

A New Species of the Aberrant Majid Crab Genus *Planotergum* Balss, 1935 (Crustacea: Brachyura, Majidae, Planoterginae) from the Southern Red Sea

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A new species of the aberrant monotypic genus *Planotergum* Balss, 1935 (Brachyura: Majidae: Planoterginae) is described from the southern part of the Red Sea, based on a single female recently found in the collection of the Zoological Museum of Moscow State University. The new species is clearly distinguished from *Planotergum mirabile* Balss, 1935 in the form of carapace, antennal article and third maxilliped, as well as morphology of the ambulatory legs. The record extends the known range of *Planotergum*, previously known only from the eastern Indian Ocean and Western Pacific, by more than 7000 km.

Key words: Decapoda, Planoterginae, *Planotergum*, New species, Red Sea.

BACKGROUND

The unusual spider crab, *Planotergum mirabile* Balss, 1935, the only representative of the subfamily Planoterginae (Crustacea: Brachyura: Majidae), was originally described by Balss (1935) from a heterosexual pair of syntypes collected in Shark Bay, Western Australia, in 1906. The species is presently known by the Australian type material and seven additional females collected from Southeast Asia and the southeastern part of the Indian Ocean (Fig. 1). Johnson (1965) described a new genus and species, *Anomalopisa incongruens* Johnson, 1965, based on two females collected in Pulau Sikijang Pelepah, Singapore, in 1953. Serène (1965) reported on another female collected in the Java Sea in April 1963, during the “Jalanidhi” cruises. Two other female specimens were collected from Roebuck Bay,

Western Australia and Keppel Islands, Queensland (Griffin and Tranter 1986), with the most recent female obtained off Geraldton City (28°58'S), Western Australia, at a depth of 85 meters (Davie 2002; Poore et al. 2008) (Fig. 1). Števíć (1991) formally synonymized *A. incongruens* with *P. mirabile*, reviewed the taxonomy of the species and proposed a new majid subfamily, Planoterginae, for the genus.

During a study of the historical collections of the Zoological Museum of Moscow State University (ZMMU), a specimen of *Planotergum* collected in the southern part of the Red Sea was found. This site is about 7,000 km to the west of all known localities of the species. A detailed morphological study showed that the specimen represents a new species, which is described here. Known specimens of *Planotergum mirabile* Balss, 1935, including one of syntypes, are used for the

comparisons during the study.

MATERIALS AND METHODS

The specimen of the new species belongs to a collection made during the cruises of RV “Akademik Alexander Kowalevski” to the Red Sea and the Gulf of Aden between 1962–1966 (Vodianitsky 1971) and was partly studied by Zarenkov (1971). The label with the present specimen of *Planotergum*, presumably written by Dr. N.N. Zarenkov, contained information on the sampling vessel, station number and date, but the geographical coordinates are clearly erroneous. Fortunately, the archive of the crustacean collections of the Zoological Museum of M.V. Lomonosov Moscow State University (ZMMU) holds a list of stations of RV “Akademik Alexander Kowalevski” compiled by Dr. V.V. Murina (1971), who was responsible for macrobenthic samples in the expedition. This document contains the correct positions and additional data. The position of the station in question in the southern Red Sea was shown on a schematic map (Murina 1971: fig. 1) and agrees with the remaining data in the label. The geographic location of the specimen follows Murina (1971).

The comparative material of *P. mirabile* examined

is deposited in the Zoological Museum of the University of Hamburg, Germany (ZMH); and the Zoological Reference Collection of the Lee Kong Chian Natural History Museum, National University of Singapore (ZRC).

The terminology used for the description generally follows that in Griffin and Tranter (1986). The measurements provided, in millimeters, are of the carapace width and length. The carapace width is the distance between the lateral margins of carapace across its widest part while the length is measured from the tip of the rostrum to the postero-dorsal margin of carapace. The abbreviations P1–5 refer to the first to fifth pereopods, respectively; P1 is cheliped.

RESULTS

TAXONOMY

Family Majidae Samouelle, 1819
Subfamily Planoterginae Števc̃ić, 1991

Remarks: Serène (1965) discussed at length that *Planotergum* has morphological affinities with the eastern American mithracine genus *Hemus* A. Milne-Edwards, 1875, and the two genera may be closely

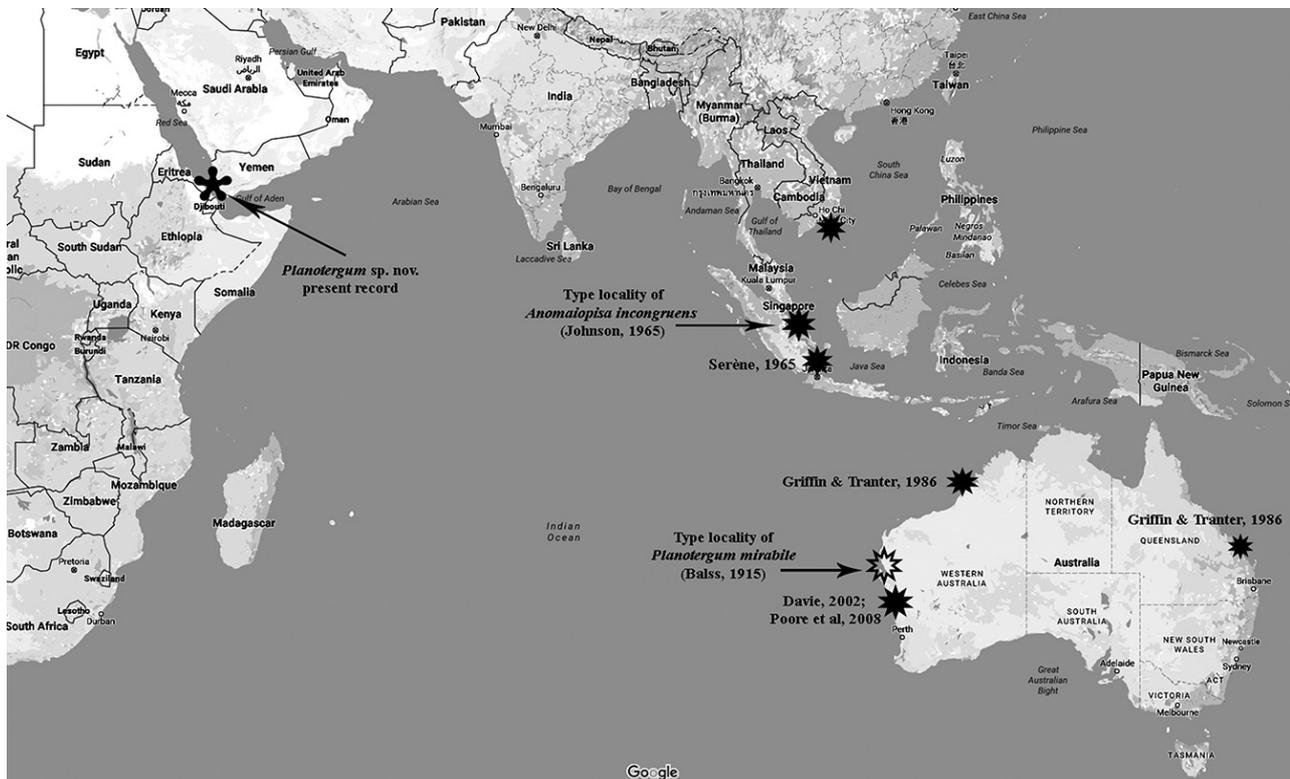


Fig. 1. Map of localities where representatives of the genus *Planotergum* Balss, 1935 have been reported.

related (Števcíć 1991; Garth 1958; Hendrickx 1999). *Planotergum*, like *Hemus*, has a relatively broad basal antennal article (like other mithracines) and shares with *Hemus* not only a similar carapace and short, hook-like ambulatory pereopods, but also relatively delicate chelipeds that are barely visible in dorsal view, and the prominently foliaceous third antennal article visible in dorsal view. On the basis of these features, Števcíć (1991) established Planoterginae as a monotypic subfamily within Majidae *sensu lato*. Ng et al. (2008) redefined Majidae and recognised four subfamilies: Majinae *s. str.*, Mithracinae MacLeay, 1838, Planoterginae Števcíć, 1991, and Eurynolambrinae Števcíć, 1994. Ng et al. (2008) transferred *Hemus* to the Planoterginae with *Planotergum*, commenting that the genus *Thoe* Bell, 1835, apparently connects the two subfamilies. Windsor and Felder (2011 2014) showed that the morphological similarities are superficial, with *Hemus* and *Thoe* actually closely related, but both belonging to the Mithracidae, which was recognized as a separate family (Windsor and Felder 2017). Tissues of *Planotergum* they examined, however, did not yield any DNA and so its phylogenetic position, and that of the Planoterginae could not be studied (Amanda Windsor, personal communication). The Planoterginae is here retained in the Majidae *sensu* Ng et al. (2008), with the removal of Mithracidae as a separate family.

Species of *Planotergum* are apparently heterochelous. Prominent heterochely is not common in the Majidae or other families in the Majoidea (Schäfer 1956; Griffin and Tranter 1986; Windsor and Felder 2014) and the degree of symmetry/asymmetry of chelipeds can be diagnostic in some brachyuran families (Schubart et al. 2002; Tavares and Cleva 2010; Spiridonov et al. 2014). The heterochely of *Planotergum* observed here needs to be further examined, possibly with genetic data to see if it helps resolve its systematic position.

Genus *Planotergum* Balss, 1935

Planotergum Balss, 1935 (type species *Planotergum mirabile* Balss, 1935, by monotypy; gender neuter)

Anomalopisa D.S. Johnson, 1965 (type species *Anomalopisa incongruens* Johnson, 1965, by original designation; gender feminine)

Planotergum mirabile Balss, 1935

(Fig. 2)

Planotergum mirabile Balss, 1935: 36, figs. 1–3 [type locality: Western Australia]; Balss 1957: 1628 (list); Serène 1965: 457, 121, figs. 1–4, pls. 1, 2; Serène 1968: 53 (list); Griffin and Tranter 1986: 92; Števcíć 1991: 121, fig. 1; Davie 2002: 332, unnumbered figure (list); Poore et al. 2008: 62; Ng et al. 2008: 121 (list).

Anomalopisa incongruens Johnson, 1965: 174, fig. 1 [type locality: Singapore].

Material examined: Female syntype (6.4 × 8.0 mm) (ZMH K-11583), Western Australia, Shark Bay, NW of Denham, Hartmeyer Expedition to southwest Australia, depth 3 m, coll. W. Michaelsen, 12.06.1905; 1 female (7.7 × 10.1 mm) (ZRC 1985.130), east of St John's Island, 5.5–18.3 m, on *Sargassum* bed, sandy bottom with some rocks, coll. D.S. Johnson, 26.08.1953; 1 female (10.2 × 13.4 mm) (ZRC 1969.11.19.12), Java Sea, Indonesia, 4°02'S 106°09'E, 20 m, among coral sand, in dredge, coll. K. Romimohtarto, on R.V. Djalandhi, 26.04.1963.

Description: Carapace pyriform, smooth or covered with epibionts (usually bryozoans), with uneven edges, curved outward, with 2 pyramidal protrusions or tubercles (Fig. 2a, b): one at center of gastric region, other on cardiac region; 2 parallel lines of fine granules between gastric and cardiac tubercles (Fig. 2a); with 3 broad lateral lobes on each side of carapace (anterior, median, posterior): anterior lobe with broad concave lateral margin and sharp corners; median (second) lobe directed obliquely, consisting of 2 quasi-triangular parts separated by deeper concavity and fissure; posterior lobe broadly triangular with truncated tip. Posterior margin of carapace rounded (Fig. 2b).

Rostrum (Fig. 2a, b) very broad, horizontally lamelliform, quasi-rectangular in dorsal view, distal anterior margin jagged. Orbit relatively shallow, with small angular pre-orbital and cupped quasi-triangular postorbital lobes, and dorsal incision. Eyes mobile, with stout eyestalk bearing 2 marked distinct blunt processes; when positioned along postorbital lobe, eye not reaching to postorbital angle (Fig. 2e, f)

Epistome absent. Sternal part of cephalothorax nearly completely covered by broad pleon. Thoracic sternum with fused sternites 1–4; sutures absent except for ridge-like structure between sternites 2 and 3. Sutures between sternites 4 and 5 nearly complete, others interrupted in proximal one-third. Episternites narrow, attached to postero-lateral margins of sternites, with sutures nearly fused to sternites.

Antenna (Fig. 2d, e) with flattened broad articles; basal article short, broad, expanded anteriorly, immovably fixed to ventral rostral surface; second article large, broadly lamellate, bearing greatly extended outer margin; third article significantly smaller with gently produced anterolateral portion; fourth article deeply inserted in anterior margin of third article. Flagellum about as long as third and fourth articles combined.

Third maxilliped (Fig. 2c) with ischium and merus markedly convex, mesial margin covered with

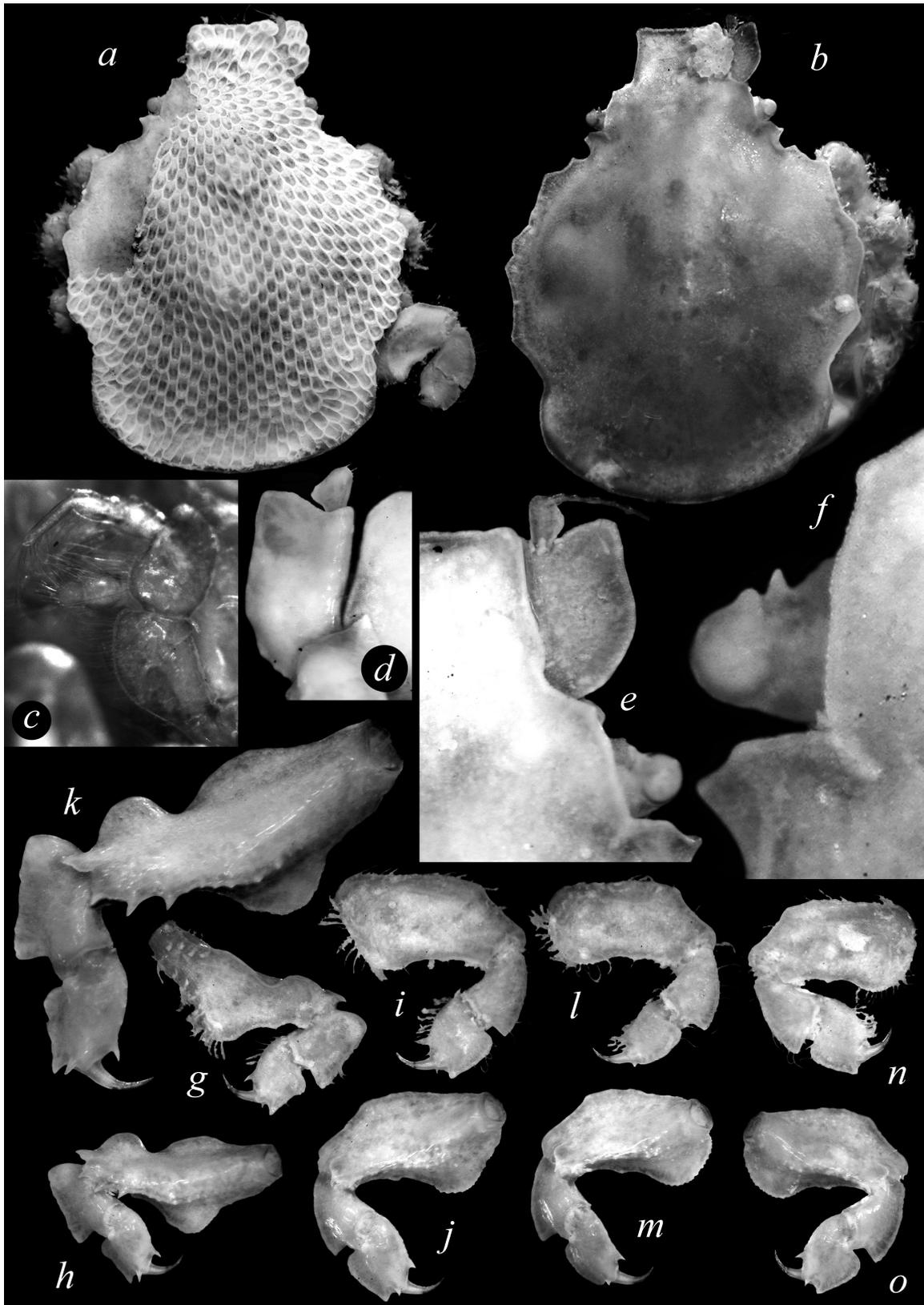


Fig. 2. *Planotergum mirabile* Balss, 1935. a, c, d, g–n, female (7.7 × 10.1 mm) (ZRC 1985.130), Singapore; b, e, f, female (10.2 × 13.4 mm) (ZRC 1969.11.19.12), Java Sea: a and b, general dorsal view; c, left third maxilliped; d, right antenna (ventral view, dorsal covered by bryozoan); e, right antenna (dorsal view); f, left eye; g, i, l, n, P2–5 (dorsal views, setae intact); h, j, k, m, o, P2–5 (ventral views, setae denuded); k, P2, ventral view.

moderately dense setae, anterior margin of merus oblique, laminated, carpus enlarged distally, with short stick-shaped process on anterior margin; broad gap between ischia of third maxilliped.

P1 (chelipeds) asymmetrical, heterochelous, short, slender, not reaching distal rostral margin, mostly concealed by carapace in dorsal view. Carpus of cheliped with lamelliform anterior face. Right chela larger than left chela, with dorsal ridge. Cutting margins of fingers entire, without teeth.

P2–5 (Fig. 2g–o) with short, flattened articles; anterodistal corner of merus spiniform, posterior face of merus with denticulated ridges. Anterior and posterior faces of carpus serrated. Anterior margin of propodi expanded with blunt dorsodistal point, ventral (flexor) margin with distal spines. Dactylus shorter than propodus, curved, slender, subchelate with small protrusions on posterodistal corner of propodus. Small spinule at ventrodistal margin of propodus near articulation with dactylus. P3 with 4 well marked teeth along distoventral and lateral margins of ischium (Fig. 2k).

Pleon very broad, rounded, emarginated by long soft setae. Telson small, ovoid, deeply inserted in distal margin of somite 6, with terminal notch.

Female genital opening, large, about half of sternite length, located at anterior margin of sternite 6, deflexed anteriorly, with rounded posterior margin.

Taxonomic notes on the type material: The original description of *P. mirabile* by Balss (1935) was based on two specimens, one male (6.5 × 7.5 mm) and one female without measurements. Balss did not indicate on which specimen the figures of the overall habitus and third maxilliped was based, but that of the thoracic sternum and pleon was stated to be the male. This male specimen, however, has a very wide pleon (Balss 1935: fig. 3) and may just be an immature female. It is also relatively small in size (6.5 × 7.5 mm) (Balss 1935: 38). Since the holotype was not selected in the original description, both specimens are syntypes. The lot with the type material of *P. mirabile* (ZMH K-11583, 6.4 × 8.0 mm) contains only one specimen—a female that is severely damaged. In this specimen, all pereopods except the right cheliped are absent. The carapace is flattened and the dorsal protuberances are absent, but this may be due to its badly damaged condition. The other features of the specimen: bilobed second lateral lobe on the carapace, distinctly truncated posterior lateral lobe, relatively more shallow orbit, condition of the second antennal article (with a serrated anterior margin and small spiny lateral process), relatively more narrow merus of the third maxilliped and structure of the carpus of the cheliped, nevertheless agree well with the material of *P. mirabile* we have on hand from

Singapore and Indonesia.

The carapace, as figured by Serène (1965) and Davie (2002), is not very accurate as it does not show the orbital and postorbital armature correctly. In addition, the third antennal article figure in Johnson (1965: fig 1c) is somewhat schematic, as it appears to show a lateral projection, but this is not accurate—the “projection” is actually the articulation point for the flagellum. This condition is not the same as the Red Sea specimen, whose projection is much larger and is more proximal in position.

Ecology: The species is known from a relatively wide depth range, from a depth of 3 m (Balss 1935) to 85 m (Poore et al. 2008). The present record and the record from the Java Sea (Serène 1965) are from intermediate depths (20–25 m). Johnson (1965) indicated that the species lives in “shallow water,” and the seas around Singapore are only 15–20 m in depth. The recorded substrates include gravel and coral sand. The carapace of these crabs is often covered with various fouling, for example, bryozoans (Fig. 2a). The morphology of the ambulatory appendages (see Schäfer 1954) and the flattened body suggests that the crab most likely leads a relatively sedentary lifestyle, living on the sea floor or on rocks.

Distribution: Western Australia (type locality, Shark Bay) (Balss 1935), south-western Australia (Poore et al. 2008); Queensland, Australia (Griffin and Tranter 1986), Java Sea (Serène 1965), Singapore (Johnson 1965).

Remarks: At present, we do not know why there is only a single female syntype *P. mirabile* in the ZMH collection. It is possible that H. Balss retained the male syntype in the Zoological Collection of the Bavarian State in Munich (Zoologische Staatssammlung München, ZSM), where he worked. The ZSM collection, however, suffered great damage during World War II (Dr. M. Türkay, pers. Comm.) and the status of the material is not known. A lectotype selection would be useful for nomenclatural stability, but the condition of the syntype female in ZMH is so poor that it is not very useful to designate it as such.

***Planotergum kowalevski* sp. nov.**

(Figs. 3–5)

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Material Examined: Holotype female (8.6 × 11.7 mm) (ZMMU Ma 3506), Indian Ocean, southern Red Sea, Straits of Bab al Mandab, r/v “Akademik Alexander Kowalevski”, station 602/52, 13°14.8'N 43°10.6'E, depth 25 m, reef-gravel bottom, beam trawl dredging, coll. V.V. Murina, 06.11.1963.

Description: Carapace smooth, pyriform, with uneven edges, curved outward, with 2 pyramidal protrusions or tubercles (Fig. 3a, b): 1 medially on gastric region, other in cardiac region (Fig. 3a–d). Three broad lateral lobes on each side of carapace: anterior lobe with broad concave lateral margins and sharp corners; median (second) lobe broadly truncate, directed laterally, divided into 2 parts by shallow concavity (Fig. 2a); posterior lobe triangle-shaped with truncated tip. Posterior margin of carapace rounded (Fig. 3a, b).

Rostrum (Figs. 3a, b, 4d) very broad, horizontally laminiiform, quasi-rectangular in dorsal view; anterior margin jagged distal. Orbit moderately deep, with small angular pre-orbital and cupped quasi-triangular postorbital lobes and dorsal incision. Eye (Figs. 4b–d, 5d) mobile, with stout eyestalk bearing 2 marked

distinct blunt processes; when positioned along postorbital lobe, eye reaching to postorbital angle (Figs. 4c–d, 5a, d).

Epistome absent (Fig. 4e). Sternal part of cephalothorax nearly completely covered by broad pleon. Thoracic sternum with fused thoracic sternites 1–4, sutures absent except for ridge-like structure between sternites 2 and 3. Sutures between sternites 4 and 5 nearly complete, others interrupted in proximal third. Episternites narrow, attached to postero-lateral margins of sternites, with indistinct sutures between sternites (Fig. 4e).

Antenna (Figs. 4d, 5a–c) with flattened, broad articles; basal article short, broad, expanded anteriorly, immovably fixed to ventral rostral surface; second article large, broadly lamellate bearing greatly extended



Fig. 3. *Planotergum kowalevski* sp. nov., holotype female (8.6 × 11.7 mm) (ZMMU Ma 3506), Red Sea: a and b, general dorsal view; c, ventral view; d, lateral view. Scale bars = 5.0 mm.

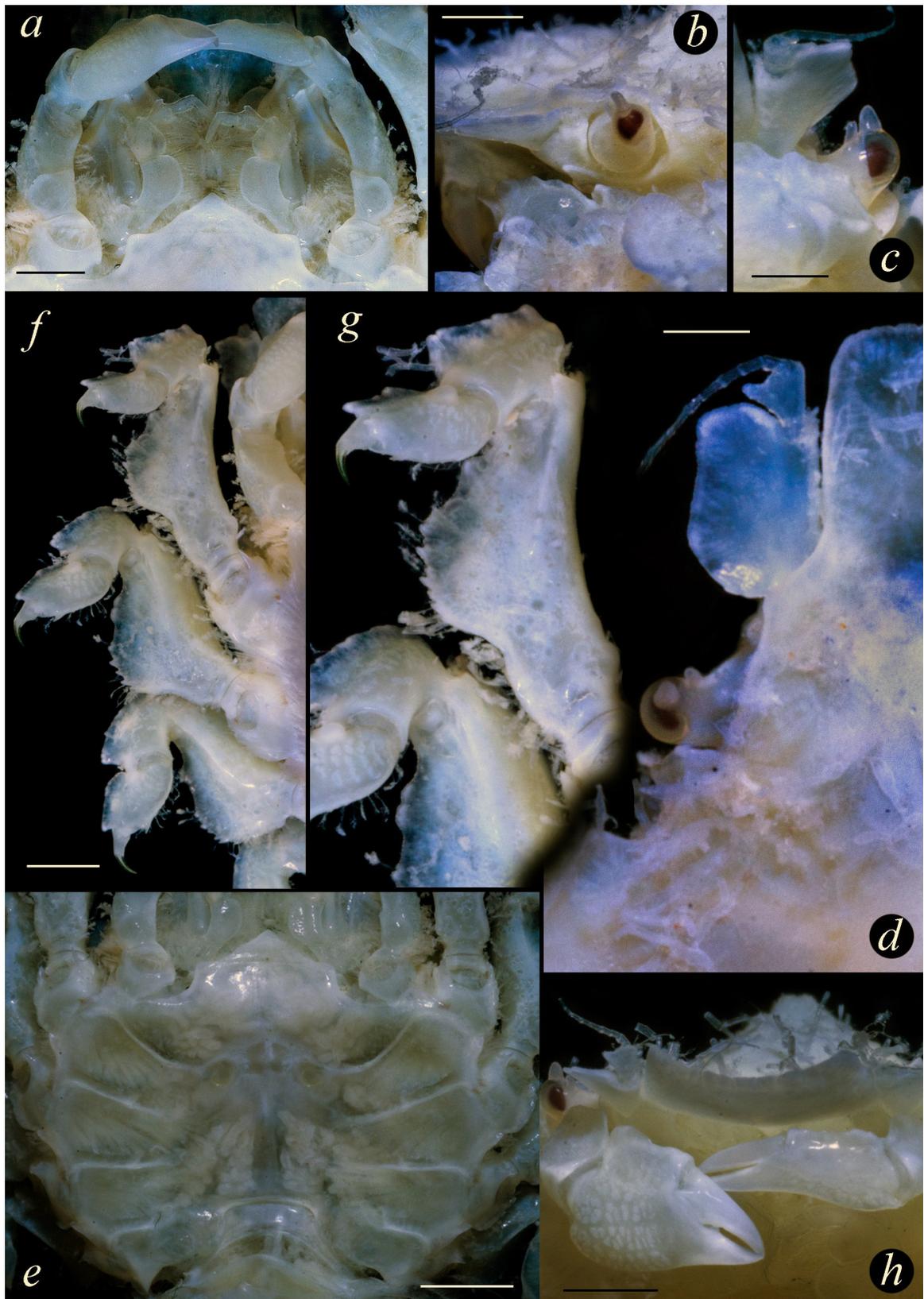


Fig. 4. *Planotergum kowalevski* sp. nov., holotype female (8.6 × 11.7 mm) (ZMMU Ma 3506), Red Sea: a, ventral view of chelipeds and third maxillipeds; b and c, eyes; d, front of carapace, dorsal view; e, thoracic sternites; f, ventral view of ambulatory appendages (P2–5); g, P2; h, chelipeds. Scale bars = 3.0 mm



Fig. 5. *Planotergum kowalevski* sp. nov., holotype female (8.6 × 11.7 mm) (ZMMU Ma 3506), Red Sea: a, front of carapace, eye and antenna, dorsal view; b, antenna, dorsal view; c, antenna, ventral view; d, ventral view of P2; e, left third maxilliped; f, ventral view of P2. Scale bars = 1.0 mm.

outer margin; third article significantly smaller, with prominently produced anterolateral portion; fourth article deeply inserted in anterior margin of third article. Flagellum about as long third and fourth articles combined.

Mouthparts, first and third maxillipeds not dissected. Ischium and merus of third maxilliped (Fig. 5e) with markedly convex mesial margin with moderately dense setae. Anterior margin of merus oblique, laminated. Carpus enlarged distally, with short stick-shaped process on anterior margin. Broad gap between ischia of third maxillipeds (Fig. 4e).

P1 (chelipeds) asymmetrical and heterochelous (Figs. 3c, 4h), short, slender, not reaching distal rostral margin, mostly concealed by carapace in dorsal view (Fig. 3a, b). Carpus of cheliped with anterior face lamelliform. Right chela larger than left chela, with dorsal ridge. Cutting margins of fingers entire, without teeth.

P2–5 (Fig. 4f) with short, flattened articles; anterodistal corners of meri spiniform, posterior faces of merus with denticulated ridges. Anterior and posterior faces of carpus serrated. Anterior margin of propodi expanded with blunt dorsodistal point, ventral (flexor) margin with distal spines. Dactylus shorter than propodus, curved, slender, subchelate with small protrusions on posterodistal corners of propodus. Small spinule present at ventrodistal margin of propodus near articulation with dactylus. P3 without teeth on distoventral margin of ischium (Figs. 4g, 5f).

Pleon very broad, rounded, margin with long soft setae. Telson small, ovoid, deeply inserted in distal margin of somite 6, with terminal notch (Fig. 4e).

Female genital opening, large, about half length of sternite 6, located at anterior margin of sternite, deflexed anteriorly, posterior margin rounded (Fig. 4e).

Affinity: *Planotergum kowalevski* sp. nov. is morphologically similar to *P. mirabile* but can clearly be distinguished by the following characters: the second anterolateral lobe (excluding postorbital tooth) is directed laterally, being broadly truncate, with a shallow concavity at the lateral margin (Fig. 3a) (vs. tooth directed more obliquely, triangular in shape and divided into two by a deep concavity and fissure in *P. mirabile*; Fig. 2a, b); the posterior lateral lobe of the carapace is markedly angular (Fig. 3a, b) (vs. more rounded; Fig. 2b; see Balss 1935: fig. 1); the third antennal article has a pronounced lateral projection (Fig. 3c) (vs. article quadrate, without any projection in *P. mirabile*; Fig. 2e, f); the merus of the third maxilliped is distinctly more quadrate (Fig. 4a) (vs. more elongate with distal projection in *P. mirabile*; Fig. 2c); and the armatures of ambulatory pereopods (P2–P5) is different, especially along the inner part of merus of P2, which is unarmed in

the new species (Figs. 3f, g, 4f) (vs. armed with 4 large sharp teeth in *P. mirabile*; Fig. 2k, h). These differences are significant and argue for recognizing the Red Sea specimen as a new species.

Ecology: Not known.

Etymology: The species is named after the r/v “Akademik Alexander Kowalevski,” which worked for a long time in the tropical seas and brought many new and interesting marine species. The name is used as a noun in apposition.

Distribution: The species is known only from the southern Red Sea.

DISCUSSION

Although the present description of the new species from the Red Sea is based only on a single specimen, it differs from *P. mirabile* in several distinct ways. Further male specimens and examination of gonopods are essential for future studies (e.g., see Wong et al. 2018). The distribution of *P. mirabile* and *P. kowalevski* sp. nov. is not surprising, as many species from the western Pacific are different from those in the Indian Ocean; even the fauna from the eastern and western Indian Oceans are often different (see Spiridonov and Zhadan 1999; Lai et al. 2006; Marin 2010; Cannici et al. 2017; Ng et al. 2018; Shih et al. 2018; Ng 2019). Among crabs, examples include the deep-water calappids *Mursia bicristimana* Alcock & Anderson, 1894 and *M. arabica* Kumar, Kumar & Galil, 2013 (Spiridonov and Apel 2007; Kumar et al. 2013); the shallow water eastern Indian Ocean portunids *Portunus pelagicus* (Linnaeus, 1761) *sensu lato* and *P. segnis* (Forskål, 1775) (Lai et al. 2010) and the intertidal ocypodids *Austruca annulipes* (H. Milne Edwards, 1837) and *A. occidentalis* (Naderloo, Schubart & Shih, 2016; Naderloo et al. 2016). In addition, the Red Sea itself, where *P. kowalevski* occurs, is an area of significant endemism for many marine taxa (e.g., Türkay 1996; Apel 2001; Ah Yong and Ng 2005; DiBattista et al. 2016; Ng et al. 2016; Ah Yong 2018). Future studies are needed to clarify whether *Planotergum kowalevski* is endemic to the Red Sea or to the western/northwestern Indian Ocean. This should also involve molecular approaches to study the population genetics of *Planotergum* in the Red Sea and Pacific and Indian Oceans (e.g., Chai et al. 2017; Jung et al. 2018).

CONCLUSIONS

The genus *Planotergum* Balss, 1935 (Brachyura:

Majidae: Planoterginae) presently includes two known species. *Planotergum mirabile* Balss, 1935 is known from Western Australia and Queensland, Java Sea and Singapore (Johnson 1965). *Planotergum kowalevski* sp. nov. is described from the southern part of the Red Sea based on a single female specimen, clearly distinguishing from the congener in the form of carapace, antennal article and third maxilliped as well as morphology of the ambulatory legs. The genus *Planotergum* is heterochelous, which is not common in Majidae or other families in Majoidea.

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Competing interests: The authors declare that they have no conflicts of interests.

Availability of data and materials: All materials and data are available in A.N. Severtzov Institute of Ecology and Evolution of RAS, Moscow, Russia, and upon request to the authors.

Consent for publication: All authors agree to submit the manuscript to *Zoological Studies*.

Ethics approval consent to participate: Not applicable.

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