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On *Plesionika persica* (Kemp, 1925) and *P. reflexa* Chace, 1985 (Crustacea: Decapoda: Pandalidae) from India

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Abstract

The availability of Indian specimens of *Plesionika persica* (Kemp, 1925) and *P. reflexa* Chace, 1985 provided more information on the taxonomy around these two species. Moreover, it is the first record of *P. persica* to India. Although *P. taiwanica* Chan and Yu, 2000 is superficially rather similar to *P. persica*, there are many differences between them and probably it is inappropriate to establish a species group for these two species. It is likely that all previous records of *P. ensis* (A. Milne-Edwards, 1881) from India actually represent *P. reflexa* Chace, 1985. Nevertheless, the present Indian specimens of *P. reflexa* have more than 10% COI sequence divergence from the topotypic materials of both *P. ensis* and *P. reflexa*, and the epipods at the pereiopods III and IV reduced or absent. This data further highlights the confusing taxonomy in the "*P. ensis*" group.

Key words: *Plesionika*, deep-sea, shrimps, taxonomy, India, first record

Introduction

Deep-sea shrimps of the genus *Plesionika* Bate, 1888 are very diverse, with 93 species known to date (Chan 2016). The taxonomy in many species of this genus is still rather confusing (Chan & Crosnier 1997; Li & Chan 2013). Recently specimens of *P. persica* (Kemp, 1925) and *P. reflexa* Chace, 1985 from India are available for study, with the former species being a new record of India. This work reports the findings after examining the Indian material. *Plesionika persica* differs from most species of the genus in having overlong thread-like posterior pereiopods but that is also a distinctive characteristic of the Taiwanese species *P. taiwanica* Chan & Yu, 2000. A comparison between *P. persica* and *P. taiwanica* is provided. *Plesionika reflexa* belongs to the "*P. ensis* (A. Milne-Edwards, 1881)" group including only two species but with very confusing taxonomy (Chan & Crosnier 1997; Fransen 2006). The characteristics of the Indian *P. reflexa* material are discussed.

The specimens examined are deposited at the Central Marine Fisheries Research Institute, Cochin (CMFRI), at the National Taiwan Ocean University (NTOU) and at the Muséum national d'Histoire naturelle, Paris (MNHN). The measurement given is carapace length (cl) measured dorsally from the postorbital margin to the posterior margin of the carapace. The synonymy provided is restricted to important taxonomic works and Indian reports on the species. For comparing genetic relatedness, partial sequences of mitochondrial cytochrome c oxidase I (COI, 657 bp) gene barcoding data (Hebert *et al.* 2003; Hajibabaei *et al.* 2007) were generated by following the methods given in Yang *et al. (*2010).

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Systematic account

Plesionika persica (Kemp, 1925)

(Fig. 1)

Parapandalus persicus Kemp, 1925: 273, fig. 8. (type locality: Gulf of Oman)
Parapandalus filipes Calman, 1939; 202, fig. 2. (type locality: Gulf of Oman, see Remarks)
Plesionika filipes—Chace 1985: 46.
Plesionika persica—Chace, 1985: 46; Tiefenbacher 1992: 120; Fransen 2006: 73, fig. 21; De Grave & Fransen 2011: 450.

Material examined. India, Kalamuku, Cochin, 250-300 m, April 2017, 1 male cl 11.8 mm, 1 specimen sex undetermined cl 10.5 mm (NTOU); Kerala, Cochin, 250-300 m, April 2017, 4 males cl 10.0–12.0 mm, 5 females cl 10.0–12.0 mm (CMFRI ED.2.4.3.5).

Diagnosis. Rostrum slightly shorter than carapace, curving downwards at basal region, slightly recurved upwards and nearly straight after passing antennular peduncle; with low rostral crest and bearing 6–8 dorsal teeth (including 3 teeth posterior to orbital margin and posteriormost tooth sometimes with incomplete basal suture) restricted to proximal half of rostrum and none with barbed tip; ventral margin armed with 5–7, rarely 3 teeth. Postrostral ridge blunt but strong, extending to about middle of carapace and not highly elevated. Carapace with fainted hepatic and branchial grooves; antennal and pterygostomian spines present and distinct, similar sized; orbital margin with upper part straight and dorsally inclined forwards, lower part slightly convex. Eyes without distinct ocellus. Stylocerite tapered anteriorly and not markedly folded upwards laterally, extending to about middle of second segment of antennular peduncle. Scaphocerite slender, 4.6–4.8 times as long as maximum width, distolateral tooth just exceeding distal margin of lamina, basicerite spine moderately long and just exceeding proximal end of lateral margin of scaphocerite. Maxilliped III and pereiopods all lacking epipods. Pereiopod I overreaching scaphocerite by dactylus and half propodus, propodus about 0.41–0.43 times as long as carpus. Pereiopod II subequal, extending to tip of scaphocerite and bearing 14–20 carpal articles. Posterior 3 pereiopods very long, with pereiopods IV and V even thread like (see Remarks). Abdomen with tergite III without any spine, dorsal ridge or groove; pleuron IV posteroventrally rounded, while pleuron V with posteroventral angle somewhat pointed; somite VI 2.2–2.5 times longer than maximum height; telson as long as somite VI and bearing 3 pairs of dorsolateral spines (excluding pair adjacent to posterior margin of telson).

Distribution. Arabian Sea and Red Sea, mesopelagic, at depths of 0–2500 m (see Tiefenbacher 1992; Fransen 2006).

Remarks. *Plesionika persica* is characterized in having extremely long thread- like pereiopods IV and V. Only three described species in genus *Plesionika* have such overlong posterior pereiopods: *P. persica* (Kemp, 1925), *P. filipes* (Calman, 1939) and *P. taiwanica* Chan & Yu, 2000 (Chan & Yu 2000). *Plesionika persica* and *P. filipes* are very similar (Chace 1985) and have their type localities nearby. Although Calman (1939) mentioned that the holotype of *P. filipes* was collected from the "South Arabian Coast", the exact position of the station (*i.e.*, St. 76B) for the holotype is 24°13'54"–24°16'42'N/59°16'42"E/59°03'30"E–59°06'30"E (see Tiefenbacher 1992), which is actually at the entrance of Gulf of Oman and very near to the type locality of *P. filipes* (23°44'30"N, 58°52'15"E; Kemp 1925). Therefore, these two species are treated as synonyms by Tiefenbacher (1992) and followed in recent works (e.g., Fransen 2006; De Grave & Fransen 2011). *Plesionika taiwanica* is endemic to Taiwan and superficially rather similar to *P. persica* except for having a much longer rostrum that bearing numerous ventral rostral teeth. Nevertheless, detailed comparisons revealed many more differences between these two species. There are strap-like epipods on the maxilliped III and anterior four pereiopods in *P. taiwanica* but all these appendages lack epipods in *P. persica*. In *P. taiwanica*, there is no rostral crest (versus a low rostral crest in *P. persica*) and the upper part of the orbital margin is slightly convex (versus straight in *P. persica*). The stylocerite is obtuse and distinctly folded upwards laterally in *P. taiwanica* but tapered anteriorly and not particularly folded upwards laterally in *P. persica*. Moreover, the lateral carapace is smooth in *P. taiwanica* but bearing fainted hepatic and branchial grooves in *P. persica*. Therefore, more studies are necessary to determine if these two species with overlong pereiopods are really closely related and can be grouped together. For example, the presence or absence of epipods on the maxilliped III and anterior pereiopods have been considered by many workers as of generic importance (see Chace 1985; Holthuis 1993).

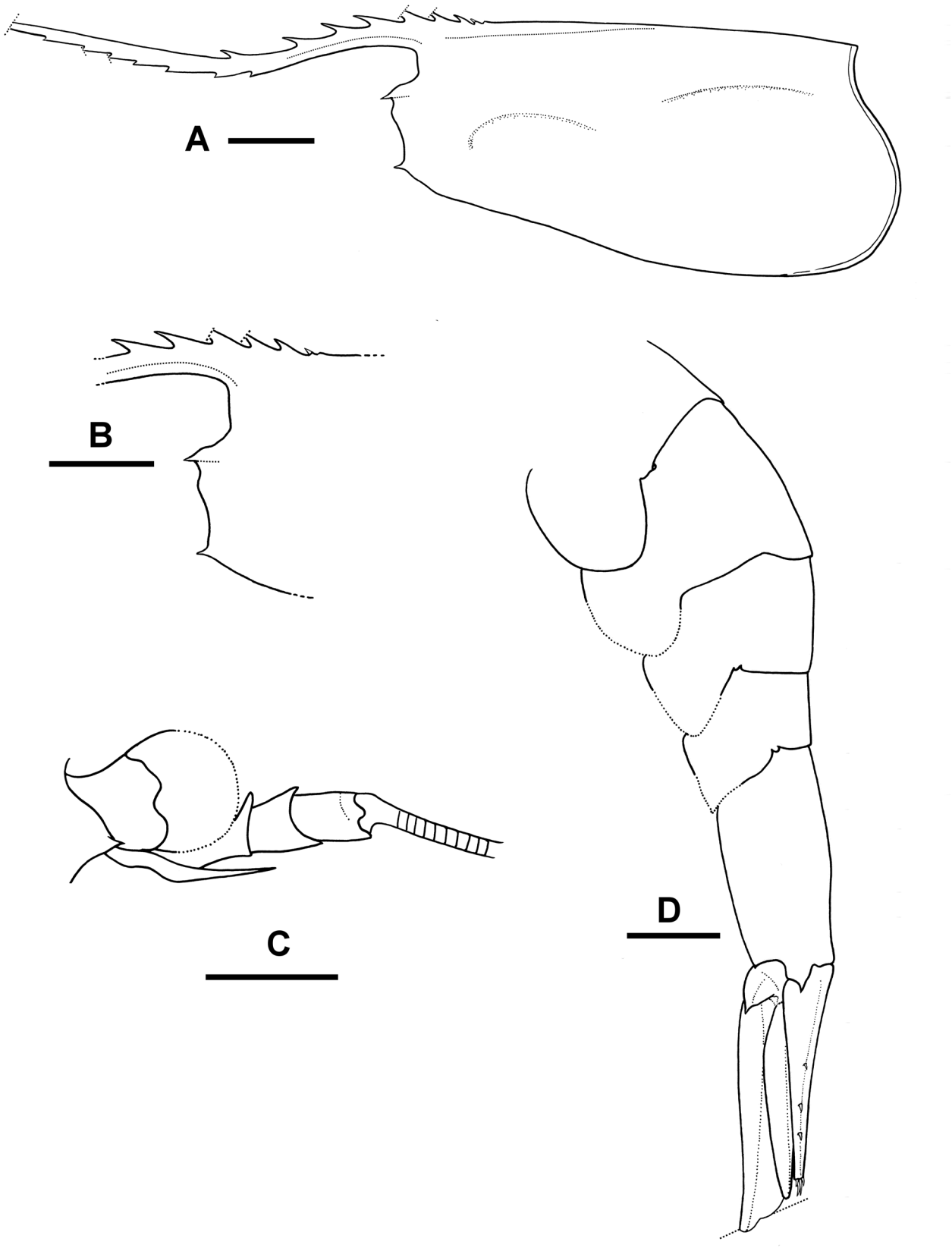

FIGURE 1. *Plesionika persica* (Kemp, 1925), Kalamuku, 250–300 m, sex undetermined cl 10.5 mm (NTOU). A, lateral carapace; B, anterior carapace, lateral; C, right antennular peduncle and stylocerite, lateral; D, abdominal somites II to VI and tail fan, lateral. Scales = 2 mm.

The "Diagnosis" provided above is based on the Indian material except for the posterior three pereiopods that are all missing or very incomplete in the specimens examined. Nevertheless, the present material can still be satisfactorily identified as *P. persica* by the remaining characters especially by the shape of the rostrum (short and with low rostral crest, bearing few teeth on both dorsal and ventral borders and with dorsal teeth restricted to proximal half of rostrum), smooth abdominal tergite III and telson having 3 pairs of dorsolateral spines (see Kemp 1925; Calman 1939; Tiefenbacher 1992; Fransen 2006). Moreover, the male specimen deposited at NTOU has fewer ventral rostral teeth (only three) than other specimens reported for the species.

Plesionika persica is recorded for the first time from India (off the Arabian coast), though this species appears to be rather common in the other parts of the Arabian Sea and the Red Sea (Calman 1939; Tiefenbacher 1992; Fransen 2006). Nevertheless, the coloration of this species is still unknown and with all known material preserved in formalin we are unable to work for genetic sequencing.

***Plesionika reflexa* Chace, 1985**

(Figs. 2, 3)

Pandalus ? ensis—Alcock & Anderson, 1899: 284. (non A. Milne-Edwards, 1881).
Pandalus (Plesionika) ensis—Alcock 1901: 96. (non A. Milne-Edwards, 1881).
Plesionika ensis—Suseelan & Mohamed 1969: 88, fig. 1. (non A. Milne-Edwards, 1881).
Plesionika reflexa Chace, 1985: 108, fig. 49. (type locality: Philippines); Hayashi 1986: 137, fig. 88; Hanamura & Takeda 1987: 116; Kensley *et al.* 1987: 318; Takeda & Hanamura 1994: 23, fig. 10; Chan & Crosnier 1997: 194, figs. 3, 24; Fransen 2006: 77, fig. 23; Li 2006: 1290; De Grave & Fransen 2011: 450.

Material examined. Sakthikulangara fishing port, Kollam district, Kerala, 200–300 m 23 Nov 2015, 1 ovig. female cl 15.0 mm (CMFRI); 250 m, 27 April 2017, 1 male cl 14.3 mm (CMFRI ED.2.4.3.8), 1 male cl 14.6 mm, 1 ovig. female cl 18.9 mm, 1 specimen sex undetermined cl 12.8 mm (NTOU M02081).

Diagnosis. Rostrum long, about 2 times longer than carapace length and far overreaching scaphocerite, slightly curved downwards at basal part but slightly recurved upwards and nearly straight after passing middle of antennular peduncle; dorsal margin armed with 6 teeth at basal part as well as 1 subapical tooth, none with barbed tip, basal teeth restricted behind distal end of antennular peduncle and not forming crest, with 2–3 of them posterior to orbital margin and posterior 2–4 teeth bearing incomplete basal suture; ventral margin with 40–43 teeth. Postrostral ridge distinct but blunt, extending to about middle of carapace and not highly elevated. Carapace only with short, fainted hepatic grooves; antennal and pterygostomian spines similar and moderately large; orbital margin with upper part nearly vertically convex, lower part also convex. Eye with distinct ocellus. Stylocerite obtuse but distally pointed, laterally slightly folded upwards, just overreaching basal segment of antennular peduncle. Scaphocerite slender, 4.6–5.0 times as long as maximum width, with distolateral tooth just exceeding distal margin of lamina, basicerite spine long and markedly overreaching proximal end of lateral margin of scaphocerite. Maxilliped III bearing well developed epipods, penultimate segment slightly shorter than terminal segment. Only anterior 3 pereiopods with epipods, those at pereiopods I and II well developed, epipod at pereiopod III small and delicate. Pereiopod II subequal and bearing 15–19 carpal articles. Pereiopod III exceeding scaphocerite by length of dactylus and a short portion of propodus, dactylus 0.41–0.47 times as long as propodus, accessory distal spine minute and little separated from base of terminal spine. Abdomen with tergite III bearing well-developed poteromesial spine, which more or less recurved upwards; pleuron IV posteroventrally rounded while pleuron V bearing distinct posteroventral denticle; somite VI 2.5–2.9 times longer than maximum height; telson 0.8 times as long as somite VI and bearing 3 pairs of dorsolateral spines (excluding pair adjacent to posterior margin of telson).

Distribution. Widely distributed in the Indo-West Pacific from Gulf of Aden to Japan and French Polynesia, at depths of 191–910 m.

Remarks. The "Diagnosis" given above was based on the present four Indian specimens; with only one of them (male cl 14. 8 mm) having intact rostrum and another one (male cl 14.3 mm) without any complete pereiopod III. *Plesionka reflexa* belongs to the "*P. ensis*" group, which currently includes only two recognized species (Chan & Crosnier 1997). Species of the "*P. ensis*" group are very characteristic in having a distinct posteromesial spine on the abdominal tergite III, rostrum long but with only a few dorsal teeth restricted to base and bearing numerous

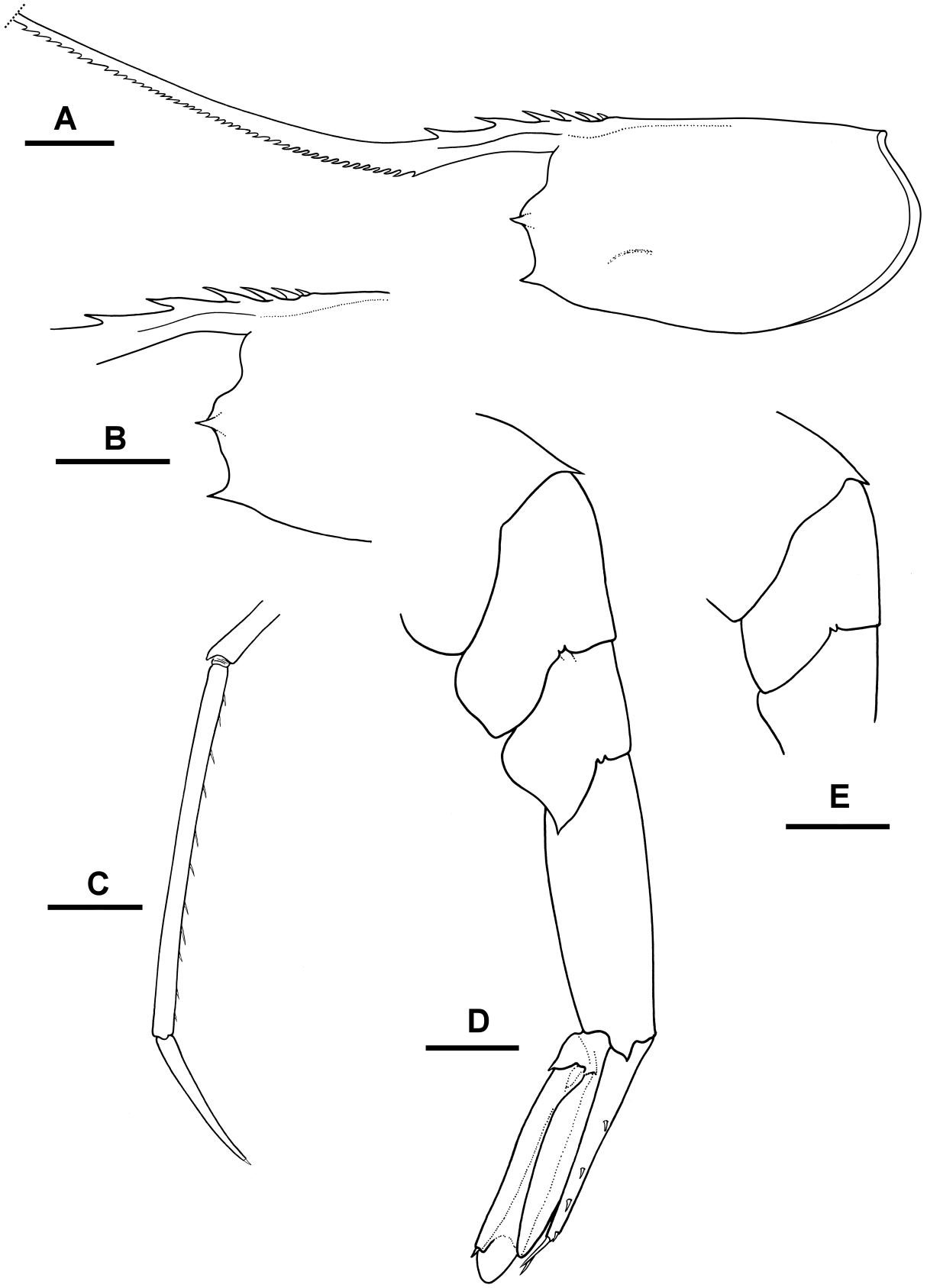

FIGURE 2. *Plesionika reflexa* Chace, 1985, Sakthikuylangara fishing port, 250 m, A–D, ovig. female cl 18.9 mm, E, male cl 14.6 mm (NTOU M02081). A, lateral carapace; B, anterior carapace, lateral; C, propodus and dactylus of left pereiopod III, lateral; D, abdominal somites III to VI and tail fan, lateral; E, abdominal somites III to V, lateral. Scales: A, B, D, E = 5 mm; C = 2 mm.

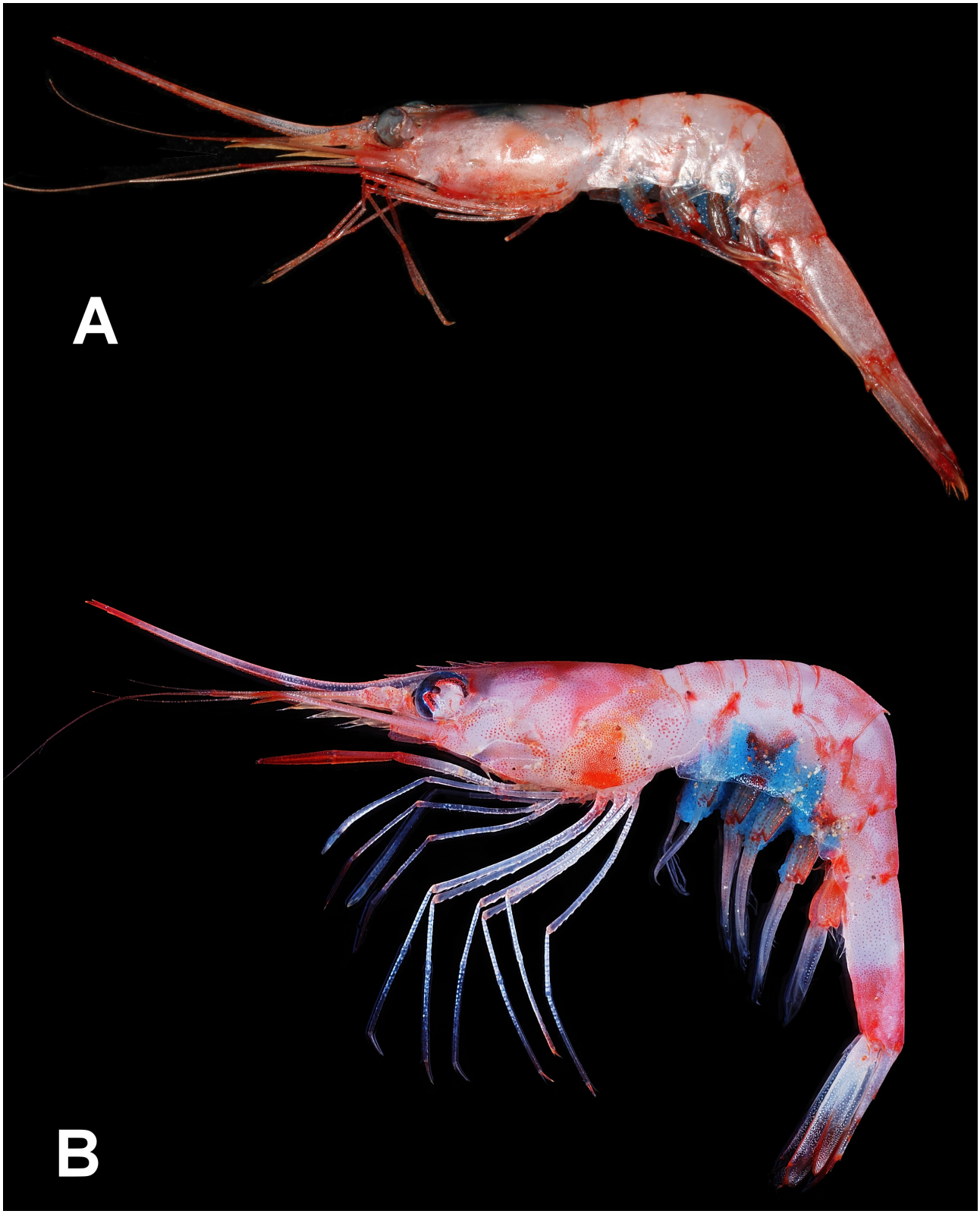

FIGURE 3. A, *Plesionika ensis* (A. Milne-Edwards, 1881), Guadeloupe, KARUBENTHOS 2015 stn DW 4609, MNHN IU-2013-19054; B, *P. reflexa* Chace, 1985, the Philippines, AURORA stn CP2695, NTOU M02080**.**

ventral teeth, posterior pereiopods rather robust and not particularly long. The two species in this group are assumed to have discrete distribution, with *P. ensis* occurring in the Atlantic while *P. reflexa* is distributed in the Indo-West Pacific. The two species differ only in *P. ensis* having the posteromesial spine on the abdominal somite III straight and the pereiopod III with shorter dactylus. On the other hand, *P. reflexa* has the abdominal somite III

posteromesial spine more or less recurved upwards and longer dactylus at the pereiopod III (see Chace 1985). However, as noticed by many workers (see Hanamura & Takeda 1987; Chan & Crosnier 1997; Fransen 2006), Indo-West Pacific material of this group has large variations in the curvature of the abdominal posteromesial spine from very straight to distinctly recurved though this spine is always straight in Atlantic specimens. The proportional length of the dactylus of the pereiopod III is also highly variable (from 0.09 to 0.46 as long as propodus) at various localities in both the Atlantic and Indo-West Pacific (see Chace 1985; Chan & Crosnier 1997; Fransen 2006). Nevertheless, the pereiopod III dactylus is shorter (0.11–0.25 as long as propodus) in the topotypic material of *P. ensis* in the western Atlantic (type locality: near Barbados) but longer (0.30–0.46 as long as propodus) in the topotypic material of *P. reflexa* in the Philippines. The present Indian specimens have the abdominal posteromesial spine from nearly straight (Fig. 2E) to distinctly recurved (Fig. 2D), and even slightly longer pereiopod III dactylus (Fig. 2C, 0.41–0.47 as long as propodus).

As discussed in Chan & Crosnier (1997), the large variations in the curvature of the abdominal posteromesial spine, length of pereiopod III dactylus and rostrum in the material of *P. ensis* and *P. reflexa* may indicate that there are actually many more species in the "*P. ensis*" group similar to the situation in the "*P. martia* (A. Milne-Edwards, 1883)" and "*P. narval* (Fabricius, 1787)" groups (Chace 1985; Chan & Crosnier 1991). The present Indian material further differs in the epipods at the pereiopods III and IV more reduced or even absent. The present specimens have the epipods of the pereiopods III half the size of those at preceding pereiopods and rather delicate. Moreover, the epipod is completely absent at the pereiopod IV in all specimens. The presence or absence of epipods at the pereiopods has often been considered as of specific value in *Plesionika* (Chace 1985; Li & Komai 2003). Fransen (2006) also reported that *P. reflexa* material in the western Arabian Sea and Burma from northern Indian Ocean differs from the typical form in having the epipods at the pereiopods III and IV reduced though a minute epipod is still present at the pereiopod IV. However, Suseelan & Mohamed (1968) mentioned that their SW Indian specimens carry well developed epipods at the anterior four pereiopods, and their fig. 1a showed that the dactylus of pereiopod III is about one fifth as long as the propodus. Genetic comparisons of the present Indian specimens (2 males, 1 ovig. female, CMFRI ED.2.4.3.8, NTOU M02081; GenBank nos. MG729438-729440) with topotypic material of *P. ensis* (Fig. 3A from the Lesser Antilles: Guadeloupe, KARUBENTHOS 2015 stn DW 4609, MNHN IU-2013-19054, GenBank no. MG729442, Poupin & Corbari 2016: fig. 6e, versus type locality Barbados) and *P. reflexa* (Fig. 3B from the Philippines: eastern Luzon, AURORA stn CP2695, NTOU M02080, GenBank no. MG729441, versus type locality S.E. Luzon) showed that there are high divergence in the barcoding gene COI amongst the specimens from different localities (9.3%, 10.3–10.7%, 14.2–14.5% divergences between material from Lesser Antilles/Philippines, Philippines/India and Lesser Antilles/India, respectively). However, there are only 0.0–0.3% genetic divergence amongst the Indian material including those with the abdominal posteromesial spine variably recurved (Fig. 2D, E). The high genetic difference of the Indian form from topotypic material of both *P. ensis* and *P. reflexa*, and the reduction or absence of epipods at the pereiopod III and IV may urge the separation of the Indian form as another species. As pointed out by Chakraborty *et al.* (2015), however, species delimitation using COI data alone is still rather controversial for *Plesionika*. For example, the COI sequence divergences amongst seven *Plesionika* species from Northeast Atlantic and Mediterranean ranged from 2.5% to 18.3% (Matzen da Saliva *et al.* 2013) while that of *P. quasigrandis* Chace, 1985 materials from India and the Philippines can be as high as 5.8–8.4% (Chakraborty *et al*. 2015). In views that *P. ensis*/*reflexa* have a very wide geographical range with highly variable morphological characters (Chan & Crosnier 1997; Fransen 2006) but no coloration difference (Fig. 3A, B as compared to Kuberan *et al.* in press: fig. 1 and the color description of the Indian material provided by Suseelan & Mohamed 1968); and the recent finding of the development of the pereiopodal epipods can be rather variable in certain species of *Plesionika* (see Chan 2016), it may be more appropriate to erect further new species in the "*P. ensis*" group after a full revision on the group. For example, the recent review by Ahamed *et al.* (2017: tables 1, 2 and key) on Asian species of *Plesionika* included both *P. ensis* and *P. reflexa*. However, *P. ensis* was omitted in their systemic account. It is likely that all previous reports of *P. ensis* from India (e.g. Alcock & Anderson, 1899; Alcock, 1901; George 1966; Suseelan & Mohamed 1968; Suseelan 1974; Kurup *et al.* 2008; Rajool Shanis *et al*. 2012; Radhakrishnan *et al*. 2012; Samuel *et al.* 2016) represented the present form. Examination of more specimens from India, as well as the other parts of the Indian Ocean, will be necessary to fully understand the development of pereiopodal epipods and the variations in the length of the dactyli of the posterior pereiopods in the Indian Ocean material.

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