

A New Amphipod Species of the Genus *Cheiriphotis* (Amphipoda, Senticaudata) from Pulau Langkawi, Straits of Malacca, Malaysia with Notes on the Distribution of the Genus

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ABSTRACT. – A new species, *Cheiriphotis selat* n. sp., was described based on specimens collected from coral rubbles found at Kuah Beach, Pulau Langkawi, Malaysia. The newly discovered amphipod species can be distinguished from its closest relative by its smaller eyes; the basis of male gnathopod 2 is anterodistally notched; a distinctly longer peduncle than the ramus of uropod 3; the inner lobe of the maxilliped does not reach the apex of palp article 1; a shallower projection on the posteroventral of epimeron 3. An identification key for the 17 known species in the genus was updated.

KEYWORDS: Amphipoda, new species, *Cheiriphotis selat*, Langkawi, Malaysia

INTRODUCTION

Over the past decade, there has been a significant emphasis on studying the amphipod community along the east coast of Peninsular Malaysia, resulting in the discovery of numerous new amphipod species, as documented in various scientific publications (Othman and Azman, 2007; Lim et al., 2010; Azman and Melvin, 2011; Lim et al., 2012; Azman and Othman, 2013 and Lim et al., 2017; 2019). Given the current gaps in knowledge and comprehension of marine amphipods in this region, it is imperative to continue the diligent effort of documenting and recording the presence of amphipod species in Southeast Asia and the adjoining waters.

The island of Langkawi (Pulau Langkawi) is situated off the northwest coast of peninsular Malaysia in the northern Straits of Malacca; 6°20'N and 99°45'E (The Times Atlas of the World, 1992). The Malacca Strait, for example, has proved to be an ideal locality for collecting amphipods, primarily due to a vast array of sedimentary habitats, sandy or mud flats, seagrass beds, patchy coral reefs and, most notably, an extensive mangrove area. The coastline is slightly longer than the east coast, measuring a total length of 1,100 km (Abdullah, 1992). The depth of the strait increases from 30 m at its most narrow part in the south to over 100 m towards the north adjoining the Andaman Sea (Wyrki, 1961). This geographical feature serves as a convenient natural laboratory, providing researchers with exceptional opportunities to study various organisms. However, there have been recorded only a total of six amphipod species from the Strait of Malacca (Othman & Morino, 2006; Azman & Othman, 2012; Tomikawa et al., 2018; Azman, 2021;

Azman et al., 2022; Azman, 2023). A species of *Cheiriphotis* Walker, 1904 is distinguishable from other species of Protomedeinae by their characteristics: the large male gnathopod 2, strongly setose pereopods 5–7, and uropod 3 with inner ramus much reduced or absent (Souza-Filho et al., 2012). A genus is established with the type species *Cheiriphotis megacheles* (Giles, 1885) from the Bay of Bengal and currently comprises 16 species. This study describes a new species of the genus *Cheiriphotis* from coral rubbles. A comprehensive morphological comparison is conducted between this newfound species and other known species from the genus. The findings shed light on the distinct characteristics of this species and contribute to our understanding of its taxonomic classification.

MATERIALS AND METHODS

The crustaceans were collected by washing coral rubbles at Kuah Beach, Pulau Langkawi (6°18'34"N 99°54'2"E) in August 1994 (Fig. 1). The coral rubbles were collected manually and then placed into a bucket filled with seawater. The alcohol solution was subsequently added into the bucket and allowed to stand for approximately 30–45 min. Subsequently, the samples underwent a thorough rinsing and were washed using seawater that passed through a 300 µm sieve. During fieldwork, the samples were initially treated with a solution containing approximately 10% formalin in seawater. Subsequently, they were transferred to a storage container containing 70% ethanol solution. The appendages were dissected from the right side of the specimens and preserved in several semi-permanent slides mounted in glycerol. They were then meticulously examined under an optical

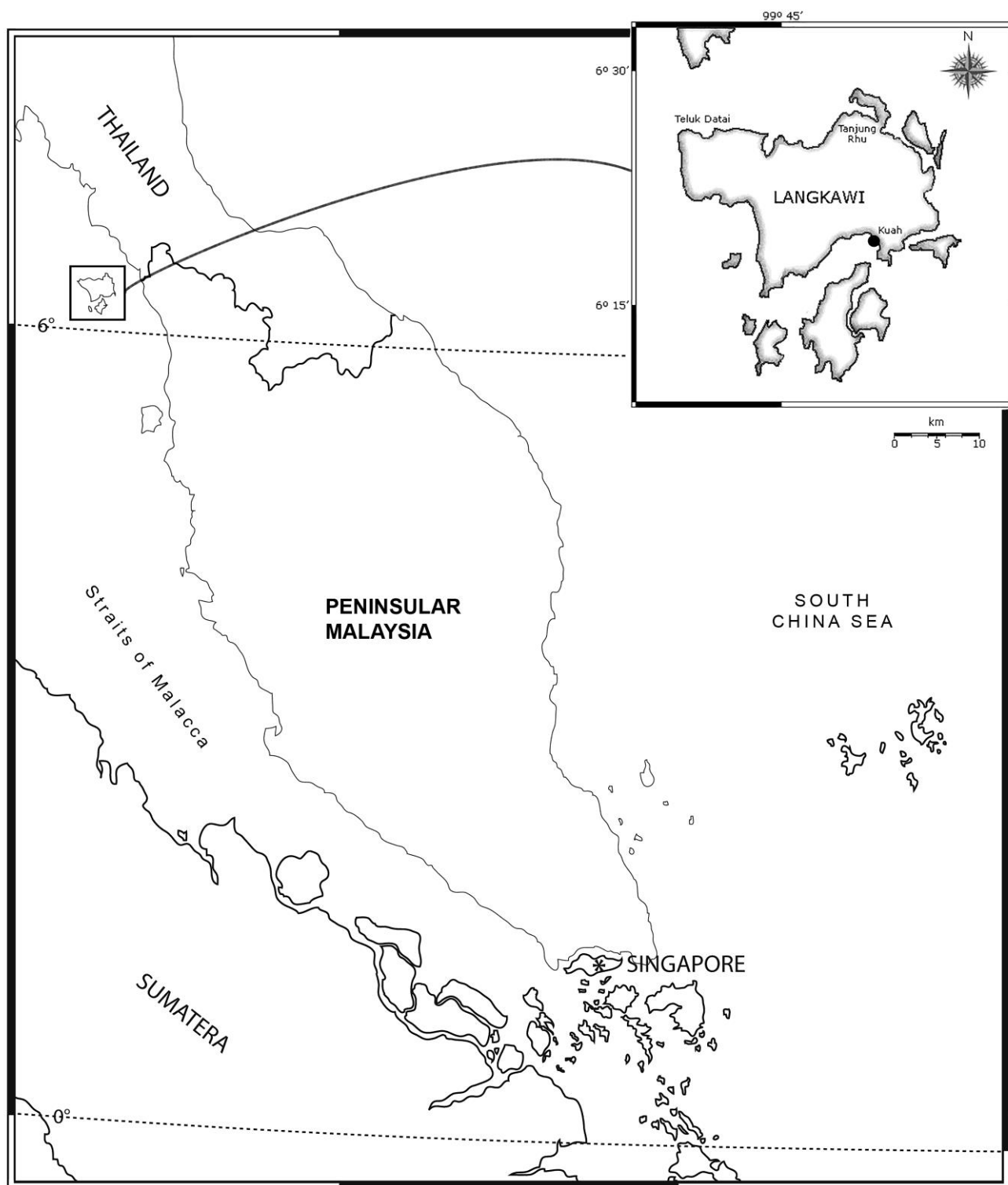


FIGURE 1. Map of Peninsular Malaysia with sampling site on Pulau Langkawi.

microscope (Olympus BX43) and a stereomicroscope equipped with a *camera lucida*. The drawings were digitised employing Adobe Illustrator CS3, following the methods described in Coleman (2003).

The materials described in this study were housed in the collections of the Universiti Kebangsaan Malaysia Muzium Zoologi, Bangi, Malaysia (UKMMZ) and the

Australian Museum, Sydney (AM). Setae definitions were based on Watling (1989). The following abbreviations were used on the plates: A, antenna; ABD, abdomen; G, gnathopod; HD, head; LL, lower lip; UL, lower lip; MD, mandible; MP, maxilliped; MX, maxilla; P, pereopod; T, telson; U, uropod; l, left; r, right.

RESULTS

Systematics

Order Amphipoda Latreille, 1816

Suborder Senticaudata

Family Corophiidae Leach, 1814

Subfamily Protomeideinae Myers & Lowry, 2003

Genus *Cheiriphotis* Walker, 1904

Type species.— *Melita megacheles* Giles, 1885 by monotypy.

Diagnosis.— See Barnard and Karaman (1991) and Wongkamhaeng et al. (2012).

Species composition.— *Cheiriphotis* contains 17 species (including the new species): *Cheiriphotis australiae* Stebbing, 1910; *C. delloyei* Pirlot, 1934; *C. durbanensis* K.H. Barnard, 1916; *C. erythraeus* Ruffo, 1969; *C. geniculata* (K.H. Barnard, 1935); *C. madagascarensis* Ledoyer, 1979; *C. mediterranea* Myers, 1983; *C. megacheles* (Giles, 1885); *C. minima* Ledoyer, 1982; *C. neotropicalis* Valerio-Berardo, 2007; *C. pediformis* Myers, 1995; *C. petronioni* Souza-Filho, Souza & Valério-Berardo, 2012; *C. rotui* Myers, 1989; *C. selat* n. sp.; *C. trifurcata* Wongkamhaeng, Azman & Puttapreecha, 2012; *C. walkerii* Stebbing, 1918; *C. williamsoni* Salman & Jabbar, 1990.

Cheiriphotis selat n. sp.

(Figs 2–4)

Type material.— Holotype, female, body length 2.8 mm, Island Resort, Kuah, Pulau Langkawi (6°18'34"N 99°54'2"E), washing coral rubbles, Azman, B.A.R. & Zuhaimi, S.; 26 May 1995, (UKMMZ-1203). Allotype, male, body length 7.6 mm, same data as holotype, (UKMMZ-1204). Paratypes, 2 males and 2 females, same data as holotype, (Australian Museum- P.72703).

Additional material examined.— 18 males, 30 females and juveniles, LNK-2, washing coral rubbles, Island Resort, Kuah, Pulau Langkawi (6°18'34"N 99°54'2"E), S. Nanni, 12 August 1994. At intertidal zone.

Type locality.— Island Resort, Kuah, Pulau Langkawi (6°18'34"N 99°54'2"E).

Etymology.— From the Malay word for 'strait' referring to the indigenous distribution of this species within the Straits of Malacca, formed as a noun in apposition.

Diagnosis.— Head with lateral cephalic lobe subacute, eyes small. Coxa 1 subtriangular and anteriorly

rounded. Gnathopod 1 basis posteriorly convex, carpus longer than propodus and setiferous, palm oblique, dactylus falcate. Coxa 2 anteroventrally rounded. Gnathopod 2, propodus stout, longer than wide, setiferous; palm oblique with one robust seta on medial margin, anterior margin with a row of plumose setae and long simple setae; dactylus falcate extending well beyond palm. Male gnathopod 2 basis with anterodistal notch, palm oblique, with three strong acute processes at inner margin, palmar corner defined by a strong spine. Uropod 3, uniramus, peduncle broad with subapical marginal robust setae, ramus shorter than peduncle with several inner marginal robust setae and one apically. Telson about twice as wide as long, with 2 groups of 3 subapical setae and 2 lateral setae on each side.

Description.— Based on female holotype, 2.8 mm.

Head, lateral cephalic lobe subacute, eyes small. **Antenna 1** longer than antenna 2; peduncle longer than flagellum, article 1 as long as article 3; article 2 longer than article 3; accessory flagellum 3-articulate; flagellum 8-articulate. **Antenna 2** peduncle longer than flagellum; peduncle article 3 as long as article 4; flagellum 7-articulate. **Upper lip**, broad, slightly concave apically. **Lower lip**, inner lobes small. **Mandible**, incisor with 4 teeth; **lacinia mobilis** with 4 teeth; palp article 1 with few inner marginal setae, article 2 truncate apically, article 3 5/6 length of article 2. **Maxilla 1**, inner lobe small with one apical seta; outer lobe reaching about 2/3 of palp, with about 8 strong tooth spines; palp, second article expanded distally with several strong spines. **Maxilla 2**, outer plate slightly longer than inner plate. **Maxilliped**, inner lobe not reaching apex of 1st palp article; outer lobe reaching about 2/3 length of article 2; palp 4-articulate, dactylus bearing unguis.

Gnathopod 1, coxa subtriangular and anteriorly rounded; basis posteriorly convex; ischium and merus about the same length; carpus longer than propodus, setiferous; propodus slight expanded ventrally, palm oblique; dactylus falcate. **Gnathopod 2**, coxa anteroventrally rounded; basis stout, anterior and posterior margins slightly concave; ischium and merus subequal in length; carpus subtriangular, longer than wide; propodus stout, longer than wide, setiferous; palm oblique with one robust seta on medial margin, anterior margin with a row of plumose setae and long simple setae; dactylus falcate extending well beyond palm. **Pereopod 3**, coxa with posterior protuberance; basis slightly broader posterodistally; ischium subquadrate; merus with slight expansion anterodistally; carpus shorter than propodus; propodus narrow; dactylus about 2/3 length of propodus, falcate.



FIGURE 2. *Cheiriphotis selat* n. sp., holotype, female, (UKMMZ-1203), 2.8 mm. Island Resort, Kuah, Pulau Langkawi. Scales for G1 ♀ and G2 ♀ represent 0.2 mm, remaining represent 0.5 mm.

Pereopod 4, coxa with posterior protuberance; basis to dactylus similar to pereopod 3. *Pereopod 5*, coxa bilobed; basis wide, equal in length to following three articles combined; ischium, merus and carpus heavily setose; propodus longer than carpus; dactylus falcate. *Pereopod 6*, coxa bilobed; basis expanded but narrower

than pereopod 5, heavily setose on anterior and posterior margin; ischium and merus heavily setose; propodus longer than carpus; dactylus falcate. *Pereopod 7*, coxa small; basis setose and expanded; ischium, merus, carpus, propodus and dactylus similar to pereopod 6.

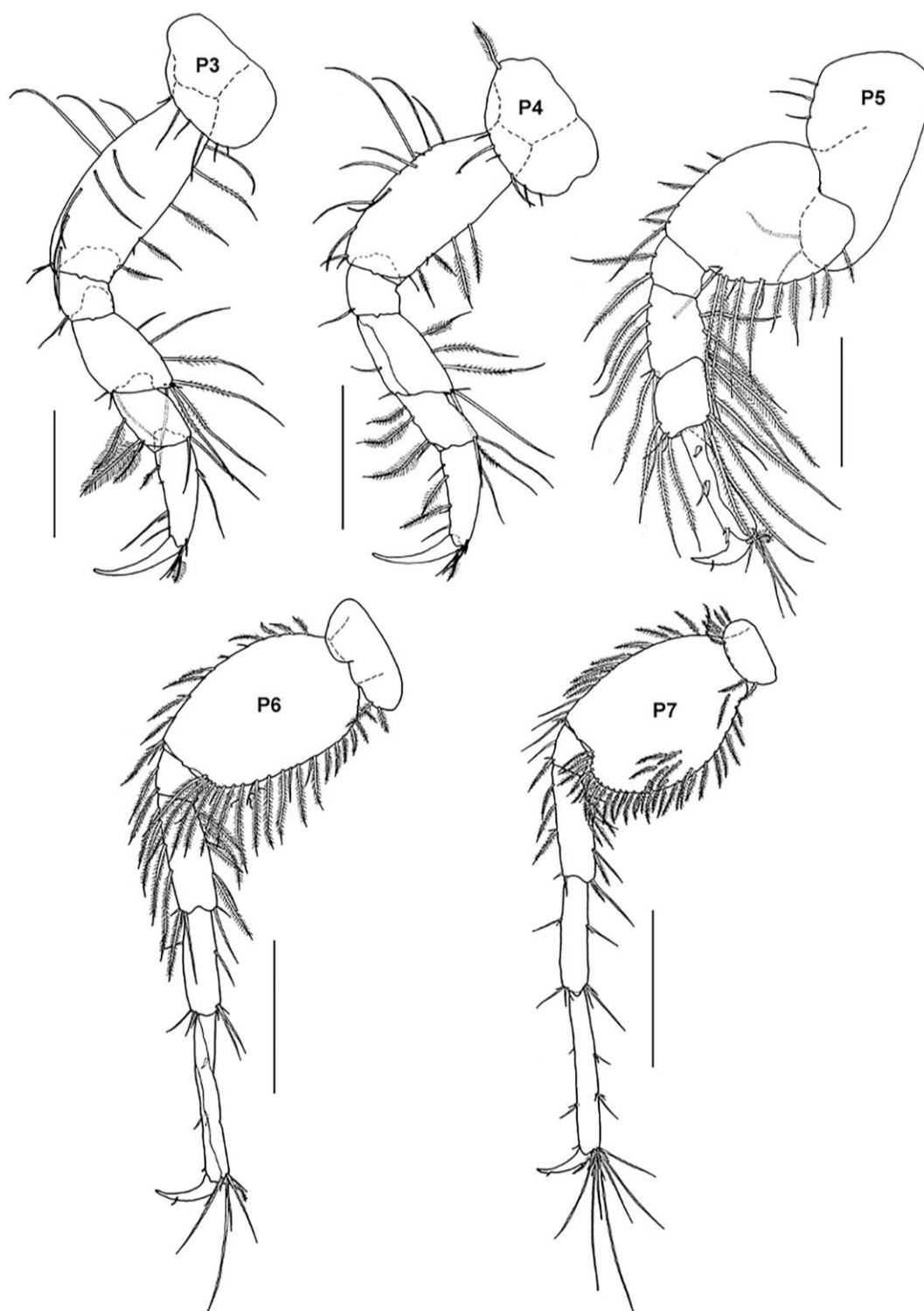


FIGURE 3. *Cheiriphotis selat* n. sp., holotype, female, (UKMMZ-1203), 2.8 mm. Island Resort, Kuah, Pulau Langkawi. Scale for P5 represents 0.2 mm, remaining represent 0.25 mm.

Uropod 1, extending well beyond apex of uropods 2–3; peduncle longer than rami, with several dorsal robust setae; rami subequal, both with robust setae along margin. *Uropod 2*, peduncle subequal in length to rami with slight elevation between rami; rami subequal in length with robust setae medially and

apically. *Uropod 3*, uniramus, peduncle broad with subapical marginal robust setae; ramus shorter than peduncle with several inner marginal robust setae and one apically. *Telson*, about twice as wide as long, with 2 groups of 3 subapical setae and 2 lateral setae on each side.

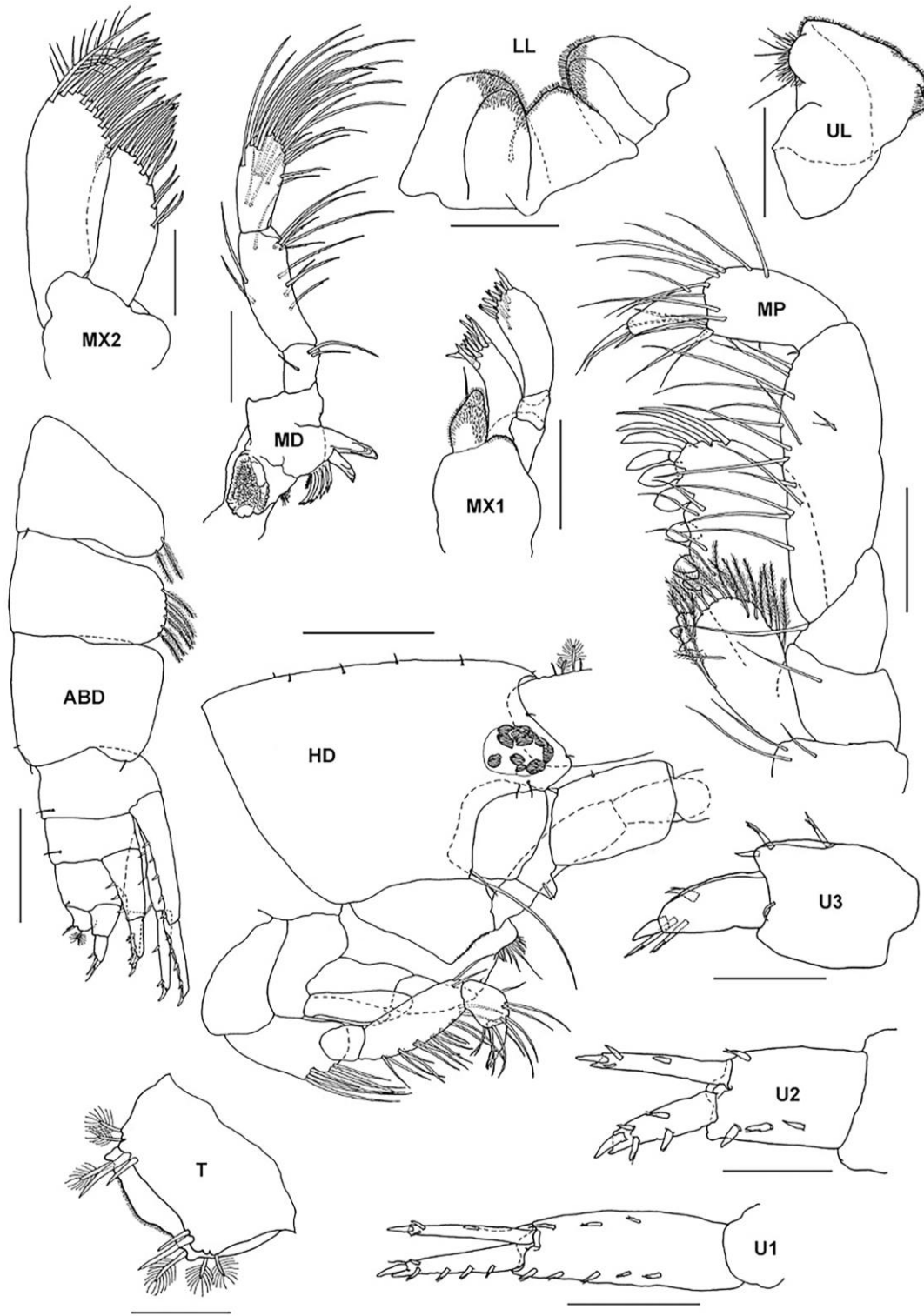


FIGURE 4. *Cheiriphotis selat* n. sp., holotype, female, (UKMMZ-1203), 2.8 mm. Island Resort, Kuah, Pulau Langkawi. Scale MX2 represents 0.05 mm; U1 represents 0.2 mm; ABD and HD represent 0.5 mm, remaining represents 0.1 mm.

Male 7.6 mm. (sexually dimorphic characters).—

Gnathopod 1, coxa subtriangular, anteroventrally acute; basis broader distally, anterior margin naked; ischium and merus about the same length; carpus slightly longer than propodus; propodus, palm oblique; dactylus falcate, slightly longer than palm. *Gnathopod 2*, coxa subquadrate; basis stout, anterodistal with

small excavation, posterior margin concave; ischium subquadrate; merus subtriangular; carpus completely fused with propodus; propodus stout, longer than wide; palm oblique, anterior margin with a row of plumose and simple setae with three strong acute processes at inner margin, palmar corner defined by a strong spine; dactylus falcate extending well beyond palm.

World key to species of *Cheiriphotis*

- 1 Uropod 3 uniramus..... 2
- Uropod 3 biramus or with short inner ramus..... 10
- 2 Antenna 1 accessory flagellum with 2 articles..... *C. minima* Ledoyer, 1982
- Antenna 1 accessory flagellum with more than 2 articles..... 3
- 3 Male gnathopod 2 carpus vestigial, partly fused with propodus..... 4
- Male gnathopod 2 carpus not fused with propodus 9
- 4 Male gnathopod 1 palm excavate..... *C. neotropicalis* Valério-Berardo, Souza and Rodrigues, 2007
- Male gnathopod 1 palm not excavate..... 5
- 5 Male gnathopod 1 carpus shorter than propodus..... *C. williamsoni* Salman & Jabbar, 1990
- Male gnathopod 1 capus longer than propodus..... 6
- 6 Epimeron 2 without plumose setae on ventral margin..... *C. walkeri* Stebbing, 1918
- Epimeron 2 with plumose setae on ventral margin..... 7
- 7 Male outer ramus of pleopod 3 tip modified into fork shape..... *C. trifurcata* Wongkamhaeng et al., 2012
- Male outer ramus of pleopod 3 not modified..... 8
- 8 Male gnathopod 2 basis without anterodistal excavation..... *C. mediterranea* Myers, 1983
- Male gnathopod 2 basis with anterodistal excavation..... ***C. selat* n. sp.**
- 9 Epimeron 2 with 2 notches on distoinferior corner..... *C. pediformis* Myers, 1995
- Epimeron 2 round on distoinferior corner..... *C. madagascarensis* Ledoyer, 1979
- 10 Head ventral margin excavated accommodating peduncular articles of antenna 2.....
- *C. rotui* Myers, 1989
- Head not as above 11
- 11 Male gnathopod 2 carpus completely fused with propodus.....*C. megacheles* (Giles, 1885)
- Male gnathopod 2 carpus short but not fused with propodus..... 12
- 12 Male gnathopod palm transverse..... *C. erythraeus* Ruffo, 1969
- Male gnathopod 2 palm oblique or acute..... 13
- 13 Male gnathopod 2 palm with a great excavation and with a strong projection defining posteroventral corner...
- 14
- Male gnathopod 2 palm without a great excavation..... 15
- 14 Male gnathopod 1 carpus slightly longer than propodus, dactylus overlapping.....
- *C. australiae* Stebbing, 1910
- Male gnathopod 1 carpus distinctly longer than propodus, dactylus not overlapping palm.....
- *C. geniculata* (K.H. Barnard, 1935)
- 15 Male gnathopod 2 palm occupying most of posterior margin of propodus.....
- *C. petronioi* Souza-Filho, Souza & Valério-Berardo, 2012
- Male gnathopod 2 palm not occupying most of posterior margin of propodus..... 16
- 16 Uropod 1 with a strong ventromedial robust seta..... *C. delloyei* Pirlot, 1934
- Uropod 1 without ventromedial robust seta..... *C. durbanensis* K.H. Barnard, 1916

Remarks.— The new species bears a striking resemblance to *C. megacheles* (Giles, 1855) in terms of general appearance which has been found in the Indian Ocean (Rabindranath 1971), Arabian Gulf (Salman & Jabbar 1990), South China Sea (Imbach, 1967) and the waters of California (J.L., Barnard 1958). The palmar

structure of male gnathopod 2 exhibits an apparent resemblance, characterised by irregular lobes and defined by a subacute process. The findings of Rabindranath (1971) regarding *C. megacheles* in the Indian Ocean exhibited similarity to the study conducted by Salman & Jabbar (1990) in the Arabian

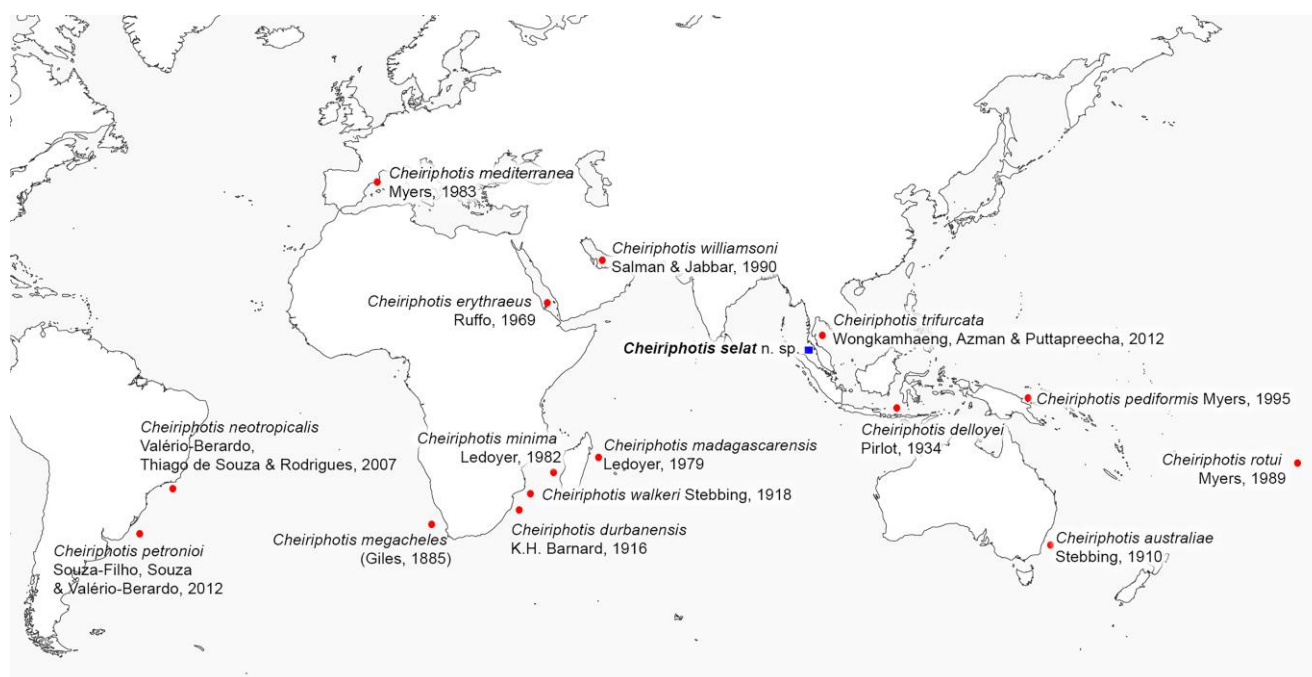


FIGURE 5. Distribution map of the genus *Cheiriphotis*. The figure summarizes locality data from the literature and records from WoRMS website.

Gulf. Both studies noted the presence of a blunt tooth and a wider palm in this species. Conversely, the specimens from the South China Sea illustrated by Imbach (1967) and California by J.L., Barnard (1958) exhibited the same palm shape, with three-pointed spine teeth, resembling *C. setat* n. sp. Nevertheless, some distinct characteristics observed in the present material, including 1) smaller eyes; 2) basis of male gnathopod 2 anterodistally notched; 3) distinctly longer peduncle than ramus of uropod 3; 4) inner lobe of maxilliped that does not reach apex of palp article 1, and 5) shallower projection on the posteroventral of epimeron 3, distinguish the present material from all known species of *Cheiriphotis*.

Geographic distribution of the genus *Cheiriphotis*

Species of *Cheiriphotis* are commonly found in tropical and southern temperate waters (Fig. 5). Only five species, namely *C. mediterranea* from the Mediterranean Sea (Myers, 1983), *C. williamsoni* from Northwest Arabian Gulf (Salman & Jabbar, 1990), *C. erythraeus* from the Red Sea (Ruffo, 1969), *C. trifurcata* from the Gulf of Thailand (Wongkamhaeng, Azman & Puttapreecha, 2012) and the new species *C. setat* from the Malacca Strait are found the Northern Hemisphere. In contrast, the Southern Hemisphere is home to eleven species, primarily found in the Indian Ocean and the Atlantic Ocean. Twelve species (i.e., *C. australiae*, *C. delloyei*, *C. erythraeus*, *C. geniculata*, *C.*

madagascarensis, *C. minima*, *C. neotropicalis*, *C. pediformis*, *C. rotui*, *C. trifurcata*, *C. walker*, and *C. williamsoni*) are known to be restricted to their type locality and surrounding areas.

Cheiriphotis mediterranea and *C. petronioi* have been observed to be commonly found in the Mediterranean Sea and the southwestern Atlantic Ocean, respectively. *Cheiriphotis durbanensis*, on the other hand, has been discovered to inhabit a range extending from the South Atlantic Ocean to Madagascar (Indian Ocean). *Cheiriphotis megacheles*, to date, is the species with the broadest longitudinal range (45°W–90°E), stretching from waters off Brazilian coasts to the Andaman Sea. Nevertheless, considering the frequent misidentification of some amphipod species labelled as ‘cosmopolitan’ (e.g. *Stenothoe gallensis*, *Melita appendiculata*), the extensively reported *C. megacheles* found in various locations may potentially be unrecognised new species.

Further studies in the Southeast Asian region, especially in Malaysian waters, may provide additional insights into the biogeographical history of *Cheiriphotis* in the tropical areas. Understanding the current distribution and connectivity of habitats is crucial in determining species diversity and diversification. Sporadic distribution may lead to species divergence; however, with increased sampling efforts, continuous distribution may have a homogenising effect via population dispersal and admixture.

The discovery of a new species of *Cheiriphotis* from Pulau Langkawi brought the total number of species in the Southeast Asian region to three (Azman et al., 2022). Additionally, this finding increased the number of valid species in the genus to 17. Furthermore, this discovery contributed to a greater representation of *Cheiriphotis* inhabiting the Northern Hemisphere, accounting for 33% and extended its geographical range.

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