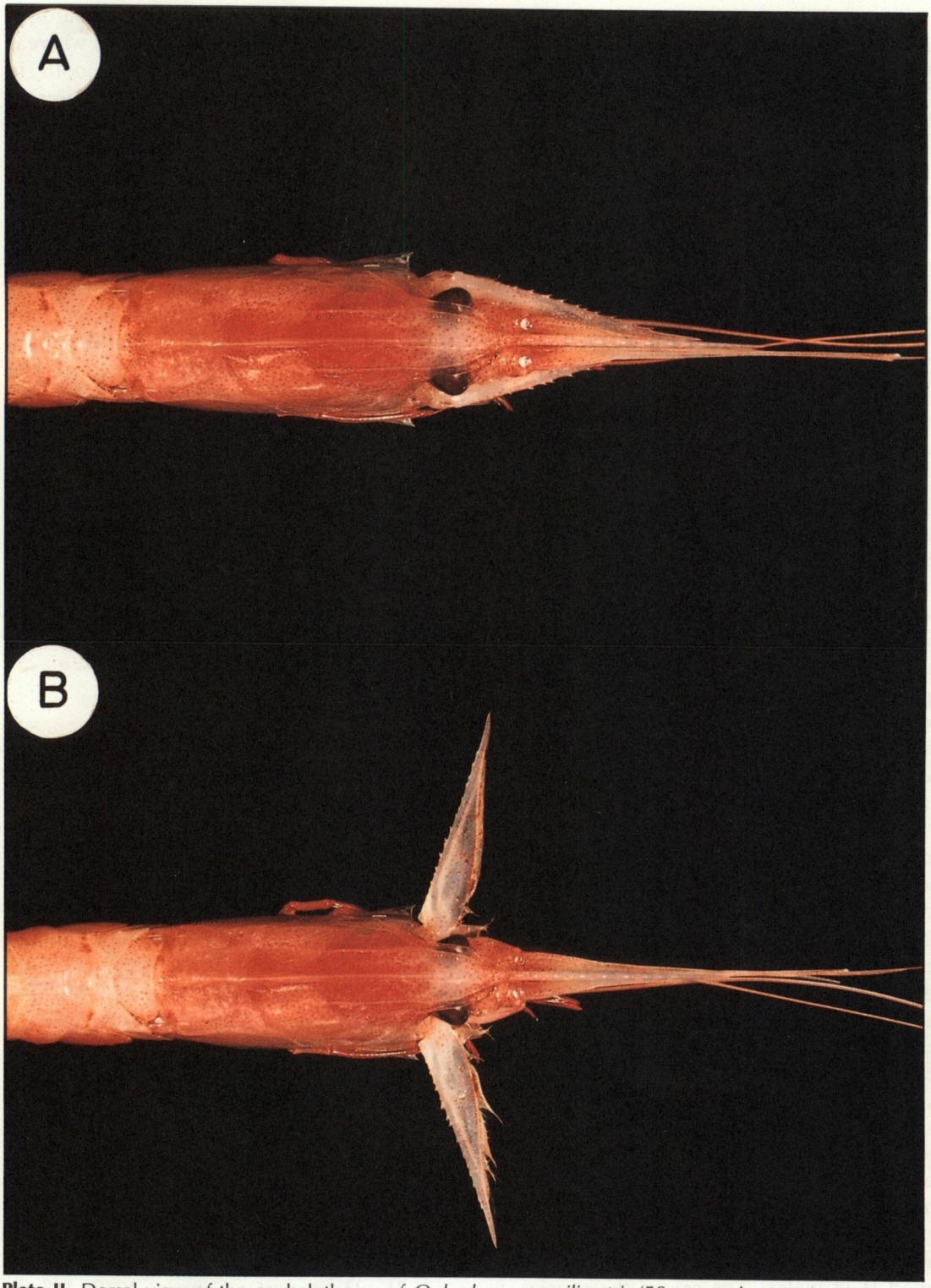
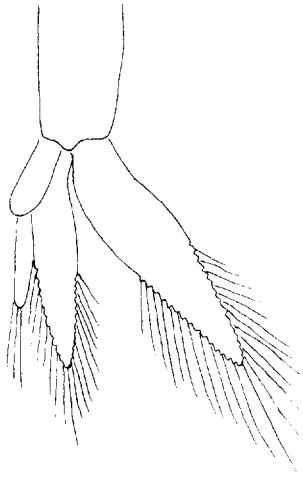


Plate II. Dorsal view of the cephalothorax of *Oplophorus gracilirostris* (58 mm ovigerous female). A, Scaphocerite in normal position; B, Scaphocerite in locked position.

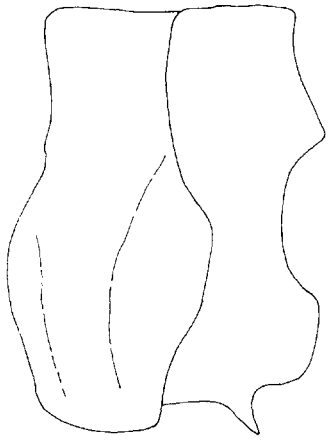
- *Material Examined*: Tong-Kang, Ping-Tong County; Chan leg.: 2 December 1984; 9 ovigerous ♀♀ 47–54 mm. 4 ♀♀ 38–55 mm. 28 July 1985; 29 ovigerous ♀♀ 46–58 mm. Ta-Chi, I-Lan County; Chan leg.: 31 December 1984; 8 ♂♂ 36–44 mm, 1 37 mm.

  Body robust and shell hard. Rostrum extending beyond scaphocerite, armed with 12–14 teeth dorsally and 9–11 teeth ventrally. Outer margin of scaphocerite provided with about 18 small spines and with rather inconspicuous barb near distal end. Lateral carinae at base of rostrum subparallel to dorsal midline of carapace. Postero-lateral angle of carapace armed with a spine, which is not so remarkable as in *O. typus*. Only exopods of maxilliped III and pereiopod I foliaceous. Abdominal tergites III, IV and V produced into overhanging spines posteriorly, with length progressively shorter from III to V. Telson somewhat longer than uropods. Eggs large, 20–30 in one ovigerous female, bean-shaped and about 2.5 × 3 mm (size rather irregular).
- *Colour*: Eye deep vermilion. Body transparent but covered with dense scarlet spots, especially in mid-lateral region of each abdominal somite and posterior margins of posterior three abdominal segments, sometimes as scarlet stripes. Lateral surfaces of abdomen with transparent yellow-green patches. Interal organs inside carapace and thoracic appendages scarlet. Branchial chamber grey-green and with some silver reflections. Anterior dorsum of carapace near base of rostrum sometimes brilliant vermilion. Photophores purple-red. Eggs scarlet or partly white and partly scarlet to nearly white when there is a blackish eye spot.
- *Distribution*: World wide. Pacific and Indian Oceans and Japan.
- *Remarks*: This species is sometimes numerous off the north-east and southern coasts of Taiwan. As noticed by Chace (1947), the sex of the species can be determined by the shape of the lower margin of the abdominal pleuron I, which is concave and spinous in males whereas it is convex and rather smooth in ovigerous females. However, in immature females the outline of the abdominal pleuron I is similar to that of the males except that only the spinous protuberance is slightly behind the midline of the pleuron and obtuse whereas it is somewhat anterior to the midline and well-developed in males. More apparent features that can be used to separate immature females from males are at the abdominal pleuron II, the abdominal sternite I and the length of the coxae in the anterior three pleopods. The antero-lateral angle of the abdomnal pleuron II is smooth in females but is distinct in males. The abdominal sternite I in males is provided with a V-shape carina and bears a blunt protuberance medially whereas this carina and the median protuberance are absent in females. The length of the coxae of the anterior three pleopods is short, less than half the length of the basis in males, but long, markedly longer than half the length of the basis in females. The appendix masculina is long and well-developed on the endopod of the pleopod II in males. The short appendix interna on the endopods of the pleopods is broad and rigid. The species closely resembles *O. typus*. Besides the comparative features that separate *O. gracilirostris* from *O. typus*, the most diagnostic characteristic of *O. gracilirostris* is the anterior section of the rostrum near the tip of scaphocerite which is armed with teeth.

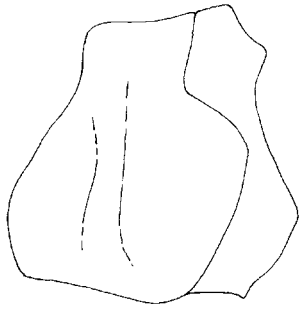
  A peculiar phenomenon is observed on the scaphocerite in *O. gracilirostris* and *O. typus*. When the scaphocerite is fully abducted, it is firmly locked by the basicerite. The scaphocerite fixed in this position can not be pulled forward to the original position. Only when the scaphocerite is lifted and separated from the basicerite can it be released and moved freely. The locking machanism is by the complementary structures of the scaphocerite and the basicerite. The scaphocerite is thick at the outer margin, especially near the base and with a well-developed knob present at its proximal end on the ventral surface. This knob is provided with a rough surface and a sharp edge on the inner surface. A deep transverse groove is



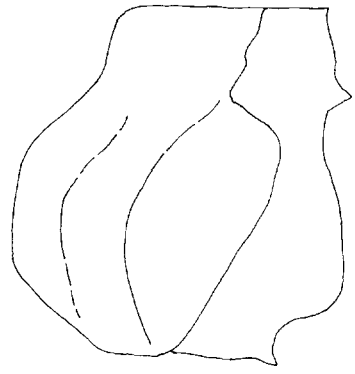
A



B

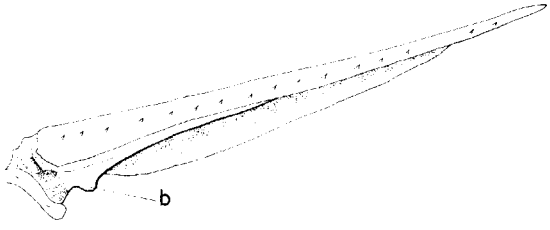


D

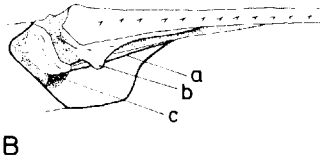


C

Fig. 3. *Oplophorus gracilirostris.*
A, Pleopod II of male (X 12.5);
B, Abdominal pleura I and II of male (X 12.5);
C, Abdominal pleura I and II of ovigerous female (X 5);
D, Abdominal pleura I and II of non-ovigerous female (X 12.5).



A



B

Fig. 4. Oplophorus gracilirostris.
A, Scaphocerite, latero-ventral view (X 12.5). (b=ventral knob);
B, Lateral view of scaphocerite and basicerite (X 12.5). (a=upper sharp edge of basicerite; b=ventral knob of scaphocerite; c=concavity of basicerite).

present posterior to the knob. On the basicerite, the outer surface is flat and with the upper and lower edges sharp. The sharp upper edge of the basicerite is straight on the anterior two-thirds but abruptly depressed near the base, where it forms a concavity and with a sharp angle at the juncture. In the normal position, the knob at the ventral scaphocerite is higher than the upper sharp edge of the basicerite. When the scaphocerite is fully extended posteriorly, the knob falls into the concavity of the basicerite and becomes lower than the upper sharp edge, thus locking the scaphocerite in place. The upper sharp edge near the concavity of the basicerite prevents the knob, lower in at this position, from moving forward. As the scaphocerite is elevated and the knob leaves the concavity, the knob is higher than the upper sharp edge of the basicerite and can pass it to move forward. *O. spinosus* and *O. novaezeelandiae* appear also to have a similar arrangement of scaphocerite and basicerite (Chace 1940, fig. 55; Crosnier and Forest 1973, fig. 5). This locking phenomenon is somewhat similar to the locking of the dorsal spine in the trigger fishes (Balistidae). Together with the hard integument and spinous outline, the firmly extended spinous scaphocerite could act as a defense mechanism by increasing the required gape of the predator's mouth to ingest its prey. On the other hand, the increased surface area may also enhance the buoyancy of these bathypelagic *Oplophorus* species floating in the deep-sea. In any event, the discovery of this locking phenomenon on the scaphocerite provides more insight into its function.

Oplophorus typus H. Milne Edwards, 1837
(Plate ID)

Oplophorus typus _ H. Milne Edwards, 1837: 424, pl. 25 figs. 6–7; Bate, 1888: 762, pl. 127 fig. 1; Chace, 1936: 30; Chace, 1947: 46, figs. 8–11; Hayashi and Miyake, 1969: 71.

Oplophorus brevirostris _ Bate, 1888: 766, pl. 127 fig. 3.

Hoplophorus typus _ De Man, 1920: 48; Dennel, 1940: 328.

? *Hoplophorus typus* _ Balss, 1925: 248, figs. 21–23 (in part); Calman, 1939: 188 (in part).

- *Material Examined*: Tong-Kang, Ping-Tong County; Chan leg.: 2 December 1984; 2 ♂♂ both 32 mm, 2 ♀♀ 34 and 35 mm. Ta-Chi, I-Lan County, Chan leg.: 8 May 1985; 1 ovigerous ♀, 1 ♀ both 39 mm.

  Body robust and shell hard. Rostrum short, with 7–9 dorsal and 4–7 ventral teeth, reaching near to tip of scaphocerite. Outer margin of scaphocerite also provided with about 16 small spines but no barb near distal inner margin of scaphocerite. Lateral carinae at base of rostrum converging posteriorly toward dorsal midline of carapace. Postero-lateral angle of carapace armed with prominent sharp-hooked spine. Only exopods of maxilliped III and pereiopod I foliaceous. Abdominal tergites III, IV and V terminated with long spine posteriorly, that of V much longer than IV and nearly as long as III. Telson slightly longer than uropods. Ovigerous female with 8 eggs, large and bean-shaped, 3.5 × 2.25 mm.
- *Colour*: Body colour as in *O. gracilirostris*.
- *Distribution*: Indo-West-Pacific: Fiji Islands, New Guinea, Philippines, Bali Sea, Timor, E. Saleyer, Andaman Islands, Maldives, Gulf of Aden, Arabian Sea, E. Africa and E. Indian Ocean. Reports from Hawaii and Atlantic Ocean may refer to related but not identical species.
- *Remarks*: De Man (1920) and Chace (1947) have extensively described the characteristics of *O. typus*. Dennell (1940) has described the distribution and structure of the photophores. The appendix masculina and appendix interna are similar to those of *O. gracilirostris*. The sex of the species can also be determined by the length of the rostrum, the outline of the antero-lateral margin of the abdominal pleuron I, the structure of the abdominal sternite I and the coxae of the anterior three pleopods. In males, the rostrum may reach or slightly extend beyond

the tip of the scaphocerite and the antero-lateral margin of the abdominal pleuron I is concave whereas in females the rostrum does not reach the tip of the scaphocerite and the antero-lateral margin of the abdominal pleuron I is convex. The appearance of the abdominal sternite I and the coxae of the anterior three pleopods in different sexes are similar to those of *O. gracilirostris*. Thus, the figure by Bate (1888) of *O. brevirostris* was actually a male of *O. typus* while his figure of *O. typus* was a female. The present species also has the ability to lock the laterally extended scaphocerites. The structure of the scaphocerite and the basicerite is similar to that of *O. gracilirostris* except the concavity of the basicerite is more well-marked in the present species. The long overhanging posterior spines of abdominal tergites III and V have a tendency to curve slightly upwards unlike the outer convex margin of those of *O. gracilirostris*. *O. typus* can be easily distinguished from *O. gracilirostris* by the rostrum near the tip of the scaphocerite being devoid of teeth and the much longer overhanging spine on the abdominal tergite V. This species is uncommon and was always accompanied by the much larger *O. gracilirostris*.

Acknowledgements

Grateful acknowledgement is extended to Dr. F.A. Chace, Jr. of the Smithsonian Institution, Washington, U.S.A., for reviewing the manuscript and making valuable suggestions.

References

Alcock, A.W. 1901. A descriptive catalogue of the Indian deep-sea Crustacea Decapoda Macrura and Anomala in the Indian Museum, being a revised account of the deep-sea species collected by the Royal Indian Marine Survey Ship Investigator. *Calcutta*: 1–286, pls. 1–3.

Bate, C.S. 1888. Report on the Crustacea Macrura collected by H.M.S. Challenger during the years 1873–76. *Report on the Scientific Results of the Voyage of the H.M.S. Challenger during the years 1873–76. Zoology*, **24**, i-xc, 1–942; figs. 1–76; pls. 1–150.

Balss, H. 1925. Macrura der Deutschen Tiefsee-Expedition. 2. Natantia. *Wissenchaftliche Ergebnisse der Deutschen Tiefsee-Expedition*. **20**, 217–315; figs. 1–75; pls. 20–28.

Calman, W.T. 1939. Crustacea: Caridea. *The John Murray Expedition 1933–34. Scientific Reports*. **6**, 183–224; figs. 1–8.

Chace, F.A. Jr. 1936. Revision of the bathypelagic prawns of the family Acanthephyridae, with notes on a new family, Gomphonotidae. *Journal of the Washington Academy of Sciences*. **26**, 24–31.

Chace, F.A. Jr. 1940. Plankton of the Bermuda Oceanographic Expeditions. IX. The bathypelagic caridean Crustacea. *New York Zoological Socity*. **25**, 117–209; figs. 1–64.

Chace, F.A. Jr. 1947. The deep-sea prawns of the family Oplophoridae in the Bingham Oceanographic Collection. *Bulletin of the Bingham Oceanographic Collection*. **11**, 1–51; figs. 1–15.

Crosnier, A. and Forest. J. 1968. Note preliminaire sur les carides recueillis par l' "Ombago" au large du plateau continental, du Gabon a "L" Angola (Crustacea Decapoda Natantia). *Bulletin du Museum National D' Histoire Naturelle, Series 2*. 1123–47; figs. 1–7.

Crosnier, A. and Forset. J. 1973. Les crevettes profondes de l' Atlantique oriental tropical. Faune Tropical, XIX. *O.R.S.T.O.M., Paris*. 1–409; figs. 1–7.

Dennel, R. 1940. On the structure of the photophores of some decapod Crustacea. *Discovery Research*. **20**, 307–82; figs. 1–31, pls. 24–26.

Filhol, H. 1885. La vie au fond des mers. *Les*

explorations sous-marines et les voyages du "Travailleur" et du "Talisman". i-vii, 1–301; figs. 1–96.

George, M.J. and Rao. P.V. 1966. On some decapod crustaceans from the southwest coast of India. *Symposium on Crustacea, Marine Biological Association of India Marine Fisheries P.O., n' 2, 1965–1966*. **1**, 327–36.

Hanamura, Y. 1979. A check list of Pelagic Shrimps from Japanese Waters. *Annual Report of the Oceanic Research and Development, Tokai University*. **1**, 161–81; fig. 1.

Hayashi, K. and Miyake. S. 1969. Bathypelagic caridean shrimp collected by "Koyo Maru" during the International Indian Ocean Expedition. *Occasional Paper of the Zoological Laboratory, Faculty of Agriculture, Kyushu University*. **2**, 59–77; figs. 1–4.

Kemp, S.W. and Sewell. R.B.S. 1912. Notes on Decapoda in the Indian Museum. II. The species obtained by R.I.M.S.S. "Investigator" during the survey season 1910–1911. *Records of the Indian Museum*. **7**, 15–32; fig. 1; pl. 1.

Kensley, B.F. 1972. Shrimps and prawns of Southern Africa. *South African Museum*. 1–65, figs. 1–31.

Man, J.G. De. 1920. The Decapoda of the Siboga Expedition, Part IV. Families. Pasiphaeidae, Stylodactylidae, Hoplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophylidae, Processidae, Glyphocrangonidae and Crangonidae. *Sibogae Expedition. Monograph*. **39a**, 1–318; pls. 1–25.

Milne-Edwards, A. 1981. Description de quelques Crustace's Macroures Provenant des grandes profondeurs de la mer des Antilles. *Annales des Sciences naturelles (Zoologie). Series 6*. 11, 1–16.

Milne-Edwards, A. 1883. *Recueil de Figures de Crustace's Nouvaeux Ou Peu Connuus.*: pls. 1–44. Paris.

Milne-Edwards, H. 1837. *Histoire naturelle des crustaces, comprenent l'anatomie, la physiologie et la classification de ces animaux*. **2**, 1–532; altas 1–32; pls. 1–42. Roret, Paris.

Miyake, S. 1982. *Japanese crustacean decapods and stomatopods in colour*. **I**. i-vii; 1–277. Hoikusha, Japan.

Rathbun, M.J. 1906. The Brachyura and Macrura of the Hawaiian Islands. *Bulletin of the United States Fish Commission*. **23**, 827–930; figs. 1–79; pls. 3–24.

Wood-Mason, J. and Alcock. A. 1891. Natural history notes from H.M. Indian marine survey steamer "Investigation". Commander R.F. Hoskyn, R.N., commanding. No. 21. Notes on the results of the last season's deep-sea dreging. *Annals and Magazine of Natural History, Series 6*. **7**, 180–202; pls. 1–3.

Yokoya, Y. 1933. On the description of decapod crustaceans inhabiting the continental shelf around Japan, cheifly based upon the materials collected by "S.S. Soyo-Maru", during the year 1923–1930. *Journal of the College of Agriculture, Tokyo Imperial University*. **12**, 1–226; figs. 1–71.