

*P. odoratissimus* is not present, *Scandarma lintou* finds refuge under man-made concrete blocks on the forest floor or in crevices of vertical concrete walls. Also in this case, the habitat is close to fresh water and protected from strong winds.

*Scandarma lintou* is a nocturnal and mostly arboreal animal. At night, it can be found climbing on leaf surfaces, twigs, trunks, vines, grasses and sometimes also on the ground. It moves up trees as high as five metres. When climbing on trees, the crabs are constantly picking small food items from the surface of the plants with both of their chelae. Food items that were observed to be ingested included flowers, fruits, bark and some small invertebrates living on trees. Water availability seems to be the more important factor limiting the activity as compared to temperature: the crabs increased activity when rainfall dampened their habitat.

*Scandarma lintou* has a seasonal breeding, taking place from June to January. Ovigerous crabs have small eggs which hatch out into pelagic, free-swimming larvae. As the hatching approaches, ovigerous females migrate to the estuaries and release larvae into brackish water. The timing of larval release does not seem to follow lunar or semilunar periodicity. Releasing behavior could be observed throughout the month during the breeding season. The timing of larval release also does not correlate with tidal peaks. Female *Scandarma lintou* most abundantly released larvae in the evening hours (between 1900 and 2000 hours). It was noticed that both sexes lose their appendages by autotomy easily during handling.

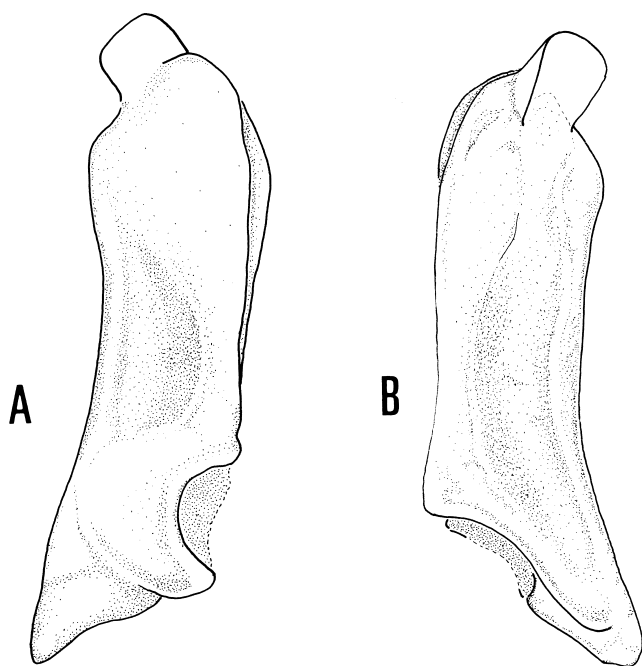


Fig. 4. *Scandarma lintou*, new species. Holotype male (17.55 by 16.9 mm) (TMCD 3276), Taiwan. Male right gonopod (setae removed), A, ventral view, B, dorsal view.

#### Description of zoea I.

Dimensions: rdl:  $0.78 \pm 0.03$  mm; cl:  $0.44 \pm 0.02$  mm; cw:  $0.36 \pm 0.02$  mm.

Carapace (Fig. 6A). Globose, smooth and without tubercles. Dorsal spine present, short and curved. Rostral spine present, straight and equal in length to dorsal spine. Lateral spines absent. A pair of setae on posterodorsal and anterodorsal regions. Posterior and ventral margin without setae. Eyes sessile.

Antennule (Fig. 6B). Uniramous; endopod absent. Exopod unsegmented with 4 terminal aesthetascs (3 long, 1 shorter and thin) and 1 terminal seta.

Antenna (Fig. 6C). Well developed protopod almost reaching the tip of the rostral spine and bearing two unequal rows of well-developed spines. Endopod absent; exopod elongated, more than 2/3 of the protopod length, with 2 terminal setae (1 long reaching to the tip of protopod, 1 shorter) and 5 small terminal spines.

Mandible. Endopod palp absent.

Maxillule (Fig. 7A). Coxal endite with 6 plumose setae. Basal endite with 5 setae (2 cuspidate and 3 plumodenticulate). Endopod 2-segmented with 1 seta on the proximal segment and 1 subterminal and 4 terminal plumodenticulate setae on the distal segment. Exopod seta absent; epipod seta absent.



Fig. 5. *Scandarma lintou*, new species. Life colours.

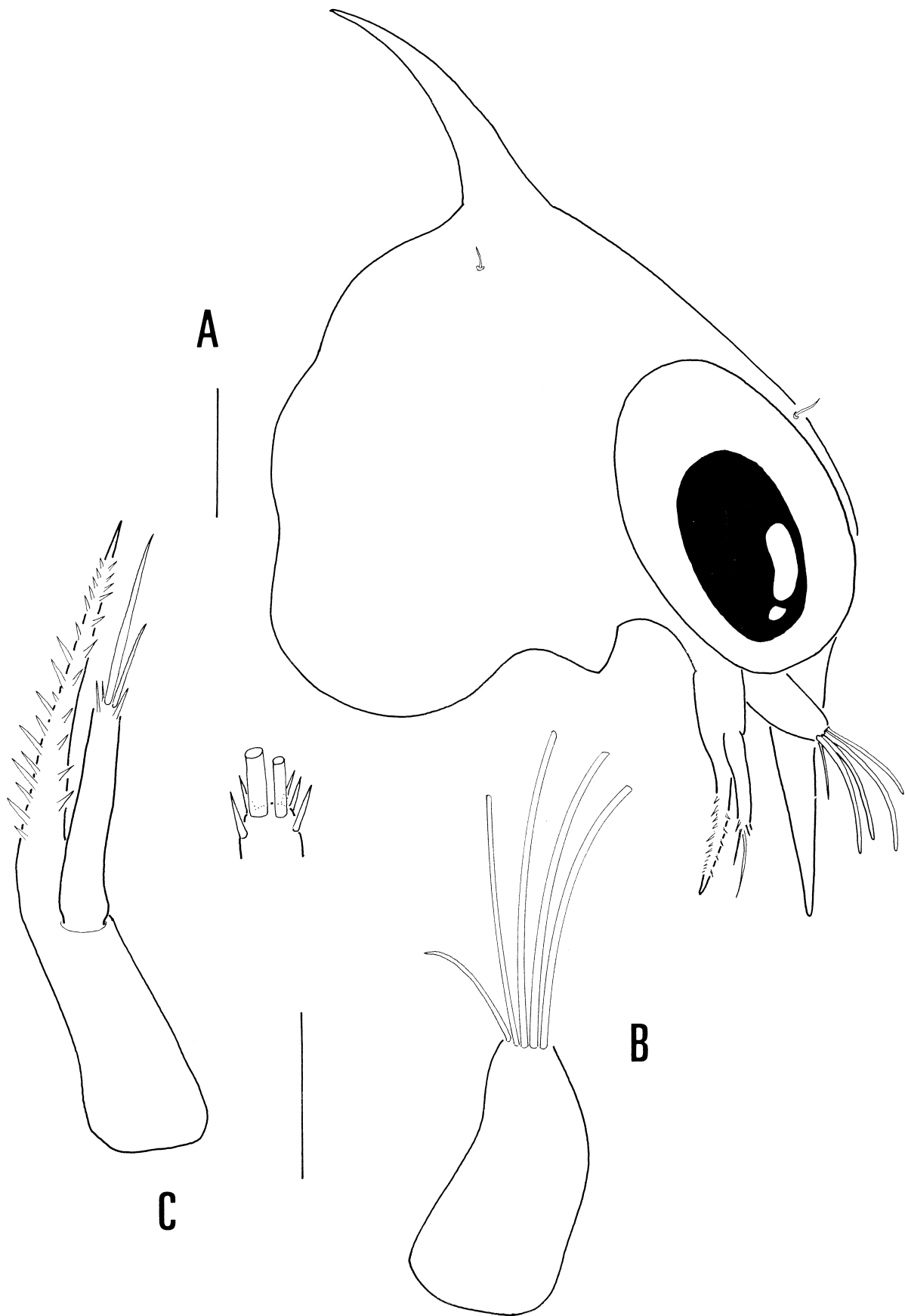


Fig. 6. *Scandarma lintou*, new species. Zoea 1, Taiwan. A, carapace, lateral view; B, antennule; C, antenna, including detail of terminal end of exopod. Scale bars: A, 0.1 mm, B,C, 0.05 mm.

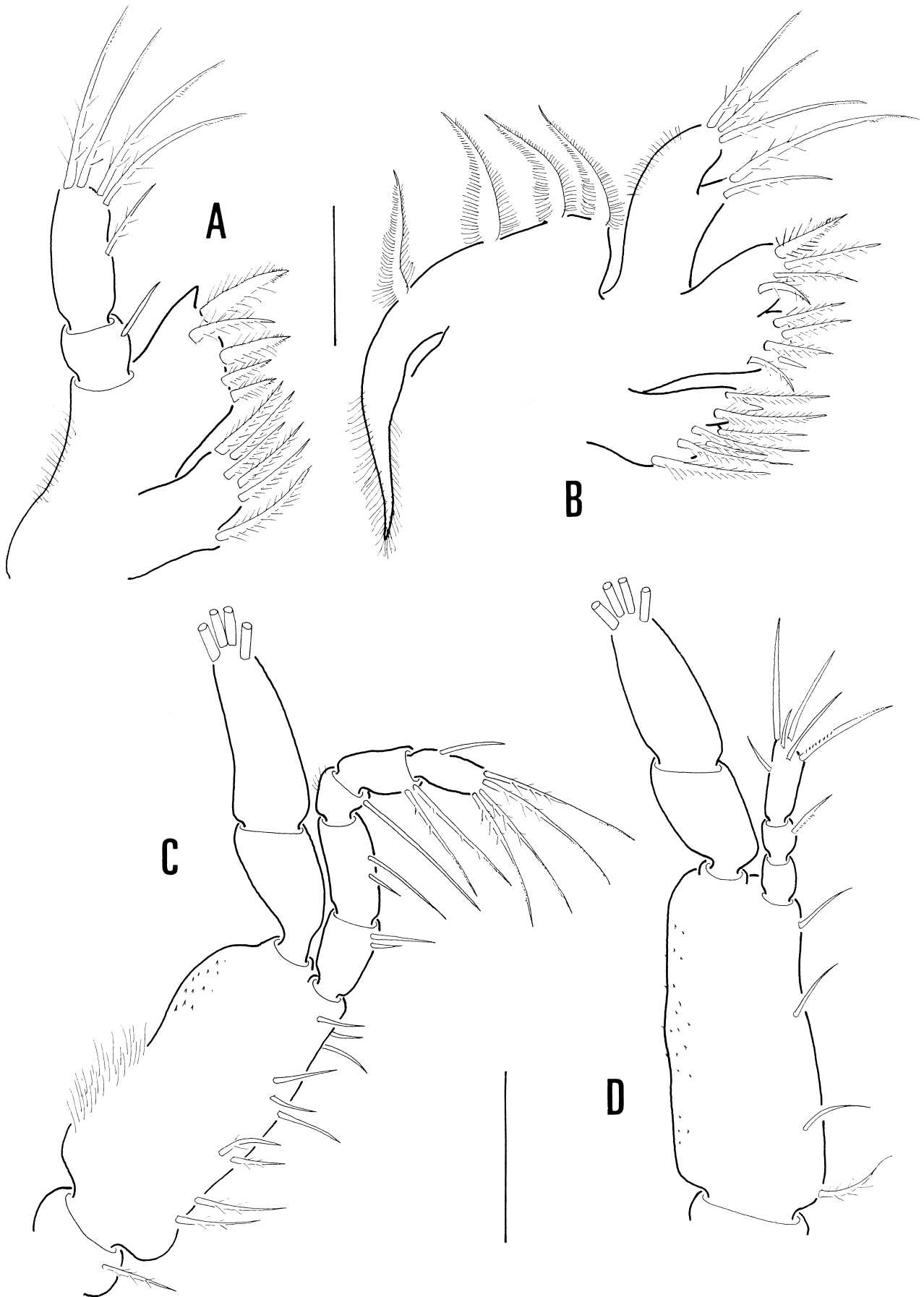


Fig. 7. *Scandarma lintou*, new species. Zoea 1, Taiwan. A, maxillule; B, maxilla; C, first maxilliped; D, second maxilliped. Scale bars: A, B, 0.05 mm; C, D, 0.1 mm.

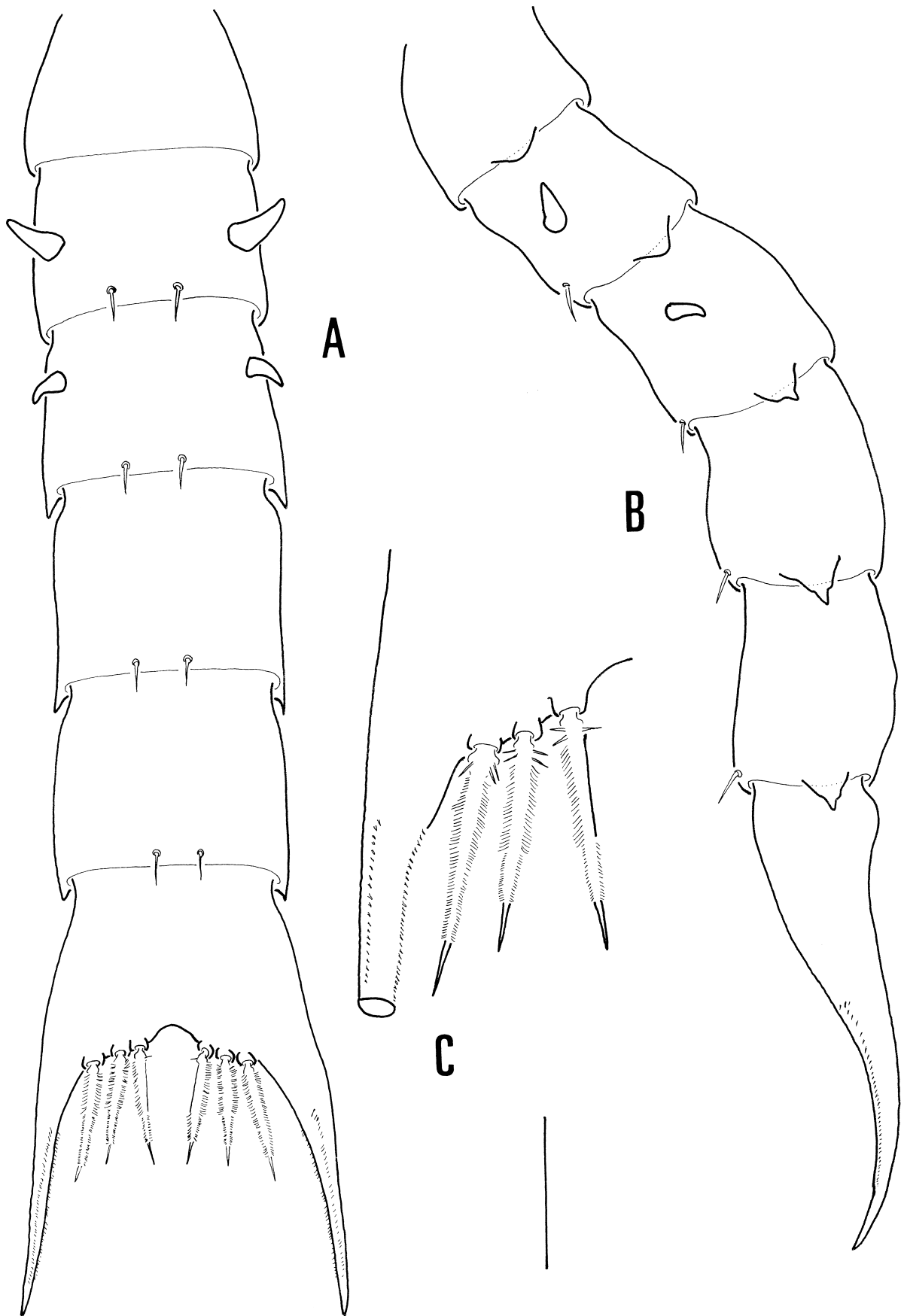


Fig. 8. *Scandarma lintou*, new species. Zoea 1, Taiwan. A, abdomen, dorsal view; B, abdomen, lateral view; C, telson detail. Scale bars: A, B, 0.1 mm; C, 0.05 mm.

Maxilla (Fig. 7B). Coxal endite bilobed with 5+2 (plus a marginal spine) plumodenticulate setae. Basial endite bilobed with 5+4 plumodenticulate setae. Endopod unsegmented, bilobed with 2+3 long plumodenticulate setae on the inner and outer lobe respectively. Scaphognathite with 4 plumose marginal setae and a long setose posterior process.

First Maxilliped (Fig. 7C). Coxa with 1 seta. Basis with 10 medial setae arranged 2,2,3,3, and a mat of long dorsobasal microtrichiae. Endopod 5-segmented with 2,2,1,2,5 (1 subterminal + 4 terminal) setae. Exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Second Maxilliped (Fig. 7D). Coxa without setae. Basis with 4 medial setae arranged 1,1,1,1. Endopod 3-segmented with 0,1,6 (3 subterminal + 3 terminal) setae. Exopod 2-segmented, distal segment with 4 long terminal plumose natatory setae.

Third Maxilliped. Absent.

Pereiopods. Absent.

Abdomen (Figs. 8A, B). Five abdominal somites. Somites 2 and 3 with pair of dorsolateral processes. Somites 3-5 with small posterolateral processes of subtriangular shape. Somites 2-5 with a pair of posterodorsal setae. Pleopods absent.

Telson (Fig. 8C). Telson bifurcated with 3 pairs of serrulate setae on posterior margin; mid-internal side of inner pair without spines. Dorsal part of each furcal branch with two rows of spines.

**Remarks.** - *Scandarma lintou* has been previously mentioned as undescribed crab with two colour photographs in the Taiwanese natural history crab book "The information of crabs' watching in Taiwan" (Lee, 2001: 135). During the publication process of the present study, an undescribed crab species, which is strikingly similar in its morphology as well as habitat preferences to *S. lintou* was discovered in Sarawak by Peter K. L. Ng (pers. comm., 2002). This crab species probably will have to be considered congeneric with *S. lintou*.

The larvae of *Scandarma lintou* did not differ among the three Taiwanese localities from which they had been obtained. The larval morphology presents the typical combination of features that characterize all sesarmid larvae. However, two remarkable characters allow to distinguish this genus and species from other related ones. The antenna presents a well developed exopod, with a length of more than 2/3 of the protopod and a long terminal seta reaching to the tip of the protopod. Among all known sesarmid zoea, only the first zoeal stage of *Selatium brockii* presents a somewhat similar antenna (see Vijayakumar & Kannupandi, 1987). Also the presence of a mat of long microtrichiae on the dorsobasal part of the basis of the first maxilliped had not been noticed previously in any other

sesarmid larvae. The larval characters clearly show that this species belongs to Sesarmidae, but confirm that it cannot be placed in any of the presently recognized sesarmid genera.

In 2002, the second author returned to the locality in southern Taiwan, where *Scandarma lintou* was initially discovered and originally abundant: the Kangkou River mouth in Pingtung County. He found that most of the vegetation had been cut down including the *Pandanus* screw pines. Together with the vegetation, most of the tree-climbing crab fauna had disappeared. Considering that *Scandarma lintou* has so far only been found near freshwater in the vicinity of the coast and that the screw pines are the most preferred shelter and feeding ground of this species, this loss of estuarine vegetation constitutes a severe threat for this crab species, which is apparently restricted to the island of Taiwan. The authors therefore recommend that the vegetation around estuaries along the southern and eastern coast of Taiwan must be protected to ensure the survival of this newly discovered and beautiful Taiwanese species.

The present description of the genus *Scandarma* is one more component to the revision of the systematics of several sesarmid genera currently carried out by P. K. L. Ng and the first author of the present study. According to Serène & Soh's (1970) classification, *Scandarma lintou* would be closest to *Pseudosesarma* or *Sesarmops*. However, the here described species, and possibly a new one from Sarawak (P. K. L. Ng, pers. comm., 2002), can be distinguished by several key characters (see genus diagnosis). Furthermore, morphological and molecular work on several sesarmid genera, has shown that *Pseudosesarma* as well as *Sesarmops* are polyphyletic and need to be re-defined (some of its members are closely related to *Chiromantes* sensu lato). A major reclassification of sesarmid species will be necessary to account for these recent findings. The DNA-sequence of the mitochondrial 16S rRNA gene of *Scandarma lintou* (unpublished) as well as its adult and larval morphology (see above), do not allow to place this species close to any currently recognized species of *Pseudosesarma* or *Sesarmops*. Consequently, and for the purpose of taxonomic clarity, a monotypic genus *Scandarma* is herewith created in the hope that its affinities to other sesarmid genera will be further clarified in the future.

## ACKNOWLEDGEMENTS

The first author was supported by a research fellowship of the Raffles Museum Singapore facilitated by Peter K. L. Ng, which also allowed him to travel to Taiwan. Peter Ng provided the information concerning the specimens of *Scandarma lintou* deposited at the ZRC and gave helpful advice during the writing of the manuscript. We would furthermore like to thank C.-H. Wang for his help in the field and for his hospitality, to Stefan Buchhauser for his help with photo editing, and to Paul Clark and one anonymous reviewer for their comments.

## REFERENCES

- Anger, K., J. Harms, M. Montú & C. de Bakker, 1990. Effects of salinity on the larval development of a semiterrestrial tropical crab, *Sesarma angustipes* (Decapoda: Grapsidae). *Marine Ecology Progress Series*, **62**: 89-94.
- Clark, P. F., D. K. Calazans & G. W. Pohle, 1998. Accuracy and standardization of brachyuran larval descriptions. *Invertebrate Reproduction and Development*, **33**(2-3): 127-144.
- Cuesta, J. A., M. Schuh, R. Diesel & C. D. Schubart, 1999. Abbreviated larval development of *Armases miersii* (Grapsidae: Sesarminae), a crab that breeds in supralittoral rock pools. *Journal of Crustacean Biology*, **19**(1): 26-41.
- Dana, J. D., 1851. On the classification of the Crustacea Grapsoidea. *American Journal of Science and Arts, series 2*, **12**: 283-290.
- Diesel, R. & M. Schuh, 1998. Effects of salinity and starvation on larval development of the crabs *Armases ricordi* and *A. roberti* (Decapoda: Grapsidae) from Jamaica, with notes on the biology and ecology of adults. *Journal of Crustacean Biology*, **18**(3): 423-436.
- Hartnoll, R. G., 1964. The freshwater grapsid crabs of Jamaica. *Proceedings of the Linnaean Society of London*, **175**: 145-169.
- Lee, J. -H., 2001. *The information of crabs' watching in Taiwan*. Big Tree Publisher Press, Taiwan. 174 pp. (In Chinese).
- Martin, J. W. & G. E. Davis, 2001. An updated classification of the recent Crustacea. *Natural History Museum of Los Angeles County Science Series*, **39**: 1- 24.
- Ng, P. K. L. & P. J. F. Davie, 1995. The terrestrial sesarmine crabs of the genera *Metasesarma* and *Geosesarma* (Crustacea: Decapoda: Brachyura: Grapsidae) of Ujung Kulon, West Java, Indonesia. *Tropical Biodiversity*, **3**: 29-43 (with color frontispiece).
- Ng, P. K. L. & C. G. S. Tan, 1995. *Geosesarma notophorum* sp. nov. (Decapoda, Brachyura, Grapsidae, Sesarminae), a terrestrial crab from Sumatra, with novel brooding behaviour. *Crustaceana*, **68**(3): 390-395.
- Ng, P. K. L., H.-C. Liu & C. D. Schubart, submitted. *Geosesarma hednon*, a new species of terrestrial crab (Crustacea: Decapoda: Brachyura: Sesarmidae) from Taiwan and Philippines. *Raffles Bulletin of Zoology*.
- Ng, P. K. L., H.-C. Liu & C.-H. Wang, 1996. On the terrestrial sesarmine crabs of the genus *Neosarmatium* (Crustacea: Decapoda: Brachyura: Grapsidae) from Taiwan. *Journal of Taiwan Museum*, **49**(2): 145-159.
- Ng, P. K. L., C.-H. Wang, H.-P. Ho & H.-T. Shih, 2001. An annotated checklist of brachyuran crabs from Taiwan (Crustacea: Decapoda). *National Taiwan Museum Special Publication Series*, **11**: 1-86.
- Schubart, C. D. & R. Diesel, 1999. Osmoregulation and the transition from marine to freshwater and terrestrial life: a comparative study of Jamaican crabs of the genus *Sesarma*. *Archiv für Hydrobiologie*, **145**(3): 331-347.
- Schubart, C. D., J. A. Cuesta, R. Diesel & D. L. Felder, 2000. Molecular phylogeny, taxonomy, and evolution of nonmarine lineages within the American grapsoid crabs (Crustacea: Brachyura). *Molecular Phylogenetics and Evolution*, **15**(2): 179-190.
- Schubart, C. D., J. A. Cuesta & D. L. Felder, 2002. Glyptograpsidae, a new brachyuran family from Central America: larval and adult morphology, and a molecular phylogeny of the Grapsoidea. *Journal of Crustacean Biology*, **22**(1): 28-44.
- Schuh, M. & R. Diesel, 1995. Breeding in a rockpool: larvae of the semiterrestrial crab *Armases [= Sesarma] miersii* (Rathbun) (Decapoda: Grapsidae) develop in a highly variable environment. *Journal of Experimental Marine Biology and Ecology*, **185**: 109-129.
- Serène, R. & C. L. Soh, 1970. New Indo-Pacific genera allied to *Sesarma* Say 1877 (Brachyura, Decapoda, Crustacea). *Treubia, Bogor*, **27**(4): 387-416.
- Vijayakumar, G. & T. Kannupandi, 1987. Laboratory-reared zoeae and megalopa of the mangrove crab *Sesarma brockii* de Man. *Indian Journal of Fisheries*, **34**: 133-144.
- Wang, C.-H. & H.-C. Liu, 1998. *Common seashore crabs of Taiwan*. Taiwan Museum Taipei (2nd edition). 136 pp. (In Chinese).