with row of large spines on upper margin; outer surface with few large spines near upper margin, remaining portion with scattered spinules; lower margin with row of spines continued onto fixed finger; fixed finger with row of minute blunt calcareous teeth on cutting edge, terminating in small corneous claw, crossing claw of dactylus. Carpus widened distally, with scattered tufts of long setae; upper margin with row of spines increasing in size distally; outer surface with scattered spines, distal margin with row of small spines. Merus somewhat compressed laterally; dorsal margin with row of small spines and short setae; lateral surface with transverse rows of flattened tubercles, ventrolateral margin with low protuberance; mesial surface glabrous, ventromesial margin with row of small tubercles; ventral surface narrow, with transverse rows of flattened tubercles and scattered long setae. Ischium unarmed, with sparse setae.

Pereopods 2 and 3 (Fig. 6) generally similar, relatively slender. Dactyli 1.4 times as long as propodi, slightly curved ventrally, but not twisted, each terminating in small corneous claw; dorsal margins each with row of sparse, moderately long setae; lateral and mesial faces with few short setae, median sulcus along lateral face; ventral margins each with row of sparse moderately long setae. Propodi distinctly longer than carpi; dorsal margins without conspicuous armature, each with row of sparse, moderately long setae; lateral faces with tufts of long setae adjacent to dorsal margins; mesial surfaces with sparse long setae; ventral surfaces each with row of widely spaced, moderately long setae. Carpi each dorsally with row of moderately long setae, and with row of moderately large spines (pereopods 2) and tiny spines on distal half (pereopods 3); lateral and mesial faces almost glabrous; ventral margins with few moderately short setae. Meri each with row of sparse, moderately long setae on dorsal and ventral margins; dorsal margins each with row of small spines on half distal (pereopods 2) and unarmed (pereopods 3); lateral and mesial faces almost glabrous; ventral margins unarmed. Ischia each with row of setae on dorsal and ventral margins. Female with paired gonopores on coxae of pereopods 3.

Pereopods 4 semichelate (Fig. 5I). Dactylus with long, dense setae dorsodistally. Propodi unarmed; propodal rasp occupying lateral face of fixed finger and extending onto distal third of palm, consisting of numerous rows of small oval corneous scales. Carpi each with small spine at dorsodistal angle.

Male with 4 well-developed, unpaired, uniramous left pleopods; pleopod 3 largest. Female also with 4 unpaired, biramous left pleopods.

Telson (Fig. 5J) with indistinct median cleft and row of small spines on terminal margin; left lobe larger and longer than right, lateral margin with row of large spines interspersed by smaller spines; right lobe unarmed on lateral margin; row of long setae on terminal margin extending onto lateral margins.

**Colour in life**. See Fig. 4. Shield dark or light brown, speckled with bluish white. Ocular peduncles cream, triangular brown area on dorsal surface starting from mesial base of cornea to proximal part of peduncle; lateral and mesial surfaces each with dark brown spot medially; dark brown band on base of cornea; ocular scale brown, with some white spots. intercalary rostral process dark brown. Antennular peduncles cream, with dark brown mark on distal margin of each article. Antennal peduncles cream or white speckled with dark brown, antennal acicle brown, spines white; antennal flagella alternately dark brown and cream. Left cheliped dark brown, partially speckled with white or orange, spines white or light brown; cutting edge of fixed finger white. Right cheliped white on dactylus and fixed finger; palm whitish cream, speckled with dark brown; carpus whitish cream distally, dark brown proximally; merus light brown. Pereopods 2 and 3 generally cream; dactyli greenish cream or light brown, with faint dark brown band proximally; propodi cream or whitish cream, with large dark brown band medially and narrower light brown bands distally and proximally; carpi and meri light brown, each with dark brown band medially and lighter brown bands distally and proximally, surface between bands speckled with light brown (Fig. 4A). In some paratypes, left cheliped orangish brown, cutting edges white (Fig. 4B) or white speckled with light brown (Fig. 4C); right cheliped light brown, dactylus and fixed finger white, with tinge of orange or pink, spines white. Pereopods 2 and 3 orangish cream; dactyli and propodi cream or orangish cream, propodi each with large dark brown band medially and narrower light brown bands distally and proximally; carpi and meri light brown, each with dark brown band medially and lighter brown bands distally and proximally, surface between bands speckled with light brown (Fig. 4B, C).

**Etymology**. The new species is named after the type locality, Teluk [= Bay] Kombal, in the northern coast of Lombok Island.

**Remarks**. In having stout ocular peduncles that reach only half the length of the ultimate article of the antennular peduncles and half the length of the fifth article of the antennal peduncles, and the presence of a median crest on the outer surface of the left cheliped palm, *D. kombalensis,* new species, closely resembles *D. chhapgari* Trivedi, Osawa & Vachhrajani, 2016, *D. foresti* Rahayu & Hortle, 2002, and *D. singaporensis* Rahayu, 2015. *Diogenes chhapgari* differs from *D. kombalensis,* new species in the armament of the left cheliped palm. In *D. chhapgari,* the median longitudinal crest on the outer face of the left cheliped palm is strongly elevated, becomes stronger and wider distally, and reaches beyond half the length; and the inner surface has two longitudinal ridges of large tubercles (Trivedi et al., 2016: fig. 2A, B). In *D. kombalensis*, new species, the longitudinal median crest is broad, consists of several rows of spines, and reaches only to the midline of the palm; and the inner face of the palm is covered with low flattened tubercles, larger tubercles on lower margin, but lacks longitudinal ridges of tubercles (Fig. 5D, H). The colour in life is also different between the two species. The dactyli and carpi of the ambulatory pereopods of *D. chhapgari* are generally cream, each with a light orange band (Trivedi et al., 2016: 195); while those of *D. kombalensis*, new species, are generally light or dark brown, each with a dark brown band (Fig. 4).

*Diogenes foresti* differs from the new species in the following characters: ocular peduncles stout, dilated proximally and on corneas; left cheliped palm with median longitudinal rows of tubercles and a proximal strong crest consisting of small tubercles on the outer surface; pereopod 2 and 3 slender, with dactyli 1.6 times as long as propodi and carpi unarmed on dorsal surfaces (Rahayu & Hortle, 2002: fig. 1). In *D. kombalensis,* new species, the ocular peduncles are slightly dilated on the cornea, but not dilated proximally; the left cheliped palm lacks a proximal strong crest of small tubercles; and the pereopod 2 and 3 have dactyli 1.4 times as long as propodi and carpi each with a row of spines on the dorsal margin (Figs. 5A, D, 6).

*Diogenes singaporensis* is distinguished from the new species by having strong spines on the article 4 of the antennal peduncle and longitudinal rows of spines on the inner surface of palm (such rows are absent in *D. kombalensis*, new species); and the antennal and antennular peduncles being somewhat longer. They overreach the distal margin of the corneas by the whole length of the distal articles of the antennular and antennal peduncles (Rahayu, 2015: 3A, F; Fig. 5A, H), instead of reaching beyond it only by the half length of the latter ones in *D. kombalensis*, new species (Fig. 5A).

**Distribution**. At this moment, found only in Teluk Kombal, on the northern coast of Lombok Island, Indonesia.

## DISCUSSION

With the discovery of the present two new species, 27 species of *Diogenes* are now known in Indonesian waters, of which 13 species belong to the *edwardsii* group (Table 1). Among those species of the *edwardsii* group, nine species were originally described from Indonesian waters, of which six species are known only from Indonesia: *D. berduri* Rahayu, 2021, *D. crassus* Asakura, 2020, *D. foresti* Rahayu & Hortle, 2002, *D. kombalensis,* new species, *D. luteus,* new species, and *D. takedai* Rahayu, 2012, while three other species: *D. fasciatus* Rahayu & Forest, 1995; *D. klaasi* Rahayu & Forest, 1995; and *D. moosai* Rahayu & Forest, 1995 are also distributed in Pakistan, western Thailand, and Singapore (Rahayu & Forest, 1995; Rahayu & Hortle, 2002; Siddiqui et al., 2004; Rahayu, 2010, 2021; Asakura, 2020; this study). Type localities for the other species are as follows: *D. avarus* Heller, 1865, Nicobar Islands; *D. dorotheae* Morgan & Forest, 1991, Cape Bossut, northwest Australia; *D. goniochirus*, Forest, 1956, Vietnam; and *D. rectimanus* Miers, 1884, Torres Strait.

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## LITERATURE CITED

Alcock A (1905) Anomura. Fasc. I. Pagurides. Catalogue of the Indian Decapod Crustacea in the Collection of the Indian Museum 2. Indian Museum, Calcutta, 197 pp.

Almón B, Cuesta JA & García-Raso JE (2022) Two new hermit crab species of *Diogenes* Crustacea: Decapoda: Diogenidae) from Atlanto-Mediterranean coasts of Iberian Peninsula: Poleward migrants or merely overlooked indigenous species? Ecology and Evolution, 12: 1–23.

Almón B, Cuesta JA, Schubart CD, Armenia L & Raso JEG (2021) Redescription of the hermit crab *Diogenes pugilator* (Decapoda: Anomura) reveals the existence of a species complex in the Atlanto- Mediterranean transition zone, resulting in the resurrection of *D. curvimanus* and the description of a new species. Zoological Journal of the Linnean Society, 195(4): 1116–1146.

Asakura A (2006) Shallow water hermit crabs of the families Pylochelidae, Diogenidae and Paguridae (Crustacea: Decapoda: Anomura) from the Sea of Japan, with the description of a new species of *Diogenes*. Bulletin of the Toyama Science Museum, 29: 23–103.

Asakura A (2020) Hermit crabs of the genus *Diogenes* Dana, 1851 (Crustacea: Decapoda: Diogenidae) collected during the *Albatross* Philippine expedition, 1907–1910, including descriptions of three new species. Publications of the Seto Marine Biological Laboratory, 45: 1–46.

Asakura A & Tachikawa H (2010) *Diogenes holthuisi*, a new species of hermit crab (Decapoda: Anomura: Diogenidae) from shallow water of the Ogasawara (Bonin) Islands, Japan. In: Fransen C, De Grave S & Ng PKL (eds.) Studies on Malacostraca: Lipke Bijdeley Holthuis Memorial Volume. Crustaceana Monographs, 14: 133–144.

Barnard KH (1950) Descriptive catalogue of South African decapod Crustacea (crabs and shrimps). Annals of the South African Museum, 38: 1–837

Chevreux E & Bouvier E-L (1892) Voyage de la goèlette Melita aux Canaries et au Sénégal. Note préliminaire sur les paguriens. Bulletin de la Société Zoologique de France, 16: 252–256.

Dana JD (1851) Conspectus Crustaceorum quae in orbis terrarium circumnavigatione, Carolo Wilkes e classe Reipublicae Foederatae duce, lexit et descripcit. Paguridea. Proceedings of the Academy of Natural Sciences, Philadelphia, 5: 267–272.

De Haan W (1833–1850) Crustacea. In: Fauna Japonica sive Descriptio Animalium, quae in Itinere per Japoniam, Jussu et Auspiciis Superiorum, qui Summum in India Batava Imperium Tenent, Suscepto, Annis 1823–1830 Collegit, Notis, Observationibus et Adumbrationibus Illustravit. Lugduni-Batavorum, Leiden. 243 pp.

Forest J (1956) Les Pagures du Viet-Nam. I. Le genre *Diogenes* Dana. Bulletin du Museum National d'Histoire Naturelle, Series 2, 28: 524–532.

Forest, J (1961) Pagurides de l'Afrique occidentale. Scientific Results of the Danish Expedition to the coasts of tropical West Africa 1945–1946. Atlantide Report, 6: 203–250.

Heller C (1865) Crustaceen. In: Reise der Osterreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodors B. von Wullerstorf-Urbair. Kaiserlich-Königliche Hof- und Staatsdruckerei, Wien, Band 2 (Abtheilung 3), pp. 1–280, pls. 1–25.

Henderson JR (1888) Report on the Anomura collected by HMS *Challenger* during the years 1873-76. Scientific Results of the Exploratory Voyage of HMS *Challenger*, (Zoology) Volume 27. Her Majesty's Stationary Office, Edinburgh, 221 pp.

Henderson JR (1893) A contribution to Indian carcinology. Transactions of the Linnean Society of London, 5(10): 325–458.

Igawa M & Kato M (2017) A new species of hermit crab, *Diogenes heteropsammicola* (Crustacea, Decapoda, Anomura, Diogenidae), replaces a mutualistic sipunculan in a walking coral symbiosis. PLoS ONE, 12(9): e0184311.

Kamalaveni S (1950) On hermit-crabs (Family Paguridae) in the collection of the Indian Museum. Records of the Indian Museum, 47: 77–85.

Komai T, Liang J & Yang T (2012) Records of four species of the shallow water hermit crab genus *Diogenes* (Crustacea: Decapoda: Anomura: Diogenidae) from southern China, with description of a new species. Journal of Natural History, 46 (19–20): 1219–1248.

Komai T, Reshmi R & Kumar AB (2013) A new species of the hermit crab genus *Diogenes* (Crustacea: Decapoda: Anomura: Diogenidae) from southern India. Zootaxa, 3613: 380–390.

Komai T, Ravinesh R & Kumar AB (2018) A new species of the hermit crab genus *Diogenes* Dana, 1851 (Decapoda: Anomura: Diogenidae) from southern India. Zootaxa, 4504: 243–252.

Komai T & Yoshida R (2020) A new species of the hermit crab genus *Diogenes* Dana, 1851 (Decapoda: Anomura: Diogenidae) from shallow coastal waters in Japan. Zootaxa, 4722(6): 571–582.

Landschoff J & Rahayu DL (2018) A new species of the hermit crab genus *Diogenes* (Crustacea: Decapoda: Diogenidae) from the coast of Kwa Zulu-Natal, South Africa. Zootaxa, 4379: 268–278.

McLaughlin PA (2002) A review of the hermit crab (Decapoda: Anomura: Paguridea) fauna of southern Thailand, with particular emphasis on the Andaman Sea, and descriptions of three new species. In: Bruce N, Berggren M & Bussawarit S (eds.), Proceedings of the international workshop on the Crustacea in the Andaman Sea, Phuket Marine Biological Center 29 November–20 December, 1998. Phuket Marine Biological Center Special Publication, 23: 385–460.

McLaughlin PA (2004) A description of the first complete specimen of *Diogenes guttatus* Henderson, 1888 (Decapoda: Anomura: Paguroidea: Diogenidae). Zootaxa, 466: 1–8

McLaughlin PA & Clark PF (1997) A review of the *Diogenes* (Crustacea, Paguroidea) hermit crabs collected by Bedford and Lanchester from Singapore, and from the '*Skeat*' Expedition to the Malay Peninsula, with a description of a new species and notes on *Diogenes intermedius* De Man, 1892. Bulletin of the Natural History Museum, London (Zoology), 63: 33–49.

McLaughlin PA & Dworschack PC (2001) Reappraisal of hermit crab species (Crustacea: Anomura: Paguridea) reported by Camill Heller in 1861, 1862 and 1865. Annalen des Naturhistorischen Museum in Wien, 103B: 135–176.

McLaughlin PA, Rahayu DL, Komai T & Chan T-Y (2007) A Catalog of the Hermit Crabs (Paguroidea) of Taiwan. National Taiwan Ocean University, Keelung, 365 pp.

Miers EJ (1881) On a collection made by Baron Hermann-Maltzan at Goree Island, Senegambia. Annals and Magazine of Natural History, (5)8: 204–220, 259–281, 364–377.

Miers E (1884) Crustacea. In: Report on the Zoological Collections Made in the Indo-Pacific Ocean during the Voyage of H.M.S. "*Alert*" 1881–2. British Museum, London, pp. 178–322, 513–575.

Morgan GJ (1989) The hermit crabs (Decapoda: Anomura: Diogenidae, Paguridae) of southwestern Australia, with descriptions of two new species. Records of the Western Australian Museum, 14(3): 391–417.

Morgan GJ & Forest J (1991) Seven new species of hermit crabs from northern and western Australia (Decapoda, Anomura, Diogenidae). Bulletin du Muséum National d'Histoire Naturelle, Series 4A, 12(34): 649–689.

Nayak VN & Neelakantan B (1985) *Diogenes maclaughlinae* (Crustacea: Decapoda: Anomura) a new species of hermit crab from Karwar area with a description of first zoeal stage. The Indian Zoologist, 9(1&2): 15–21.

Nayak VN & Neelakantan B (1989) A new species of hermit crab, *Diogenes karwarensis* (Decapoda: Anomura) from the west coast of India. Journal of the Bombay Natural History Society, 86(1): 71–77

Rahayu DL (1996) Notes on littoral hermit crabs (excluding Coenobitidae) (Crustacea: Decapoda: Anomura) mainly from Singapore and peninsular Malaysia. Raffles Bulletin of Zoology, 44(2): 335–355.

Rahayu DL (2012) A new species of the hermit crab genus *Diogenes* Dana, 1851 (Decapoda, Anomura, Diogenidae) from Lombok, Indonesia. In: Komatsu H, Okuno J & Fukuoka K (eds.) Studies on Eumalacostraca: a Homage to Masatsune Takeda. Crustaceana Monographs, 17: 263–274.

Rahayu DL (2015) New record and new species of the hermit crab genus *Diogenes* Dana, 1851 (Decapoda: Anomura: Diogenidae) from Singapore. Raffles Bulletin of Zoology, 31: 182–192.

Rahayu DL (2021) Hermit crabs of the family Diogenidae (Crustacea: Decapoda: Anomura) collected during the South Java Deep-Sea 2018 biodiversity cruise in Indonesia, with description of two new species. Raffles Bulletin of Zoology, Supplement 36: 162–180.

Rahayu DL (2022) Hermit crabs of Singapore (Crustacea: Decapoda: Anomura: Diogenidae, Paguridae), with description of two new species. Raffles Bulletin of Zoology, 70: 329–363.

Rahayu DL & Forest J (1995) Le genre *Diogenes* (Decapoda, Anomura, Diogenidae) en Indonésie, avec la description de six espèces nouvelles. Bulletin du Muséum National d'Histoire Naturelle, Paris, Series 4, 16: 383–415.

Rahayu DL & Hortle KG (2002) The genus *Diogenes* (Decapoda, Anomura, Diogenidae) from Irian Jaya, Indonesia, with description of a new species. Crustaceana, 75: 609–619.

Rahayu DL & Osawa M (2012) Hermit crabs (Crustacea: Decapoda: Diogenidae) from the KUMEJIMA 2009 Expedition, Japan. In: Naruse T, Chan T-Y, Tan HH, Ahyong ST & Reimer JD (eds.) Scientific Results of the Marine Biodiversity Expedition — KUMEJIMA 2009. Zootaxa, 3367: 176–190.

Rahayu DL & Pratiwi R (2022) *Diogenes matabiru*, a new species of hermit crab from Lombok Island, Indonesia (Crustacea, Decapoda, Anomura, Diogenidae). Zootaxa, 5093(4): 493–500.

Roux P (1828–1830) Crustacés de la Méditerranée et de son littoral, décrits et lithographiés. Chez Levrault, Paris & Marseille, pp. i–iv + 1–176, pls. 1–45.

Siddiqui FA, Kazmi QB & McLaughlin PA (2004) Review of the Pakistan species of *Diogenes* Dana, 1851 (Decapoda: Anomura: Paguridea: Diogenidae). Tropical Zoology, 17: 155–200.

Siddiqui FA & McLaughlin PA (2003) A new species of the hermit crab genus *Diogenes* (Decapoda: Anomura: Paguroidea: Diogenidae) from Pakistan, with a comparative diagnosis of *D. guttatus* Henderson, 1888. Proceedings of the Biological Society of Washington, 116: 956–966.

Stebbing TRR (1910) General catalogue of South African Crustacea (Part V. of S. A. Crustacea, for the Marine Investigations in South Africa). Annals of the South African Museum, 6: 281–593.

Stimpson W (1858) Prodromus descriptionis animalium evertebratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federatamissa, Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. Pars VII. Crustacea Anomura. Proceedings of the Academy of Natural Sciences, Philadelphia, 10: 225–252.

Terao A (1913) A catalogue of hermit-crabs found in Japan (Paguridae excluding Lithodidae), with descriptions of four new species. Annotationes Zoologicae Japonenses, 8: 355–391.

Trivedi JN, Osawa M & Vachhrajani KD (2016) A new species of the genus *Diogenes* Dana, 1851 (Crustacea: Decapoda: Anomura: Diogenidae) from Gujarat, northwestern India. Zootaxa, 4208(2): 189–197.

Wang F & Dong Y (1977) Two new species of hermit crabs (Crustacea, Anomura) from China. Acta Zoologica Sinica, 23(1): 109–112.

Wang F-Z & Tung Y-M (1980) Two new species of hermit crabs (Crustacea, Anomura) from China. Acta Zootaxonomica Sinica, 5(1): 35–37.

Xiao L-C, Wang Y-L & Sha Z-L (2015) A new species of the genus *Diogenes* (Decapoda, Anomura, Diogenidae) from the South China Sea. Crustaceana, 88: 1439–1445.