

**TAXONOMIC NOTES ON THREE INDO-WEST PACIFIC  
SPECIES OF CALAPPA  
(DECAPODA: BRACHYURA: CALAPPIDAE)**

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**ABSTRACT.** - The nomenclature of the Chinese calappid crab, *Calappa undulata* Dai & Yang, 1991, is clarified. *Calappa quadrimaculata* Takeda & Shikatani, 1990, recently synonymised with *C. lophos* (Herbst, 1782), is shown to be a valid species, easily distinguished by various carapace and male abdominal features as well as the live coloration of adults.

**KEY WORDS.** - Taxonomy, nomenclature, *Calappa*, synonymy

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**INTRODUCTION**

Although Galil (1997) recently revised the Indo-West Pacific species of *Calappa*, several aspects of her study require further comment, in particular the nomenclature and taxonomic history of *C. undulata* Dai & Yang, 1991, and the validity of *C. quadrimaculata* Takeda & Shikatani, 1990, which she considered to be a junior synonym of *C. lophos* (Herbst, 1782).

Specimens examined during this study are deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum, National University of Singapore; Chiba Prefectural Museum (CBM), Chiba, Japan; National Taiwan Ocean University (NTOU), Keelung, Taiwan; South China Sea Institute of Oceanology (SCSIO), China; Institute of Oceanology, Chinese Academy of Sciences (IOCAS), Qingdao, China; and Berlin Museum (ZMB), Germany. The terminology used essentially follows that by Galil (1997), with the numbering of the

posterolateral lobes starting from the outer edge of the carapace (i.e. outermost lobe is regarded as the first). Measurements provided are of the carapace widths and lengths respectively.

## TAXONOMY

### *Calappa undulata* Dai & Yang, 1991

*Calappa undulata* Dai & Yang, 1991: 101; Chen, 1993: 686, Fig. 7ah; Galil, 1997: 314, Figs. 25, 26c, d, 34.

**Material examined.** - Holotype male (48.5 by 38.6 mm) (IOCAS), station K16B7, South China Sea, 21° 30'N 113° 30'E, on muddy sandy bottom, 39 m, coll. 10 Apr. 1960.

Paratype 1 female (52.0 by 38.0 mm) (SCSIO), station SSDI128, Nansha Islands (= Spratly Islands), 66 m, coll. 10 Apr. 1990.

Others 1 female (37.9 mm) (IOCAS), Nansha Islands (= Spratly Islands), 60 m, coll. 30 May 1993. 1 male, 1 female (ZRC 1999.121), Andaman Sea, Pichai Fish Port, Phuket, Thailand, coll. H. H. Tan, Apr. 1999.

**Remarks.** - In her recent revision of *Calappa*, Galil (1997) recognised the species, *C. undulata*, described from the South China Sea. Galil (1997: 314) attributed the authorship of the species to "Dai, 1991", but this is incorrect. The treatment by Galil (1997) of this species also does not treat several aspects which are important in helping to better understand the history and taxonomy of this species.

*Calappa undulata* was mentioned only in a key of the Chinese *Calappa* by Dai & Yang (1991: 101), but the species was not treated in the main text itself. No indication was made that it was new or that it was one of Chen's species. But, as the key contains several useful diagnostic characters, the name must nevertheless be regarded as validly published under the current Zoological Code (ICZN, 1985). The correct citation for this species should thus be *Calappa undulata* Dai & Yang, 1991. Chen (1993), apparently unaware of Dai & Yang's (1991) action, subsequently described *Calappa undulata* as a new species. Galil (1997), without comment, regarded *Calappa undulata* Dai & Yang, 1991, and *Calappa undulata* Chen, 1993, as synonyms.

The specimen figured by Galil (1997) is a specimen which was not examined by Chen (1993) in her description of the species. As Dai & Yang (1991) did not mention any material, all the specimens which they might have seen are thus syntypes. But, as Dai & Yang (1991) did not indicate anywhere in their book that the name "*Calappa undulata*" was attributed to Chen or that they had obtained the name from her study, it cannot be assumed that *Calappa undulata* Dai & Yang, 1991, and *Calappa undulata* Chen, 1993, refer to the same species. As such, the two type specimens used by Chen (1993) in her description of *Calappa undulata* cannot be assumed to be part of the type series of *Calappa undulata* Dai & Yang, 1991.

In the Chinese edition of the book on Chinese crabs, Dai et al. (1986) did not mention *Calappa undulata*. Although the Chinese and English editions of the book are supposed to be similar, there are some important differences, with the English version containing several more species (see Ng, 1992) which were apparently discovered after 1986. Chen had originally described *Calappa undulata* in the mid 1980s and presented the results in an unpublished report in

1990. This report was available to Dai. Dai subsequently used the name "*Calappa undulata*" when preparing the English edition of the book on Chinese crabs, on the presumption that the name had already been published by Chen (A.Y. Dai, S.L. Yang, pers. comm.). Unfortunately, this presumption was incorrect and the name as used in the key by Dai & Yang (1991) is a valid indication taking priority over that published by Chen (1993).

Although *Calappa undulata* Dai & Yang, 1991, is valid and consequently a senior objective synonym of *Calappa undulata* Chen, 1993, type specimens were not identified by Dai & Yang (1991). As the authors are now certain that Dai & Yang (1991) had based their name on Chen (1993), Chen's type specimens of *Calappa undulata* Chen, 1993, are therefore, also the types of *Calappa undulata* Dai & Yang, 1991. We hereby designate the holotype of *Calappa undulata* Chen, 1993, a male (carapace length 38.6 mm, carapace width 48.5 mm) now in the Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China, as the lectotype of *Calappa undulata* Dai & Yang, 1991. The paratype female of Chen's (1993) thus becomes a paralectotype.

The description and figures of *C. undulata* provided by Chen (1993) are very detailed and no redescription is necessary here. We also include two specimens recently obtained from somewhere in the Andaman Sea. These two specimens agree very well with the descriptions, figures and colour records of *C. undulata* by Chen (1993) and Galil (1997), and we have little hesitation in referring them to this species. It represents a considerable range extension.

***Calappa quadrimaculata* Takeda & Shikatani, 1990**

(Figs. 1a, b; 2a; 3a, c, e, g, j, l)

*Calappa quadrimaculata* Takeda & Shikatani, 1990: 479, figs. 14; Jeng, 1997: 36, 39, Fig. 45; Jeng, 1998: 60; Huang & Lützen, 1998: 1327.

*Calappa lophos* Galil, 1997: 302 (part) (not *Cancer lophos* Herbst, 1782).

**Material examined.** - **TAIWAN:** Tachi fishing port, Ilan County: 1 male (50.0 by 33.0 mm) (ZRC 1997.617), coll. P. K. L. Ng, 3-4 Aug.1996; 1 male (60.1 by 38.5 mm) (ZRC 1998.535), coll. J.F. Huang, 11 Apr.1991; 1 female (62.3 by 40.7 mm), coll. T.Y. Chan, 9 Sep.1984; GengFang fishing port, Ilan County, in shallow water tangle nets: 1 female (68.8 by 45.5 mm) (ZRC 1999.677), coll. P. K. L. Ng, 28 May 1999; NangFangAo, ShuAo, Ilan County: 1 male (69.6 by 44.3 mm) (NTOU), coll. P.H. Ho, 4 Nov.1985; Mito, Kaohsiung County: 2 males (52.7 by 36.0 mm, 49.0 by 32.7 mm) (NTOU), coll. J.F. Huang, 1 Jan.1992. **JAPAN:** Nakagusuku Bay, Okinawa, Ryukyus: 1 male (83.7 by 50.8 mm) (CBM 492), gill net, 1020 m, coll. T. Komai, 22 Jun.1994.

**Remarks.** - Takeda & Shikatani (1990: 482) described *C. quadrimaculata* on the basis of numerous specimens from the Ryukyus and northern Taiwan, distinguishing it from the similar *C. lophos* (Herbst, 1782) by "... the proportional difference of the carapace and the morphological difference of the posterior lobes of the carapace". Takeda & Shikatani (1990) noted that the mean carapace width to length ratio of *C. quadrimaculata* was 1.61 (range 1.571-1.63) whilst in *C. lophos*, the mean ratio was 1.43. In *C. quadrimaculata*, the first and second posterior carapace lobe are almost equal in width, while in *C. lophos*, the second lobe is at most, only 2/3 as wide as the first. Galil (1997: 304), in her revision of the Indo-West Pacific species of *Calappa*, dismissed the characters highlighted by Takeda & Shikatani (1990) to distinguish *C. quadrimaculata* from *C. lophos*, commenting only that "... they described features typical to young *C. lophos* specimens". Without any further comment, she synonymised both species.

The specimens of *C. quadrimaculata* and *C. lophos* on hand, however, indicate that the two are valid species. The two characters Takeda & Shikatani (1990) used to diagnose *C. quadrimaculata* from *C. lophos* do work, and these, as well as many other characters, easily distinguish adults of the two species. The carapace of adult specimens of *C. quadrimaculata* always appears distinctly broader than that of *C. lophos*, and appears transversely ovate rather than more rounded (carapace width to length ratio in the present specimens 1.5-1.6 vs. 1.3-1.5) (Fig. 1a, b vs. Fig. 1c-f), the first and second posterolateral lobes are subequal in width or the second tooth is only slightly shorter (Figs. 1a, b, 3a) (vs. the second lobe is 0.5-0.7 times as wide as first lobe, Figs. 1c-f, 3b); and the anterior half of the dorsal surface of the carapace is distinctly less convex (vs. higher and more inflated) (Fig. 1a, b vs. Fig. 1c-f). For *C. quadrimaculata*, these differences are also evident from the excellent descriptions and figures in Takeda & Shikatani (1990). These characters, especially the proportions of the first and second posterolateral lobes, are reliable even for small specimens of *C. lophos* examined (Fig. 1f).

*Calappa quadrimaculata* is a relatively small species when compared to *C. lophos*. Specimens of *C. quadrimaculata* measuring 50.0 by 33.0 mm (ZRC 1997.617) are already mature, with the G1 well chitinised and setose (Fig. 3g). Specimens of *C. lophos* larger than 50 mm in carapace width, however, are still immature, with the G1 relatively soft and setae sparse to absent (Fig. 3h, i). The G1s of *C. lophos* only develop more subtruncate basal parts when they become adults (larger than ca. 7080 mm carapace width), with the G1s of smaller specimens have a relatively more slender basal part (Fig. 3h, i). In *C. quadrimaculata*, however, specimens measuring 50 mm in carapace width already have a distinct subtruncate G1 basal part (Fig. 3g). Adult *C. lophos* are large crabs, easily reaching 100 mm in carapace width (Galil, 1997; Ng, 1998). The largest specimen of *C. quadrimaculata* known measures only 78.0 mm in carapace width (Takeda & Shikatani, 1990: 479).

On the basis of the specimens on hand, there are other less distinct morphological characters which can also serve to distinguish them. Comparing specimens of similar size, in *C. quadrimaculata*, the anterolateral margin is lined with numerous small, evenly spaced granules (Fig. 3a); but in *C. lophos*, the larger granules are positioned regularly between smaller ones and are also more closely packed (Fig. 3b). The teeth along the posterior carapace margin in *C. quadrimaculata* are relatively larger with the clefts and fissures separating them deeper (Figs. 1a, b, 3a) than in *C. lophos* (Figs. 1c-f, 3b). The third posterior carapace lobe in *C. quadrimaculata* is distinctly triangular, and while the margins and adjacent areas are granular, there is no discernible median oblique ridge. In *C. lophos*, however, the third posterior carapace lobe is more truncate and there is almost always the remnants of an oblique median ridge, even if it is very short and only near the sharpest point. In addition, the male telson of *C. quadrimaculata* is proportionately shorter (Fig. 3c vs. Fig. 3d); and the ambulatory propodus is proportionately wider (Fig. 3e vs. Fig. 3f) between specimens of comparable sizes.

The fresh colours of adults of the two species are strikingly different. Compared to *C. quadrimaculata*, *C. lophos* has a well developed purple to reddish streak between each of the large posterior anterolateral teeth, even in small specimens (vs. uniformly coloured), the dorsal surface of the carapace has two or four purple spots as well as scattered uneven spots, short longitudinal or oblique purple streaks (vs. at most with four well defined spots only [sometimes almost undiscernible] and without any other streaks or markings), the outer surface of the carpus of the cheliped has at least two well developed oblique purple streaks as well as scattered spots, with smaller specimens having a more prominent median purple spot as

well (vs. only median purple spot present, sometimes almost undiscernible, but never with other markings), the anterior outer margin of the merus of the cheliped has a distinct and continuous purple band just behind the convex margin (vs. absent), the outer surface of the chela has scattered purple streaks (vs. uniformly coloured), the inner surface of the carpus and chela has a pronounced reticulated purple pattern of dense streaks and spots (vs. only a small patch of purple on the subdorsal part, otherwise uniformly coloured), and the pterygostomial region has a purplish red streak or blotch (vs. with plain coloration) (Figs. 1c-f, 2b, c vs. Figs. 1a, b, 2a). Jeng's (1997, 1998) colour photographs of a fresh specimen of *C. quadrimaculata* from Taiwan; and colour figures of *C. lophos* by Sakai (1965, 1976), Miyake (1982), Ho (1996) and Wang (1988) all agree very well with the present colour diagnoses of the two species. Smaller specimens of *C. lophos* (ca. 30-40 mm carapace width) still have four distinct round purple spots on the carapace (Fig. 1f) but as the specimens become larger, the two anterior spots gradually become fainter and are eventually lost. Large specimens of *C. lophos* lose all four round spots, with the posterior part of the carapace being replaced by scattered unevenly shaped spots and/or short longitudinal stripes (Fig. 1c-e). Small specimens of *C. lophos* also have a spot on the carpus of the cheliped which disappears, being replaced by streaks when they become larger. *Calappa quadrimaculata*, however, almost always keeps the four purple carapace spots throughout (Fig. 1a), and the carpus of the cheliped always has only the median spot. As *C. quadrimaculata* is not known to grow as large as *C. lophos*, further comparisons are difficult. It is important to observe, however, that in *C. quadrimaculata*, the four carapace spots may sometimes appear faint and in one specimen (a female, 68.8 by 45.5 mm, ZRC 1999.677), the spots are barely visible and almost blend with the background colour (Fig. 1b). The carapace of this specimen, however, has no other patterning. Another useful character is the presence of many uneven light coloured longitudinal streaks on the carapace in *C. lophos* (Fig. 1c-f), a feature which is completely absent in *C. quadrimaculata* (Fig. 1a, b). This distinctive colour pattern is evident even on the smallest specimen of *C. lophos* we have examined for which colours are still visible.

The proportions of the carapace (width to length ratio) may not always work because the last anterolateral spines sometimes vary in their strength and sharpness. In some specimens, the tips may be broken or more acute, which can affect the carapace ratio. The value of carapace proportions in separating juvenile specimens cannot be determined. While we have examined juvenile specimens which we believe are conspecific with *C. lophos* (the second posterolateral lobe is only two thirds the width of the first tooth), we have yet to examine juveniles of *C. quadrimaculata*. As mentioned earlier, although juvenile specimens of *C. lophos* closely resemble *C. quadrimaculata*, their live colours differ nevertheless. It is possible that juveniles of both species are too similar to effectively distinguish, but this does not alter the fact that the adults are very different, and specimens larger than 30-40 mm in carapace width, even without any fresh colours, are easily distinguished.

It is pertinent also to note that *C. quadrimaculata* and *C. lophos* have been collected together in northeastern Taiwan, and both are present in southern Taiwan (cf. present data, Jeng, 1997, 1998, Huang & Lützen, 1998; J.F. Huang, pers. comm.). This is true of southern Japan as well (Takeda & Shikatani, 1990). Trawls can obtain both species. On the basis of the specimens of other species the first author has collected, *C. quadrimaculata* appears to occur relatively shallower waters compared to *C. lophos*, being collected together with *C. philargius* (Linnaeus).

There is no need to redescribe *C. quadrimaculata* as this has been done relatively well by

Takeda & Shikatani (1990). The present note only serves to highlight characters which serve to distinguish it from *C. lophos*.

While the present study clarifies the identities of *C. lophos* s. str. and *C. quadrimaculata*, the identities of the specimens attributed to *C. lophos* from most of the Indian Ocean by Galil (1997) and other authors is another matter. We have examined the specimen of "*C. lophos*" illustrated by Galil (1997: 305, Fig. 17a, a male 47.3 mm in carapace width in the Paris Museum) from Nosy Bé in Madagascar, and while it superficially resembles *C. quadrimaculata* in carapace features (e.g. carapace proportions and the subequal widths of the first and second posterolateral lobes), it differs in several other characters, and is probably new. Ongoing morphological and genetic studies of *C. lophos* and its allied species by the



Fig. 1. Live colours. a, b, *Calappa quadrimaculata* a, male (50.0 by 33.0 mm) (ZRC 1997.617) (Taiwan); b, female (68.8 by 45.5 mm) (ZRC 1999.677) (Taiwan). cf, *Calappa lophos* c, female (85.0 by 70.2 mm) (NTOU) (Taiwan); d, male (95.8 by 77.0 mm) (NTOU) (Taiwan); e, male (ca. 95 mm carapace width) (not preserved) (Andaman Sea, Thailand); f, juvenile male (30.5 by 23.4 mm) (ZRC 1999.757) (Taiwan).

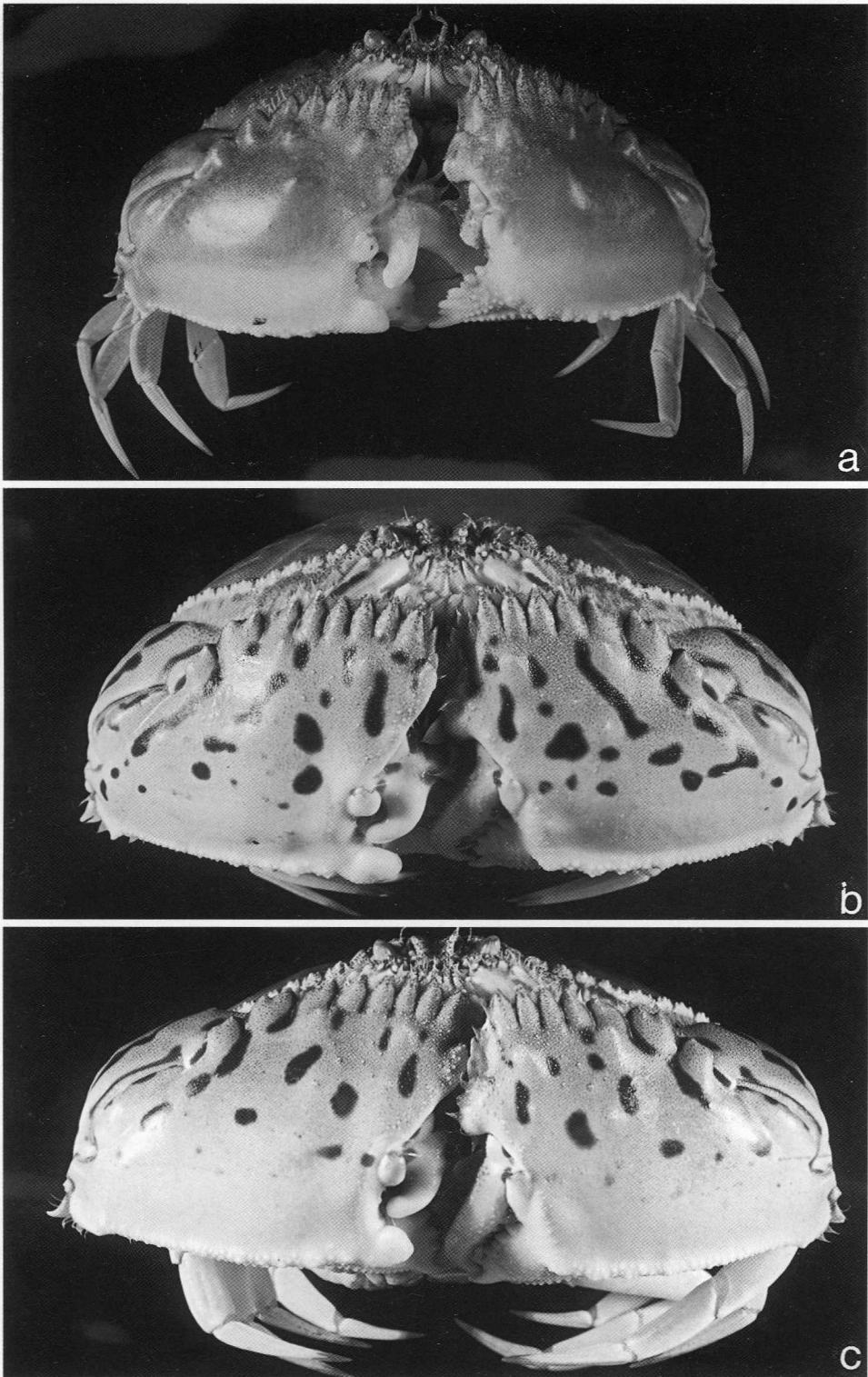


Fig. 2. Chelipeds. a, *Calappa quadrimaculata*, female (68.8 by 45.5 mm) (ZRC 1999.677) (Taiwan). b, c, *Calappa lophos* b, female (85.0 by 70.2 mm) (NTOU) (Taiwan); c, male (95.8 by 77.0 mm) (Taiwan).

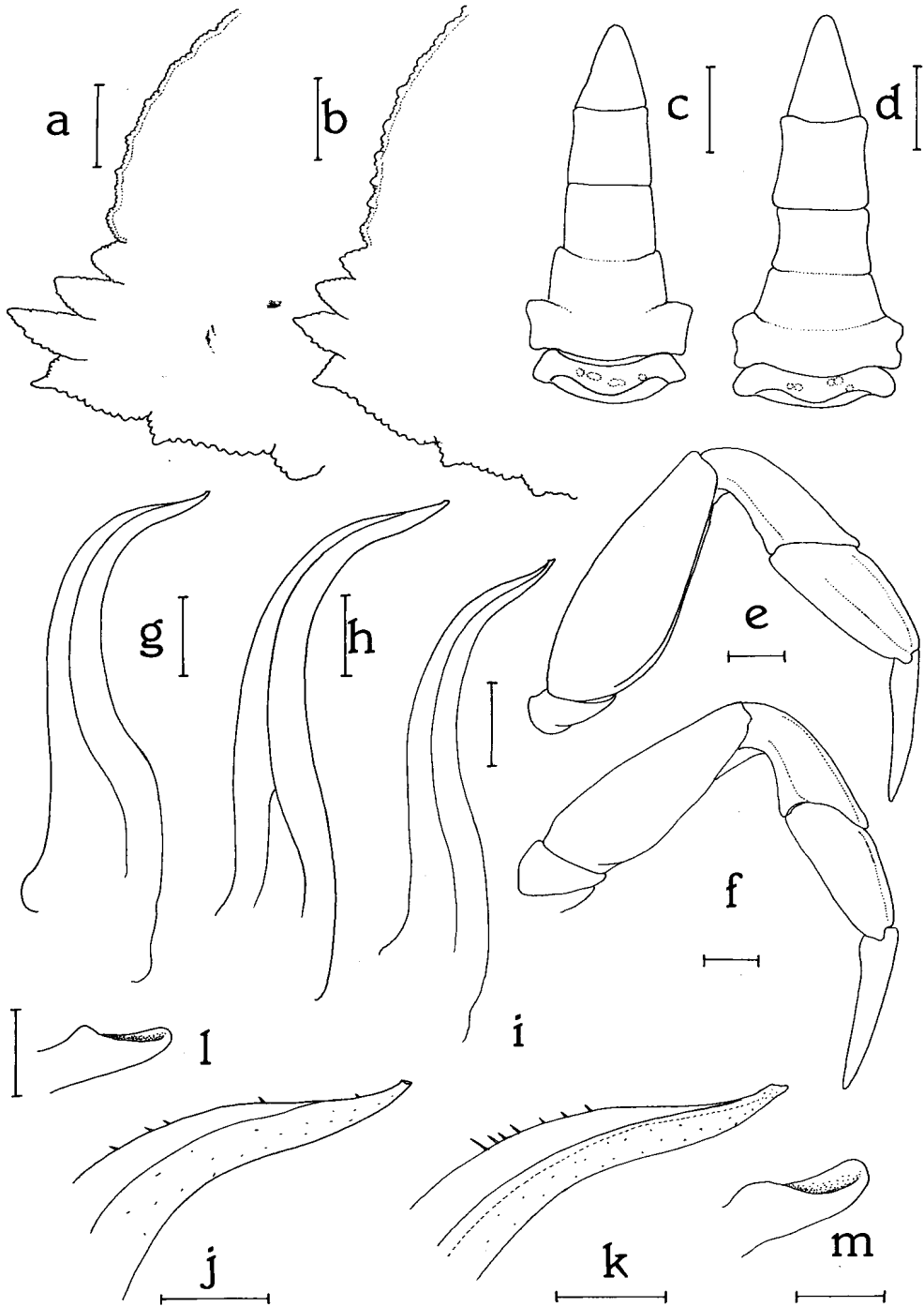


Fig. 3. a, c, e, g, j, l: *Calappa quadrimaculata* a, c, e, male (60.1 by 38.5 mm) (ZRC 1998.535); g, j, l, male (50.0 by 33.0 mm) (ZRC 1997.617). b, d, f, h, i, k, m: *C. lophos* b, d, f, male (60.0 by 42.0 mm) (ZRC 1998.206); h, m, (54.7 by 41.7 mm) (ZRC 1998.206); i, male (53.6 by 38.6 mm) (ZRC 1998.206). a, b, right side of carapace dorsal surfaces; c, d, male abdomens; e, f, right last ambulatory legs; g, i, left G1s (setae denuded); j, k, tips of left G1s; l, m, tips of left G2s. Scales: ad = 5.0 mm, e, f = 2.5 mm; g, i = 1.0 mm; j, k = 0.5 mm; l, m = 0.1 mm.



first author and his colleagues indicate that the Indian Ocean in fact has three species, *C. lophos* s. str., *C. guerinii* (Brito Capello, 1871) and the above mentioned undescribed species from Madagascar. Sakai (1999) recently figured specimens of all the species described by Herbst (1782), including *Calappa lophos*. His specimen of the dried holotype (Sakai, 1999: pl. 8A) agrees very well with what is here recognised as *C. lophos*.

**Comparative material:** -*Calappa lophos*. "EAST INDIES": Holotype male (106.5 by 68.5 mm) (ZMB 2168), no other data. **TAIWAN:** Tachi fishing port, Ilan County: 2 males (NTOU), coll. T.Y. Chan, 9 Sep.1984; 1 female (NTOU), coll. 4 Dec.1997; 3 juveniles (NTOU), coll. S.H. Wu, 20 May 1997; 1 female (NTOU), coll. J.F. Huang, 2 Mar.1990; 1 male (NTOU), coll. J.F. Huang, 17 Oct.1985; 1 male (NTOU), coll. T.Y. Chan, 4 Oct.1984; 1 female (NTOU), coll. coll. T.Y. Chan, 27 Oct.1984; 1 male (NTOU), coll. J.F. Huang, 18 Dec.1991; 1 male (NTOU), coll. J.F. Huang, 5 Sep.1987; 1 ovigerous female (NTOU), coll. J.F. Huang, 23 Aug.1990; 1 male (28.3 by 21.5 mm) (ZRC), coll. P. K. L. Ng, 3-4 Aug.1996; 3 males (smallest 34.2 by 25.0 mm), 1 female, 1 juvenile female (ZRC 1998.206), coll. P. K. L. Ng, 3-4 Aug.1996; 1 female (30.5 by 23.4 mm) (ZRC 1999.757), coll. P. K. L. Ng, 7 Jun.1999; 1 male (95.8 by 77.0 mm), 1 female (85.0 by 70.2 mm) (NTOU), coll. T.Y. Chan, 30 Sep.1999. Nang-Fang-Ao, Shu-Ao, Ilan County: 1 male, 3 females (NTOU), coll. J.F. Huang, 20 Aug.1991; 1 male (NTOU), coll. P.H. Ho & J.Y. Shy, 13 Nov.1985; 1 male (NTOU), coll. J.F. Huang, 7 Oct.1991. 2 females (NTOU), Keng-Fang, northeastern Taiwan, coll. J.F. Huang, 21 Dec.1990. 1 male, 1 female (NTOU), Toucheng, coll. 19 Mar.1973. Kaohsiung County: 1 male (NTOU), Mito, coll. J.F. Huang, 3 Apr.1988; 1 female (NTOU), Hsin-Ta-Kang, coll. J.F. Huang, 10 May 1991; 2 males, 3 females (1 with sacculinid) (ZRC 1998.207), Tungkang fishing port, coll. P. K. L. Ng, 5 Aug.1996; 2 males (50.5 by 36.3 mm, 44.9 by 33.2 mm) (CBM 2841), Tungkang fishing port, coll. T. Komai, 5 Aug.1996. 1 male (NTOU), Talin, 22 28.96°N 122 21.01°E, 13m, coll. J.F. Huang. 1 female (NTOU), no precise locality. 1 male (NTOU), no precise locality, coll. S.H. Wu, 1990s. 1 male, 2 females (1 ovigerous) (NTOU), no precise data. **JAPAN:** 1 male (CBM 2878), off Chaoshi, Chiba, 2030 m, sand mud, coll. trawler, 1990. Tosa Bay, Kochi: 1 male, 1 female, 2 juveniles (CBM 3309), off NiyodoGawa, 3045 m, beam trawl, coll. K. Sasaki, 7 Sep.1992; 1 male (CBM 3556), off Saga, Saga Fishery Port, 5060 m, coll. H. Endo, 20 Feb.1997; 1 male (CBM 3298), off Saga, coll. T. Komai, 27 Nov.1996. Boso Peninsula, Chiba Prefecture: 1 young male (CBM 145), Chikura, coll. 3 Dec.1992; 1 male (CBM 4696), off Hota, Uchobo coast, 3040 m, gill net, coll. T. Komai, 11 Jun.1998. 14 juveniles (6.3 by 5.4 mm 10.0 by 12.0 mm) (CBM 4247), off Sabiura, Kushimoto, Kii Peninsula, coll. S. Yamaguchi, 8 Sep.1978. **THAILAND:** 4 males (largest 123.4 by 79.7 mm), 5 females (largest 116.1 by 80.9 mm), 2 juveniles (ZRC 1998.1141), Andaman Sea, from trawlers, coll. P. K. L. Ng, Dec.1998. 5 males, 1 juvenile (ZRC), Andaman Sea, Pichai Fish Port, Phuket, coll. H. H. Tan, Apr.1999.

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