

On the Occurrence of *Megabalanus stultus* (Darwin), 1854 (Cirripedia: Balanomorpha) in Taiwan: a Reappraisal

Arnold Ross

Scripps Institution of Oceanography, La Jolla, California 92093-0202, USA E-mail: arross@att.net

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Arnold Ross (1999) On the occurrence of *Megabalanus stultus* (Darwin), 1854 (Cirripedia: Balanomorpha) in Taiwan: a reappraisal. *Zoological Studies* 38(3): 275-278. The sessile barnacles, *Megabalanus stultus* (Darwin), 1854 and *M. ajax* (Darwin), 1854 are obligatory symbionts found on actively growing surfaces of milleporine corals. These morphologically distinct species are geographically isolated from one another, with the former occurring in the tropical western Atlantic and the latter in the western Pacific. Contrary to current thought, *M. stultus* occurs only in the western Atlantic, the type locality for which is herein designated as St. Vincent I. The type host for *M. stultus* is likely *Millepora complanata* Lamarck, 1816 whereas that for *M. ajax* is *Mil. platyphylla* Hemprich and Ehrenberg, 1834.

Key words: *Megabalanus ajax* (Darwin), Type locality, Type host, Morphology.

Darwin (1854) was the first to describe the obligatory symbiotic barnacles *Balanus stultus* and *Balanus ajax*, both of which occur on the fire coral, *Millepora* Linnaeus, 1758. Although Darwin vacillated when it came to placing *B. stultus* in a specific group, Ross (1968: 14) referred it to the subgenus *Megabalanus* Hoek, 1913, which was later accorded generic rank (Newman and Ross 1976: 39). There are more than 50 megabalanines worldwide that are divided among 3 genera in the Megabalaninae (Newman 1979, Henry and McLaughlin 1986).

Darwin cited the Philippine Archipelago as the type locality for *M. ajax*, and 2 localities for *M. stultus*, Singapore and the West Indies. The latter has been long considered the provenance of *M. stultus* (Ross 1968, Newman and Ross 1976, Henry and McLaughlin 1986, Young 1988), but recently, Soong and Changlai (1992) reported it from Taiwan. This discovery has provided me with the opportunity to compare specimens from both regions, and the accompanying reappraisal clarifies the question of the type locality and type host of *M. stultus*, as well as the identities of these widely separated megabalanine populations, the distribution of which is detailed in Newman and Ross (1976).

SYSTEMATICS

Family Balanidae Leach, 1817
Subfamily Megabalaninae Newman, 1979
Genus *Megabalanus* Hoek, 1913

Megabalanus ajax (Darwin), 1854
(Fig. 1A-D)

Balanus ajax Darwin 1854: 214, pl. 3, fig. 1a-d; Kolosváry 1950: 292.

Megabalanus ajax: Newman and Ross 1976: 67 (synonymy, distribution); Henry and McLaughlin 1986: 49, figs. 4l, 13a-d (types).

not *Megabalanus stultus* (Darwin) 1854; Soong and Changlai 1992: 24, figs. 1-2 (= *M. ajax* (Darwin) 1854; morphology, Taiwan).

Materials: Coral reefs of inshore waters off Nanwan, Bashi Strait, southern Taiwan; 21°55'N, 120°50'E; 3 m; on *Millepora platyphylla* Hemprich and Ehrenberg, 1834; K.-Y. Soong coll., 2 July 1991, Scripps Institution of Oceanography (SIO), Benthic Invertebrates, C-9944, 4 specimens.

Diagnosis: Shell large, massive, to 60 mm in rostro-carinal diameter and 100 mm in height; parietes smooth, pale pink; scutum with prominent longitudinal striae forming hood-like projections at inter-

section with growth ridges or growth ridges beaded, basal margin uniformly and deeply scalloped on internal and external surfaces, not bisulcate; exterior of tergum commonly with longitudinal striae, crests for depressor muscles lacking; crest of labrum lacking teeth.

Remarks: Soft part morphology, especially labral dentition, has not been utilized to a great extent for species discrimination in this group (cf. Henry and McLaughlin 1986). The absence of labral teeth in *M. ajax* and their presence in *M. stultus* serve to separate these species. In the specimens Soong and Changlai (1992: 27) studied, the medial notch of the labrum is effectively closed in comparison to the specimen illustrated by Ross (1968: fig. 3d) in which it is open. However, the degree to which it is open or closed may be an artifact arising from the techniques and media used for mounting the mouth parts, especially those of large specimens, on glass microscope slides, and consequently it may prove to be of little taxonomic value.

Megabalanus stultus (Darwin), 1854

(Fig. 1E-H)

Balanus stultus Darwin, 1854: 216.

Balanus (Megabalanus) stultus: Ross 1968: 14, fig. 3 (synonymy, morphology); Southward 1975: 16 (morphology).

Megabalanus stultus: Newman and Ross 1976: 68 (distribution); Henry and McLaughlin 1986: 52, figs. 4m, 13e-h (synonymy); Young 1988: 357, fig. 2 (synonymy, morphology); Lewis 1992: 51 (ecology, Barbados I.).

not *Megabalanus stultus*: Soong and Changlai 1992: 24, fig. 1-2 (= *M. ajax* (Darwin), 1854; morphology, Taiwan).

Materials: Coral reefs off Barbados I., Windward Is., on *Millepora complanata* Lamarck, 1816; J. B. Lewis coll., 20 Nov. 1990; SIO, C-9722, 7 specimens.

Diagnosis: Shell small, slight, to 30 mm in rostro-carinal diameter and less in height; parietes slightly to strongly ribbed, white to suffused with purple; scutum lacking longitudinal striae, growth ridges not beaded, basal margin smooth, strongly bisulcate, medially protuberant; tergum lacking longitudinal striae, crests for depressor muscles poorly developed; crest of labrum with teeth.

Remarks: Wall configuration in this species is commonly elongate-oval with either the rostro-carinal or lateral diameter exceeding the height (Ross 1968: 15). Lewis (1992: 62) found that in Barbados a rostro-carinal diameter (r-c) of about 19 mm was the average size of *M. stultus* at maturity, some 18 mo after settlement. Thereafter, the growth rate decreased accordingly, although some individuals were found to ultimately attain a diameter of about 30

mm, which is relatively large for a balanid, but relatively small for a megabalanid. Thus, the size of this species is manifestly smaller than the western Pacific *M. ajax*, the dimensions of which places it among the largest megabalanines.

DISCUSSION

Morphology: Size alone is not a good character, but when taken in conjunction with other morphological features the megabalanine from Taiwan reported as *M. stultus* is not conspecific with that from the western Atlantic, but rather represents *M. ajax*. Although Henry and McLaughlin (1986) did much to unravel the taxonomy of megabalanines, species discrimination remains vexatious. Indeed, the taxo-

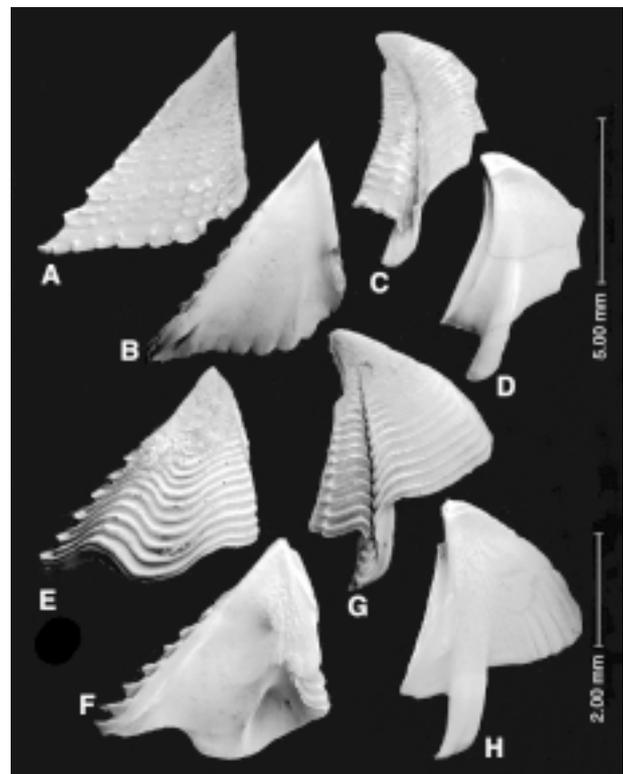


Fig. 1. *Megabalanus ajax* (Darwin), 1854, Taiwan, SIO C-9944 (r-c 22.0 mm). A, external view of right scutum. B, internal view of left scutum. C, external view of right tergum. D, internal view of left tergum. *Megabalanus stultus* (Darwin), 1854, Barbados, SIO C-9722 (r-c 17.0 mm). E, external view of right scutum. F, internal view of left scutum. G, external view of right tergum. H, internal view of left tergum. In these scanning electron micrographs of relatively young specimens, the pronounced scalloping of the basal margin of the scutum in *M. ajax* is apparent, whereas the basal margin is smooth, but medially protuberant in *M. stultus*.

onomic uncertainty here must be attributed to incorrect locality data and to misidentification of the host milleporines.

Type locality: Darwin (1854: 216) cited "... Singapore, Mus. Cuming. West Indies*, Mus. Brit. - Mus. Stutchbury." as the locality data for *M. stultus*. His footnote (*) references the British Museum specimen purchased from the estate of the Rev. Lansdown Guilding, B. A. Oxon. (1797-1831), purportedly from the West Indies (Dance 1966: 288), a locality that he obviously trusted to be correct. Apparently, Hugh Cuming relied on his memory more than on written notes when it came to providing locality information on *M. stultus* as well as many other species. Indeed, many of his localities have proven erroneous as Pilsbry (1916: 250) noted. Ross (1968: 19) contended that the western Pacific record (Singapore) for *M. stultus* was doubtful, and subsequent workers accepted his findings (Henry and McLaughlin 1986, Young 1988).

The precise locality from which the type specimens of *M. stultus* were collected remains unknown. However, my request for information from the Natural History Museum, London on the Guilding collection has revealed that the Rev. Guilding, excluding his time for education in England, was born and later died on St. Vincent I., and therefore his collection represents specimens largely, if not solely, from that island. Consequently, the type locality is here designated as St. Vincent I. in the Windward Is. (approx. general coordinates 13°15'N, 61°12'W).

The distribution of obligate commensal barnacles is tied to the distribution of their hosts (Soong and Changlai 1992). In view of the late Neogene isolation of the Caribbean, the vast expanse of the Pacific Ocean, and the absence of milleporine reefs in the eastern Pacific, it is doubtful that *M. stultus* occurs in Taiwan, or conversely *M. ajax* in the western Atlantic.

Type host: Darwin (1854: 216) remarked that *M. stultus* was "Attached to Milleporae..." Ross (1968: 15) reported it on *Mil. complanata* as did Lewis (1992: 51), whereas Pilsbry (1927: 38) and Young (1988: 359) found it on *Mil. alicornis* Linnaeus, 1758. Although Darwin (1854: 214) cited *Mil. complanata* as the host for *M. ajax*, which is also repeated by Henry and McLaughlin (1986: 50) without comment, Soong and Changlai (1992) found *M. ajax* to occur only on *Mil. platyphylla*. According to Boschma (1948), *Mil. platyphylla* is known only from the Indo-West Pacific region, whereas *Mil. complanata* is a species limited to the tropical western Atlantic, and therefore the type host of *M. ajax*, as given by Darwin, must be an error. In a footnote,

Kolosváry (1950: 292) stated that Darwin's *Mil. complanata* is actually *Mil. platyphylla*, probably on the authority of Hilbrand Boschma who provided him with the specimens he studied, and whom he cited. Therefore, the type host of *M. ajax* is *Mil. platyphylla*, whereas that of *M. stultus*, likely *Mil. complanata*, can only be determined upon reexamination of the specimens Darwin described.

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拙慙巨藤壺於臺灣分布之重新評估

Arnold Ross¹

拙慙巨藤壺和亞傑巨藤壺都是千孔珊瑚表面的共生種類。他們外型有異，地理分布也不相同，前者在西大西洋低緯海域，後者在西太平洋。與最近報導不同，拙慙巨藤壺應只出現在西大西洋，而聖文森島是初發現地，他的模式宿主應是大西洋的豎板千孔珊瑚，而亞傑巨藤壺的模式宿主應是太平洋的板葉千孔珊瑚。

關鍵詞：亞傑巨藤壺，模式地點，模式宿主，型態。

¹Scripps Institution of Oceanography, La Jolla, California 92093-0202, USA