

ON THE TAXONOMY AND ECOLOGY OF *LABUANIMUM TRAPEZOIDEUM*
(DECAPODA, BRACHYURA, SESARMIDAE), A CRAB LIVING ON
RIVERINE CLIFFS IN TAIWAN

BY

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ABSTRACT

The unusual sesarmid crab, *Labuanimum trapezoideum* (H. Milne Edwards, 1837) is reported from Taiwan and is the second species of this genus known from the island. The taxonomy of the species is discussed and observations of its ecology are provided for the first time. In Taiwan, this species was found from 200 m to several kilometers away from the sea. It is always found on vertical to nearly vertical rock faces along flowing streams.

RÉSUMÉ

Le crabe inhabituel Sesarmidae *Labuanimum trapezoideum* (H. Milne Edwards, 1837) a été trouvé à Taiwan. C'est la deuxième espèce du genre connue de l'île. La taxonomie de l'espèce est discutée et des observations sur son écologie sont fournies pour la première fois. A Taiwan, cette espèce a été trouvée de 200 m à plusieurs kilomètres de la mer; elle a toujours été observée sur des falaises rocheuses verticales ou subverticales le long de rivières rapides.

INTRODUCTION

The genus *Labuanimum* was established by Serène & Soh (1970) for species which have a rounded basal antennular segment that is only slightly broader than

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long, well developed postfrontal lobes, and elongate ambulatory legs in which the dactylus is shorter than the propodus. They recognized 10 species in the genus, viz. *L. cruciatum* (Bürger, 1893), *L. demani* (Bürger, 1893), *L. finni* (Alcock, 1900), *L. gracilipes* (H. Milne Edwards, 1853), *L. politum* (De Man, 1888) (type species by original designation), *L. rotundatum* (Hess, 1865), *L. nannophyes* (De Man, 1895), *L. schutteii* (Hess, 1865), *L. sinuatifrontatum* (Roux, 1933), and *L. trapezoideum* (H. Milne Edwards, 1837).

In East Asia, only one species of *Labuanium* has been formally reported thus far, the tree-dwelling *L. rotundatum* (cf. Liu, 1999; Ng et al., 2001). Over the last year, we have obtained Taiwanese specimens of a second, poorly known species of *Labuanium* not hitherto known from East Asia, *L. trapezoideum*.

In the present paper, the species is formally documented for Taiwan and redescribed, and notes are provided of its habits and general ecology. It is also recorded from the Andaman Islands for the first time. The abbreviations G1 and G2 are used for the male first and second pleopods, respectively; the measurements (in millimetres) provided are of the carapace width and length, respectively. The height of the chela was measured across the highest point of the palm. The abdomen was measured across the widest part of somites 4 and 5, because in females these are the segments that broaden most substantially during growth. The material examined is in the Institute of Zoology, Academia Sinica, Taipei, Taiwan (ASIZ); the Zoological Reference Collection of the Raffles Museum, National University of Singapore (ZRC); and the Muséum national d'Histoire naturelle, Paris (MNHN). Although the authors obtained numerous specimens during the study, all of which were examined and measured, many of these were subsequently released and not preserved.

TAXONOMY

Family SESARMIDAE

Genus *Labuanium* Serène & Soh, 1970

Labuanium trapezoideum (H. Milne Edwards, 1837) (figs. 1-6)

Sesarma trapezoidea H. Milne Edwards, 1837: 74 (type locality not known).

Sesarma oblongum Von Martens, 1868: 611 (type locality Philippines).

Sesarma trapezoideum var. *longitarsis* De Man, 1889: 427, pl. 10 fig. 8 (type locality Fiji).

Sesarma trapezoideum — De Man, 1902: 532; Holthuis, 1978: 27.

Labuanium trapezoideum — Serène & Soh, 1970: 401; Cai & Ng, 2001: 691, fig. 18D-H.

(For rest of synonymy, see Tesch, 1917: 207.)

Material examined. — Lectotype: male, 29.0 by 30.0 mm (MNHN B3637), no locality (photographs examined). Other material: 1 male (25.9 by 27.5 mm) (ASIZ-72718); c. 2 km from sea,

Changbin, Taitung County, Taiwan 23°18'22''N 121°24'14''E, coll. C.-T. Lai, 15 October 2001. — 2 males (12.3 by 13.5 mm, 11.5 by 12.4 mm), 2 females (25.4 by 29.4 mm, 14.5 by 15.8 mm) (ZRC 2002.418), coll. P. K. L. Ng & H.-C. Liu, June 2002. — 1 female (29.5 by 31.7 mm) (ASIZ-72739), Changbin, Taitung County, Taiwan 23°18'22''N 121°24'14''E, coll. C.-T. Lai & H.-C. Liu, 14 November 2001. — 1 male (24.0 by 25.6 mm), 1 female (32.8 by 35.6 mm) (ASIZ-72722), Changbin, Taitung County, Taiwan, 23°18'22''N 121°24'14''E, coll. M.-S. Jeng, C.-T. Lai & H.-C. Liu, 24 December 2001. — 1 male (24.3 by 26.8 mm) (ASIZ-72740), Changbin, Taitung County, Taiwan, 23°18'22''N 121°24'14''E, coll. H.-C. Liu, 26 February 2002. — 1 female (32.4 by 35.5 mm; with larvae) (ASIZ-72741) (voucher zoeae in ZRC 2002.420), Changbin, Taitung County, Taiwan, 23°18'22''N 121°24'14''E, coll. H.-C. Liu, 26 February 2002. — 4 females (36.6 by 40.4 mm, 28.5 by 31.4 mm, 23.9 by 26.8 mm, 21.3 by 23.1 mm) (ASIZ-72742), c. 400 m from sea, Changbin, Taitung County, Taiwan, 23°18'16''N, 121°25'46''E, coll. H.-C. Liu, 26 February 2002. — 1 male (28.4 by 30.3 mm), 3 females (24.5 by 27.7 mm, 23.7 by 27.8 mm, 30.3 by 32.7 mm) (ZRC 2002.419), coll. P. K. L. Ng & H.-C. Liu, June 2002. — 1 male (30.2 by 32.9 mm) (ZRC), Taitung, Taiwan 23°18'22''N 121°24'14''E, coll. H.-C. Liu, 15 November 2001. — 2 females (18.2 by 19.1 mm, 22.1 by 24.2 mm) (ASIZ-72848), c. 400 m from sea, Changbin, Taitung County, Taiwan, 23°18'16''N 121°25'46''E, coll. H.-C. Liu, 17 August 2002. — 1 male (32.3 by 35.1 mm), 1 female (31.9 by 33.9 mm) (ZRC), Sungai Ifis, Halmahera, Indonesia, coll. D. Robb, September 1994. — 2 females (ZRC), Andaman Islands, Indian Ocean, coll. I. Das, 24 February 2000, 3 March 2000.

Description. — Carapace trapezoidal, longer than broad, anterior half narrower than posterior part; dorsal surfaces with regions well defined, evenly covered with numerous very short setae that do not obscure surface; posterolateral regions with finely granular oblique striae. Cardiac and intestinal regions separated by broad depression. Frontal margin strongly deflexed, almost 90° from horizontal; from dorsal view, 4 truncate to subtruncate lobes clearly discernible, separated by prominent clefts, median lobes separated by deep cleft, leading posteriorly to prominent Y-shaped groove towards gastric region. Low but sharp postfrontal crest immediately behind each lateral frontal lobe; epigastric crests low, sharp, behind median frontal lobes but posterior to postfrontal crests. Supraorbital margin smooth, entire. Lateral carapace margin almost straight, antero- and posterolateral parts not discernible; external orbital tooth distinctly triangular, outer margin gently convex, separated from first lateral tooth by deep cleft; first lateral tooth low, broadly triangular; second lateral tooth not clearly discernible, visible only as slight swelling, separated from first tooth by shallow indentation. Infraorbital tooth triangular, well developed, sublamelliform, directed almost 90° from surface. Posterior margin of epistome with prominent, sharp triangular tooth which projects out perpendicularly. Basal antennular segment subglobose, flagellum folding obliquely; not separated from quadrate basal antennal segment by septum, antennal flagellum short. Merus of third maxilliped longitudinally ovate, anterior part widest, posterior part tapering gently to ischium, shorter than ischium; ischium with barely discernible median sulcus; exopod very slender, hidden behind ischium when apposed against it, reaching to just before anterior edge of merus, flagellum long, reaching beyond width of merus.

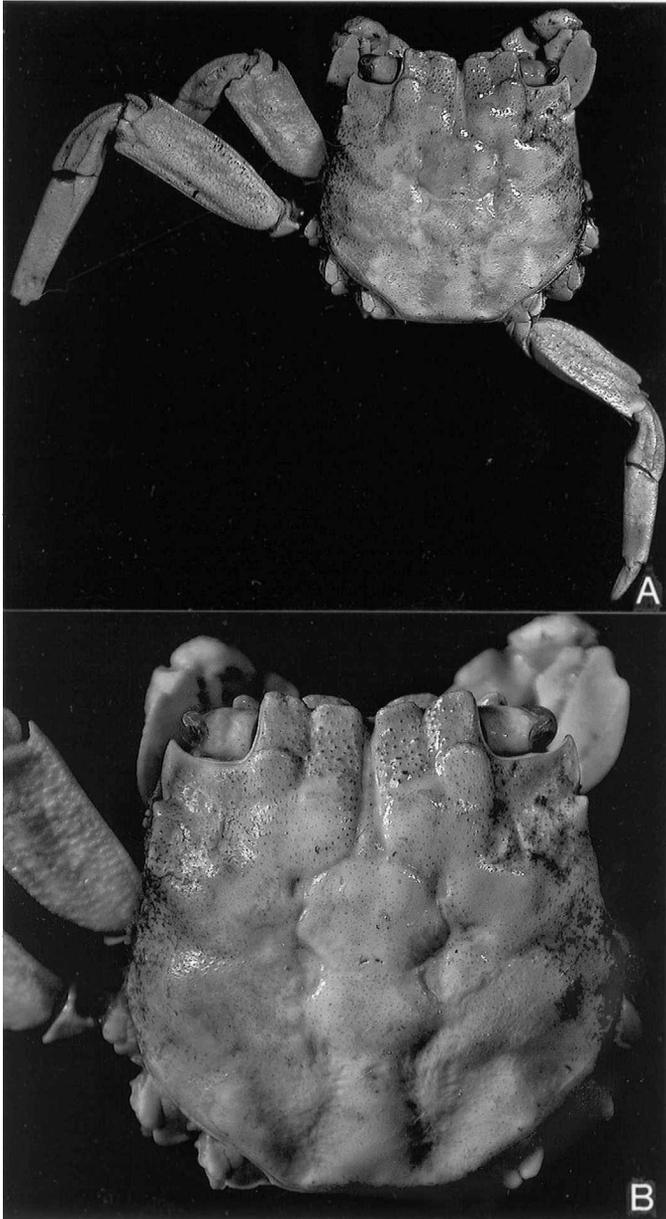


Fig. 1. *Labuanium trapezoideum* (H. Milne Edwards, 1837). Lectotype male (29.0 by 30.0 mm) (MNHN B3637). A, overall view; B, carapace, dorsal view.

Fig. 2. *Labuanium trapezoideum* (H. Milne Edwards, 1837). A, preferred habitat: moist riverine cliff with overhanging vegetation adjacent to a stream in Taitung County, Taiwan; B, C, colour in life, male (24.0 by 25.6 mm) (ASIZ-72722).



Male chelipeds almost equal. Merus relatively short, outer surface prominently granulated, with prominent dorsal subdistal sharp tooth. Carpus strongly granulated on outer surface, inner angle rounded. Palm relatively inflated, outer surface prominently granulated, many granules arranged in uneven oblique rows; dorsal outer surface with numerous uneven oblique rows of small granules, but not pectinated, not forming distinct stridulatory ridge(s); fingers shorter than palm, cutting edges with sharp teeth and denticles, tips corneous with inner surface spoon-like; dorsal surface of dactylus with 41-43 small transverse tubercles, with proximal and distal ones poorly defined.

Ambulatory legs very long; third leg longest. Merus relatively broad; surfaces gently rugose, dorsal margin almost smooth, entire, cristate, subdistal tooth sharp; ventral margin with inner crest more developed; outer surface with shallow longitudinal groove. Carpus with 2 distinct subparallel ridges on outer surface. Outer surface of propodus with low ridge on subventral outer surface, median part with shallow longitudinal groove; ventral margin with scattered setae except for that of first ambulatory leg, which has dense comb-like short setae on distal part. Dactylus slender, gently curved, margins lined with very short, sharp spinules.

Surfaces of thoracic sternites smooth; sternites 1-3 completely fused; sternites 3 and 4 separated by gently concave (towards buccal chamber) suture. Abdomen broadly triangular, all somites mobile; telson shorter than somite 6, lateral margins gently convex with rounded tip; somite 6 with distal part of lateral margins distinctly convex, proximal part almost straight, subparallel; somites 3-5 increasingly trapezoidal in shape; lateral margins of somite 5 gently convex, that of somite 4 gently concave, that of somite 3 gently convex. Somites 1 and 2 narrow in a transverse sense, somite 1 with prominent transverse median keel.

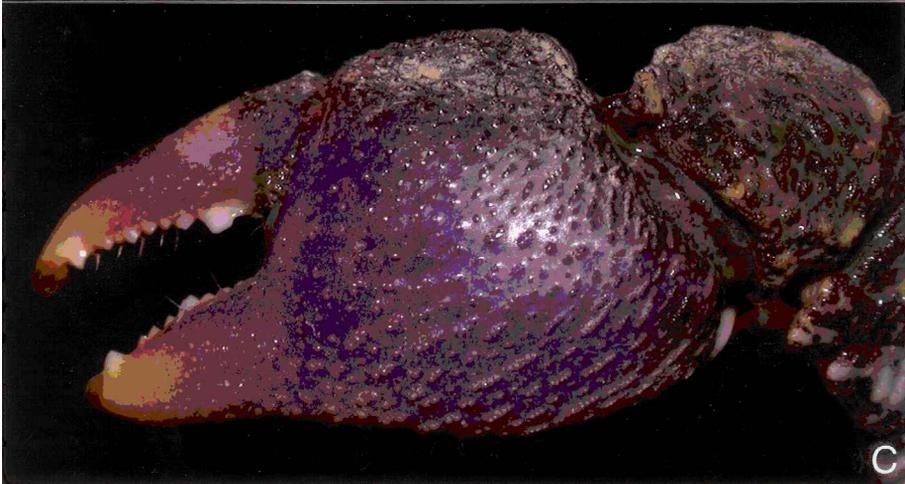
G1 relatively short, gently curving outwards, broadly C-shaped; subdistal part with inner surface dilated, bulbous, with long setae that obscure margin and tip; distal part with chitinous tip, which appears subtruncate from dorso-marginal view, tapering from lateral view. G2 short.

Females. — The females agree well with the males in non-sexual characters, except that the first ambulatory propodus does not have the comb-like setae on the ventral margin, the chelae are proportionately more slender and smaller, and the dactylus does not have tubercles along the dorsal margin.

Colour. — See figs. 2B, C, 3.

Remarks. — In the Paris Museum is one dried female specimen of *Sesarma trapezoidea* (MNHN B3637) measuring 29.0 by 30.0 mm that is believed to be the

Fig. 3. *Labuanium trapezoideum* (H. Milne Edwards, 1837). A, B, female (32.7 by 30.3 mm) (ZRC 2002.419b); C, male (28.4 by 30.3 mm) (ZRC 2002.419a). Colour in life. A, frontal view; B, C, outer view of chelae.



type, but has no label or other indications. Henri Milne Edwards (1837: 74) listed that he had at least one specimen, without locality data, measuring 15 lines in length (= 31.75 mm). De Man (1887: 678) commented that he had examined the single female type of this species in the Paris Museum, noting that it measured 28.0 by 30.0 mm. All these measurements are very close and suggest we are dealing with the same specimen, and hence that this was the one used by Milne Edwards (1837) in his original description. Although the brief description by H. Milne Edwards suggests that he only had one specimen at his disposal, we cannot be absolutely certain. As such, we hereby designate this specimen, MNHN B3637, as the lectotype of *Sesarma trapezoidea* H. Milne Edwards, 1837 (fig. 1).

Labuanium trapezoideum is very different in form from *L. politum*, the type species of the genus, and allied species like *L. rotundatum*. Other than in their relatively long ambulatory legs, they actually share few characters and it is rather difficult to regard them as congeneric. Serène & Soh (1970: 402), in establishing *Labuanium* had already noted that this genus seems to be composed of two groups, one of which included *L. trapezoideum*, *L. fnni*, and *L. gracilipes*, and the other one containing the rest of the species. In the form of the carapace, the chela (with numerous stridulatory dactylar tubercles on the dorsal margin), and even in colour pattern, *L. trapezoideum* bears a striking resemblance to *Sesarmops weberi* (De Man, 1892), and we would be more inclined to place those two species together in the same genus. Within *Sesarmops*, *S. weberi* is aberrant; not only in its relatively small size, but also in the presence of stridulatory dactylar tubercles on the dorsal margin of the dactylus of the cheliped and in its short, stout G1, which has the distal chitinous part short and bent. *Labuanium trapezoideum* and *Sesarmops weberi*, of course, differ in the relative lengths of their ambulatory legs, but this can hardly be regarded as a significant generic character. One of the authors (PKLN) examined the types and other specimens of *S. weberi*, and the form of its antennae and antennules agree well with those of *L. trapezoideum*. But considering the rather unstable state of many sesarmid genera, in particular *Labuanium*, *Sesarmops* Serène & Soh, 1970, *Chiromantes* Gistel, 1848, and *Pseudosesarma* Serène & Soh, 1970, we prefer to refrain from any action for the time being.

The taxonomy of *L. trapezoideum* has been discussed in depth (see Tesch, 1917: 217, for discussion and full bibliography), with *Sesarma oblongum* Von Martens, 1868, and *Sesarma trapezoideum* var. *longitarsis* De Man, 1889, generally regarded as junior synonyms. De Man (1887: 678), who examined the types of *Sesarma trapezoidea* and *Sesarma oblongum* in the Paris Museum and the Berlin Museum, respectively, showed that these two species are clearly synonymous. In establishing *Sesarma trapezoideum* var. *longitarsis*, De Man (1889) noted that it differed from the typical form (De Man, 1889, pl. 9 fig. 7) primarily in its relatively longer ambulatory legs (De Man, 1889, pl. 10 fig. 8). De Man himself (1902: 532),

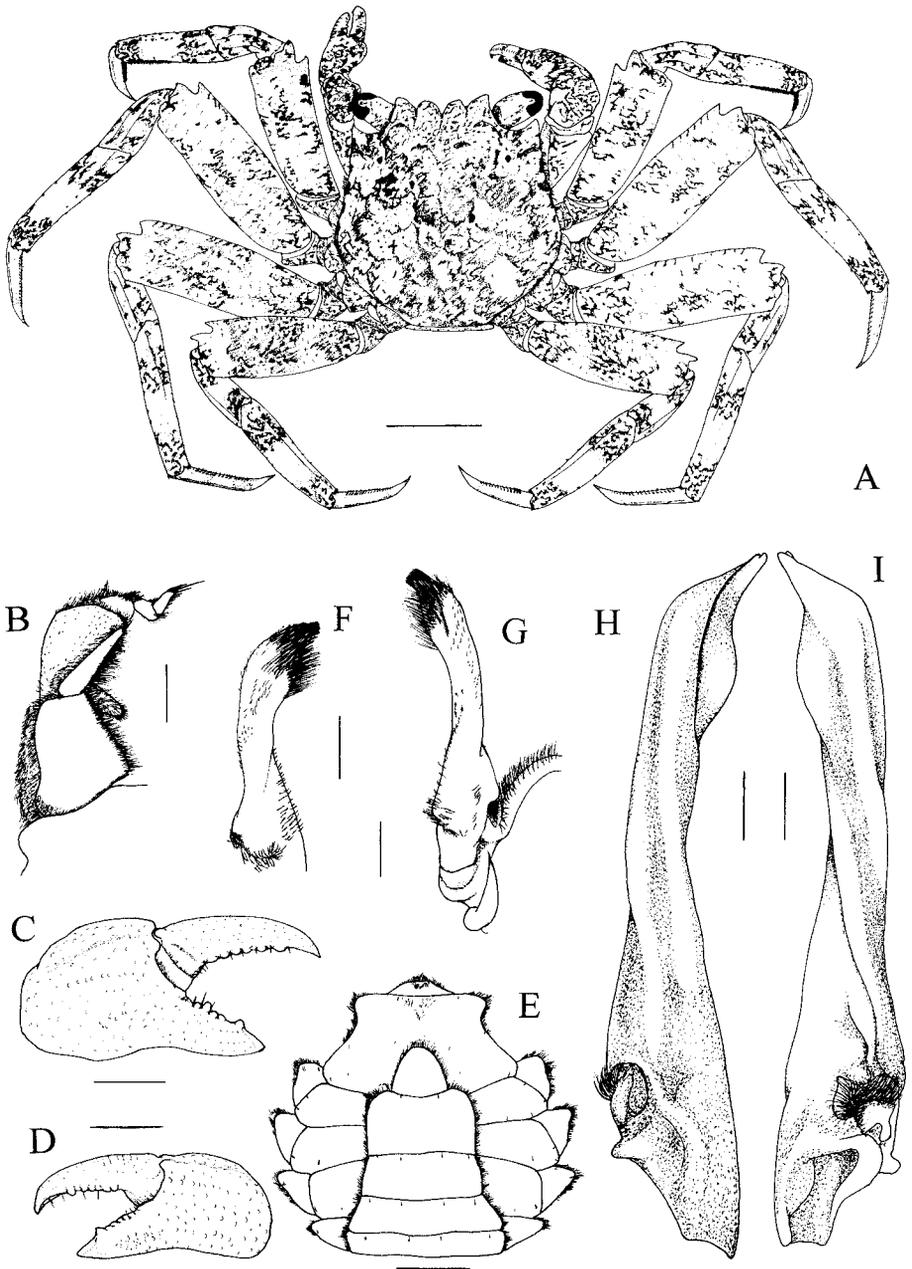


Fig. 4. *Labuanium trapezoideum* (H. Milne Edwards, 1837). Male (20.4 by 25.6 mm) (ASIZ-72722). A, overall view; B, right third maxilliped; C, right chela; D, left chela; E, thoracic sternum and abdomen; F, right G1, dorso-marginal view; G, right G1, ventro-marginal view; H, right G1, dorsal view, setae denuded; I, right G1, ventral view, setae denuded. Scales: A = 10.0 mm, B, F, G = 2.0 mm, C, D = 3.0 mm, E = 5.0 mm, H, I = 1.0 mm.

however, later felt that *Sesarma trapezoideum* var. *longitarsis* is within the range of variation for *Sesarma trapezoideum* s. str. and considered it a synonym, an action that was followed by Tesch (1917: 207).

In the specimens we have at hand from Halmahera and Taiwan, the lengths of the ambulatory legs, in particular the relative proportions of the propodus and dactylus, are usually associated with size. Larger specimens of both sexes have relatively longer legs compared to smaller ones, especially with regard to the dactylus and propodus. In all other respects, the specimens are identical. We have observed a similar trend for *L. rotundatum* (Hess, 1865) from Guam (PKLN, HCL, unpubl. data). It is worthwhile to note that De Man (1889) had one 23.0 by 25.0 mm female from Fiji that he identified as *Sesarma trapezoidea* and one larger 29.5 by 30.0 mm male, also from Fiji, which he described as *Sesarma trapezoideum* var. *longitarsis*. Other than in the relative proportions of their legs, the two taxa agree in almost all other respects. The median frontal lobes do vary somewhat in shape, from truncate to occasionally triangular in form. The present specimens confirm the synonymy of the two taxa.

The maximum carapace width of *L. trapezoideum* observed in this study was 30.2 mm (ZRC 2002.419a) for males (total number of specimens examined 34) and 36.6 mm (ASIZ-72742) for females (total number of specimens examined 52). The smallest ovigerous female obtained measured 21.9 mm in carapace width (number of ovigerous specimens examined 10), but on the basis of the abdomen morphology, the smallest mature female observed was 18.2 mm in carapace width (ASIZ-72848). Fig. 5 shows the relationship between abdominal and carapace width for both sexes. Females have disproportionately wider abdomens compared to males once they are larger than 10 mm carapace width, i.e., specimens smaller than this cannot be sexed or easily separated on the basis of their abdominal structure. Males have relatively much larger chelae than females, with the change been most marked from carapace widths of c. 12 mm and upward (fig. 6).

Distribution. — *Labuanium trapezoideum* has been reported from the eastern Indian Ocean (western Sumatra), eastern Indonesia (Ambon and Halmahera) to the Philippines, northern Queensland (Australia), Fiji, Micronesia, Hawaii, and French Polynesia, but is nowhere regarded as common. Davie (2002: 222) also noted that the species is present in Taiwan but did not elaborate this observation. The present specimens from the Andamans extend the species' range further westwards into the Indian Ocean. The colour pattern of fresh specimens is very diagnostic (figs. 2B, C, 3) and is often apparent even on long preserved specimens.

Ecology and behaviour. — Almost nothing is known about the ecology and habits of *L. trapezoideum*. De Man (1902) observed that it can occur very far

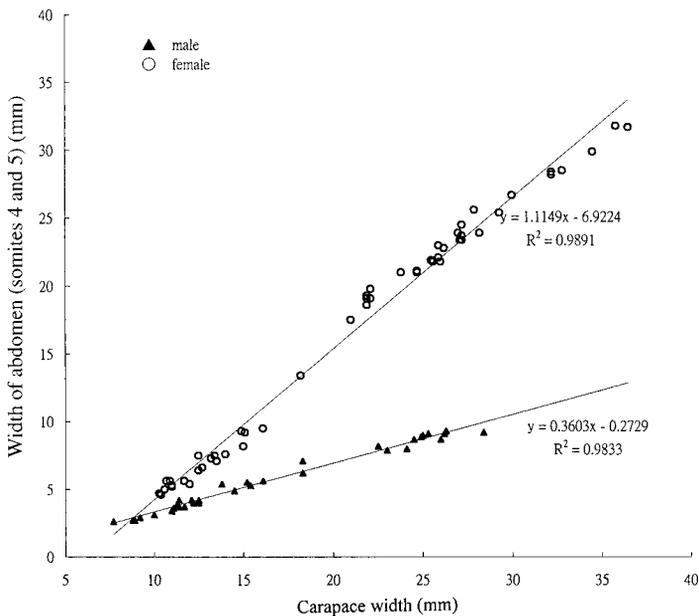


Fig. 5. *Labuanium trapezoideum* (H. Milne Edwards, 1837). Graph showing relationship between carapace width and width of abdomen.

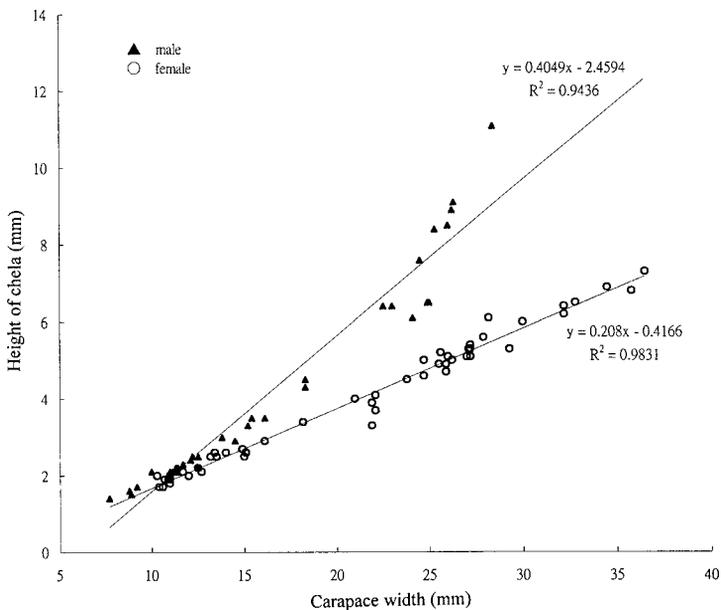


Fig. 6. *Labuanium trapezoideum* (H. Milne Edwards, 1837). Graph showing relationship between carapace width and height of chela.

inland, reporting it from a mountain 800 m above sea level in Halmahera. Davie (2002: 222) commented that the species is present in estuarine, mangrove, and intertidal habitats. In Taiwan, we have found *L. trapezoideum* from 200 m to about two kilometers away from the sea. It has not been found in intertidal or mangrove habitats as yet. According to locals (C. T. Lai, pers. comm.) living in the area, the species can also be found many kilometres further inland. The highest elevation at which we have found it thus far is about 125 m above sea level. It is always found on vertical to nearly vertical cliffs with flowing water directly beneath (depth usually 15-100 cm), especially at points where the streams meander (fig. 2A). The surfaces of these riverine cliffs usually have narrow crevices, are shaded, and are covered with moist algae and mosses. The crabs have been observed as high as four metres up on those cliffs. They can be found during the day but are generally more active at night. The colour pattern of *L. trapezoideum* is well adapted to the pattern of the rocks and vegetation, providing effective camouflage. When disturbed, the crab retreats into crevices or jumps into the water below. Crabs that have jumped into the water scramble back onto the rock surface underwater, and usually climb back up out of the water after a few minutes. One specimen was observed moulting in the field. This takes place under water, while it clings on the cliff surface. The fresh exuvium is then flushed away by the flowing water. We have also seen fresh exuviae on the stream bed. Another specimen moulted a few hours after capture but died during ecdysis.

Ovigerous females disturbed by us seldom jumped into the pool below but relied on their camouflage instead, remaining completely still. Females of *L. trapezoideum* have small eggs that hatch into pelagic, free-swimming larvae. Ovigerous females apparently stay in the normal habitat and have not been seen to migrate to the sea. Even when the eggs are ready to hatch (i.e., are very dark coloured and the eyes already visible), the ovigerous females are still some distance from the estuary and they apparently do not migrate out to release their zoeae. One ovigerous female, which was obtained at night about two kilometers from the sea, released her larvae at noon on the following day. These larvae (ASIZ-72741) were kept in fresh water and were still alive after 10 hours. It would thus appear that the females release their zoeae where they live, the larvae being swept out to the open sea by the fast flowing waters. Certainly the zoeae can live long enough in fresh water for this to occur. So far, ovigerous females of *L. trapezoideum* have been found from November to February and May. In the observations we have made thus far, small specimens (7-15 mm in carapace width) were found in good numbers between April and July but never at the end of the year. This pattern is not typical for most brachyuran species that live in freshwaters (see Liu & Li, 2000).

Labuanium trapezoideum has been found only in the area around Taitung in eastern Taiwan thus far, but probably occurs in many of the streams there.

Unfortunately, many of these streams have not been sampled carefully and more cryptic species can be expected (see Ng et al., 2002).

ACKNOWLEDGEMENTS

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