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ON SOME BALANIDS LIVING IN CORALS, COLLECTED BY THE SNELLIUS EXPEDITION IN 1930

by

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with Plates XI-XV and 2 text-figures

Prof. H. Boschma, director of the Rijksmuseum van Natuurlijke Historie, sent me some Balanids associated with *Millepora platyphylla* Hemprich & Ehrenberg, partly preserved in formalin, partly in a dry state. The material was collected by the Snellius Expedition in 1930, the data concerning the present material are (Boschma, 1936, p. 19): "April 23-27. Obi latoe, northwest of Obi major (22). Most of the collecting was done on the reef of the small island Poeloe Toesa at the east side of Obi latoe. This is a highly varied reef with a great number of species of corals. A peculiar phenomenon observed here was the occurrence of multitudes of small brown flatworms on colonies of *Merulina* and *Montipora*, which covered the greater part of the surface of these corals. Among other groups of animals Balanids of large size attached to *Millepora* may be mentioned and several species of Foraminifera living on a sandy stretch with algae."

In a letter dated August 24, 1949, Prof. Boschma wrote me in regard to the specimens dealt with here: "Part of the material is labelled "Poeloe Toesa", another part "Obi latoe". All this material was collected on the small island Pulu Tusa near the larger island Obi latu. The name of the *Millepora* is *Millepora platyphylla* Hemprich & Ehrenberg." The amended spelling of the localities is in conformity with modern practice.

I want to thank Prof. Boschma for publishing the results of my investigations on these Balanids in the journal of the Leiden Museum.

In the material I found two species of Balanids, viz.:

- 1, *Balanus tintinnabulum occator* Darwin;
- 2, *Pyrgoma milleporae* Darwin, forma *typica* Darwin and forma *snelli* n. f.

Pulu Tusa near Obi latu represents a new locality for the two species of Balanids. Moreover, till now *Millepora platyphylla* was not known as a substratum for Cirripeds, and the association *Millepora platyphylla* × *Balanus tintinnabulum* × *Pyrgoma milleporae* was not on record.

In the material preserved in formalin I discovered the hitherto unknown nauplii of *Balanus tintinnabulum occator*, and I could examine the alimentation biology of this subspecies. As far as concerns *Pyrgoma milleporae* the material likewise yielded some results in regard to the alimentation of the species, of which no previous data were available.

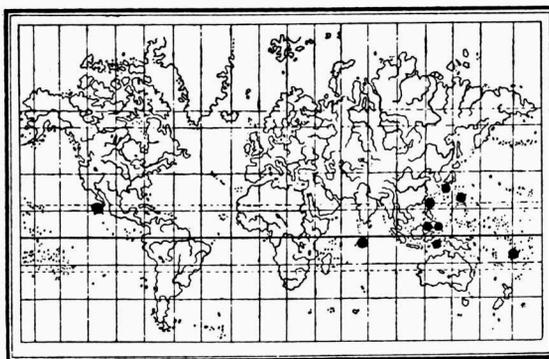


Fig. 1. Distribution of *Balanus tintinnabulum occator* Darwin.

***Balanus tintinnabulum occator* Darwin**

(Pls. XI, XII, XIII fig. a, text-fig. 1)

Distribution: Indopacific region: Zamboanga, Mindanao (Pilsbry); California, on a *Haliotis splendens* (Kolosváry); Indopacific (Krüger); Bonin, Ogasawara Islands (Hiro); Formosa: Kizan on coastal rock, Kankau, Fiji Islands, Indian Ocean, submerged, litoral, epibiotic (Hiro).

A. Studies on the dry material.

Remarks. All specimens are completely covered with a layer of the coral *Millepora platyphylla*. Original colour purple-lilac, orifice narrow. Parietes ribbed. "Scuta with small, sharp, hood-formed points, arranged in straight radiating lines; terga with the spur placed at either its own width, or less

than its own width, from the basi-scutal angle" (Darwin). In the young stages the hood-formed sharp points are not to be seen; in the semi-adult stage they are small, in the adult stage well developed. The spur of the tergum in our specimens is small and short, different from the specimens described by Pilsbry (1916). The inner surface of the scutum is similar to that of *Balanus tintinnabulum tintinnabulum*, the adductor ridge is very weakly developed. The longitudinal furrow of the tergum is variable.

Measurements

Height	3	2.5	3.5	3.4	3.3
Diameter of base	4 × 3.5	3.8 × 3.2	6 × 4	4.5 × 3.5	3.3 × 4.4
Diameter of orifice	1.4 × 1	1.3 × 0.9	1.2 × 1.6	1.2 × 1.4	1.3 × 1

All specimens are attached to *Millepora platyphylla*, associated with *Pyrogoma milleporae*, on the coral as well as on the shell of the large *Balanus*. All the Balanids were overgrown by the coral, the most strongly developed and the thickest on the carina. The empty shells of the Balanids also are overgrown with coral.

Locality. Pulu Tusa near Obi latu, April 23-27, 1930, Snellius Expedition; coral reef, depth 2-7 m (diving with diving hood).

B. Studies on the material preserved in formalin.

I have dissected three specimens of *Balanus tintinnabulum occator* and in two of these I found numerous eggs and nauplii. In the development of the eggs two stages can be observed, viz.:

1, embryos without filaments, antennulae, antennae, mandibula and caudal spine;

2, embryos in which these organs are beginning to develop.

Among the eggs I also found nauplii I. The peculiarities of the organs in these nauplii are the following. The labrum is prominent, long and thick. Corniculi present, filaments not visible. Antennula with 7 bristles, antenna with 4 and 5 bristles, mandibula with 4 and 3 bristles. Caudal appendix and abdominal appendix very strongly developed.

The eggs are elongated oval, the nauplius I also is elongated oval.

Alimentation. In the mid gut I found: granules of quartz, round algae, diatoms, bristles, mucus.

The mandibula and the maxilla are similar to those of the typical subspecies, *Balanus tintinnabulum tintinnabulum*. The labrum also is typical.

The penis on its terminal part bears groups of bristles; in one group the number of these bristles is 20.

Pyrgoma milleporae Darwin

(Pl. XIII figs. b—1, Pls. XIV, XV, text-fig. 2)

Distribution: Mindanao, Philippine Islands (imbedded in *Millepora complanata*¹), sometimes associated with *Balanus ajax* (Darwin); Japan, Bonin Islands, Ogasawara, Port Lloyd (depth 5 m), Sunda Islands (Nilsson-Cantell); Tanabe Bay (*Millepora confertissima*, *M. gonagra*, *M. tortuosa*, *M. truncata*), Malay Archipelago (Hiro); in *Millepora latifolia*, *M. exaesa*, *M. platyphylla* (Red Sea), *M. murrayi* (Boschma).

A. Studies on the dry material.

Remarks. "The articular ridge or projection of the scutum is prominent, but its length is variable in accordance with the breadth of the area of articulation of the tergum" (Hiro). The specimens from Pulu Tusa are

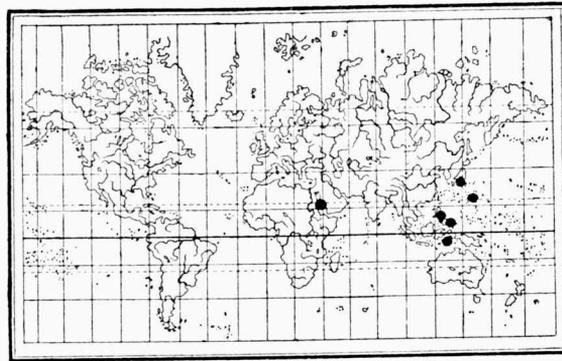


Fig. 2. Distribution of *Pyrgoma milleporae* Darwin.

not so typical as those described and figured by Hiro (1938, fig. 10). The articular ridge is more or less prominent. Two formae can be distinguished, viz.:

Pyrgoma milleporae f. *typica* Darwin;

Pyrgoma milleporae f. *snelliusi* n. f.

In *Pyrgoma milleporae* f. *typica* the scutum has a prominent articular ridge, and in *Pyrgoma milleporae* f. *snelliusi* there is not a prominent articular ridge on the scutum.

The forma *typica* has a flat shell. Here the orifice is narrow, the periphery of the orifice is prominent. The maximum diameter of the shell is 1.3 cm,

¹ Darwin's *Millepora complanata* is *M. platyphylla* Hemprich & Ehrenberg (cf. Boschma, 1948).

the shell is round or oval. Scutum very elongated, tergum triangular, convex, without a spur.

The forma *snelliusi* has a more or less conical shell, the orifice is narrow, but the periphery is not prominent. The tergum has a very narrow articular furrow, and the apex of the tergum is not horizontally flat (as in the forma *typica*), but more or less pointed.

Our *Pyrgomas* are attached to the coral *Millepora platyphylla*. On a coral fragment, of 18.5 by 10 cm and a thickness of 3-3.5 cm, I found 175 specimens. On another coral fragment, of 22 by 15 cm and a thickness of 3-3.5 cm, I found 67 specimens. They are all covered with a layer of coral, the same holds for the specimens on the shells of *Balanus tintinnabulum occator*. The original surface of the *Pyrgomas* cannot be seen as they are completely covered with coral matter.

Pyrgoma is considered as a further evolutionary stage than *Creusia*, namely the four compartements have become completely coalescent.

In a previous paper (Kolosváry, 1949) I described the occurrence of *Pyrgoma milleporae* in *Millepora* sp. associated with a colony of *Pocillopora damicornis cespitosa*, from unknown locality in the Pacific.

Locality. Pulu Tusa near Obi latu, April 23-27, 1930, Snellius Expedition; coral reef, depth 2-7 m (diving with diving hood).

B. Studies on the material preserved in formalin.

In some specimens I found eggs and nauplii of the 1st stage. The eggs are broadly oval, not elongated oval as in *Balanus tintinnabulum occator*. In the nauplius I the antennula has 5 segments. The terminal segments have a dorsal bristle. The number of the bristles of the antennula is 7. The antenna has a large base with 1 spine and 12-13 segments with 13 bristles. Altogether the mandibula has 9-10 segments and 14 bristles. The number of the segments and of the bristles is variable; the short bristle is characteristic of the mandibula, the latter therefore can be regarded as a spine.

The nauplius I is broadly oval; the corniculi are short, the labrum also is short and rounded, small. The caudal spine is very weakly developed, the abdominal appendix is small and curved.

All the ventral ends of the segments of the 6 podites have a more or less distinct appendix. On these appendices there also can be observed two spines (or short bristles). Filaments are not to be seen.

Alimentation. In the mid gut I found: diatoms, round, green algae, small granules of quartz and other black, yellow and red granules, small filaments of algae, and fragments of bristles.

Mandibula. With 5 teeth and with two terminal teeth at the pointed angle. The lower teeth occur in pairs. On the end of the mandibula there are many bristles, which are short and thick.

Maxilla I. With a straight edge, which has 7 large spines and 4 small spines.

Palpus. With long bristles on the terminal part.

Labrum. Nilsson-Cantell remarked that the number of teeth of the labrum is variable. I found that one side has 7, the other 4 teeth. The teeth are short and thick, conical. The median suture is more or less deep.

Penis. Very long, with numerous segments. On the terminal segments there is a variable number of spines. The latter are single or double, or 3 or 4 spines occur in groups. On the end of the penis (the glans) there are very long bristles, characteristic of the species. These long bristles occur in 3 to 4 groups, situated around the end of the glans penis.

Spermatozoa. The mature spermatozoa are very long. The acrosoma also is long and under the acrosoma there are the remains of the cytoplasm. This cytoplasmatical globule forms the remains of the idioplasm, as is apparent in the material. In this part I found fine transversal rows, a tigroidisation of the idioplasmatical remains. The centrosome is very long, on the lower end of the centrosoma there is a small cylindrical ring, which, however, not always distinctly can be seen. As a continuation of the chromatin thread the flagellum has developed, which is of varying length. In young stages the latter is short, in the mature stage it is long.

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EXPLANATION OF THE PLATES

Plate XI

Balanus tintinnabulum occator. *a, b*, shells covered with coral and *Pyrgoma*; *c, d*, scutum and tergum of young specimen; *e-m, r*, opercular valves of semiadult specimens; *n-p, t*, opercular valves of adult specimens; *s* penis.

Plate XII

Balanus tintinnabulum occator. *a*, penis; *b*, mandibula; *c*, maxilla I; *d*, palpus; *e*, labrum; *f*, IIrd podit; *g*, IIIrd podit; *h*, nauplius I, ventral view.

Plate XIII

Balanus tintinnabulum occator (*a*) and *Pyrgoma milleporae* (*b-l*). *a*, nauplius I, lateral view; *b, c*, shells of forma *typica*; *d*, two specimens, the shell and the orifice covered with coral; *e, h, k, l*, scuta (pro parte with terga) of forma *typica*; *f, g*, internal and external view of tergum of forma *typica*; *i, j*, two penes.

Plate XIV

Pyrgoma milleporae. *a, d, e*, internal surface of scuta (pro parte with terga) of forma *snelliusi*; *b*, conical shell of forma *snelliusi*; *c*, internal surface of tergum of forma *snelliusi*; *f*, palpus; *g*, labrum with variation in teeth; *h*, maxilla I; *i*, mandibula; *j*, nauplius in egg shell; *k*, nauplius removed from egg shell, lateral view.

Plate XV

Pyrgoma milleporae. *a*, fully developed spermatozoon; *b-d*, stages in the development of spermatozoa; *e*, spermatozoon with details of structure (1, acrosoma; 2, idioplasmatical globule; 3, centrosoma; 4, cylindrical ring; 5, flagellum as continuation of the chromatic thread); *f-h*, Ist, IIrd and IIIrd podites of nauplius I; *i*, nauplius I, ventral view.

