

**LIMNORIA CRISTATA (ISOPODA: LIMNORIIDAE),  
A NEW SPECIES OF MARINE WOOD - BORER  
FROM SINGAPORE**

**L. J. Cookson and S. M. Cragg**

*ABSTRACT.* - *Limnoria cristata*, new species, a crustacean marine wood-borer from Singapore, can be readily distinguished from other limnoriids by the large lateral crests on the pleon and pleotelson which surround an oval dished depression extending over the dorsal surface of most of this region, and by the lack of a secondary unguis on pereopods 2 to 7. This species has been reported only from intertidal driftwood in a mangrove forest.

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**INTRODUCTION**

Wood-boring species of the flabelliferan family Limnoriidae are most numerous in tropical waters. In the tropical Indo-West Pacific region alone, 14 out of a world-wide total of 24 described wood-boring species are found (Table 1). The presence of these crustaceans is most commonly noted in situations where their activities result in significant damage to wooden man-made structures (see for example Santhakumaran, 1969; Barnacle & Ampong, 1975; Cookson *et al.*, 1989) and they appear to be scarce in mangrove forests despite the abundance of dead wood in the intertidal zone (Cragg, 1986; Cragg & Aruga, 1988; papers reviewed by Santhakumaran, 1985). However, some species have been recorded from naturally-occurring dead mangrove wood (Kensley & Schotte, 1987) where they probably contribute to the process of wood breakdown described by Cragg (1986).

The species described in this paper was collected as a result of a National University of Singapore investigation of the wood-boring fauna of Singapore mangrove forests and the environmental variables affecting their distribution. The specimens were collected from the innermost reach of the West Johore Strait. Lim (1984) reported a mean surface temperature of 29.6°C (range 27.8-31.5°C) and mean surface salinity of 25.1 (range 19.1-29.8) ‰, which should be similar to conditions found at the collection site of the new species. The site itself, coded MK2 in a map given by Murphy & Lee (in press), is beside a small creek (Sungei Mandai Kechil), but the quantity of run-off in this area is small.

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**Table 1. Records of wood-boring limnoriids from tropical seas in the Indo-West Pacific region.**

Species	Sea	Reference
<i>Limnoria andamanensis</i>	Andaman Is., Andaman Sea	Rao & Ganapati, 1969
Rao & Ganapati	Bougainville Is., Coral Sea	Rayner, 1976
<i>Limnoria foveolata</i> Menzies	Kai Is., Arafura Sea	Menzies, 1957
<i>Limnoria indica</i>	Penang, Strait of Malacca	Jones <i>et al.</i> , 1972
Becker & Kampf	Manila, S. China Sea	Kühne, 1976
	Hong Kong, S. China Sea	Kühne, 1976
	Andaman Is., Andaman Sea	Ganapati & Rao, 1960
	Port Douglas, Coral Sea	Cookson <i>et al.</i> , 1989
	Manadapam, Indian Ocean	Becker & Kampf, 1958
<i>Limnoria insulae</i> Menzies	Port Douglas, Coral Sea	Cookson <i>et al.</i> , 1989
	Andaman Is., Andaman Sea	Ganapati & Rao, 1960
<i>Limnoria kautensis</i>	New Ireland, Bismark Sea	Cookson & Cragg, 1988
Cookson & Cragg		
<i>Limnoria multipunctata</i> Menzies	Kai Is., Arafura Sea	Menzies, 1957
	E. New Guinea, Coral Sea	Rayner, 1976
<i>Limnoria pfefferi</i> Stebbing	Andaman Is., Andaman Sea	Ganapati & Rao, 1960
	Christmas Is., Indian Ocean	Menzies, 1959
	Manila, S. China Sea	Kühne, 1976
	Port Moresby, Coral Sea	Kühne, 1976
<i>Limnoria platycauda</i> Menzies	Andaman Is., Andaman Sea	Ganapati & Rao, 1960
	Satta Hip, Gulf of Thailand	Kühne, 1975
<i>Limnoria septima</i> Barnard	Andaman Is., Andaman Sea	Barnard, 1936
<i>Limnoria sexcarinata</i> Kühne	Satta Hip, Gulf of Thailand	Kühne, 1975
<i>Limnoria tripunctata</i> Menzies	Hong Kong, S. China Sea	Kühne, 1976
	Madras, Indian Ocean	Becker & Kampf, 1958
	Admiralty Is., Bismark Sea	Rayner, 1976
<i>Limnoria unicornis</i> Menzies	Andaman Is., Andaman Sea	Ganapati & Rao, 1960
	Lae, Bismark Sea	Rayner, 1976
	Port Douglas, Coral Sea	Cookson <i>et al.</i> , 1989
<i>Paralimnoria andrewsi</i> (Calman)	Christmas Is., Indian Ocean	Calman, 1910
	Port Moresby, Coral Sea	Kühne, 1976
<i>Paralimnoria asterosa</i>	New Ireland, Bismark Sea	Cookson & Cragg, 1988
Cookson & Cragg		

## MATERIALS AND METHODS

Wood containing the specimens described in this paper was obtained in the course of a survey of dead wood on the forest floor of a mangrove forest. The presence of *Limnoria* was indicated by the branching pattern of superficial burrows with lines of pin-point holes marking the line of burrows just beneath the wood surface. Specimens were extracted by splitting slivers from the surface of the wood and picking out animals with a fine, moistened, sable brush.

Specimens are deposited with the Museum of Victoria (NMV), British Museum (Natural History) (BMNH), London, and the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore.

***Limnoria cristata*, new species**

(Pls. 1-2; Figs. 1-3)

**Material examined.** - Holotype - male (3.0 mm, 1.0 mm wide pleotelson) (NMV J15441 with 1 slide), from a plank of driftwood lodged in gully between mounds created by the mud lobster *Thalassina* in mangrove forest at approximately the level of mean high water neap tides, Mandai Kechil, Singapore, 1°26'N 103°46'E, coll. S. M. Cragg & D. H. Murphy, 7.xii.1987.

Paratypes - 1 male (3.0 mm) (NMV J15442 with 1 slide); 1 female (non-ovig.) (4.1 mm) (NMV J15443 with 1 slide); 1 male (3.1 mm), 1 intersex (2.6 mm), 3 females (non-ovig.) (2.9-3.4 mm), 1 female (ovig.) (3.5 mm) (NMV J15444); 3 males (2.6-3.1 mm), 3 females (3.0-3.4 mm) (BMNH 1989: 986: 6); 4 males (2.2-3.1 mm), 3 females (3.0-3.2 mm) (ZRC: 1989: 2981-2987), same data as holotype.

**Description.** - In preserved material, body pale yellow. Most of dorsal surface of pleon and pleotelson forms oval concavity or scoop. Scoop bordered by transverse carina on pleonite 1, lateral crests on pleonites 2 to 5 and pleotelson, and posterior margin of pleotelson. Dorsomedial region of pleonites 2 to 5 with longitudinal ridge which bears pair of nodes on each pleonite, nodes most widely separated on pleonite 2, becoming progressively closer together on more posterior pleonites. Pleonite 5 with pair of nodes close to anterior margin, also with single median node more posteriorly. Pereonites and pleonite 1 with transverse carinae bearing many setae, pleonites 4 and 5 with transverse carinae lacking prominent setae. Pleonite 5 0.45 times as long as pleotelson. Pleotelson with pair of small puncta close together, near dorsomedial anterior margin. Lateral crests of pleotelson greatly developed, forming bosses. Anterior half of pleotelson with pattern of slightly depressed areas or large pits, roughly bilaterally symmetrical; surface structure of large pits composed of scales, lacking scale spikes; dorsal surface of remainder of pleotelson with scale structure fused, covered with many small pits and solitary scale spikes on pit margins. Posterior margin of pleotelson without dorsal row of tubercles or scale spikes; posterior margin fringed with 4 large stout setae between which are short-sheathed flexible setae and thin scale spikes.

Antenna 1 with 3 flagellar articles; first article long, 0.16 times as long as peduncle article 3; second article with 4-7 aesthetascs; scale small, lacking apical brush seta. Flagellum of antenna 2 with 3 articles. Mandibular palp with 3 articles, third article reduced but still with comb-like setae with 2 rows of "teeth". Mandibular incisors with rasp and file. Lacinia mobilis of right mandible broadened apically, with regular or irregular row of small teeth. Outer lobe of maxilla 1 with 10 spines, 5 simple and 5 bluntly serrated; bluntly serrated spines with 4 of similar length, fifth relatively short. Epipod of maxilliped sub-triangular, distally narrowed to finger-like projection, 2.6 times as long as wide, not reaching articulation of palp; epipod with 2 simple true setae present.

Secondary unguis of pereopod 1 long, bifid; pereopods 2-7 without secondary unguis; ventral comb-like setae (not dorsal comb-like setae) absent on merus, present on carpus of pereopods 6 and 7. Uropod peduncle without lateral tubercles; endopod 0.7 times as long as peduncle.

Pleopod 2 with plumose setae up to 0.5 times length of exopod. Appendix masculina reaching beyond endopod tip, articulating near mid-length of endopod. Endopod of pleopod 5 anterior to exopod, elongated, 0.9 times as long as endopod of pleopod 2; peduncle of pleopod 5 without lateral true seta.

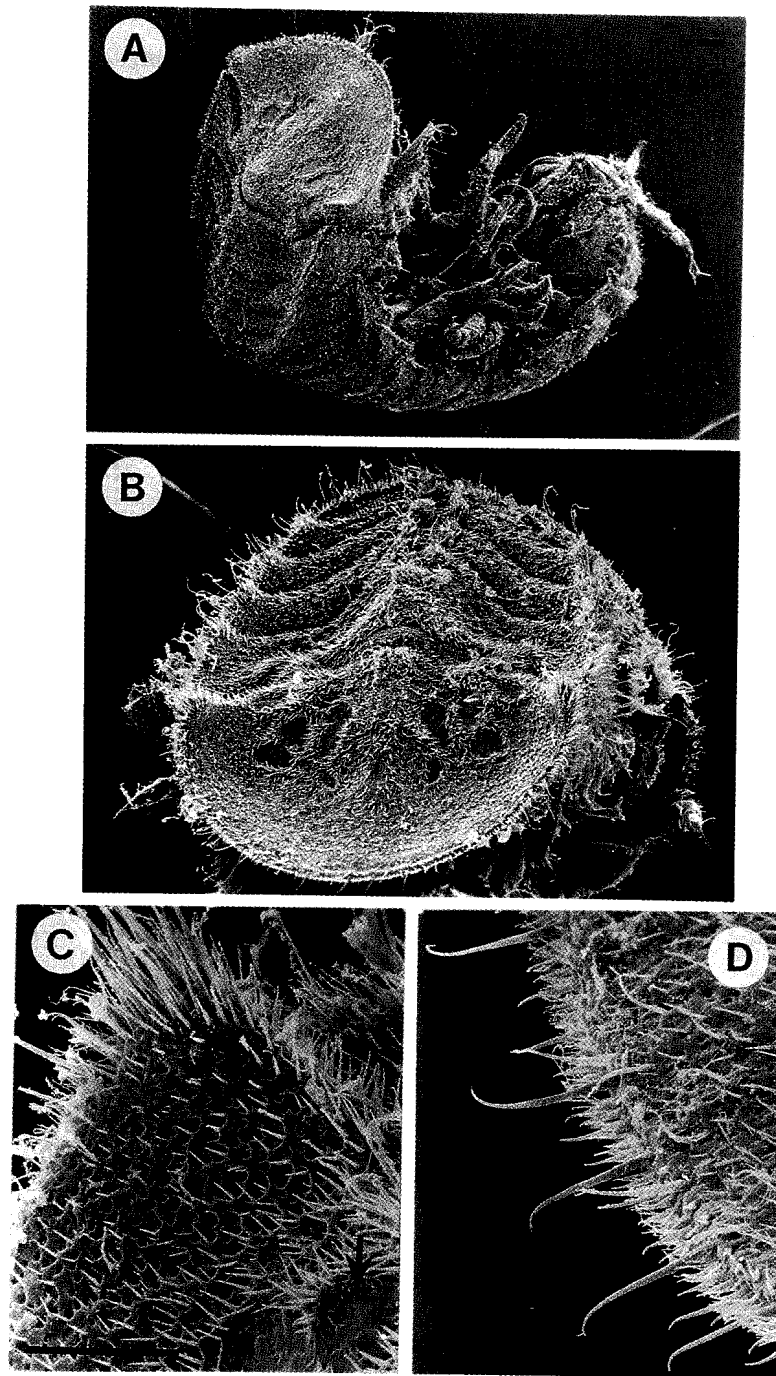
**Etymology.** - From the Latin for crested, “*cristata*”.

**Remarks.** - *Limnoria cristata*, new species, is a distinctive species which can be readily separated from other limnoriids by the lack of a secondary unguis on pereopods 2 to 7, and the sculpturing and large lateral crests on the pleon and pleotelson. In most species of *Limnoria*, pleonite 5 and the pleotelson are the only sculptured segments. These segments can be used to seal the burrow. However, in *L. cristata* the dorsal surface of pleonites 1-4 is also sculptured and may be exposed when the burrow is sealed. The concave abdominal segments and lateral crests of *Limnoria* may partly function as wood debris or frass collectors. Relatively more surface debris perhaps with associated bacteria would be expected to accumulate on the dorsal surface of these segments in *L. cristata* than in other species. Bacteria found on the exoskeleton of *L. tripunctata* may play a role in nutrition, particularly as a source of nitrogen (Zachary *et al.*, 1983). If this is so, the larger collection area may confer a selective advantage on *L. cristata*.

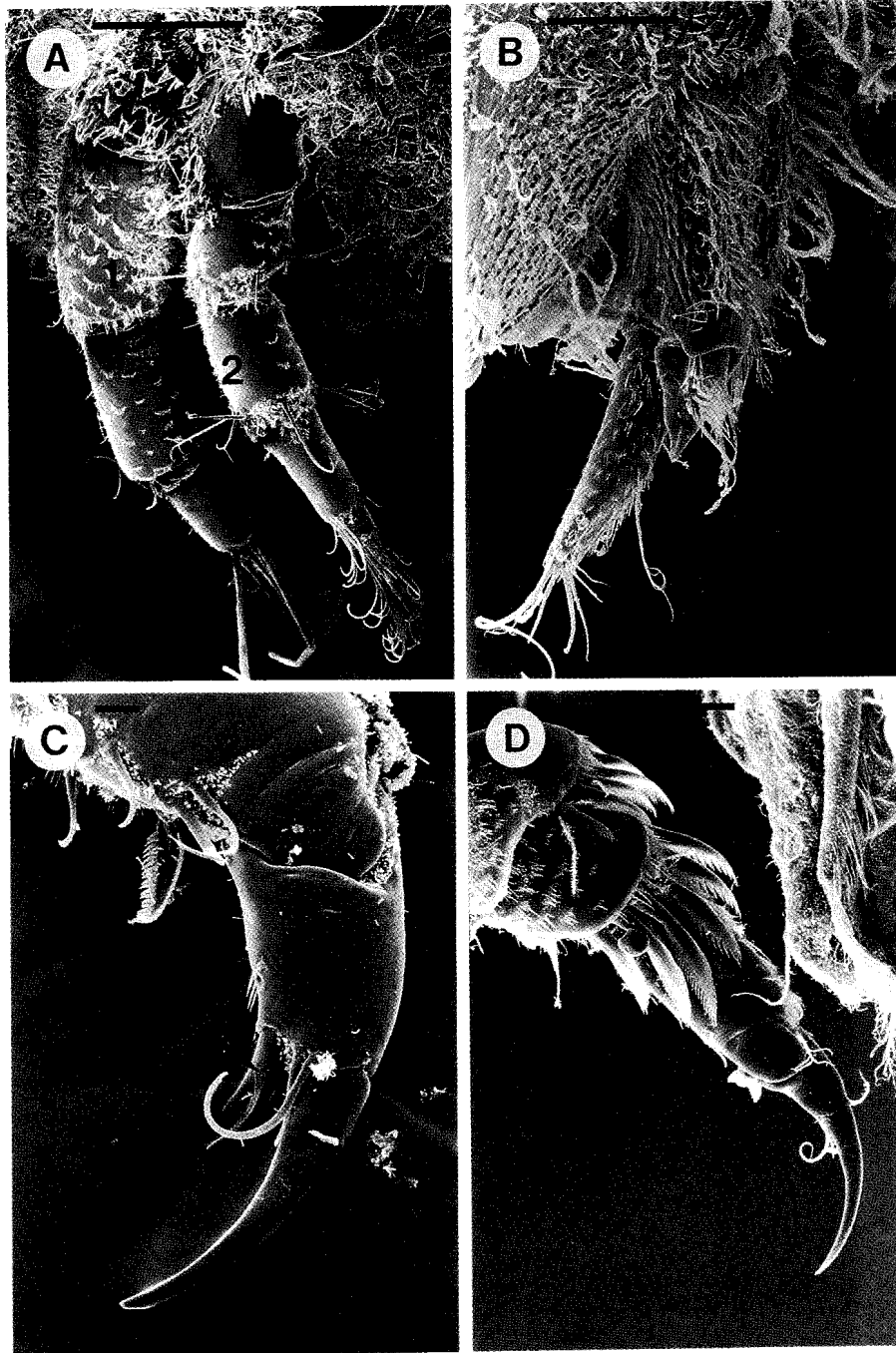
The position of the small anterior puncta on the pleotelson can vary slightly by being even closer together than indicated for the holotype. In one female paratype (NMV J15444), the puncta are joined to give the appearance of one broad central punctum. These forms suggest a transitional stage to the medial punctum found on *L. tripunctata* and *L. unicornis* (and some other species). A further small variation is that some paratypes have a slight longitudinal carina posteromedially on the pleotelson. The general pattern of small anterior puncta and a posterior longitudinal carina is sometimes found on the pleotelson of *L. multipunctata*, and both species also have only three flagellar articles on antenna 1. The dorsomedial sculpture found on pleonite 5 is also very similar to that found on *L. tripunctata*. However, *L. cristata* appears to be most similar to *L. unicornis*. Both species lack a dorsal row of tubercles or scale spikes on the posterior margin of the pleotelson, have a similar setal arrangement on the posterior margin of the pleotelson, a mostly fused scale structure on the dorsal surface of the pleotelson, a reduced or slightly reduced mandibular palp, four flagellar articles on antenna 2, and a triangular or sub-triangular maxillipedal epipod.

The absence in *L. cristata* of a secondary unguis on pereopods 2-7 is not unique amongst the Limnoriidae, as a similar condition is also found in a new species from the Northern Territory, Australia, where the secondary unguis is absent on pereopod 7 (Cookson, pers. obs.).

The sawn timber from which the specimens described in this paper were obtained must have originated from outside the mangrove forest in which it was found. It is most likely to have entered as driftwood from settlements found near the mangroves (Murphy, pers. comm.). Though several species of *Limnoria* have been reported to colonize mangrove wood (Kensley & Schotte, 1987), searches for marine borers in dead wood originating from mangrove trees at Mandai Kechil and other mangrove sites around the coast of Singapore (Murphy & Cragg, unpublished) have not detected the presence of *L. cristata*. This suggests that the normal habitat for this species is indeed elsewhere. Prior to the use of timber along the shoreline, the major



Pl. 1. Scanning electron micrographs of *Limnoria cristata*, new species, scale bar = 100  $\mu$ m. A, oblique lateral view of partially curled male; B, concave area on pleon and pleotelson, posterodorsal view; C, lateral boss and surface of pleotelson, note many small pits and also large pit (arrowed) in which scale structure is still evident; D, posterior margin of pleotelson showing four large stout setae, one large sheathed seta (bottom) as well as smaller sheathed setae, and scale spikes. Sheathing not visible at this magnification.



Pl. 2. Scanning electron micrographs of *Limnoria cristata*, new species, scale bar = 100  $\mu\text{m}$  for A, B, D and 10  $\mu\text{m}$  for C. A, right antennae 1 and 2 of a female; B, right uropod of a female; C, distal articles of pereopod 1, note large bifid secondary unguis (arrowed) (male); D, distal articles of pereopod 7, note absence of secondary unguis (male).

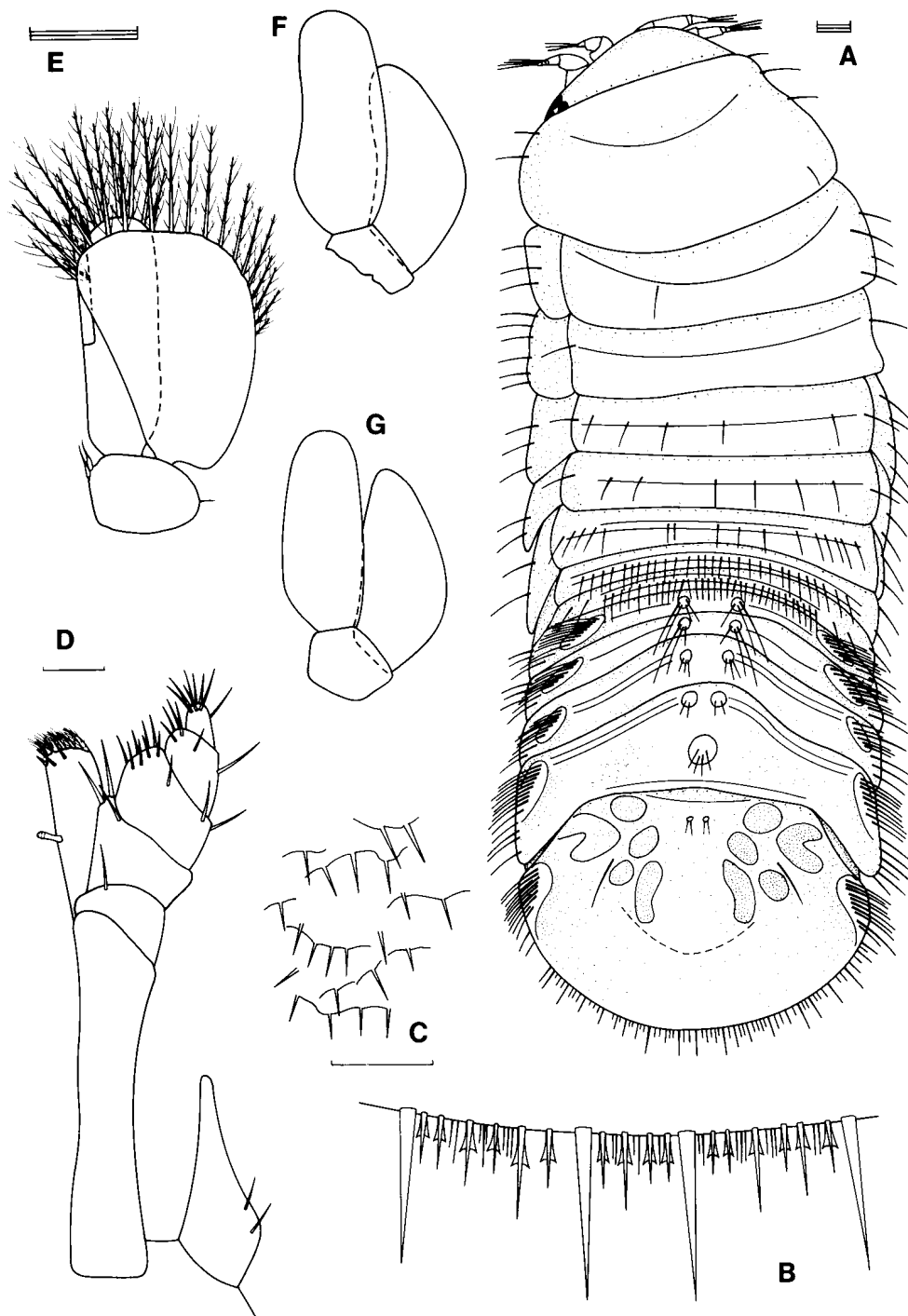


Fig. 1. *Limnoria cristata*, new species. A-F, male, NMV J15441, holotype: A, dorsal view; B, posterior margin of pleotelson, dorsal view; C, dorsal structure of pleotelson; D, maxilliped; E, pleopod 2; F, pleopod 5. G, male, NMV J15442, paratype, pleopod 5. Scales: single bar = 50  $\mu$ m, triple bar = 200  $\mu$ m.

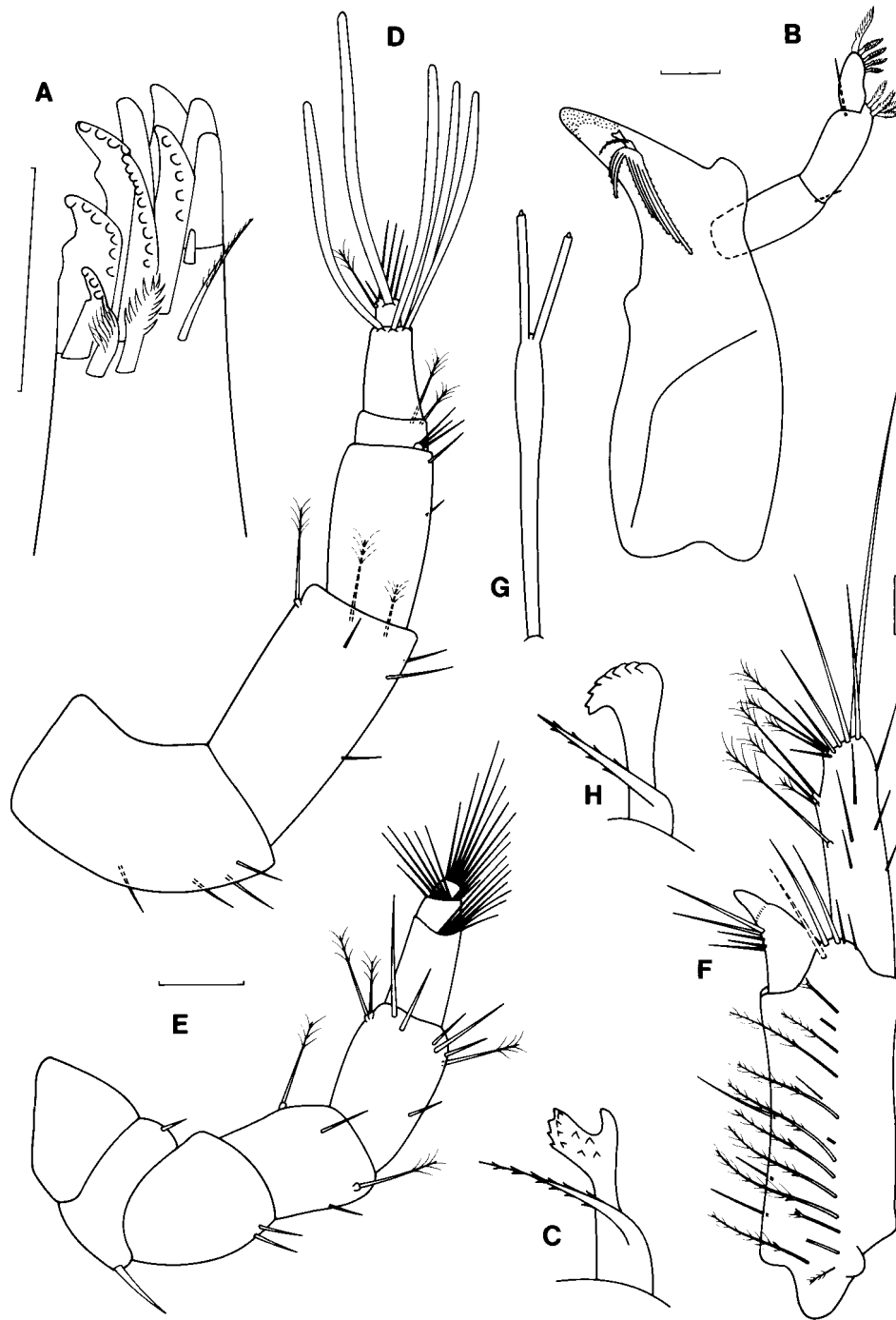


Fig. 2. *Limnoria cristata*, new species. A-F, male, NMV J15441, holotype: A, maxilla 1; B, right mandible; C, lacinia mobilis of right mandible; D, antenna 1; E, antenna 2; F, uropod, ventral view. G, female, NMV J15443, paratype, an aesthetasc from antenna 1. H, male, NMV J15442, paratype, lacinia mobilis of right mandible. Scale: single bar = 50  $\mu$ m.



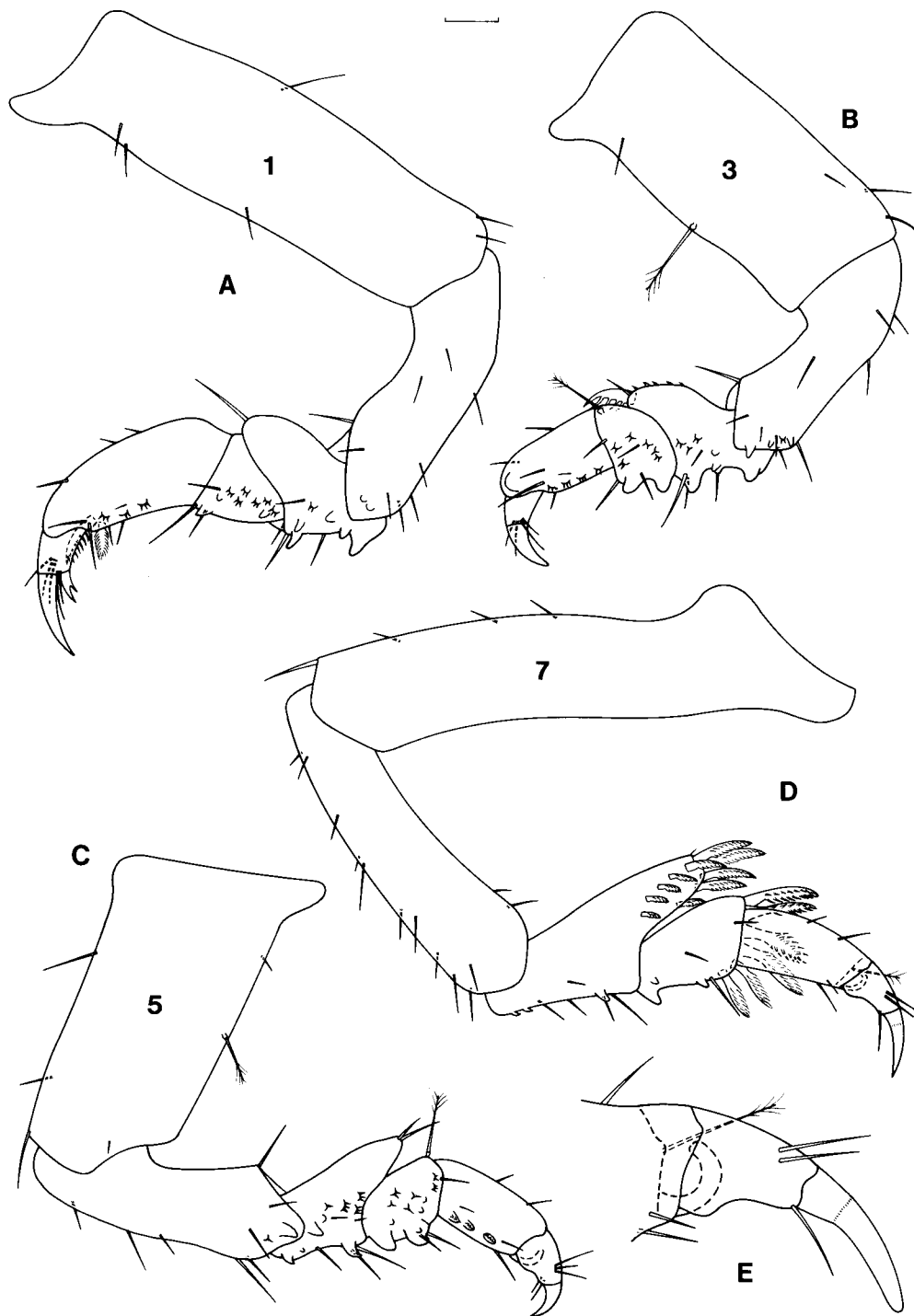


Fig. 3. *Limnoria cristata*, new species. A-E, male, NMV J15441, holotype: A-D, pereopods 1, 3, 5 and 7; E, dactylus of pereopod 7; all lateral views. Scale: single bar = 50  $\mu$ m.

niche for marine wood-borers in the tropics, apart from mangroves, would have been water-logged wood brought to the sea by rivers. If such wood is the natural environment for this species, it may, as has been suggested by Cookson and Cragg (1988) for *Paralimnoria asterosa* and *Limnoria kautensis*, normally be a subtidal organism.

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