

POLYCHELID LOBSTERS OF TAIWAN (DECAPODA: POLYCHELIDAE)

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ABSTRACT. – Polychelids collected by joint Taiwanese/French deepwater trawling around Taiwan are reported. Nine species in two genera of Polychelidae are now known from Taiwan of which six species represent new records. *Pentacheles laevis*, *Polycheles aculeatus*, *P. auriculatus*, *P. galil*, *P. helleri*, and *P. sculptus* are newly reported from Taiwan. Previous records of *P. enthrix* from Taiwan are referable to *P. amemiyai*, a species previously regarded as a synonym of the former. Therefore, *P. amemiyai* is removed from the synonymy of *P. enthrix* and redescribed. Differences are noted between Taiwanese *P. typhlops* and Atlantic material suggesting that *P. typhlops* may comprise two or more species. Comparative illustrations and a key to the Taiwanese Polychelidae are given.

KEY WORDS. – Crustacea, Decapoda, Polychelidae, Taiwan, new records.

INTRODUCTION

The blind deep-sea lobsters of the family Polychelidae are characterized by their fixed, rudimentary eye-stalks, and the presence of chelae on the first four or five pereopods. The Taiwanese fauna is known from three studies: Chan & Yu (1989, 1993), and Galil (2000), all based on material collected by commercial trawlers limited to a depth of 600 m. Chan & Yu (1989) reported the presence of *P. typhlops* Heller, 1862, and *P. baccatus* Bate, 1878, and Chan & Yu (1993) subsequently added *P. enthrix* (Bate, 1878) to the Taiwanese fauna. In her world revision of the Polychelidae, Galil (2000) identified Taiwanese records of *P. baccatus* as a new species, *P. coccifer*. Thus, Galil (2000) recognised three species from Taiwanese waters: *Polycheles coccifer* Galil, 2000, *P. enthrix* Bate, 1878, *P. typhlops* Heller, 1862.

Recent expeditions organized by Taiwanese institutions together with the Muséum national d'Histoire naturelle, Paris, and the Institut de Recherche pour le Développement, France (IRD) to explore the deepwater fauna around Taiwan have yielded many polychelid specimens previously unknown from Taiwan. The present report is based on polychelids collected by joint Taiwanese/French deepwater exploratory trawling off Taiwan and other specimens in the collections of the National Taiwan Ocean University and the Raffles Museum of Biodiversity Research, Singapore. Five species are new records for Taiwanese waters. Results of the present study also show that previous records of *P. enthrix* from Taiwan are referable to *P. amemiyai* Yokoya, 1933, herein removed from the synonymy of *P. enthrix*.

MATERIALS AND METHODS

Descriptive terminology follows Galil (2000) and Ahyong & Brown (2002). Specimens are deposited in the collections of the National Taiwan Ocean University, Keelung (NTOU), the South Australian Museum, Adelaide (SAM), and the Zoological Reference Collection (ZRC), Raffles Museum of Biodiversity Research, Singapore. Measurements of specimens are in millimetres. Abbreviations: carapace length (cl.), millimetres (mm), beam trawl (CP), Otter Trawl Le Drézén type JUNEAUX (CD).

SYSTEMATICS

POLYCHELIDAE WOOD-MASON, 1874

Pentacheles Bate, 1878

Pentacheles laevis Bate, 1878

(Figs. 1A-C, 4A)

Pentacheles laevis Bate, 1878: 278 [type locality: Moluccas, Indonesia, 4°33'N, 127°06'E]; Galil, 2000: 291 (key), 301-305, Fig. 7; Ahyong & Brown, 2002: 54-56, 75, Figs. 1A-B.

Pentacheles gracilis Bate, 1878: 279 [type locality: off Fiji, 19°07.50'S, 178°19.35'E].

Polycheles granulatus Faxon, 1893: 197 [type locality: off Panama, 4°03'N, 81°31'E].

Pentacheles beaumontii Alcock, 1894: 236 [type locality: off Colombo, Sri Lanka].

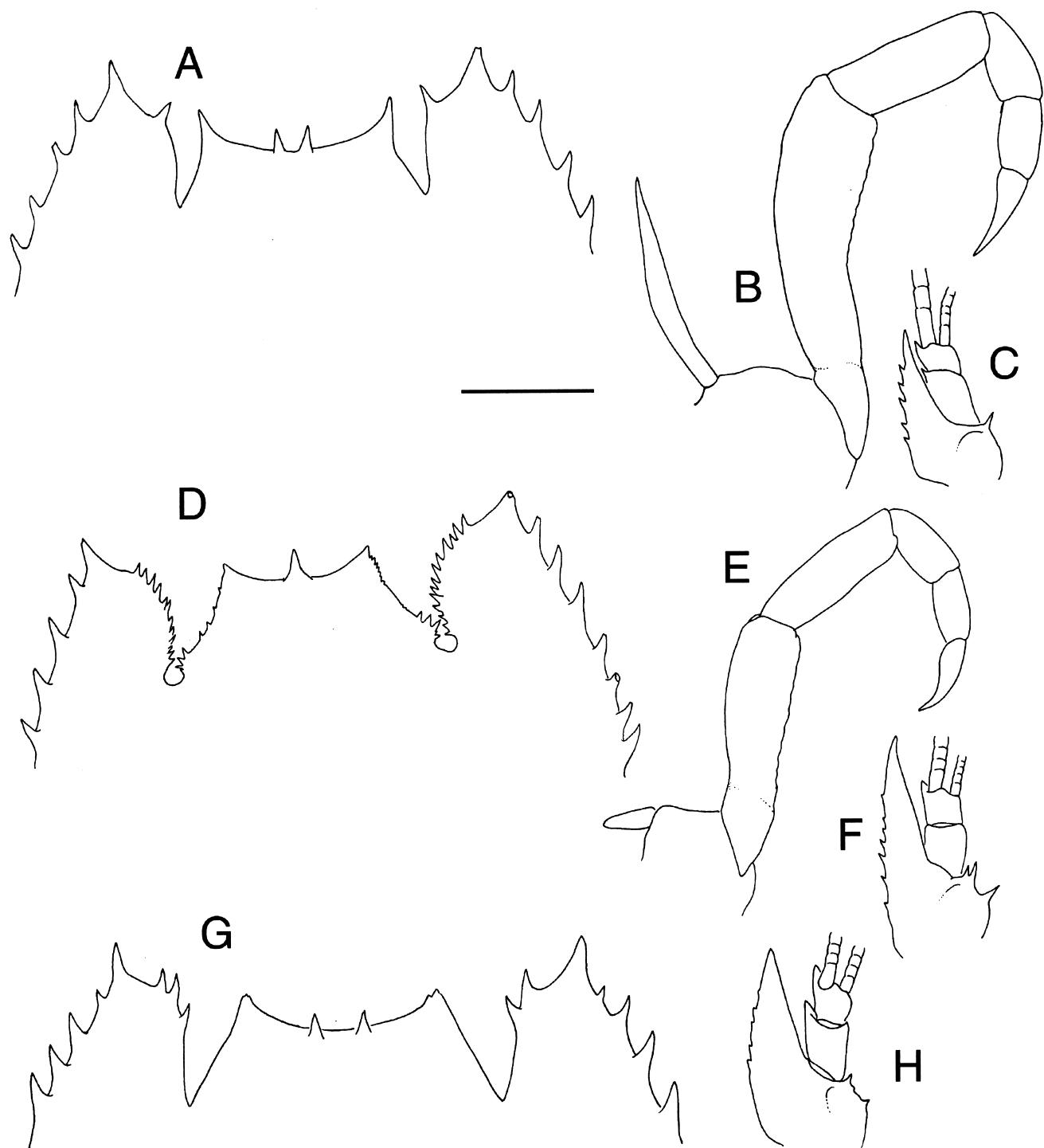


Fig. 1. A-C, *Pentacheles laevis* Bate, 1878 (NTOU, female, cl. 27 mm). D-F, *Polycheles typhlops* Heller, 1862 (ZRC 2001.0146, female, cl. 41.4 mm). G, H, *Polycheles coccifer* Galil, 2000 (NTOU, female, cl. 33.9 mm). A, D, G, anterior carapace. B, E, maxilliped 3, right. C, F, H, antennule, right dorsal. Scale A, C, E, G, H = 4 mm, B = 2 mm, D, F = 2.7 mm.

Polycheles dubius Bouvier, 1905a: 480 [type locality: off the Azores, 44°04'N, 9°81'W].

Polycheles eryoniformis Bouvier, 1905b: 644 [type locality: Madeira].

Material examined. – *NE Taiwan*: 1 female (cl. 16.9 mm), (NTOU), 24°28.99'N, 122°12.79'E, 500-1183 m, TAIWAN 2003 CD210, 1 Jun.2003; 1 female (cl. 22.5 mm), (NTOU), 24°28.59'N, 122°12.66'E, 490-1027 m, TAIWAN 2003 CD 214, 27 Aug.2003. *SW Taiwan*: 1 female (cl. 27.0 mm), (NTOU), 22°14.8'N, 120°02.8'E, 880-1070 m, TAIWAN 2000 CP23, 29 Jul.2000; 1 damaged specimen (cl. 22.1 mm), (NTOU), 22°16.56'N, 120°06.11'E, 736-1040 m, TAIWAN 2001 CD134, 22 Nov.2001; 1 male (cl. 35.8 mm), 1 female (cl. 35.6 mm), (NTOU), 22°12.04'N, 119°59.96'E, 1110-985 m, TAIWAN 2001 CD141, 24 Nov.2001.

Remarks. – The Taiwanese specimens agree well with published accounts (Galil, 2000; Ahyong & Brown, 2002). The inner and outer orbital margins are each armed with a single spine and the lateral margins of the carapace are armed as follows: 7-10:3:14-15.

Distribution. – Worldwide, from the Indo-West Pacific, Eastern Pacific, Western and Eastern Atlantic, at depths between 347 and 2505 m. A new record for Taiwan.

Polycheles Heller, 1862

Polycheles aculeatus Galil, 2000

(Figs. 3D, 4B)

Pentacheles aculeatus Galil, 2000: 312-315 [type locality: New Caledonia, 22°35.6'S, 166°26.2'E].

Material examined. – Tai-Shi fishing port, I-Lan County, NE Taiwan: 1 male (cl. 34.6 mm), (NTOU), commercial trawler, coll. C.W. Lin, 6 May.2003.

Remarks. – The single specimen agrees well with the type description (Galil, 2000) differing only in having a 6-7: 3-4: 11 instead of 6-7: 3: 8-10 lateral carapace spines, and 5-6 instead of 6-7 branchial spines.

Distribution. – Vanuatu, New Caledonia, Lifou, Indonesia, Western and Eastern Australia, the East China Sea and for the first time from Taiwan; 144-1053 m (Galil, 2000).

Polycheles amemiyai Yokoya, 1933

(Figs. 2, 4C)

Polycheles amemiyai Yokoya, 1933: 44-45, Fig. 23 [type locality: Bungo Strait, Japan].

Stereomastis nana - Baba et al., 1986, pl. 109 [not *S. nana* (Smith, 1880)].

Polycheles enthrrix - Chan & Yu, 1993: 107; Galil, 2000: 322-325 [part] [not *P. enthrrix* (Bate, 1878)].

Material examined. – *Taio-Yu-Tai, N Taiwan*: 1 ovigerous female (cl. 50.5 mm), (NTOU), commercial trawler, coll. C. W. Lin, 10 Jun.2001. *Tai-Shi fishing port, I-Lan County, NE Taiwan*: 1 male (cl. 45.2 mm), (NTOU), commercial trawler, 28 May.1998; 1

ovigerous female (cl. 63.4 mm), (NTOU), commercial trawler, 6 Jun.1998; 1 female (cl. 53.2 mm), (NTOU), commercial trawler, 27 Sep.2002; 1 male (cl. 49.1 mm), (ZRC 2001.0126), commercial trawler, coll. P. Ng. *Nangfangao fishing port, I-Lan County, NE Taiwan*: 2 females (cl. 21.3-25.3 mm), (NTOU), commercial trawler, 10 Apr.1991. *SW Taiwan*: 1 female (cl. 25.4 mm), (NTOU), 22°11.40'N, 120°22.58'E, 452-280 m, TAIWAN 2001 CD140, 23 Nov.2001.

Diagnosis. – Carapace with two rostral spines and a single spine midway between rostral spines and spine on inner orbital margin. Outer proximal margin of basal antennular segment with 2 spines. Gastric region of carapace with 1 or 2 spines of similar size to spines of median carina; branchial carinae obsolete; branchial groove without spines; postcervical groove with antrorse spine on posterior margin between median carina and branchial carina. Median carina of abdominal tergites 1-4 entire, with short antrorse tooth on tergites 1-3 or 4, each without posterior upright tooth. Abdominal tergites 2-5 relatively smooth, without distinct oblique grooves. Pereopod 1 merus with dorsal and ventral margins minutely and sparsely spinulate.

Description. – Carapace subrectangular, margins slightly convergent proximally; dorsal surface sparsely setose, faintly punctate; gastric region at most with single spine of similar size to median spines, and occasionally with scattered, minute spinules; lateral surface with row of setae along lateral carina; frontal margin broadly curved, with two rostral spines, and a single spine midway between rostral spines and spine on inner orbital margin; lower anterior margin with 2 small spines adjacent to antennal protopod. Median submarginal tooth short, inconspicuous. Dorsal orbital sinus broadly triangular; outer angle of orbital sinus produced anteriorly, margin unarmed. Lateral margins of carapace with evenly graded spines, slightly decreasing in size posteriorly; spine formula 7-10: 4-5: 12-18. Cervical and postcervical incisions with smooth margins. Postcervical groove unarmed. Median posterostral carina prominent, spine formula 1,1,1-2:0-1. Median postcervical carina prominent, irregular, spine formula 2, 0-2. Postorbital carina ill-defined. Branchial carina sinuous, indicated by row of well-spaced tubercles. Branchial groove unarmed. Dorsal posterior border of carapace smooth, with 2 pairs of antrorse spines.

Abdominal tergites smooth, punctate, mesially carinate; dorsum without oblique grooves. Anterior margin of tergite 1 with short antrorse median tooth and small sublateral spine. Tergites 2-3 or 4 with short antrorse median tooth, shorter and blunter posteriorly. Tergite 5 with blunt median carina; tergite 6 with short median carina posteriorly. Pleuron 2 pointed anteriorly; surface smooth; margins setose but not granulate or denticulate; lower margin faintly concave. Telson with low, obsolete proximal swelling; without granules. Pleura 3-6 becoming narrower posteriorly; margins smooth, without denticles or tubercles. Uropodal protopod without tubercles or granules; endopod with blunt mid-rib, surface slightly irregular; exopod with median sulcus, surface slightly wrinkled.

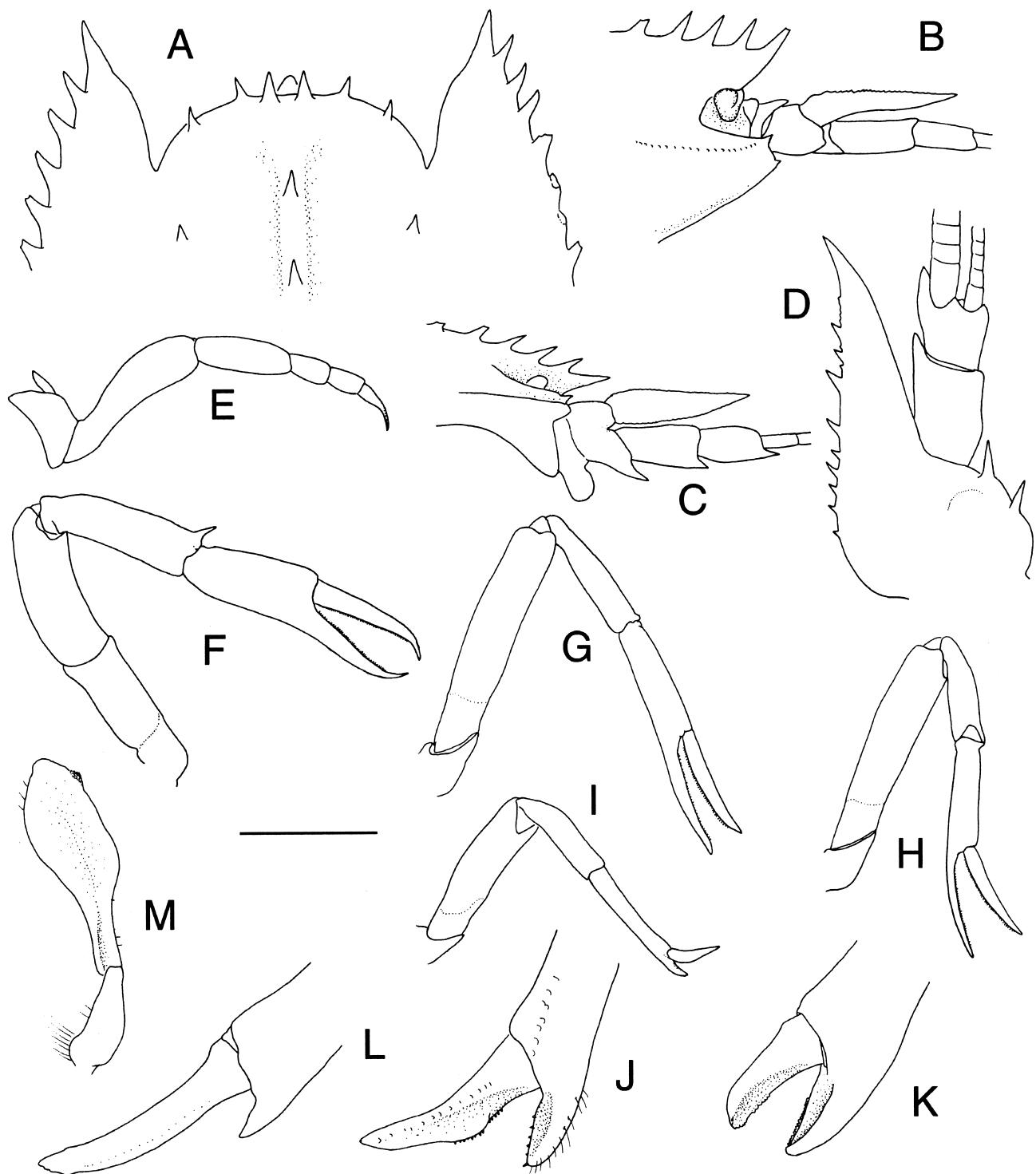


Fig. 2. *Polycheles amemiyai* Yokoya, 1933. A-J, NTOU, female, cl. 25.4 mm. K, NTOU, female, cl. 50.5 mm. L, M, ZRC 2001.0126, male, cl. 49.1 mm. A, anterior carapace, dorsal. B, anterior cephalothorax, right lateral. C, anterior cephalothorax, right ventral. D, antennule, right dorsal. E, maxilliped 3, right. F, pereopod 2, right lateral. G, pereopod 3, right lateral. H, pereopod 4, right lateral. I, pereopod 5, right lateral. J-L, pereopod 5 chela, right internal. Scale A-C, E-I = 4 mm, D, L, K = 2 mm, M = 8 mm.

Eyestalk with small dorsal conical tooth.

Basal antennular segment produced anteriorly to a sharp point, mesial margin with 8-12 teeth, apex extending beyond distal segment of antennular peduncle; outer proximal margin rounded, with two spines of which the distal most is largest. Distal segment of antennular peduncle with blunt inner tooth.

Distal and proximal segments of antennal peduncle with stout inner distal spine; scaphocerite lanceolate, not extending anteriorly beyond distal segment.

Maxilliped 3 epipod rudimentary, about 0.21-0.26 ischium length.

Pereopod 1 about as long as body. Merus with curved spine on dorsal distal margin; dorsal and ventral margins minutely and sparsely spinulate, with spines on lower margin more numerous. Carpus nearly as long as merus; adults with 2 rows of irregular spinules on distodorsal surface; ventral surface smooth, distally with spinule and blunt projection mesially. Dactylus about as long as palm; palm minutely spinulate along upper and ventral margins, bearing distolateral spine as well as blunt projection.

Pereopod 2 with ischium and basis fused; ischiobasis articulating with merus; merus and ischiobasis unarmed; carpus with dorsodistal spine; propodus dorsally cristate; dactylus and pollex with curved apices, opposable margins pectinate.

Pereopods 3-5 with merus and ischium fused, articulating with basis. Pereopod 5 in males with pollex about one-quarter length of dactylus; adult females with pollex and dactylus of equal length.

Pleopod 1 uniramous, forming copulatory organ, comprising distal and proximal segments; proximal segment (basis) shorter than distal segment, outer margin setose; distal elongate, spatulate, with appendix interna on inner subdistal margin; inner proximal margin sparsely setose.

Colour in life. – Body and limbs orange-pink in large adults and somewhat pink-red in smaller specimens. Carapace grooves, median carina and lateral spines whitish. Abdominal tergites 2-5 with pair of submedian white patches near anterior margin. Base of uropodal protopod whitish. Eggs bright orange.

Remarks. – In revising the Polychelidae, Galil (2000) synonymised *P. amemiyai* Yokoya, 1933, from Japan, and *P. kermadecensis* (Sund, 1920), from the Kermadec Islands, with *P. enthrrix* Bate, 1888. Although the three nominal species closely resemble each other, *P. kermadecensis* was recently shown to be distinct from *P. enthrrix* (see Ahyong & Brown, 2002). Similarly, on the basis of the present study, we believe that *P. amemiyai* should also be removed from the synonymy of *P. enthrrix*.

Galil (2000) identified Japanese material reported by Baba et al. (1986) (under *Stereomastis nana*) and Taiwanese

material reported by Chan & Yu (1993) (under *Polycheles enthrrix*) as *P. enthrrix*. Comparison of *P. enthrrix* sensu stricto with Taiwanese specimens and the account of Baba et al. (1986) shows that they differ subtly but consistently. The Taiwanese/Japanese form differs from *P. enthrrix* in having fewer spines on the frontal margin of the carapace, in having a short median carina instead of an indistinct swelling on the sixth abdominal tergite, and in colour-in-life. In *P. enthrrix* the frontal margin between the inner orbital margins is lined with spines. Conversely, in the Taiwanese/Japanese form, only a single spine is present between the paired rostral spines and the spine of the inner orbital margin. The most striking difference between the two forms, however, is the colour-in-life. *Polycheles enthrrix* is uniformly deep-red in life (Ahyong & Brown, 2002), whereas the Taiwanese/Japanese form is generally orange-pink or pink-red with the cervical and branchial grooves, lateral and posterior margins of the carapace white or cream in colour. The Taiwanese/Japanese form agrees in almost all respects with the figure and brief account of *P. amemiyai* Yokoya, 1933, described from Japan. Yokoya (1933) did not record the colour-in-life of *P. amemiyai*, but his description and figure clearly indicate the spination of the frontal margin of the carapace – in precise agreement with the specimens reported here. Unfortunately, the holotype of *P. amemiyai* appears to be lost (Galil, 2000, T. Komai, pers. comm.) and Yokoya's (1933) account of *P. amemiyai* neither mentions the number of spines on the anterolateral margin of the basal antennular segment, nor are any spines shown in his figure. However, in all other respects, the present specimens agree with the type description and figure of *P. amemiyai*. Therefore, *P. amemiyai* is herein recognised as a distinct species and removed from the synonymy of *P. enthrrix*.

As with *P. enthrrix*, *P. amemiyai* differs from *P. kermadecensis* in colour-in-life and in lacking the numerous dorsal spines on the gastric and branchial regions of the carapace. As with *P. enthrrix*, *P. kermadecensis* also differs from *P. amemiyai* in bearing more numerous frontal spines on the carapace. *Polycheles kermadecensis* bears a similar colour pattern to *P. amemiyai* in having white carapace grooves and margins, but differs in being pale pinkish-purple instead of orangish-pink or pinkish-red in life.

The Taiwanese specimens of *P. amemiyai* are morphologically uniform, showing slight variation in the lateral carapace spination and acuteness of the antorse median abdominal spines. The antorse median spines on abdominal tergites 1-4 are generally sharp in small specimens and blunt in adults. Hence, variation in the acuteness of the median antorse tooth on the posterior abdominal tergites in *P. amemiyai* resembles that of *P. enthrrix* and *P. kermadecensis* as reported by Ahyong & Brown (2002). Variation is also present in the chelation of the fifth pereopod in the females. In the juvenile female, the dactylus is about twice as long as the pollex, whereas in the adult, the pollex and dactylus are equal. In females, the dactylus becomes relatively shorter with increasing body size.

The Japanese specimen figured in colour by Baba et al. (1986) as *Stereomastis nana* is clearly referable to *P. amemiyai*. The

colour and frontal ornamentation of the carapace agree precisely with the present specimens of *P. amemiyai*. In removing *P. kermadecensis* from the synonymy of *P. enthrrix*, Ahyong & Brown (2002) suggested that all records of *P. enthrrix* require verification. Judging by the known distribution of *P. amemiyai*, it is likely that other records of *P. enthrrix* from the East China Sea and Japan are also based on the former species. Thus, *P. enthrrix* has a central to western Pacific distribution, ranging from Fiji to eastern Australia. *Polycheles kermadecensis* has a southwestern Pacific distribution, ranging from the Kermadec Islands to eastern Australia, and *P. amemiyai* is presently known only from the northwestern Pacific around Japan and Taiwan.

Distribution. – Presently known only from Taiwan and Japan at depths of 452 (perhaps 280, see station data of CD140) - 1000 m (Baba et al., 1986, as *Stereomastis nana*).

***Polycheles auriculatus* Bate, 1878**

(Figs. 3A-C, 4D)

Pentacheles auriculatus Bate, 1878: 280 [type locality: off Kandavu

Island, Fiji, 19°07.50'S, 178°19.35'E].

Polycheles auriculatus - Galil, 2000: 293, 315-317, Fig. 12.

Material examined. – NE Taiwan: 1 male (cl. 15.0 mm), (NTOU)

24°47.5'N, 122°17.4'E, 1134 m, TAIWAN 2000 CP61, 4 Aug. 2000.

SW Taiwan: 1 eryoneicus larva (cl. 15.5 mm), (NTOU), 22°10.0'N,

120°15.9'E, 794-850 m, TAIWAN 2000 CP30, 30 Jul. 2000.

Remarks. – The 15.0 mm specimen agrees in most respects with published accounts (Bate, 1878; Galil, 2000), differing in having 8 instead of 7 lateral carapace spines on the posterior division, 5-6 instead of 10 spines on the branchial carina, and 2 instead of 3-4 spines on the posterior margin of the cervical groove. These differences appear to be size related, for at 15.0 mm carapace length, the present specimen is smaller than the any of those reported by Galil (2000).

The larval specimen from Station CP30 is tentatively assigned to *P. auriculatus*. It agrees with *P. auriculatus* in having paired rostral spines, a spine on the inner and outer margin of the dorsal orbit, paired spines on the outer margin of the basal antennal segment, and lacks an antrorse median spine on the fifth abdominal tergite.

Distribution. – Western Australia to Vanuatu, New Caledonia, the Philippines, Fiji, the Marquesas Islands and for the first time from Taiwan; 532-1500 m (Galil, 2000).

***Polycheles coccifer* Galil, 2000**

(Figs. 1G, H, 4E)

Polycheles coccifer Galil, 2000: 292, 320-322, Fig. 15 [type locality: Philippines, 11°59'N, 121°13'E].

Polycheles baccatus - Chan & Yu, 1989: 168, pl. 1 figs. c-d; 1993: 109 [not *P. baccatus* Bate, 1878].

Material examined. – Tai-Shi fishing port, I-Lan County, NE Taiwan: 1 female (cl. 44.9 mm), (NTOU), commercial trawler, 28

Sep.1987; 1 male (cl. 33.5 mm), (NTOU), commercial trawler, 5 Mar.1993; 1 male (cl. 34.1 mm), (NTOU), commercial trawler, 10 Jun.1993; 1 female (cl. 29.7 mm), (NTOU), commercial trawler, 25 Nov.1994; 1 male (cl. 21.2 mm), (NTOU), commercial trawler, 20 May.1997; 1 female (cl. 32.0 mm), (NTOU), commercial trawler, 3 Oct.1997. *Nangfangao* fishing port, I-Lan County, NE Taiwan: 1 ovigerous female (cl. 30.6 mm), (NTOU), 2 May.1985; 1 male (cl. 29.6 mm), (ZRC 2001.0144, part), commercial trawler, coll. P. Ng et al., 28 May.1997. *Tong-Kang* fishing port, Ping Tong County, SW Taiwan: 1 ovigerous female (cl. 38.6 mm), (NTOU), commercial trawler, 25 Feb.1995; 1 ovigerous female (cl. 46.9 mm), (NTOU), commercial trawler, coll. S. H. Wu, Dec.1998. SW Taiwan: 1 male (cl. 34.4 mm), (NTOU), 22°24.06'N, 120°13.03'E, 300 m, TAIWAN 2002 CP165, 26 May.2002. Taiwan, no specific locality: 1 female (cl. 33.9 mm), (NTOU), commercial trawler, coll. S. H. Wu, Nov.2001.

Remarks. – Galil (2000) showed that previous records of *P. baccatus* from Taiwan are based on an undescribed species that she named *P. coccifer*. *Polycheles coccifer* differs from *P. baccatus* chiefly by the lower number of lateral carapace spines in the anterior division: 6-8 vs 10-12. The present specimens of *P. coccifer* agree closely with the type description but exhibit a greater range in the lateral carapace spination – 7-8:3-5:14-28 compared to 6-7:4-6:20-23 (Galil, 2000).

Distribution. – Western Pacific Ocean from Taiwan and Japan to the Philippines, Indonesia, New Caledonia and Vanuatu at depths between 155-533 m (perhaps 99-610 m; see Galil (2000)).

***Polycheles galil* Ahyong & Brown, 2002**

(Figs. 3J, K, 4F)

Polycheles galil, 2002: 56-60, 75, Figs. 2, 3A-B [type locality: 258 km NW of Port Hedland, Western Australia, 18°42'S, 116°21'E].

Material examined. – NE Taiwan: 1 female (cl. 26.3 mm), (NTOU), 24°28.99'N, 122°12.79'E, 500-1183 m, TAIWAN 2003 CD210, 1 Jun.2003. SW Taiwan: 1 female (cl. 22.2 mm), (NTOU) 22°12.92'N, 120°25.93'E, 316-477 m, TAIWAN 2001 CD137, 23 Nov.2001; 3 males (cl. 22.7-41.7 mm), 2 females (cl. 22.9-27.9 mm), (NTOU), 22°13.13'N, 120°20.17'E, 441-789 m, TAIWAN 2001 CD138, 23 Nov.2001.

Colour in life. – Abdomen pink. Carapace white-pink. Antennae, antennules, pereopods, pleopods, and uropods pink-red.

Remarks. – The Taiwanese specimens agree well with the recent account of the species (Ahyong & Brown, 2002). As indicated by Ahyong & Brown (2002), Pacific and northwestern Australian specimens reported by Galil (2000) as *P. phosphorus* are referable to *P. galil*. The most obvious feature distinguishing *P. galil* from *P. phosphorus* is the presence of a median antrorse spine on the first five instead of first four abdominal tergites. Ahyong & Brown (2002) lacked colour-in-life data for *P. galil*, so the species is shown in colour for the first time in Fig. 4(F, G). The present specimens were collected at 316-789 m depth.

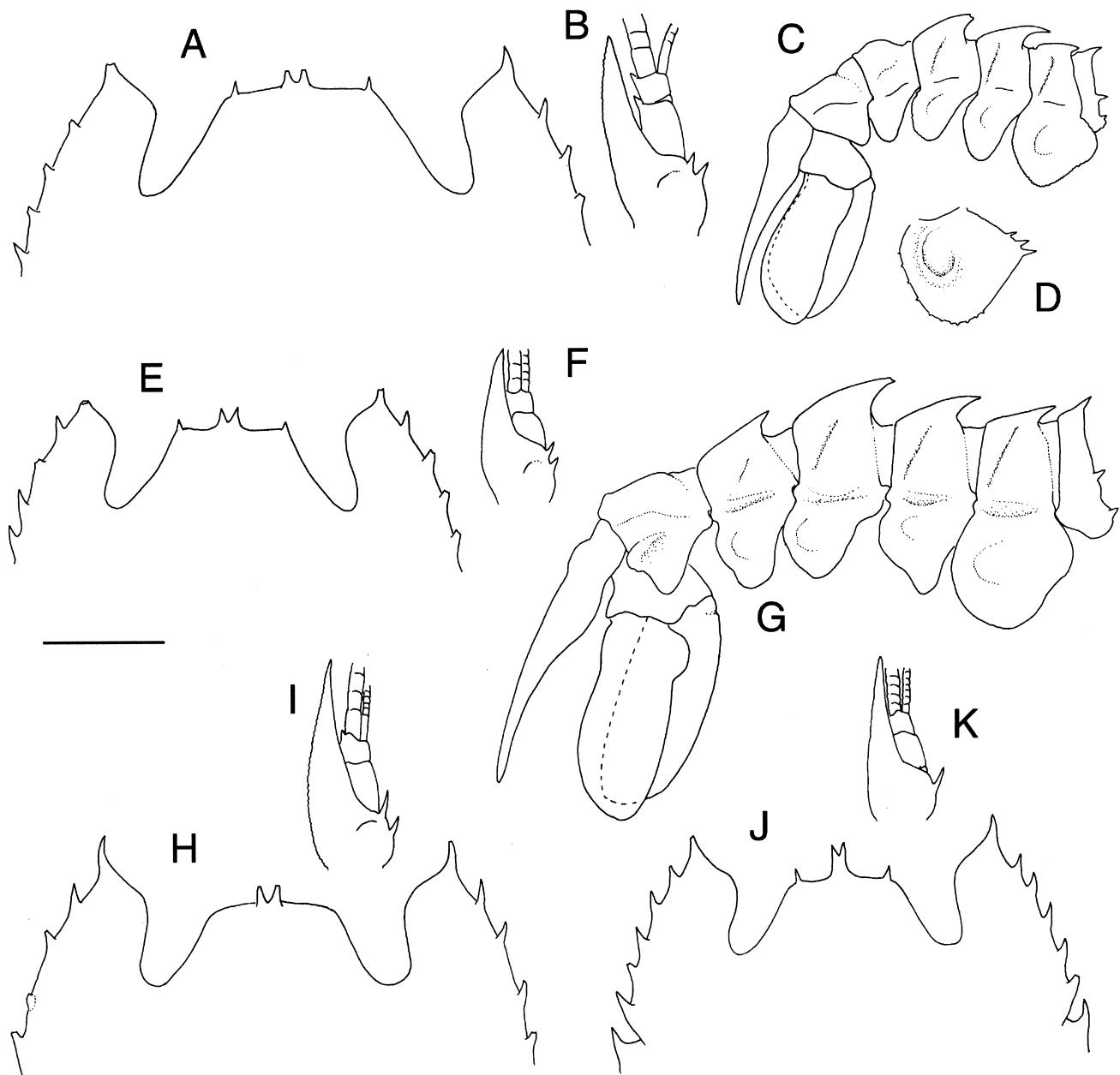


Fig. 3. A-C, *Polycheles auriculatus* (Bate, 1878) (NTOU, male, cl. 15.0 mm). D. *Polycheles aculeatus* Galil, 2000 (NTOU, male, cl. 34.6 mm). E-G, *Polycheles sculptus* Smith, 1880 (NTOU, female, cl. 24.2 mm). H, I, *Polycheles helleri* Bate, 1878 (NTOU, ovigerous female, cl. 50.0 mm). J, K, *Polycheles galil* Ahyong & Brown, 2002 (NTOU, female, cl. 27.9 mm). A, E, H, J, anterior carapace. B, F, I, K, antennule, right dorsal. C, G, abdomen, right lateral. D, abdominal pleuron 2. Scale A, B = 2 mm, C-G = 4 mm, D, H-K = 8 mm.



Fig. 4. A, *Pentacheles laevis* Bate, 1878 (TAIWAN 2000 stn CP 23, female cl. 27 mm). B, *Polycheles aculeatus* Galil, 2000 (Tai-Shi fishing port, 1 male cl. 34.6 mm). C, *Polycheles amemiyai* Yokoya, 1933 (Tai-Shi fishing port, ovigerous female cl. 63.4 mm). D, *Polycheles auriculatus* (Bate, 1878) (TAIWAN 2000 stn CP 61, male cl. 15.0 mm). E, *Polycheles coccifer* Galil, 2000 (Tai-Shi fishing port, male cl. 33.5 mm). F, *Polycheles galil* Ahyong & Brown, 2002 (TAIWAN 2001 stn CD 138, male cl. 41.7 mm). G, *Polycheles helleri* Bate, 1878 (TAIWAN 2001 stn CP 125, ovigerous female cl. 50.0 mm). H, *Polycheles typhlops* Heller, 1862 (Tai-Shi fishing port, ovigerous female cl. 54.3 mm).

Distribution. – Northwestern Australia to Indonesia, New Caledonia, Vanuatu, the Philippines, Japan and for the first time from Taiwan; 200-1354 m.

***Polycheles helleri* Bate, 1878**

(Figs. 3H, I, 4G)

Polycheles helleri Bate, 1878: 277 [type locality: N of New Guinea, 2°33'S, 144°04'E, by lectotype selection (Ahyong & Brown, 2002)]; Galil, 2000: 327-329, Fig. 18.

Material examined. – NE Taiwan: 1 male (cl. 23.0 mm), (NTOU), 24°15.7'N, 122°11.6'E, 2947-2903 m, TAIWAN 2000 CP53, 3 Aug.2000; 1 ovigerous female (cl. 50.0 mm), (NTOU); 1 male (cl. 20.1 mm), 3 females (cl. 19.8-20.7 mm), (NTOU), 24°25.38'N, 122°12.41'E, 1138-1187 m, TAIWAN 2002 CD199, 12 Sep.2002; 1 male (cl. 19.9 mm), (NTOU), 24°28.99'N, 122°12.79'E, 500-1183 m, TAIWAN 2003 CD210, 1 Jun.2003. SE Taiwan: 1 female (cl. 30.4 mm), (NTOU), 22°08.68'N, 121°01.68'E, 1263-1268 m, TAIWAN 2001 CP127, 22 Aug.2001; 1 male (cl. 21.2 mm), 1 female (cl. 20.7 mm), (NTOU), 22°19.15'N, 121°4.63'E, 1171-1212 m, TAIWAN 2003 CD 226, 29 Aug.2003; 1 female (cl. 28.5 mm), (NTOU), 22°8.7'N, 121°0.97'E, 1259-1383 m, TAIWAN 2003 CD 228, 30 Aug.2003. SW Taiwan: 1 ovigerous female (cl. 50.0 mm), (NTOU), 22°6.95'N, 120°02.35'E, 1274-1218 m, sticky mud, TAIWAN 2001 CP125, 21 Aug.2001; 1 male (cl. 23.1 mm), (NTOU), 22°00.54'N, 119°27.94'E, 2334-2543 m, TAIWAN 2002 CP185, 26 Aug.2002; 1 female (cl. 20.3 mm), (NTOU), 21°39.91'N, 118°20.94'E, 1649-1629 m, TAIWAN 2002 CP189, 27 Aug.2002.

Remarks. – The present series includes the largest known specimen of *P. helleri*, having a carapace length of 50 mm and agrees well with those reported by Galil (2000). The lateral carapace spination of the present specimens, 5-6:3-4:6-10, encompasses that reported by Galil (2000).

The colour-in-life of *P. helleri* resembles *P. galil*: the carapace and abdomen are pale pink and the uropods and pereopods are a darker, reddish pink. The eggs of *P. helleri* are bright orange but no ovigerous female of *P. galil* has yet been recorded from Taiwan. *Polycheles helleri*, however, differs from *P. galil* by having two instead of one spine on the outer margin of the basal antennular segment, unarmed instead of armed inner and outer angles of the dorsal orbital sinus, and a smooth instead of spinous branchial region. The Taiwanese specimens were collected at depths between 1138 and 2947 m.

Distribution. – Western Indian Ocean to Australia, Indonesia, New Guinea, New Caledonia, Japan and now from Taiwan; 787 m (Galil, 2000)-2947 m (present record).

***Polycheles sculptus* Smith, 1880**

(Figs. 3E-G)

Polycheles sculptus Smith, 1880: 346, pl. 7 figs. 1-6 [type locality: off Nova Scotia, Canada, 43°10'N, 61°20'W]; Galil, 2000: 292, 340-344, Fig. 24.

Pentacheles spinosus A. Milne Edwards, 1880: 66 [type locality: W of Tortugas, off Dominica].

Material examined. – SW Taiwan: 1 female (cl. 45.1 mm), (NTOU), 22°15.07'N, 120°08.02'E, 748-690 m, TAIWAN 2001 CP133, 21 Nov.2001. *Pratas (Dong-Sha Islands)*: 1 female (cl. 23.4 mm), (NTOU), 1265 m, “R.V. Fishery Researcher 1” stn A-35, 25 Apr.1996; 1 female (cl. 24.2 mm), (NTOU), 1520 m, “R.V. Fishery Researcher 1”, 25 Apr.1996.

Remarks. – Of the known Taiwanese polychelids, *P. sculptus* would most likely be confused with *P. galil*. *Polycheles sculptus* differs from *P. galil* chiefly in bearing two instead of one spine on the outer margin of the basal antennular segment.

Of all known species, *P. sculptus* most closely resembles *P. talismani* from West Africa. Galil (2000) distinguished *P. talismani* from *P. sculptus* by 1) having more lateral carapace spines posterior to the postcervical incision (8-10 vs 6-7), 2) a denticulate instead of smooth double dorsal carina on the sixth tergite and 3) a prominent instead of obsolete proximal dorsal crest on the telson. The lateral carapace spination exhibited by the present specimens of *P. sculptus* (6:3:7-8) shows that the lateral carapace spines posterior to the postcervical incision overlap in the two species. Therefore, the latter two features distinguishing *P. sculptus* from *P. talismani*, namely the form of the dorsal carina on the sixth abdominal tergite and proximal crest on the telson, appear to be the most reliable distinguishing characters.

Distribution. – Worldwide: both sides of the Atlantic Ocean, including the Mediterranean Sea, and widely distributed in the Indo-West Pacific. *Polycheles sculptus* is reported for the first time from Taiwan; 200-4000m (Galil, 2000).

***Polycheles typhlops* Heller, 1862**

(Figs. 1D-F, 4H, 5A, B)

Polycheles typhlops Heller, 1862: 392, pl. 1 figs. 1-6 [type locality: off Sicily]; Chan & Yu, 1989: 166, pl. 1; 1993: 105.

Pentacheles agassizii A. Milne Edwards, 1880: 65 [type locality: off Grenada].

Polycheles doderleini Riggio, 1885: 103, pl. 3 figs. 1-5 [type locality: Palermo].

Pentacheles hextii Alcock, 1894: 237 [type locality: Andaman Sea].

Polycheles intermedius Balss, 1914: 599 [type locality: between Iceland and the Hebrides].

Material examined. – Tai-Shi fishing port, I-Lan County, NE Taiwan: 1 ovigerous female (cl. 54.3 mm), 1 female (cl. 53.6 mm), (NTOU), commercial trawler, 4 Sep.1989; 1 female (cl. 26.5 mm), (NTOU), commercial trawler, 20 Jul.1990; 1 female (cl. 29.8 mm), (NTOU), commercial trawler, Dec.1990; 1 male (cl. 24.3 mm), (NTOU), commercial trawler, 20 Oct.1995; 3 males (cl. 32.2-33.2 mm), 2 ovigerous females (cl. 49.0-56.3 mm), 3 females (cl. 26.0-56.6 mm), (NTOU), commercial trawler, 11 Mar.1997; 1 male (cl. 46.8 mm), (ZRC 2001.0125), coll. P. Ng, 6 Nov.2000. Nangfangao fishing port, I-Lan County, NE Taiwan: 2 males (cl. 20.8-39.7 mm), (NTOU), commercial trawler, 16 Mar.1985; 3 males (cl. 34.3-38.9 mm), 1 ovigerous female (cl. 59.4 mm), 2 females (cl. 29.3-32.5 mm), (NTOU), commercial trawler, 22 May.1990; 1 male (cl. 41.3 mm), 1 female (cl. 24.4 mm), (NTOU), commercial trawler, 19 Jun.1991; 1 ovigerous female (cl. 53.1 mm), 1 female (cl. 34.9 mm),

(NTOU), commercial trawler, 21 May.1992; 1 female (cl. 41.4 mm), (ZRC 2001.0146), commercial trawler, coll. P. Ng, 22 May.1998; 3 males (cl. 34.4-43.6 mm), 3 females (cl. 45.4-49.2-49.4 mm), (ZRC 2001.0144), commercial trawler, P. Ng et al., 28 May.1997. SW Taiwan: 1 ovigerous female (cl. 49.9 mm), (NTOU), 22°12.92'N, 120°25.93'E, 316-477 m, TAIWAN 2001 CD137, 23 Nov.2001. Tong-Kang fishing port, Ping-Tong County, SW Taiwan: 2 males (cl. 32.3-35.5 mm), (NTOU), commercial trawler, 23 Mar.1985; 1 female (cl. 46.3 mm), (NTOU), commercial trawler, 25 Feb.1995; 1 male (cl. 32.3 mm), (NTOU), commercial trawler, 14 May.1995; 2 males (cl. 34.5-36.1 mm), 2 females (cl. 36.4-41.8 mm), (ZRC 2001.0145), coll. P. Ng et al. Pratas (Dong-Sha Islands): 1 male (cl. 43.8 mm), (NTOU), commercial trawler, Jun.1991. Taiwan, no specific locality: 1 female (cl. 50.4 mm), (NTOU), 1993. Mediterranean Sea: 2 females (cl. 22.7-26.6 mm), (NTOU, exchanged from B. S. Galil), Israel, 25 Jan.1995; 1 male (cl. 20.6 mm), 1 female (cl. 21.4 mm), (NTOU, exchanged from B. S. Galil), Israel, 1500 m, 7 Dec.1995; 1 female (cl. 43.4 mm), (SAM), Genova Gulf, Primavera, Italy, 200-300 m, 1933.

Remarks. – *Polycheles typhlops* is currently attributed a near worldwide distribution, ranging throughout the Indo-West Pacific and both sides of the Atlantic. Four nominal species are currently included in the synonymy of *P. typhlops* with three from the Atlantic (*P. agassizii*, *P. doderleini*, *P. intermedius*) and one from the Indo-West Pacific (*P. hextii*).

The Taiwanese specimens agree in most respects with the Mediterranean specimen and Galil's (2000) figure of an Atlantic specimen, but differ chiefly in the ornamentation of the second to fifth abdominal tergites and telson. In the

Taiwanese specimens (Fig. 5A), the anterior and posterior margins, and lower lateral surfaces of the abdominal tergites 2-5 are strongly tuberculate or denticulate, the pleura are distinctly granulate with distinctly denticulate margins (more pronounced in males) and the submedian carinae of the telson are distinctly granulate. In the distinct abdominal ornamentation, the present specimens agree closely with Alcock's (1894) *P. hextii* from the Andaman Sea, which is presently regarded as synonymous with *P. typhlops*. In contrast to the Taiwanese specimens, the Mediterranean specimens examined here and Galil's (2000) figured Atlantic specimen have sparsely tuberculate anterior and posterior margins of the second to fifth abdominal tergites, the lower tergal surfaces lack tubercles and the pleura are only sparsely tuberculate (Fig. 5B). The submedian carinae of the telson in Atlantic specimens are minutely instead of distinctly tuberculate as in large Taiwanese specimens.

It is noteworthy that eastern and western Australian specimens of *P. typhlops* in the collections of the Australian Museum agree with the Taiwanese specimens in the strong tergal ornamentation but generally have less denticulate pleural margins. The aforementioned differences between the few Atlantic and Pacific specimens suggests *P. typhlops* might represent a species complex. If this proves the case, *P. hextii* will have to be resurrected for at least part of the Pacific material. The present specimens are referred to *P. typhlops*, however, until types of all nominal synonyms of *P. typhlops* and more specimens from all regions can be studied to assess

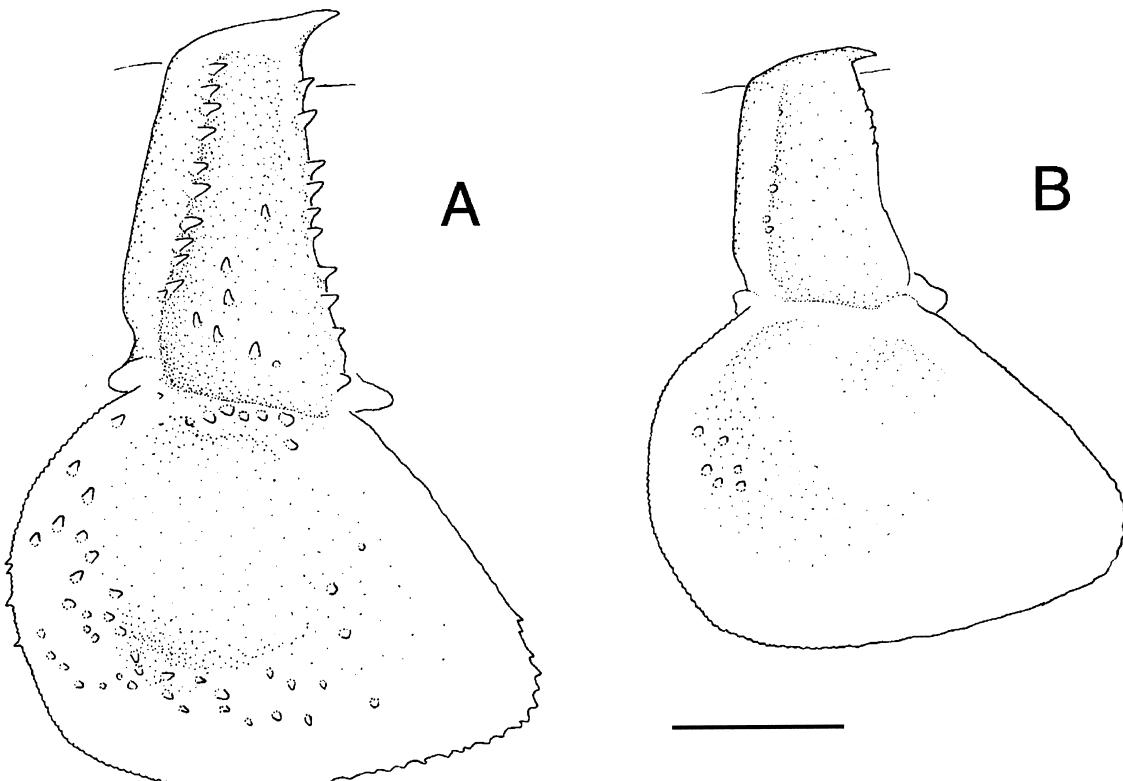


Fig. 5. Second abdominal tergite and pleuron, right lateral. A, *Polycheles typhlops* Heller, 1862 (Nangfangao fishing port, ZRC 2001.0144, ovigerous female cl. 49.4 mm). B, *Polycheles typhlops* Heller, 1862 (Genova Gulf, Mediterranean Sea, SAM, female cl. 43.4 mm). Scale = 5 mm.

the stability or degree of variation in the abdominal granulation.

Distribution. – Widespread throughout the Indo-West Pacific and both sides of the Atlantic; 77-2055 m (Galil, 2000).

KEY TO THE POLYCHELIDAE OF TAIWAN

1. Epipod of maxilliped 3 longer than ischium. Carapace without submedian cervical spines (i.e., the pair of spines at the anterior end of the median postcervical carina). Posterolateral margins of the carapace distinctly convex *Pentacheles laevis*
- Epipod of maxilliped 3 vestigial, less than one-third ischium length. Carapace with submedian cervical spines. Posterolateral margins of the carapace nearly straight *Polycheles* spp. 2
2. One rostral spine. Dorsal orbital sinus subdivided into two by interlocking spines lining the margins of the orbit *P. typhlops*
- Two rostral spines. Dorsal orbital sinus not subdivided 3
3. Dorsal orbital sinus V-shaped. Posterior division of lateral margin of carapace with 12 or more spines 4
- Dorsal orbital sinus U-shaped. Posterior division of lateral margin of carapace with fewer than 11 spines 5
4. Outer margin of dorsal orbit spinose. Branchial carina coarsely tuberculate. Dorsum of abdomen tuberculate *P. coccifer*
- Outer margin of dorsal orbit unarmed. Branchial carina obsolete, unarmed. Dorsum of abdomen smooth, not tuberculate *P. amemiyai*
5. Median carina on abdominal tergite 5 without antorse spine 6
- Median carina on abdominal tergite 5 with antorse spine 7
6. Second abdominal pleuron without anterior spine. Posterior margin of cervical groove with 3-4 spinules between midline and branchial carina *P. auriculatus*
- Second abdominal pleuron with one or more anterior spines. Posterior margin of cervical groove with 1 spinule between midline and branchial carina *P. aculeatus*
7. Inner angle of dorsal orbital sinus rounded, unarmed ... *P. helleri*
- Inner angle of dorsal orbital sinus with a spine 8
8. Outer proximal margin of basal antennular segment with 1 spine *P. galil*
- Outer proximal margin of basal antennular segment with 2 spines *P. sculptus*

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