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ORIGINAL ARTICLE

Redescription of *Philyra sexangula* Alcock, 1896 (Decapoda, Brachyura, Leucosiidae), with description of a new genus and species from the northern Indian Ocean

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ABSTRACT

The identity of *Philyra sexangula* Alcock, 1896 (Leucosiidae), an inhabitant of mangrove habitats, is clarified. The redescription of the lectotype male and examination of fresh material collected from Pichavaram mangrove forest located in Tamil Nadu State of India revealed that *P. sexangula* shows significant morphological differences from the generic characters of *Philyra sensu stricto*. Therefore, a new genus *Bellayra* gen. nov., is established herewith for the species. In addition, one new species, *Bellayra persicum* gen. nov., sp. nov., is described based on a syntype male of *P. sexangula* collected from the Persian Gulf. Furthermore, *Philyra taekoae* Takeda, 1972 and *Philyra nishihirai* Takeda and Nakasone, 1991, described from Japan are also transferred to *Bellayra* gen. nov.

KEYWORDS

India, Leucosiidae, mangroves, Persian Gulf, Systematics.

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Introduction

The taxonomy of the leucosiid genus *Philyra* Leach, 1817, remains problematic and is generally regarded as a heterogeneous grouping (*e.g.*, see Takeda and Nakasone, 1991; Tan, 1995; Chen and Türkay, 2001; Rahayu and Ng, 2003; Ng *et al.*, 2008; Galil, 2009; Ng, 2021). Galil (2009) partially revised *Philyra* and established seven new genera. Galil (2009) diagnosed the generic characteristics of *Philyra sensu stricto* and distinguished it from other closely related genera on the basis of the following characteristics: male first gonopod having a subterminally alate apical process, the third maxilliped possesses a subquadrate exopod, the first two male abdominal somites are transversely narrow with the third to sixth abdominal somites fused and lacking a median abdominal denticle. *Philyra sensu stricto* is currently represented by only two species *Philyra globus* (Fabricius, 1775) and *Philyra samia* Galil, 2009 (Galil, 2009). Galil (2009), however, provisionally retained 27 species under *Philyra sensu lato* due to the unavailability of specimens for examination and/or the brief descriptions which were not detailed enough to ascertain the generic status of these species. One of those unresolved taxa is *Philyra sexangula* Alcock, 1896.

Alcock (1896) described *P. sexangula* on the basis of two male syntypes: one male collected from Sacramento Shoal, Godavari coast, Andhra Pradesh State, India, and the other one from the Persian Gulf. During the present study, one fresh male specimen was collected from Pichavaram mangrove forest located in Tamil Nadu State, India. The examination of the syntypes and the fresh specimen revealed that the species shows significant differences from *Philyra sensu stricto* in the overall form of the carapace, male pleon and male first gonopod which convinced us to assign it to a new genus *Bellayra* gen. nov.

Material and Methods

The specimens examined in the present study are deposited in the Zoological Reference Collection (LFSc.ZRC), Department of Life Sciences, Hemchandracharya North Gujarat University, Patan, Gujarat, India and Zoological Survey of India (ZSI), Kolkata, India and Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum, National University of Singapore. The morphological terminology used in the description follows Takeda and Nakasone (1991) and Rahayu and Ng (2003). All the measurements are recorded in millimeters (mm). The following abbreviations are used in the present study: CL, carapace length, measured along the vertical median line of the carapace; CB, carapace breadth, measured at the broadest point; P2–P5, second to fifth pereopods respectively (first to fourth ambulatory legs); G1, male first gonopod; G2, male second gonopod; coll, collector.

Systematics

Family Leucosiidae Samouelle, 1819

Bellayra gen. nov.

Zoobank: urn:lsid:zoobank.org:act:DFEA5A1E-511C-4DCE-9A1A-119367DED2DB

Type species. *Philyra sexangula* Alcock, 1896, by present designation (gender feminine)

Other species included. *Bellayra taekoae* (Takeda, 1972) gen. nov., comb. nov. (type locality: Japan), *Bellayra nishihirai* (Takeda and Nakasone, 1991) gen. nov., comb. nov. (type locality: Japan), *Bellayra persicum* gen. nov., sp. nov. (type locality: Persian Gulf).

Diagnosis. Carapace rhomboidal, markedly punctuate, punctae extending to ventral surface; regions well defined with granules. Anterolateral and posterolateral margins of carapace with obtuse tubercle. Male pleon (Figs. 1d, 2d) with 3 articulating somites, somite 1 narrow, median part slightly protruding, somites 2 – 6 tightly fused, distinct median denticle on somite 6, telson with rounded apex; female pleon with 4 articulating somites, somites 3 – 6 tightly fused. G1 straight or twisted with broad triangular or twisted apical lobe.

Description. Carapace rhomboidal, slightly broader than long, dorsal surface convex with small to moderately large granules, with numerous punctae extending to ventral surface, regions relatively distinct; gastric, cardiac, branchial, intestinal regions elevated with scattered granules. Front weakly concave, with

small median protuberance, epistome and anterior boundaries of pterygostomial regions projecting beyond edge of front, visible dorsally. Median tuberculated ridge undulating, running from frontal region merging with elevated intestinal region; hepatic facet broad, shallow, upper and lower margins beaded, not merging anteriorly, joining with anterolateral margin posteriorly; single row of tubercles on branchial region may be present; anterolateral, posterolateral, and posterior margins rimmed by obtuse tubercles. Posterior margin with angulated lateral ends on both sides. Third maxillipeds granular, merus almost as long as ischium, ischium longer than wide, exopod elongated, expanded, row of long setae on merus and ischium. Cheliped not inflated or elongate, merus granular, cutting edges of fingers with narrow gap when closed. Ambulatory legs slender, smooth. Male pleon (Figs. 1d, 2d) with 3 articulating somites, covered with numerous punctae; somite 1 narrow, median part slightly protruding; somites 2 – 6 fused, immovable, with distinct median denticle on somite 6, telson long with rounded apex. Female pleon with 4 articulating somites; first and second somites narrow, covered with small granules, third to sixth somites fused, smooth, lateral margins granular; telson long, ellipsoidal. G1 long, slender, straight or twisted along most of length, tip triangular or twisted.

Etymology: The genus is named in honor of Bella Galil for her valuable contribution to the taxonomy of the family Leucosiidae. The name is in arbitrary combination with the suffix of the genus name *Philyra*.

Remarks: Galil (2009), in her revision of *Philyra* Leach, 1817, separated it into two groups of genera. The first group has the first two male pleonal somites free (*Philyra sensu stricto*, *Afrophila* Galil, 2009, *Atlantolocia* Galil, 2009, *Ryphila* Galil, 2009, and *Ovilyra* Ng, 2021) while the second group has the first male pleonal somite articulated (*Atlantophila* Galil, 2009, *Lyphira* Galil, 2009, *Pyrhila* Galil, 2009, *Hiplyra* Galil, 2009). In this regard, *Bellayra* gen. nov. belongs to the second group. However, *Bellayra* gen. nov. can be immediately distinguished from the other genera of the second group on the basis of the following characters: rhomboidal carapace, carapace covered with moderate to large granules with numerous punctae which extend to ventral surface, and male G1 straight or twisted with broadly triangular or twisted apical lobe. The morphological comparison between *Bellayra* gen. nov. and closely related genera is given in Tab. 1.

Kemp (1915), while describing *Philyra alcocki* Kemp, 1915, wrote that the first two male pleonal somites are immobile but the first author has examined the type and fresh specimens of *P. alcocki* and observed that the first two somites of the male abdomen are free. This indicates that *P. alcocki* belongs to the first group of genera identified by Galil (2009). Kemp (1915) also commented that *P. alcocki* shows some resemblance to *B. sexangula* (Kemp, 1915), but these two species are very different in terms of carapace shape (rhomboidal *vs.* suborbicular in *P. alcocki*), frontal margin (no median tooth *vs.* median tooth in *P. alcocki*), male pleonal somite 1 and 2 (1st somite free *vs.* 1st and 2nd are free in *P. alcocki*), G1 apical lobe (triangular *vs.* spatuliform in *P. alcocki*) and they are certainly not congeneric (Trivedi *et al.*, 2022). *Philyra alcocki* is now referred to the new genus *Alcolyra* Trivedi, Mitra and Ng, 2022 (Trivedi *et al.*, 2022).

Table 1. Morphological comparison between *Bellayra* gen. nov. and its closely related genera (modified from Galil, 2009).

Character	*Bellayra* gen. nov.	*Atlantophila* Galil, 2009	*Lyphira* Galil, 2009	*Pyrhila* Galil, 2009	*Hiplyra* Galil, 2009
Carapace shape	rhomboidal	suborbicular	suborbicular	suborbicular	suborbicular
Carapace regions	distinct	indistinct	indistinct	indistinct	indistinct
Carapace surface	moderate to large granules with numerous punctae	glabrous	glabrous	granulate	punctate and variably granulate
Thoracic sternites	punctate	smooth	granulate	granulate	glabrous
G1	main shaft straight or twisted along the length	main shaft coiled	main shaft straight	main shaft straight	main shaft straight
G1 apical process	triangular or twisted	digitate	cornute	long tubular process	short with rounded tip

Japanese species, *Philyra taekoae* Takeda, 1972 and *Philyra nishihirai* Takeda and Nakasone, 1991, show affinities towards *Bellayra* n. gen. in the following characters: rhomboidal carapace, carapace covered with moderate to large granules with numerous punctae which extend to the ventral surface, male pleon with first pleonal somite free, and male G1 straight with triangular or twisted apical lobe respectively (Takeda, 1972; Sakai, 1976; Takeda and Nakasone, 1991; Rahayu and Ng, 2003). *Philyra nishihirai* and *P. taekoae* are herewith referred to *Bellayra* gen. nov.

Bellayra sexangula (Alcock, 1896) gen. nov., comb. nov.

(Figs. 1–3)

Philyra sexangula Alcock, 1896: 238, 241, 242, pl. VII, fig. 2.— Ng *et al.*, 2008: 93 (in list).— Galil, 2009: 281 (in list).— Dev Roy, 2017: 209, 225 (in list).— Trivedi *et al.*, 2018: 49 (in list).

Material examined. Lectotype (here designated), male (CL 7.24 mm, CB 7.85 mm) (ZSI-893/10), Sacramento shoal, Godavari coast, Andhra Pradesh State, India. Other material: male (CL 7.30 mm, CB 8.15 mm), (LFSc.ZRC-149), Pichavaram mangrove forest, Tamil Nadu, India, 11°26'20"N 79°47'54"E, 4.II.2018, coll. Mariasingarayan Yosuva.

Comparative material: *Bellayra nishihirai* gen. nov., comb. nov. : 2 females (CL 4.4 mm, CB 5.3 mm, CL 4.9 mm, CB 5.7 mm) (ZRC 2002.601); 1 male (CL 5.9 mm, CB 6.3 mm) (ZRC 2002.602), sandy-mud substrate in mangrove near river mouth, Kamora, Irian Jaya, Indonesia, 22.IX.2001, coll. I. Ermayanti; 1 female (CL 4.6 mm, CB 5.5 mm) (ZRC 2002.608), sandy-mud substrate in mangrove near river mouth, Kamora, Irian Jaya, Indonesia, 10.VII.2001, coll. A. Pratiwi.

Diagnosis. Carapace rhomboidal, slightly broader than long; dorsal surface punctuated, minutely granular; regions relatively defined, elevated, tuberculated ridge along median part, tubercles getting larger in cardiac and intestinal regions; lateral margins finely tuberculate, epibranchial angle obtuse, distinct tubercle on posterolateral margin; posterolateral angle with prominent obtuse tubercle. Chelipeds robust, large, about 2.5 times as long as carapace width. Male pleon with 3 articulating somites, somites 2 to 6 tightly fused; somite 6 with distinct median denticle; telson broadly triangular, longer than broad. G1 straight along most of length, tapering at tip, apical lobe (Fig. 3f, h) with long setae.

Redescription. Carapace rhomboidal (Figs. 1a, 2a), slightly broader than long. Dorsal surface strongly convex; minutely granular with numerous punctae which extend to the ventral surface (Figs. 1d, 2d), regions relatively distinct; cardiac, branchial, intestinal regions elevated, metagastric, urogastric, cardiac regions elevated with small truncate tubercle medially, elevated intestinal region with large truncate tubercle medially confluent with elevated cardiac region (Fig. 2e), undulating median tuberculated ridge running from frontal region, merging with elevated intestinal region, reaching highest elevation in metagastric region (Fig. 2e); mesogastric region indicated anteriorly with median row of small granules, concave laterally; protogastric region depressed; branchial region with tuberculated ridge running slightly on the median part of posterolateral margin, anterior part longitudinal, posterior part oblique; hepatic facet broad, shallow, floor of facet with numerous punctae, upper and lower margins beaded, not merging anteriorly, posteriorly, facet joining anterolateral margin at well marked obtuse angle. Anterolateral, posterolateral, posterior margins rimmed by obtuse tubercles; epibranchial angle obtuse; posterolateral margin sinuous, slightly concave. Front slightly elevated, weakly concave, with small median proturbance. Posterior margin almost straight, weakly beaded.

Third maxillipeds (Fig. 3c) covered with numerous punctae; merus 0.9 times as long as ischium along inner margin; ischium 1.6 times longer than wide; basis expanded, more than half length of exopod; carpus, propodus and dactylus not visible in external view when reposed, articulating on inner surface of merus, dactylus apex with long setae. Exopod (Fig. 3c) much longer than wide, about twice length of merus, outer and inner margins with fringes of setae.

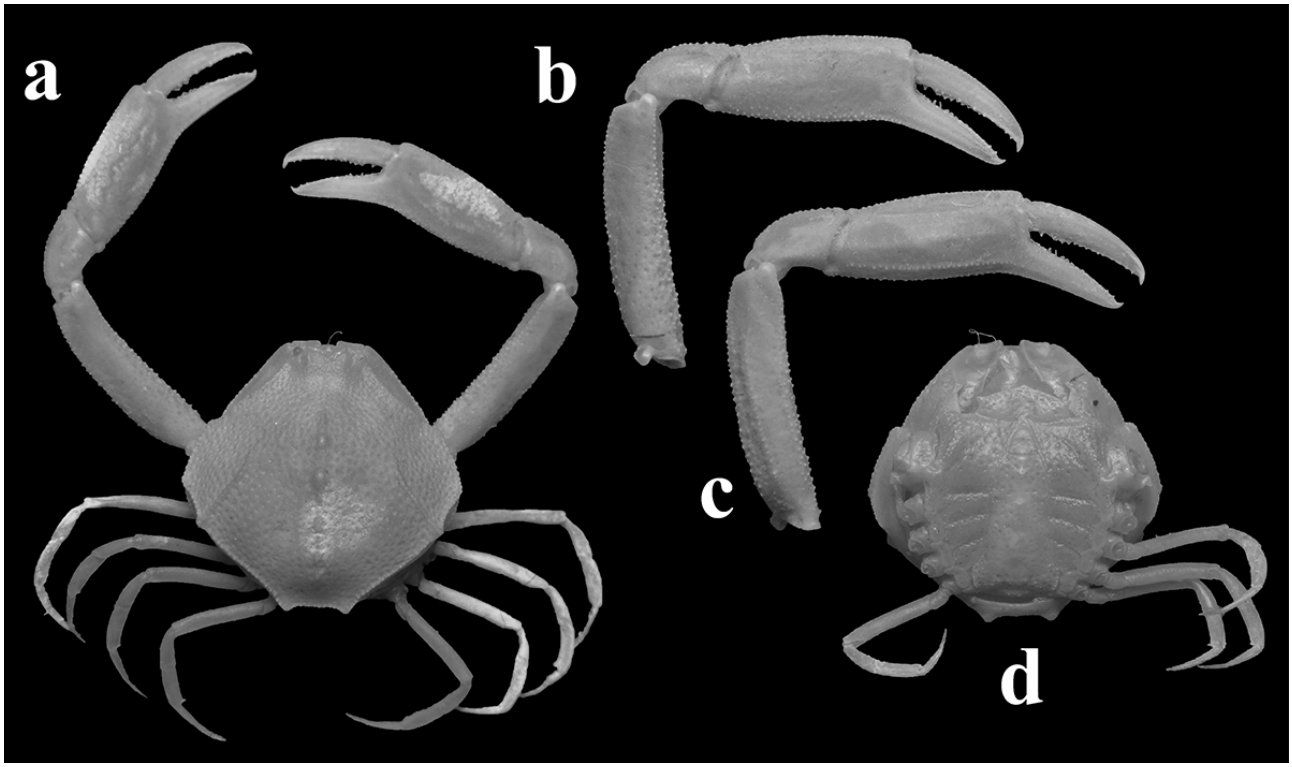

Figure 1. *Bellayra sexangula* gen. nov., comb. nov., lectotype, male (CL 7.24 mm, CB 7.85 mm) (ZSI-893/10). **a**, Habitus, dorsal view; **b**, right cheliped, outer view; **c**, right cheliped, inner view; **d**, carapace, ventral view.

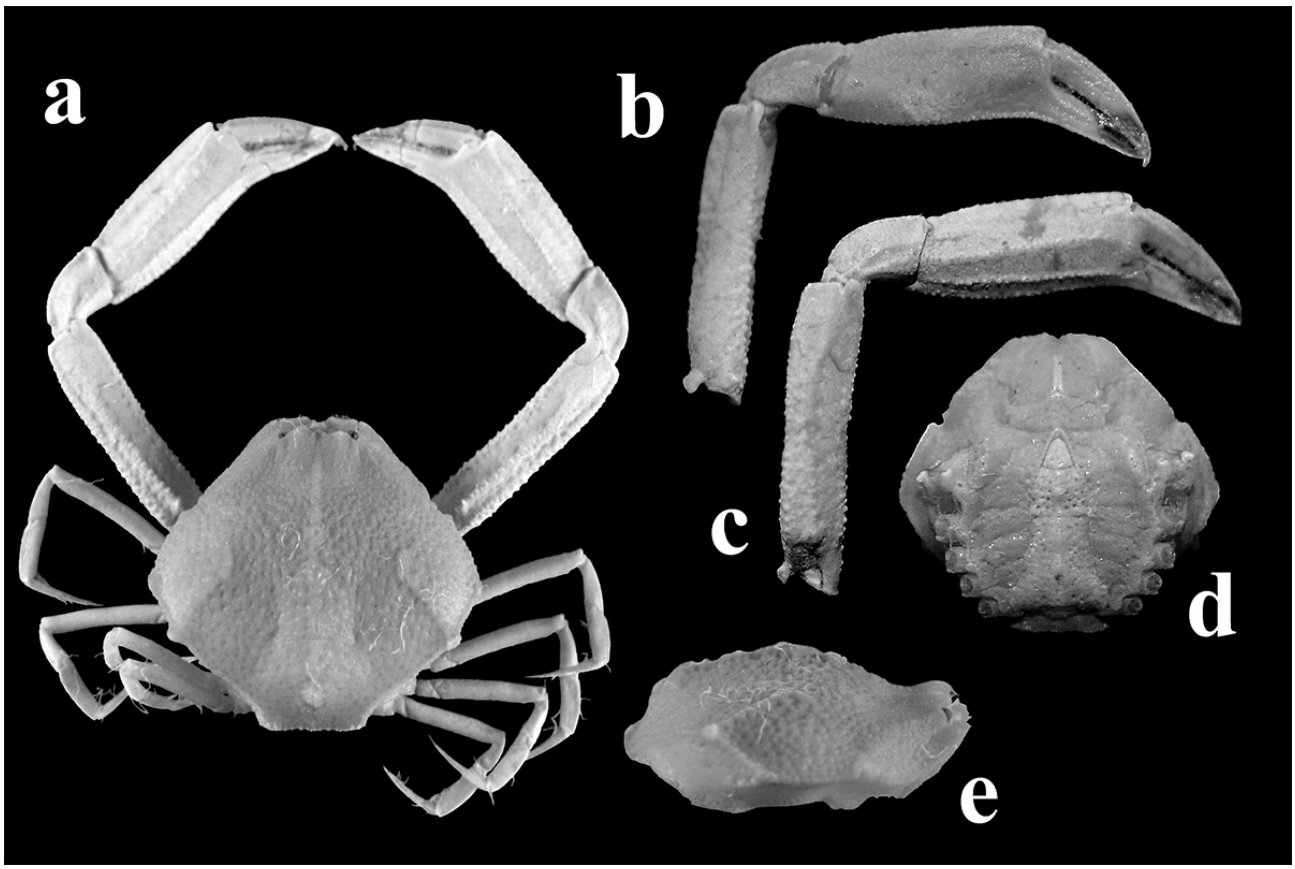

Figure 2. *Bellayra sexangula* gen. nov., comb. nov., male (CL 7.3 mm, CB 8.15 mm) (LFSc. ZRC-149). **a**, Habitus, dorsal view; **b**, right cheliped, outer view; **c**, right cheliped, inner view; **d**, carapace, ventral view; **e**, carapace, lateral view.

Chelipeds (Figs. 1a, b, c, 2a, b, c) about 2.5 times length of carapace width. Merus with upper and lower margins beaded, outer surface with tuberculated ridge running parallel to upper margin, inner surface smooth. Carpus about one-third length of merus, elevated medially. Palm (Figs. 1a, b, c, 2a, b, c, 3a, b) longer than dactylus, upper and lower margins beaded, outer surface smooth (Figs. 1b, 2b, 3a), inner surface (Figs. 1c, 2c, 3b) with 3 ridges, lower most ridge tuberculated running parallel to lower margin of palm. Dactylus outer margin smooth, inner margin with ridge running parallel to upper margin. Pollex outer margin smooth, inner margin with ridge running parallel to lower margin. Cutting edges of fingers with blunt denticles covered with scattered setae (Figs. 1b, c, 2b, c, 3a, b).

P2–P5 (Figs. 1a, 2a) subcylindrical; total length decreasing from first to last pair, glabrous, upper and lower margins of propodus and dactylus covered with long setae.

Thoracic sternum covered with numerous punctae, with thickened margins along the bases of ambulatory legs. Sternopleonal cavity deep, reaching to mid-distance between fused thoracic sternites 1–3 (Figs. 1e, 2e, 4a); margin lined with granules, those on distal part proportionately larger (Figs. 1d, 2d).

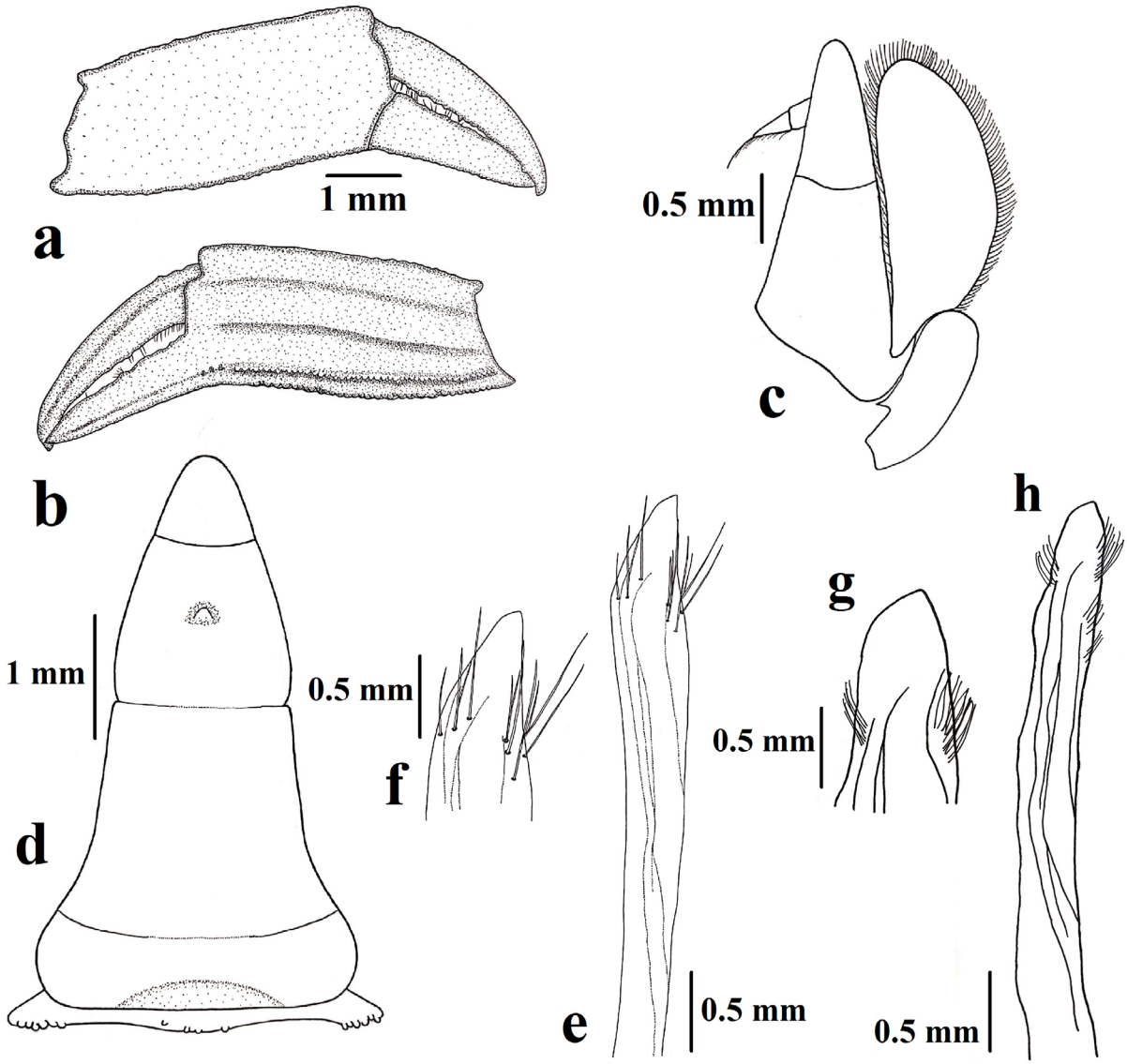

Figure 3. *Bellayra sexangula* gen. nov., comb. nov., lectotype, male (CL 7.24 mm, CB 7.85 mm) (ZSI-893/10). **a**, Right chela, outer view; **b**, right chela, inner view; **c**, left third maxilliped, outer view; **d**, abdomen; **e**, G1 abdominal view; **f**, G1 apical lobe; **g**, G1 apical lobe, male (CL 7.3 mm, CB 8.15 mm) (LFSc. ZRC-149); **h**, G1 abdominal view.

Male pleon (Figs. 1d, 2d, 3d) with 3 articulating somites, covered with numerous punctae, somite 1 narrow, with posterolateral angle tuberculated, median part slightly protruding with few tubercles; somite 2 to 6 fused, immovable, complete suture between somites 2 and 3 as well as 5 and 6 visible, distinct denticle on middle portion of somite 6, telson longer than broad, broadly triangular, with rounded apex. G1 (Fig. 3e, g) long, slender, straight along most of length, tapering at tip, apical lobe (Fig. 3f, h) with long setae.

Distribution. So far known only from India: Andhra Pradesh (Alcock, 1896; Dev Roy, 2017); Tamil Nadu (present study).

Remarks. Alcock (1896) described *P. sexangula* on the basis of two male specimens: one male collected from Sacramento Shoal, Godavari coast, Andhra Pradesh State, India, and the other one from the Persian Gulf. No holotype was selected so both specimens are syntypes. We examined both syntypes in the ZSI and they are actually not conspecific. The male specimen from India agrees best with the figure and description provided by Alcock (1896: 240, pl. VII, fig. 2) and we believe the figure was actually based on it. As such, we here select the Indian male (CL 7.24 mm, CB 7.85 mm) (ZSI-893/10) as the lectotype of *P. sexangula* Alcock, 1896. This lectotype agrees very well with our recent male specimen from Tamil Nadu in India LFSc.ZRC-149). The other syntype male, (CL 7.88 mm, CB 7.83 mm, ZSI-896/10) from the Persian Gulf is here made the holotype for a new species, *B. persicum* gen. nov., sp. nov.

Bellayra sexangula gen. nov., comb. nov. most closely resembles *B. persicum* gen. nov., sp. nov. but differs in the following characters: carapace highly granular with abundant punctae (Figs. 1a, 2a) (*vs.* carapace relatively less granular with scattered punctae in *B. persicum* gen. nov., n. sp., Fig. 4a); median ridge having five denticles (Figs. 1a, 2a) (*vs.* single broad denticle present on mesogastric region in *B. persicum* gen. nov., n. sp., Fig. 4a); median denticle present on sixth abdominal somite small and narrow (Figs. 1d, 2d) (*vs.* large and broad in *B. persicum* gen. nov., n. sp., Fig. 4d, 5d); G1 main shaft straight (Figs. 2h, 2e) (*vs.* G1 main shaft twisted two times in *B. persicum* gen. nov., n. sp., Fig. 5e); and tip of the G1 is broadly triangular (Figs. 2e, 2f) (*vs.* tip of G1 tubular in *B. persicum* gen. nov., n. sp., Fig. 5f).

Bellayra sexangula gen. nov., comb. nov. can be distinguished from *B. nishihirai* gen. nov., comb. nov. (type locality: Oura River, Okinawa-Jima Island, Japan) in the following characters: mesogastric region of carapace smooth laterally (Figs. 1a, 2a) (*vs.* a row of granules in *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2A; Rahayu and Ng, 2003: fig. 2); hepatic region without row of tubercles (Figs. 1a, 2a) (*vs.* with single row present in *B. nishihirai*, Fig. 6a; Rahayu and Ng, 2003: fig. 2); posterior margin straight (Figs. 1a, 2a) (*vs.* weakly concave *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2A; Rahayu and Ng, 2003: figs. 1a, 2); cheliped merus outer surface with tuberculated ridge running parallel to upper margin (Figs. 1a–c; 2a–c) (*vs.* rows of scattered granules in *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2D; Rahayu and Ng, 2003: figs. 2, 3a); palm inner surface with three ridges (Figs. 1c, 2c, 3b) (*vs.* with only scattered granules present in *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2D; Rahayu and Ng, 2003: fig. 3a); the third maxilliped merus apex is rounded (Fig. 3c) (*vs.* angular in *B. nishihirai*, Takeda and Nakasone, 1991: fig. 2C; Rahayu and Ng, 2003: fig. 3i); the inner and outer margin of merus are smooth (Fig. 3c) (*vs.* beaded in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2C; Rahayu and Ng, 2003: fig. 3i); the pleonal abdominal somites 2 – 6 are fused with two complete sutures (Figs. 1d, 2d, 3d) (*vs.* no complete sutures but with only three lateral incisions in *B. nishihirai*, Fig. 6b; Takeda and Nakasone, 1991: fig. 2E); lateral margins of pleonal somites 1 and 2 smooth (Figs. 1d, 2d, 3d) (*vs.* beaded in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2E); telson broadly triangular and 1.1 times as long as broad (Figs. 1d, 2d, 3d) (*vs.* narrow and 1.8 times as long as broad in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2E; Rahayu and Ng, 2003: fig. 3c); and the G1 apical lobe broadly triangular (Fig. 3f, h) (*vs.* twisted in *B. nishihirai*, see Takeda and Nakasone, 1991: figs. 2F, 2G; Rahayu and Ng, 2003: figs. 3d, 3e).

Bellayra sexangula gen. nov., comb. nov. can be distinguished from *B. taekoae* gen. nov., comb. nov. (type locality: Sumiyo, Amami-Oshima Island of Ryukyu Island, Japan) in the following characters: carapace less

tuberculated (Figs. 1a, 2a) (*vs.* strongly tuberculated in *B. taekoae,* Takeda, 1972: Fig. 1A; Takeda and Nakasone, 1991: fig. 1D); carapace median area without large tubercles (Figs. 1a, 2a) (*vs.* median row of large tubercles in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); intestinal region with single large truncate tubercle (Figs. 1a, 2a) (*vs.* intestinal region covered with numerous tubercles in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); single row of tubercles present on branchial region (Figs. 1a, 2a) (*vs.* no row of tubercles present in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); third maxilliped merus apex is rounded (Fig. 3c) (*vs.* angular in *B. taekoae*, see Takeda, 1972: fig. 1B; Takeda and Nakasone, 1991: fig. 1F); third maxilliped exopod outer border strongly convex (Fig. 3d) (*vs.* gently convex in *B. taekoae*, see Takeda, 1972: fig. 1B; Takeda and Nakasone, 1991: fig. 1F); male pleon with sutures between somites 2 and 3 as well as 5 and 6 visible (Fig. 3d) (*vs.* sutures absent in *B. taekoae*, see Takeda and Nakasone, 1991: fig. 1E); and male G1 apical lobe tip pointed (*vs.* tip rounded in *B. taekoae*, see Sakai, 1976: text fig. 63b, c).

***Bellayra persicum* gen. nov., sp. nov.**

(Figs. 4, 5)

Zoobank: urn:lsid:zoobank.org:act:702C4D77-49BB-4EBD-A357-45E0887B22B3

Material examined. Holotype: male (CL 7.88 mm, CB 7.83 mm) (ZSI-896/10), Persian Gulf.

Comparative material: see material examined and comparative material under *B. sexangula*.

Diagnosis. Carapace rhomboidal, slightly broader than long. Dorsal surface moderately convex, punctuate, minutely granular; regions relatively defined, elevated, finely tuberculated ridge along median part, larger tubercle on cardiac region; lateral margins finely tuberculate, epibranchial angle obtuse, distinct tubercle on posterolateral margin; posterolateral angle with prominent obtuse tubercle. Chelipeds robust, large, about 2.5 times as long as carapace width. Male abdomen with 3 articulating somites, somites 2 to 6 tightly fused; somite 6 with distinct median denticle; telson broadly triangular, longer than broad. G1 long, slender, 2 times twisted along its length, tip elongated, tubular, apical lobe with long setae.

Description. Carapace rhomboidal (Fig. 4a), slightly broader than long. Dorsal surface convex, globose; minutely granular with scattered punctae extending to ventral surface (Fig. 4d), regions relatively indistinct; gastric, cardiac, branchial, and intestinal regions elevated, broad truncate tubercle on metagastric region, undulating median ridge starting from protogastric region merging with elevated intestinal region, reaching highest elevation in metagastric region (Fig. 4a, e); protogastric region depressed; branchial region with broad tuberculated ridge originating from posterolateral margin, its anterior part longitudinal, posterior part oblique hepatic facet broad and shallow, floor of facet with scattered punctae, upper and lower margins obtusely beaded, not merging anteriorly, posteriorly facet joins anterolateral margin at obtuse angle. Anterolateral, posterolateral, posterior margins rimmed by obtuse tubercles; epibranchial angle obtuse; posterolateral margin sinuous, slightly convex. Front almost straight, slightly elevated, bilobed, divided by shallow median groove. Posterior margin almost straight, weakly beaded bearing blunt teeth on each lateral side.

Third maxillipeds (Fig. 5c) covered with numerous punctae; merus 0.9 times as long as ischium along inner margin; ischium 1.7 times longer than wide; basis expanded, more than half length of exopod; carpus, propodus and dactylus not visible in external view when reposed, articulating on inner surface of merus, dactylus apex bearing long setae. Exopod (Fig. 5c) outer margin convex, much longer than wide, around twice the length of merus, outer and inner margins bearing fringe of setae.

Chelipeds (Fig. 4a, d) subequal, about 2.5 times length of carapace width. Merus with upper and lower margins beaded, inner surface punctate posteriorly, broad ridge running throughout the length terminating in tubercle proximally. Carpus about one-third length of merus, elevated medially. Palm (Fig. 5a, b) longer than dactylus, upper and lower margins covered with scattered granules, ventral margin granular (Fig. 5a, b), inner surface (Fig. 5b) with 3 ridges, lower-most ridge

tuberculated running parallel to lower margin of palm. Fingers terminating in sharp tooth. Dactylus outer margin smooth, inner margin with ridge running parallel to upper margin. Pollex outer margin with scattered granules, inner margin with ridge running parallel to lower margin. Cutting edges of fingers with blunt denticles covered with scattered setae.

P2–P5 (Fig. 4a, d) subcylindrical; total lengths decreasing from first to last pair, glabrous; merus longest as compared to carpus, propodus, and dactylus; upper and lower margins of propodus and dactylus covered with long setae.

Thoracic sternum covered with sparse punctuations, slightly concave, with thickened margins along bases of ambulatory legs. Abdominal fossa margin beaded along anterior two sternites (Fig. 4d).

Male abdomen (Figs. 4d, 5d) with 3 articulating somites, covered with few punctae, somite 1 narrow, with posterolateral angle tuberculated, median part slightly protruding; somite 2 to 6 fused, immovable, posterolateral angles with prominent bulge, complete suture between somites 5 and 6 visible, distinct tubercle on center of somite 6, telson longer than broad, largely triangular, with curved apex. Lateral margins of somite 6 convex.

G1 (Fig. 5e) long, slender, 2 times twisted along the length, tip elongated, tubular, apical lobe (Fig. 5f) with long setae.

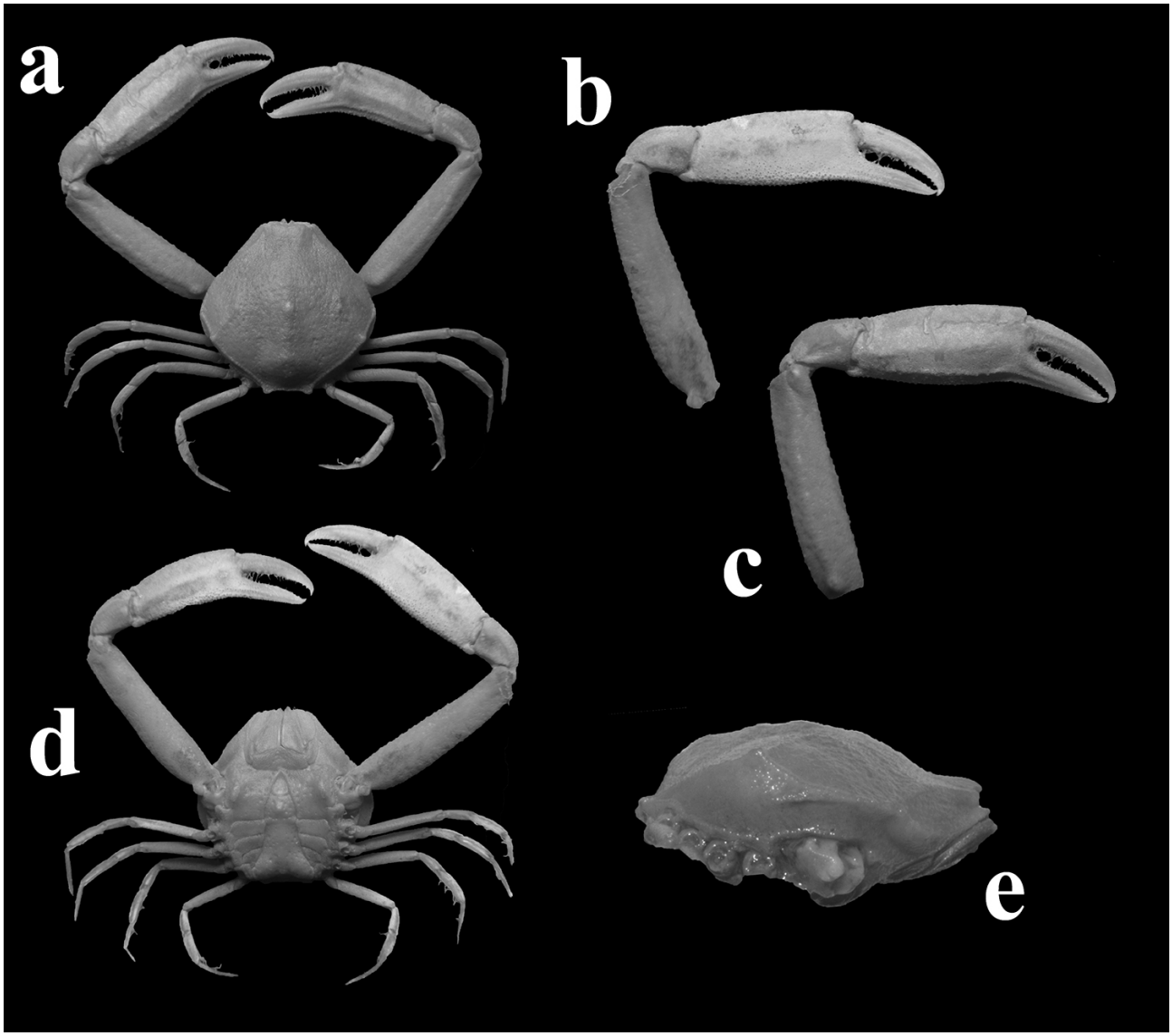

Figure 4. *Bellayra persicum* gen. nov., sp. nov., holotype, male (CL 7.88 mm, CB 7.83 mm) (ZSI-896/10). **a**, Habitus, dorsal view; **b**, right cheliped, outer view; **c**, right cheliped, inner view; **d**, carapace, ventral view; **e**, carapace, lateral view.

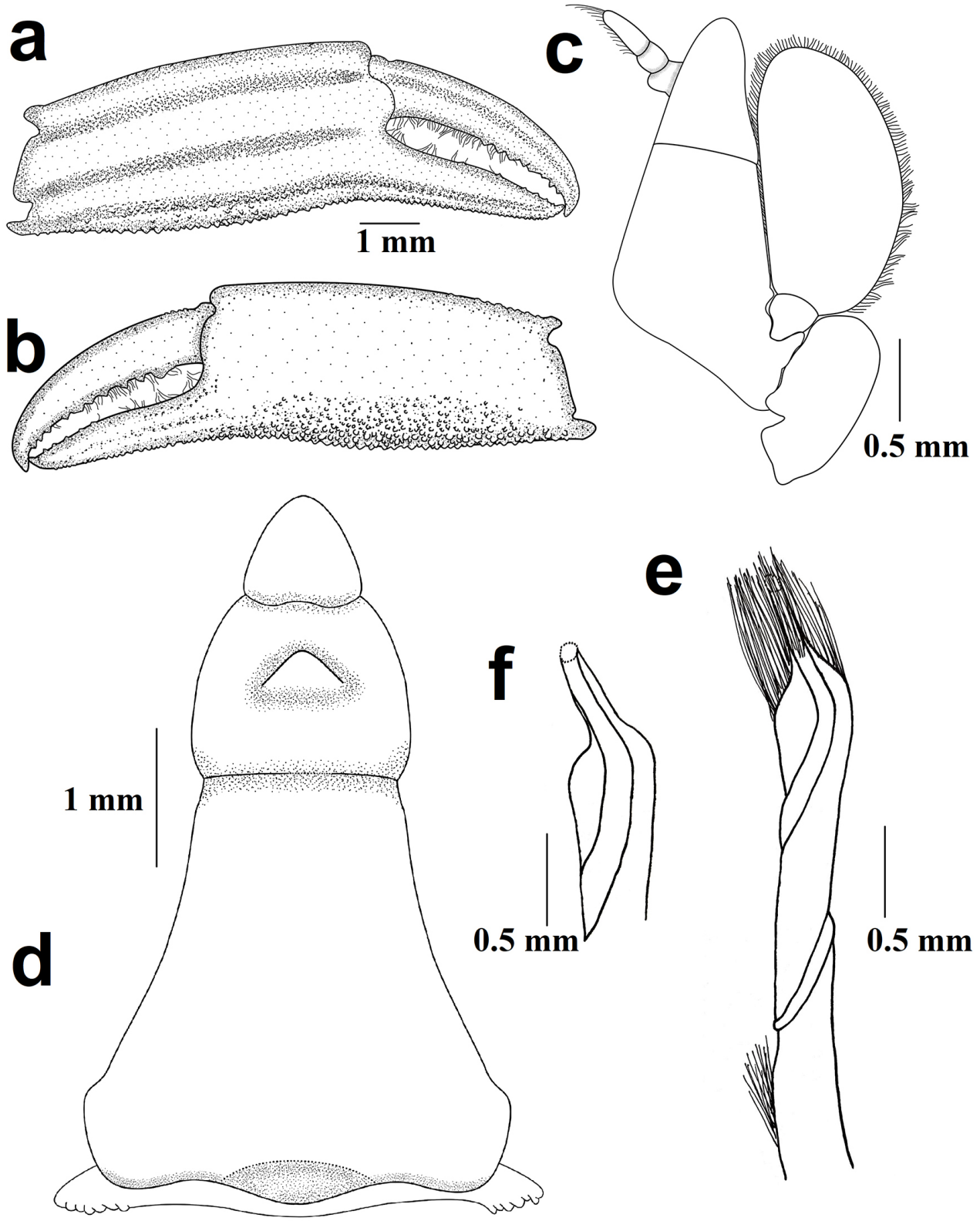

Figure 5. *Bellayra persicum* gen. nov., sp. nov., holotype, male (CL 7.88 mm, CB 7.83 mm) (ZSI-896/10). **a**, Right chela, outer view; **b**, right chela, inner view; **c**, left third maxilliped, outer view; **d**, abdomen; **e**, G1 abdominal view; **f**, G1 apical lobe (setae omitted).

Distribution. So far only known only from Persian Gulf.

Etymology. The species name is derived from the type locality, Persian Gulf, which is called "Sinus Persicus" in the ancient Greek literature.

Remarks. *Bellayra persicum* gen. nov., sp. nov. can be distinguished from *B. nishihirai* gen. nov., comb. nov. (type locality: Oura River, Okinawa-Jima Island, Japan) in the following characters: mesogastric region of carapace smooth laterally (Fig. 4a) (*vs.* a line of granules in *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2A; Rahayu and Ng, 2003: fig. 2); hepatic region without row of tubercles (Fig. 4a) (*vs.* single row present in *B. nishihirai*, Fig. 6a; Rahayu and Ng, 2003: fig. 2); posterior margin straight (Fig. 4a, d) (*vs.* weakly concave *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2A; Rahayu and Ng, 2003: figs. 1a, 2); cheliped merus outer surface with tuberculated ridge running parallel to upper margin (Fig. 4a) (*vs.* rows of scattered granules in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2D; Rahayu and Ng, 2003: figs. 2, 3a); palm inner surface with three ridges (Fig. 5a) (*vs.* scattered granules present in *B. nishihirai*, Fig. 6a; Takeda and Nakasone, 1991: fig. 2D; Rahayu and Ng, 2003: figs. 3a); the third maxilliped merus apex is rounded (Fig. 5c) (*vs.* angular in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2C; Rahayu and Ng, 2003: fig. 3i); the inner and outer margin of the third maxilliped merus smooth (Fig. 5c) (*vs.* beaded in *B. nishihirai*, see Takeda and Nakasone, 1991: fig. 2C; Rahayu and Ng, 2003: fig. 3i); the lateral margins of pleonal somites 1 and 2 smooth (Figs. 4d, 5d) (*vs.* beaded in *B. nishihirai*, Fig. 6b; Takeda and Nakasone, 1991: fig. 2E) and the G1 is twisted 2 times (Fig. 5e) (*vs.* not twisted in *B. nishihirai*, see Takeda and Nakasone, 1991: figs. 2F, 2G; Rahayu and Ng, 2003: figs. 3d, 3e).

Bellayra persicum gen. nov., sp. nov. can be distinguished from *B. taekoae* gen. nov., comb. nov. (type locality: Sumiyo, Amami-Oshima Island of Ryukyu Island, Japan) in the following characters: carapace less tuberculated (Fig. 4a) (*vs.* highly tuberculated in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); carapace median line without large tubercles (Fig. 4a) (*vs.* median line with large tubercles in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); intestinal region without tubercles (Fig. 4a) (*vs.* intestinal region covered with numerous tubercles in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); single row of tubercles present on branchial region (Fig. 4a) (*vs.* no row of tubercles present in *B. taekoae*, see Takeda, 1972: fig. 1A; Takeda and Nakasone, 1991: fig. 1D); the third maxilliped merus apex rounded (Fig. 5c) (*vs.* angular in *B. taekoae*, see Takeda, 1972: fig. 1B; Takeda and Nakasone, 1991: fig. 1F); third maxilliped exopod

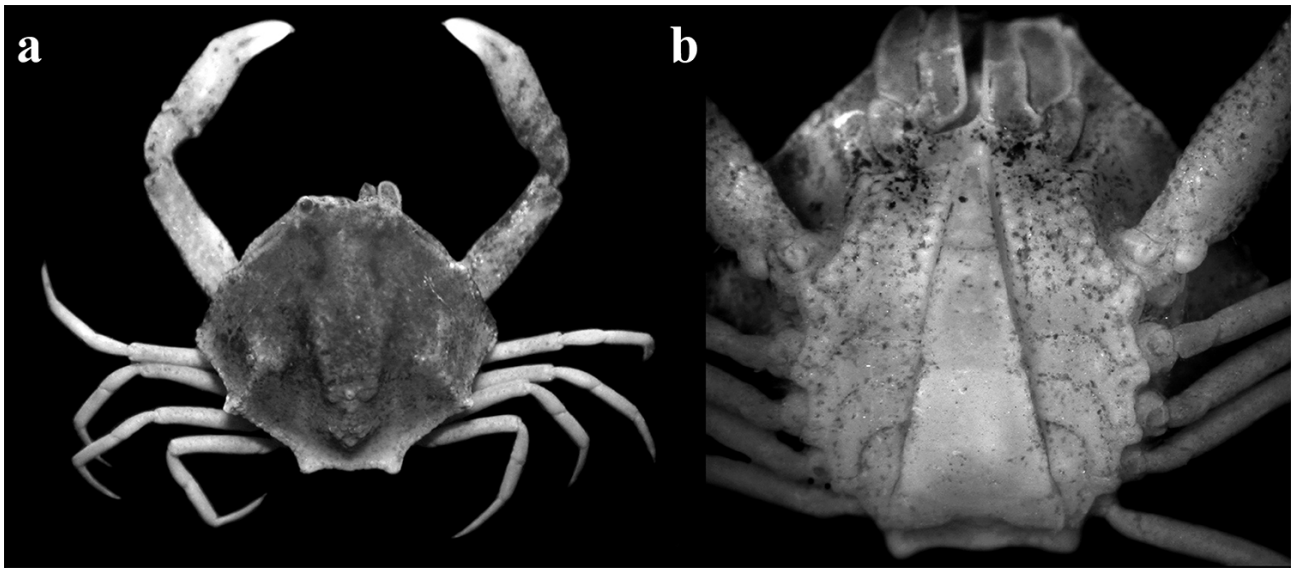

Figure 6. *Bellayra nishihirai* gen. nov., comb. nov., male (CL 5.9 mm, CB 6.3 mm) (ZRC 2002.602). **a**, Habitus, dorsal view; **b**, ventral view.

has the outer border strongly convex (Fig. 5d) (*vs.* gently convex in *B. taekoae*, see Takeda, 1972: fig. 1B; Takeda and Nakasone, 1991: fig. 1F); male pleon has sutures between somites 5 and 6 visible (Figs. 4d, 5d) (*vs.* sutures absent in *B. taekoae*, see Takeda and Nakasone, 1991: fig. 1E); and the G1 is twisted 2 times (Fig. 5e) (*vs.* not twisted in *B. taekoae*, Sakai, 1976: text fig. 63c).

Key to species of the genus Bellayra gen. nov

1. A single row of tubercles on branchial region of carapace absent ..... *B. taekoae* gen. nov., comb. nov.
– A single row of tubercles on branchial region of carapace present 2
2. G1 with main shaft twisted twice ..... *B. persicum* gen. nov., sp. nov.
– G1 with main shaft straight 3
3. G1 long, slender, straight with apical lobe triangular ..... *B. sexangula* gen. nov., comb. nov.
– G1 long, slender, straight with tip twisted ..... *B. nishihirai* gen. nov., comb. nov.

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