

ON SOME SPECIES OF *DEMANIA* LAURIE, 1906
(CRUSTACEA: DECAPODA: BRACHYURA: XANTHIDAE)
FROM MALAYSIA, SINGAPORE AND THE PHILIPPINES,
WITH A KEY FOR THE GENUS

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ABSTRACT. - The xanthid crab, *Demania baccalipes* (Alcock, 1898) is recorded from Singapore for the first time, whilst *Demania reynaudi* (H. Milne Edwards, 1834) and *Demania scaberrima* (Walker, 1887) are recorded from the Philippines and Penang (Peninsular Malaysia) respectively. All three species are almost certainly poisonous, and *D. reynaudi* has already been implicated in at least one fatal poisoning. Variations in their carapace and cheliped sculpture and structure are also discussed. On the basis of these variations, *Demania squamosa* Guinot, 1977 described from Vietnam, is synonymised with *Demania reynaudi*. The affinities of the three species with related congeners is also briefly discussed. A key is provided to the 16 recognised species.

INTRODUCTION

In recent years, there has been an increase in interest in the taxonomy and systematics of crabs of the genus *Demania* Laurie, 1906, because of several reports of human death as a result of their ingestion (see Garth & Alcalá, 1977). The genus was first revised by Guinot (1977, 1979), and again by Garth & Ng (1985). The genus, as recognised at present, contains 17 species (Ng *et al.*, 1987; Deb, 1986):

- Demania splendida* Laurie, 1906 (type species)
- Demania reynaudi* (H. Milne Edwards, 1834)
- Demania scaberrima* (Walker, 1887)
- Demania baccalipes* (Alcock, 1898)
- Demania cultripes* (Alcock, 1898) (= *D. alcalai* Garth, 1975)
- Demania rotundata* (Serène, in Guinot, 1969) (= *D. japonica* Guinot, 1977)
- Demania intermedia* Guinot, 1969
- Demania toxica* Garth, 1971
- Demania macneilli* Garth, 1976
- Demania squamosa* Guinot, 1976
- Demania garthi* Guinot & Richer de Forges, 1981
- Demania serenei* Guinot & Richer de Forges, 1981
- Demania crosnieri* Serène, 1984
- Demania wardi* Garth & Ng, 1985
- Demania indiana* Deb, 1986
- Demania alcocki* Deb, 1986
- Demania bangladeshensis* Ng, Huda & Banu, 1987

The earliest reference to the crab's toxicity was by André (1931), as *Medaeus reynaudi*, who recorded that the crab was regarded as poisonous by people from the Gulf of Tonkin, Vietnam. Halstead & Courville (1965) and Guinot (1967) also documented the crab's toxicity. André's (1931) species was recognised by subsequent authors as belonging to the genus *Demania*. Guinot (1977, 1979), in partially revising the genus, established a new species, *Demania squamosa* for André's (1931) specimen of "*Medaeus reynaudi*".

The first documented report of a crab of the genus *Demania* causing a human fatality was by Alcalá & Halstead (1970) from the Philippines, and by a new species, the appropriately named *D. toxica* Garth, 1971. A second case of fatal poisoning, also from the Philippines, was reported by Garth (1975) for *D. cultripipes* (Alcock, 1898) (= *D. alcalai* Garth, 1975, fide Scrène, 1984; Garth & Ng, 1985). Screening of several Filipino xanthid by Carumbana *et al.* (1976) also showed *D. cultripipes* (as *D. alcalai*) to be a toxic crab. The latest record of a human fatality from the Philippines was of a man who consumed a crab (*Demania* sp.) in 1984 (Garth, *in litt.* 18 January 1985).

In this paper, *Demania baccalipes* is recorded from Singapore for the first time and *D. reynaudi* from Philippine waters. The significance of infraspecific variations within these two species, as well as their affinities is also discussed. The male first pleopod (abbreviated as G1) is also figured. Variations in the sculpture and structure of the carapace and

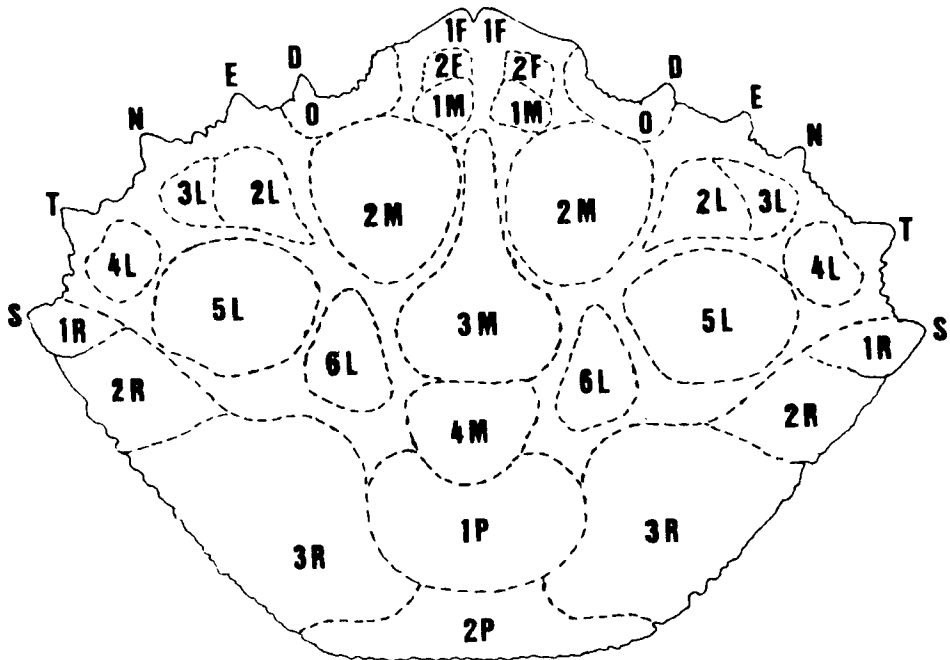


Fig. 1. Carapace regions of *Demania* (after Garth & Ng, 1985).

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chelipeds of *D. reynaudi* and *D. squamosa* also lead the authors to believe that the two taxa are in fact, synonymous. Opportunity is also taken to provide photographs of the colour pattern of *D. scaberrima*. Finally, a key to the 16 *Demania* species is also provided. Only material not previously cited by Garth & Ng (1985) is documented in the present paper. Since an almost complete bibliography has already been provided by Garth & Ng (1985), only the pertinent papers for the present study and those not previously cited are included here.

The carapace nomenclature is adapted from Garth & Ng (1985) (Fig. 1). Measurements provided are of the carapace width and length respectively. Nomenclature for carapace regions follows that used by Garth & Ng (1985). Specimens are deposited in the Zoological Reference Collection (ZRC), Department of Zoology, National University of Singapore; Reference Collection, Universiti Sains Malaysia (USM), and Universiti Sains Malaysia Muka Head Marine Station (USMMS), both Penang, Malaysia.

TAXONOMY

FAMILY XANTHIDAE MACLEAY, 1838

GENUS *DEMANIA* LAURIE, 1906

Demania reynaudi (H. Milne Edwards, 1834)

(Pl. 2A)

Xantho reynaudi H. Milne Edwards, 1834: 392

Xantho reynaudi - Odhner, 1925: 79, 81 (part)

Medaeus reynaudi - André, 1931: 649

Demania ? *reynaudi* - Serène, 1968: 76

Demania baccalipes - Sakai, 1976: 421, Pl. 151 fig.1

Demania reynaudi - Guinot, 1977: XIX, Pl. 7 fig.1; Guinot, 1979: 58, Pl.5 fig.1

Demania squamosa Guinot, 1977: XX, fig. 77D, DI, Pl. 7 fig.2

Demania squamosa - Guinot, 1979: 59, fig. 17D, DI, Pl. 5 fig.2

(not *Xantho reynaudi* Serène, 1966; for other incorrect references to the species, see Garth & Ng (1985) under *D. scaberrima*)

Material. - 1 carapace (72.3 by 55.2 mm) (ZRC. 1987.1191), in net set at 60 feet, in coral reef, Tanon Strait, between Negros Island and Cebu Island, Tabuk Tubig, Tanjay, southern Negros Oriental, 30 km north of Dumaguete City, Philippines, 5.xi.1984.

Remarks. - The carapace of the Filipino specimen of *D. reynaudi* was sent to John S. Garth (Allan Hancock Foundation, University of Southern California) by Angel C. Alcalá (Silliman University, Dumaguete City, Philippines), the subject which had apparently killed a man and a dog who had eaten it. Garth subsequently sent the specimen to the first author for further study. Details of its toxicity have been published by Alcalá, Takeshi Yasumoto (Tohoku University, Japan) and their collaborators (Alcalá *et al.*, 1988). They showed the presence of palytoxin in the leg tissues, and attempts were being made to obtain live specimens (Alcalá, *in litt.* to Garth, 26 February 1985). No other specimens have however, been obtained to date (Alcalá, *in litt.* 19 June 1987). This represents the first documented toxicity of the crab *Demania reynaudi*.

Guinot (1977, 1979) established a new species, *Demania squamosa* for André's (1931) Vietnamese specimens (det. as *Medaeus reynaudi*) after comparing them with the holotype

of *Demania reynaudi*, which was described from somewhere in the Indian Ocean. She cited the more produced anterolateral lobes and more prominent granules on the carapace of *D. reynaudi* as differences from *D. squamosa*. Otherwise the two species were identical. The GI of *D. squamosa* was figured, but that of *D. reynaudi* was not available since the solitary type was a female specimen. They share numerous similarities, notably the unusual nodules on the dorsal margins lining the meri of the last two pairs of ambulatory legs.

The sculpture and structure of the anterolateral lobes (E, N, T, S) of the present specimen however, appear to be intermediate between the condition observed in *D. reynaudi* and *D. squamosa*. The 3M region is similar to *D. squamosa*, but its IP region and anterolateral lobes are almost identical with those of *D. reynaudi*. Its 3R region also appears to be intermediate between the two species, with the granules neither very prominent (as in *D. reynaudi*) or indistinctly flattened (as in *D. squamosa*). Since the type female of *D. reynaudi* was very large (70.0 by 53.0 mm), much larger than the type of *D. squamosa* (56.5 by 46.0 mm), the differences observed are unlikely to be specifically significant. Guinot (1977, 1979) and Garth & Ng (1985) have already documented significant degrees of variation in *D. scaberrima*, and Garth & Ng (1985) had commented that the value of the various characters that have been used thus far to differentiate the various *Demania* species is questionable. As such, the authors are convinced that *D. squamosa* is a junior synonym of *D. reynaudi* and have accordingly, synonymised the two species.

Demania reynaudi is also closely affiliated with *D. baccalipes* (Alcock, 1898), first described from Ceylon (= Sri Lanka). At first sight, the carapaces and chelipeds of the types appear very different, the 3M region of *D. baccalipes* being clearly demarcated from the 2M along its anterior borders by deep grooves, whereas along its posterior border, only shallow, indistinct depressions separate them. In *D. reynaudi* however, the posterior borders of the 3M are separated from the 2M by more distinct grooves. The 3M, 4M and IP regions of *D. baccalipes* are also indistinctly separated by shallow depressions in contrast to the deep grooves present in *D. reynaudi*. Most significantly, the IP, and especially the 3R regions in *D. reynaudi* are strongly granulose whereas in *D. baccalipes*, these regions are much smoother. The nodules on the dorsal margins of the meri of the last pair of legs are usually small and indistinct in *D. baccalipes* compared to those on *D. reynaudi*, which are few in number, large and very prominent. The cheliped palm of typical *D. baccalipes* is also usually more delicate than that of *D. reynaudi*, the outer surface being lined with several rows of small granules, not the large and strong granules present on *D. reynaudi*. The chelipeds of the present Singapore specimen of *D. baccalipes* however, is more akin to that of *D. reynaudi*.

Interesting, all known specimens of *D. baccalipes* are smaller than the type of *D. reynaudi*. The type of *D. baccalipes* is 61.0 by 47.0 mm; Chhappgar (1957) recorded a 60.0 by 45.0 mm male from Bombay, India, while the ZRC has a 61.0 by 45.0 mm male from Pulau Angsa in the Malacca Strait (Buitendijk, 1950; Garth & Ng, 1985), and the present Singapore male is 66.0 by 52.0 mm. *Demania squamosa* measured 56.5 by 46.0 mm; the type of *D. reynaudi* was 70.0 by 53.0 mm, and the Filipino carapace 72.3 by 55.2 mm. There is a possibility that as the species increases in size, the external morphology of the species also changes. There are no significant differences in their GI structures (Chhappgar, 1957; Garth & Ng, 1985 for *D. baccalipes*; Guinot, 1977, 1979 for *D. squamosa*; present study for *D. reynaudi*). In fact, Garth & Ng (1985) had already remarked that there is a good chance that *D. squamosa* will prove to be synonymous with *D. baccalipes*. If this is

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eventually shown to be true, then *D. baccalipes* in turn becomes a junior synonym of *D. reynaudi* since the latter species is now regarded as a senior synonym of *D. squamosa*. The authors are however, adopting a very conservative approach, and retaining Alcock's (1898) species until specimens are obtained that have characters (especially of the carapace and dorsal margins of the meri of the last ambulatory legs) that are more intermediate between *D. reynaudi* and *D. baccalipes*.

Specimens identified as *D. baccalipes* by Sakai (1976) are almost identical with the present carapace from the Philippines, the IP and 3R regions being strongly granulose. Sakai's specimens are hence referred to *D. reynaudi* instead. Serène (1966), following Odhner's (1925) contention that *D. scaberrima* was a junior synonym of *D. reynaudi*, listed *D. reynaudi* from Thailand. Both species are in fact, distinct, and the Thai record reverts back to *D. scaberrima*.

Specimens recorded as *D. reynaudi* from Singapore (Buitendijk, 1950; Ow-Yang, 1963; Yang, 1979) are erroneous, and have been shown to belong to *D. scaberrima* instead (fide Garth & Ng, 1985). *Demania reynaudi* has previously been recorded from the Indian Ocean and Vietnam (Gulf of Tonkin), and is recorded at present from the Philippines and Japan (as *D. bacalipes*).

Demania baccalipes (Alcock, 1898)

(Pl. 1, 2B; Fig. 2)

Xantho (Lophoxanthus) reynaudi var. *baccalipes* Alcock, 1898: 117

Xantho (Lophoxanthus) baccalipes - Chhappgar, 1957: 427, Pl. 8 Fig. 1, m, n

Lophoxanthus reynaudi var. *baccalipes* - Balss, 1938: 51; Buitendijk, 1950: 77; Ow-Yang, 1963: 226

Demania ? baccalipes - Serène, 1968: 76

Demania scaberrima baccalipes - Guinot, 1969: 235; Guinot, 1971: 1074

Demania baccalipes - Guinot, 1977: Guinot, 1979: 59, Pl.4 fig.9; Yang, 1979: 19; Garth & Ng, 1985: 302, Pl.5, fig. 2D-F; Deb, 1986:132, Pl. 2 fig. 4

Material. - 1♂ (66.0 by 52.0 mm) (ZRC.1987.1189), off Changi Point, Singapore, by inshore fisherman, 27.i.1987.

Remarks. - The present specimen is the first record of this species from Singapore. Since the species has previously been collected from Pulau Angsa in the Malacca Straits (Buitendijk, 1950; Garth & Ng, 1985), the present record is not at all surprising. The carapace of the large male specimen is very close to the specimen from Pulau Angsa, although most of its regions appear slightly more granulose and rugose. Most significantly, the IP and 3R regions are smooth or not strongly granulose, a character which easily separates *D. baccalipes* from its closest relative, *D. reynaudi*. Garth & Ng (1985) had already commented on the close affinity between *D. baccalipes* and *D. squamosa*, the latter which was synonymised with *D. reynaudi* earlier. In the structure of its ambulatory legs and chelipeds however, the present specimen is almost identical to *D. reynaudi*. The dorsal margins of the last ambulatory meri are lined with large broadly rounded granules, quite unlike the smaller bead-like ones on the Pulau Angsa and Indian specimens of *D. baccalipes*. The chelipeds of the present specimen are also very large, and much more inflated and heavily built than that from Pulau Angsa. The outer surface of the palm also appears quite different from that of the Pulau Angsa *D. baccalipes* figured by Garth & Ng (1985), with large and strong granules. In fact, the size and ornamentation of the palm bears a very close resemblance to that of *D. reynaudi* instead. These differences however, may be a result of age and size since the Pulau Angsa specimen is slightly smaller. The GI

of the specimen is almost identical to that figured by Chhapgar (1957) and Garth & Ng (1985) for the species.

The carapace and chelipeds of the Singapore specimen are very prominent, closely resembling those described for *D. scaberrima* (fide Garth & Ng, 1985). This bright and distinctive colour pattern is characteristic of many known poisonous species, and is an indirect confirmation of their toxicity. The monochrome photographs of the two species figured in this paper, although lacking in colours, show the pattern very clearly. The darker areas are deep maroon, whilst the lighter areas are orangish-brown to beige.

Deb (1986) figured the specimen(s) of *D. baccalipes* contained in the Zoological Survey of India (ZSI) (= Indian Museum), including the G1. These figures agree very well with those by Garth & Ng (1985). The holotypes of this species and the related *D. cultripes* Alcock, 1898, bear the registration numbers ZSI C5079/1 (from Sri Lanka) and ZSI C4733/9 (from Singapore) respectively.

Demania scaberrima (Walker, 1887)

(Pl. 2C)

For synonymy, see Garth & Ng (1985)

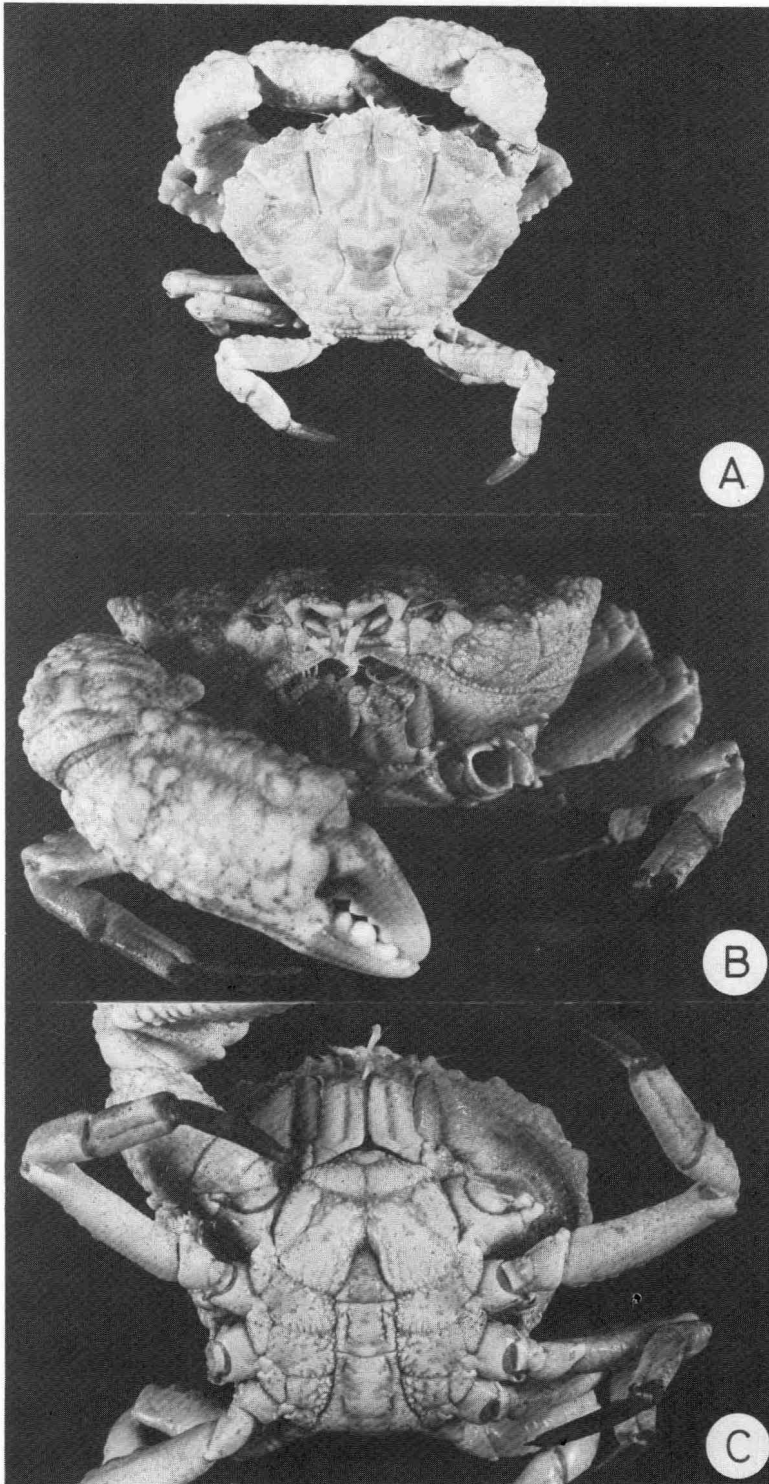
Material. - 1♀ (USM), P.O.0.37, trawled off Batu Maung, Penang island, Peninsular Malaysia, leg. C. F. Wang, 10.v.1981; 1♀ (USM), trawled off Penang island, Peninsular Malaysia, no other data; 1♂ (USM), trawled off Muka Head, Penang island, Peninsular Malaysia, no date; 2♂ (ZRC.1987.1187-1188), trawled off Batu Maung, Penang island, Peninsular Malaysia, leg. Harinder R. Singh, 20.ix.1982; 2♂, 3♀ (USMMS), trawled off Penang island, Peninsular Malaysia, no other data.

Remarks. - *Demania scaberrima* appears to be the most common species in the genus, and more specimens of this species have been obtained than any other *Demania*. The variability of this species has been discussed in detail by Garth & Ng (1985), and the present specimens from Penang agree with their descriptions in almost all respects. *Demania scaberrima* has previously been recorded from various parts of the Indo-West Pacific region. The record for Penang is new, although the species does not appear to be uncommon, and is frequently encountered by trawlers operating in the adjacent waters. A relatively recent specimen originally preserved in formalin retains most of its original colour, which agrees with that of Singapore specimens described by Garth & Ng (1985) (Pl. 2C). The darker areas are deep maroon whilst the lighter coloured areas vary from orangish brown to beige (see Ng *et al.*, 1988; Tan & Ng, 1988). The colour of a Japanese specimen of *D. scaberrima* figured by Sakai (1976) is much paler than that of the authors' fresh specimen, and suggests that his figure was based on a faded specimen.

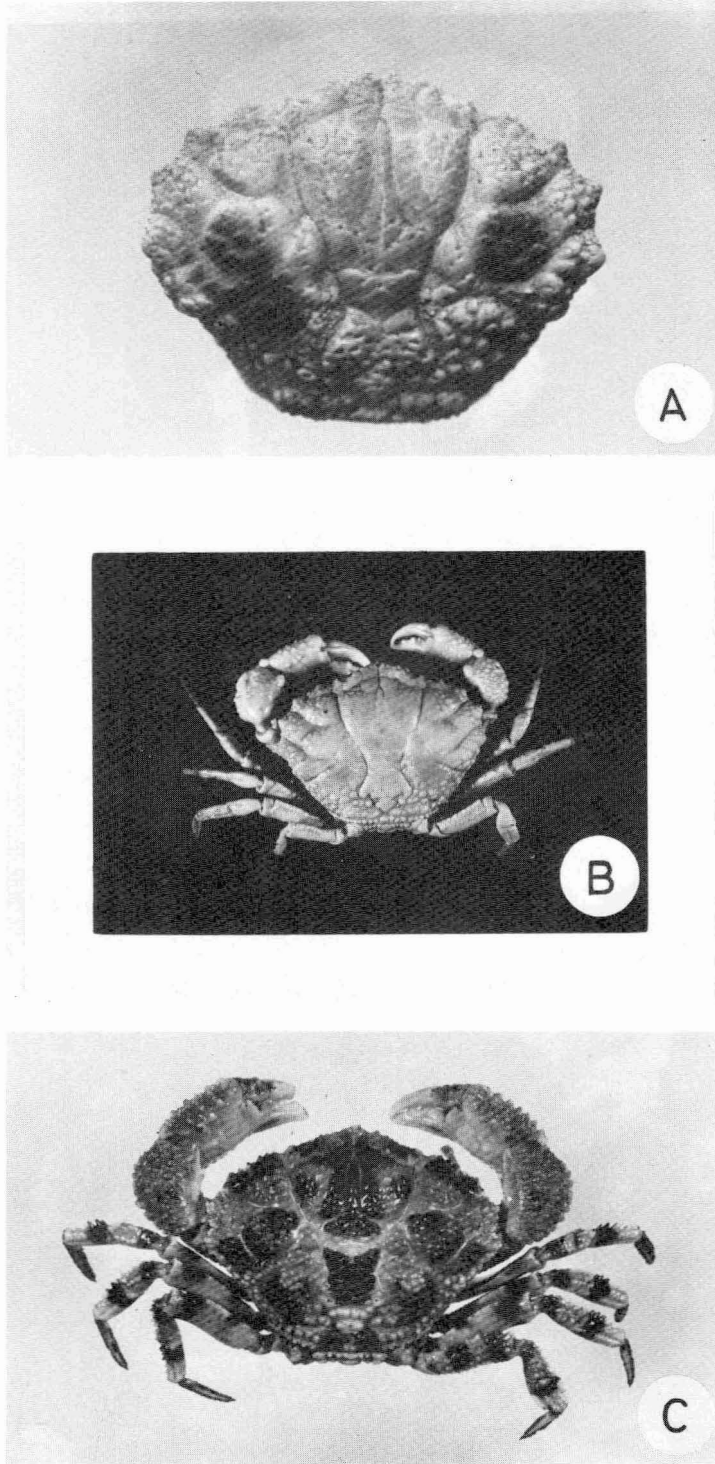
GENERAL REMARKS

With the present record of *Demania baccalipes*, three *Demania* species are now known from Singapore; the other two being *D. scaberrima* and *D. cultripes*. *Demania alcalai* Garth, 1975 was synonymised with *D. cultripes* by Serène (1984), and substantiated by Garth & Ng (1985). Another species described from northern Queensland, Australia, *D. macneilli* Garth, 1976, is extremely close to *D. cultripes*, and there is a very good chance that the two are also synonymous. Guinot (1977, 1979) and Garth & Ng (1985) in documenting and discussing the variation in sculpture of *D. scaberrima*, the most commonly encountered species, has shown that the carapace ornamentation is rather variable and not

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Pl. 1. *Demania baccalipes* (Alcock, 1898), male, (ZRC. 1987. 1189), Singapore.



Pl. 2 A. *Demania reynaudi* (H. Milne Edwards, 1834), carapace, (ZRC.1987.1191), Philippines; *Demania baccalipes* (Alcock, 1898), male, (ZRC.1987.1189), Pulau Angsa; C, *Demania scaberrima* (Walker, 1887), male, (ZRC.1984.6399), South China Sea.

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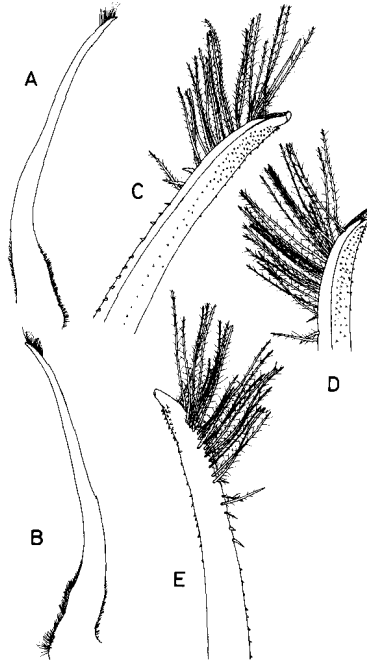


Fig. 2. *Demania baccalipes* (Alcock, 1898), male (ZRC.1987.1189), Singapore. G1s.

very reliable in distinguishing species. *Demania macneilli* differs from *D. cultripes* mainly in the dorsal surfaces of the carapace and outer surfaces of the cheliped palm being more granulose and rugose. Otherwise, both species are identical. For the moment however, *D. macneilli* is recognised as a separate taxon. The validity of the species *D. alcocki*, described as new by Deb (1986) is rather doubtful. The solitary type specimen is only 7.0 by 6.0 mm and clearly a juvenile. Its affiliations are with *D. garthi* except in the proportions of the carapace, form of the sculpture on the carapace and cheliped surfaces, and strength of the anterolateral teeth. Most of these characters, especially the carapace proportions, are known to change with size. *Demania alcocki* will probably prove to be synonymous with *D. garthi* when intermediate-size specimens become available. It is provisionally recognised here.

Despite the many papers which have been written or have dealt with the genus *Demania* over the years, there is still very little consensus as to the degree of variation or the actual number of species present. The toxicity of crabs of this genus however, cannot be disputed, and several deaths can confidently be attributed to them. Only in *D. reynaudi* however, have biochemical assays and tests been carried out (Yasumoto *et al.*, 1986; Alcalá *et al.*, 1987; Fukui *et al.*, 1987) and the type of toxin (palytoxin) ascertained. How and from where the crab accumulates this powerful toxin, and how the crab is able to withstand its effects is still not known.

The colour pattern of those *Demania* species in which this character is known is interesting. All seem to possess the striking maroon, orange, beige and white markings which seems to characterise the genus. The maroon and orange is always concentrated on regions N, E, 0, 5L, 2R, median areas of the 3R, 3M, 4M, parts of the 2M closer to the 3M, and IP. The legs in almost all the species are also characteristically banded orange

and white. The present specimens of *D. scaberrima* and *D. baccalipes* show this colour pattern very clearly and the carapace of *D. reynaudi* from the Philippines also show remains of this. The first author has seen a colour photograph of a fresh *D. cultripes* (Alcock, 1898) (identified as *D. alcalai* Garth, 1975) which has an almost identical pattern (poster presentation, Fukui *et al.*, 1986). Sakai (1976) provided beautiful colour plates of fresh *D. scaberrima*, *D. rotundata* and *D. serenei* (as *D. intermedia*, fide Guinot & Richer de Forges, 1981) from Japan, which also show the above mentioned colour pattern very clearly. It is extremely likely that such a distinctive and easily recognisable colour pattern has evolved to warn and discourage potential predators.

KEY TO THE GENUS *DEMANIA*

The present key is for the 16 species recognised at present in the genus *Demania*. Serène (1984) had previously prepared a detailed key to the genus but several of the characters that he had used to separate his taxa have since been shown to be variable and not very reliable, especially with regards to the dimensions of the carapace and degree of ornamentation. The GI structure has not proved to be very useful in diagnosing the various species, and has been shown to vary (especially the tip) in some species. External characters, notably of the carapace, legs and cheliped have to be used instead.

This revised key is intended to overcome some of these shortcomings. Admittedly, several of the taxa may prove to be synonyms of each other, and the key has been constructed in such a way as to be easily adapted to anticipated future changes in their taxonomy. Closely related species which are likely to be synonyms of one another, as far as possible, have thus been placed together in the same group. *Demania alcalai* Garth, 1976 was synonymised with *D. cultripes* (Alcock, 1898) (fide Serène, 1984); *D. japonica* Guinot, 1977 with *D. rotundata* (Serène, in Guinot, 1969) (fide Garth & Ng, 1985); and *D. squamosa* Guinot, 1977 with *D. reynaudi* (H. Milne Edwards, 1834) (present study).

1. Dorsal margins of ambulatory leg merus lined with rounded granules, inner angle of cheliped carpus with blunt, rounded tubercle 2

Dorsal margins of ambulatory leg merus crested, crenated, spinose or serrate, inner angle of cheliped carpus with sharp or distinctly acute tooth or spine 3
2. IP region of carapace smooth or only slightly rugose, without any granules or distinct grooves *D. baccalipes*

IP region of carapace strongly granulose, very rough *D. reynaudi*
3. Dorsal margin of ambulatory merus lined with many spines of varying sizes, appearing uneven or serrate, dorsal surface of carapace covered with strong granules or numerous smaller ones, especially on antero- and posterolateral regions 4

Dorsal margin of ambulatory merus crested, smooth, without any trace of spines or teeth, dorsal surface of carapace almost smooth, rugose, or with numerous small granules 8

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4. Ambulatory carpus and propodus lined with prominent, well defined sharp spines or teeth, dorsal surface of carapace with numerous large rounded or sharp granules, frontal margin lobulated, sinuous, trapezoidal, projecting beyond carapace *D. scaberrima*
- Ambulatory carpus and propodus carinate, smooth or lined with very small granules, surface of carapace lined with numerous small or large sharp granules, frontal margin straight, truncate, not strongly projected beyond carapace 5
5. Dorsal surface of carapace with numerous large, sharp granules, teeth on anterolateral margin not clearly differentiated *D. crosnieri*
- Dorsal surface of carapace with numerous small granules, teeth of anterolateral margin clearly differentiated 6
6. Dorsal margins of ambulatory merus slightly serrate, merus, propodus and dactylus normal length (short), 2M region of carapace partly divided longitudinally *D. serenei*
- Dorsal margins of ambulatory merus lined with sharp spinules, merus, propodus and dactylus long, 2M region of carapace entire 7
7. Granules on carapace and chelipeds small, sharp, teeth on anterolateral margin spiniform, sharp *D. garthi*
- Granules on carapace and chelipeds flattened, appears rugose, teeth on anterolateral margin lobiform, blunt *D. alcocki*
8. Surface of cheliped palm covered with numerous evenly-spaced large rounded granules, with dense short pubescence between them 9
- Surface of cheliped palm smooth, rugose or covered with small granules, not densely pubescent 11
9. Carapace gastric regions rugose, granulated and highly rugose on antero- and posterolateral regions *D. indiana*
- Carapace gastric regions smooth, rugose only on the antero- and posterolateral regions..... 10
10. Anterolateral margin low, lobulated, rounded without distinct teeth *D. toxica*
- Anterolateral margin with distinctly cut triangular teeth *D. bangladeshensis*

11. Dorsal surface of carapace covered with numerous small granules 12
- Dorsal surface of carapace smooth except for base of IP and antero- and posterolateral regions which are rugose or covered with large, low granules 14
12. Anterolateral margin differentiated into three acute teeth, carapace appearing rectangular, frontal margin almost straight, truncate, not projecting beyond carapace *D. intermedia*
- Anterolateral margin smooth, lobulated or cut into low, rounded teeth, carapace more rounded, squarish, frontal margin crenulated, distinctly lobulated, usually projects beyond carapace 13
13. Ventral margin of ambulatory merus smooth, anterolateral teeth low, acuminate, F, M, P regions of carapace punctate *D. wardi*
- Ventral margin of ambulatory merus serrate, anterolateral lobes low, rounded, F, M, P regions of carapace squamose or rugose *D. rotundata*
14. Anterolateral margin lobulated, carapace appearing squarish, frontal margin strongly clefted, lobes divergent, sinuous, ambulatory propodus foliaceous, surface of cheliped palm strongly rugose *D. splendida*
- Anterolateral margin cut into three blunt but distinct triangular teeth, carapace broad, frontal margin with very narrow cleft, slightly sinuous, surface of cheliped palm, slightly rugose or smooth 15
15. 2M and 3M regions of carapace completely separated from each other, regions of carapace covered with low granules, very rugose, outer surfaces of cheliped palm strongly rugose..... *D. macneilli*
- 2M and 3M regions of carapace incompletely separated from each other, median regions of carapace relatively smooth, not distinctly rugose, outer surfaces of cheliped palm slightly rugose..... *D. cultripes*

Acknowledgements. - The authors are most grateful to Dr. John S. Garth for his kindness throughout this study, and for critically reading the manuscript. The authors also wish to thank Professor Angel C. Alcalá for obtaining the Filipino specimen, for his kind information regarding the specimen, and access to unpublished material. The first author is also grateful to Professor Takeshi Yasumoto and Dr. Michio Murata for sharing their observations of *D. reynaudi* and *D. cultripes* with him. Thanks are also due to Dr. Wong Tat Meng (USM) for access to his specimens and permission to retain some for the ZRC, to Dr. Zubir Din for permission to examine the specimens at the USM Marine Station at Muka Head, Penang, and to Mr. K. Sagathevan (University of Malaya) for his photo-

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graphs of *D. scaberrima*. Photographs were taken by Mr. H. K. Yip of the Department of Zoology, National University of Singapore. This work has been partially supported by a research grant RP64/83 from the National University of Singapore.

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