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The Echinoid Fauna of North-eastern New Zealand

By ALAN N. BAKER,

Marine Laboratory, Department of Zoology, Victoria University of Wellington.

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Abstract

A TROPICAL temnopleuroid echinoid, *Tripneustes gratilla* (Linnaeus), hitherto unknown from New Zealand, is described from New Zealand material collected off the north-east coast. Material from new east coast localities shows that the following species range more widely in New Zealand waters than was previously realised: *Phormosoma bursarim* A. Agassiz (Chatham Rise to Bay of Plenty); *Centrostephanus rogersii* (A. Agassiz) (Mayor Island northwards); *Brissus gigas* Fell (Poor Knights to Three Kings Islands). Twenty-nine echinoids known from New Zealand north of East Cape are listed and the relationship of this fauna to the rest of New Zealand and the Australian-Indo-Pacific region is outlined: 20 species are apparently restricted to waters north of East Cape, and many show a close relationship with the Australian and Indo-Pacific echinoid faunas.

INTRODUCTION

THE Pacific coast of New Zealand north of East Cape (37° 40' S) has been shown to support an assemblage of marine organisms which is markedly distinct from that occurring further south (Powell, 1961; Pawson, 1961, 1965a and b). The fauna of this north-eastern coastline is strongly influenced by the South Pacific trade wind drift, an extensive surface current emanating from tropical latitudes. Consequently, many of the inhabitants of the continental shelf and slope show a zoogeographic relationship with the tropical Pacific. Echinoids are no exception, and in recent years an increasing number of species have been discovered in northern New Zealand waters which lend strong support to earlier conclusions that the echinoid fauna of this region has close Australian and Indo-Pacific affinities (Fell, 1953; Pawson, 1965a and b).

Sampling of the sublittoral and shelf faunas along the northern coasts (particularly the west) of New Zealand has been meagre, and data on the distribution of echinoids are fragmentary. In an account of the echinoids and holothurians collected by the 1962 *Tui* Expedition, Pawson (1965a) lists 29 species of echinoids known from the far north of New Zealand and the Norfolk Island-Kermadec area. Seventeen species in Pawson's list were then known from near the New Zealand coast. Since 1962, skin-divers collecting around the northern offshore islands of New Zealand have discovered a number of new echinoids and have provided new information on the distribution of shallow water species (Baker, 1967).

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The present paper describes *Tripneustes gratilla* (Linnaeus)—a tropical echinoid hitherto unknown from New Zealand—collected by skin-divers at the Bay of Islands and Poor Knights Islands, and gives new distributional data for *Phormosoma bursarium* A. Agassiz, *Centrostephanus rodgersii* (A. Agassiz), and *Brisus gigas* Fell. Twenty-nine echinoids which are now known from New Zealand waters north of East Cape are listed with accompanying distributional and bathymetric data in Table I.

NEW RECORDS

Super-order DIADEMATACEA Duncan, 1889

Order ECHINOTHURIOIDA Claus, 1880

Phormosoma bursarium A. Agassiz

Mortensen, 1935, p. 135; Pls. II, fig. 20; III, figs. 1-2; LXXIV, figs. 11-15. (Complete synonymy.)

MATERIAL EXAMINED: 30/9/62, 8mls E of White Island, Bay of Plenty, 177° 20' E, 37° 30' S, 550m, two specimens collected by Dr R. B. Pike, Victoria University of Wellington.

REMARKS: The specimens agree in most respects with Mortensen's (1935) description. Their measurements are:

	Horizontal Diameter	Peristome	Apical System	No. of Aboral IA Plates
1.	82mm	25	17	12-13
2.	60	22	13	11-12

I found no trace of the coarse, densely thorny marginal fringe spines mentioned by Mortensen as one of the features distinguishing *P. bursarium* from the Atlantic species *P. placenta*. However, many of aboral and marginal spines are missing on the present specimens; the delicate nature of the spines and the flexibility of the test make the species particularly prone to damage during capture.

Two specimens of this widely distributed Indo-Pacific species were first recorded from the Chatham Rise and Islands by Fell (1958). The present record is the first from the New Zealand mainland.

Order DIADEMATOIDA Duncan, 1889

Centrostephanus rodgersii (A. Agassiz)

Mortensen, 1940, p. 320, figs. 162-163; Pls. XXXV, figs. 6, 13-15; XXXVII, figs. 3-8; XXXVIII, figs. 1-4; LXXVII, figs. 1-12, 15-18, 21. (Complete synonymy.)

MATERIAL EXAMINED: 23/10/67, Mayor Island, Bay of Plenty, 176° 15' E, 37° 16' S, 6m, two specimens collected alive by skin-diver Mr R. C. Jones, Victoria University of Wellington.

REMARKS: The specimens are typical examples of this large deep purple echinoid. One specimen is probably near maximum size for the species; its dimensions are as follows: Horizontal diameter, 110mm; height, 46mm; peristome, 40mm; apical system, 25mm; longest spine, 85mm.

The species was previously known from near Little Barrier Island (36° 14' S) northwards (Fell, 1949), and the present extension of its range into the Bay of Plenty was not unexpected. *C. rodgersii* is also known from eastern Australia, Lord Howe Island, and the Kermadec Islands.

Super-order ECHINACEA Claus, 1876

Order TEMNOPLEUROIDA Mortensen, 1942

***Tripeustes gratilla* (Linnaeus) (Pl. 1)**

Mortensen, 1943, p. 500, figs. 306–307; Pls. XXXIII, figs. 1–3; XXXIV, figs. 2–6; XXV, figs. 3–4; XXVII, figs. 1–2, 4–10; XXXVIII, figs. 1–4; LVI, fig. 11. (Complete synonymy.)

MATERIAL EXAMINED: 1964, Deepwater Cove, Bay of Islands, 174° 18' E, 35° 11.5' S, "shallow water", one naked, fragmented specimen collected by skin-diver Mr K. Tarlton, Whangarei. 1966, Poor Knights Islands, 174° 44' E, 35° 28' S, 30m, one specimen collected alive by Mr W. Palmer, Whangarei.

REMARKS: The specimens have the following dimensions:

	h.d.	Height	Peristome	Apical System
1.	136mm	79	27	19
2.	149	88	26	22

Test regularly hemispherical, circumference rounded subpentagonal. Oral side flat, slightly sunken towards peristome.

Amb 74 percent of interamb at ambitus, but wider than interamb adorally. Interporiferous area about twice the width of pore zone at ambitus. Inner pore series very regular, median and outer series irregular, particularly in ambital region. Amb plates trigeminate, but compressed to give a pseudo-polyporous arrangement of pores. Pore zones contain two distinct, vertical series of tubercles, there being one tubercle to every third or fourth plate aborally. Secondary and miliary tubercles scattered and numerous.

Interamb tubercles arranged in horizontal series of 5–6 on each plate. Primary series extend to apical system, secondary series to just above ambitus. One to three large secondary tubercles lie outside primary series. Small secondary and miliary tubercles numerous, forming rectangular pattern around larger tubercles adorally.

Apical system: oculars I and V insert; ocular and genital plates possess 2–4 tubercles on their inner margins. Periproctal plates also carry tubercles. Miliary radioles and pedicellariae scattered over all plates of apical system.

Peristome: buccal membrane covered with numerous small, closely set plates bearing pedicellariae. Buccal plates also carry a few radioles. Gill slits sharp, moderately deep (2.5mm).

Radioles short (< 16mm), gently tapered, longitudinally striated, forming a dense cover. Globiferous pedicellariae with valves terminating in one long curved tooth very abundant. Narrow-valved tridentate pedicellariae of two kinds: one with valves distinctly widened distally; the other only slightly, or not at all widened. Typical ophicephalus and triphyllous forms present. C-shaped spicules occur in pedicellariae and tube feet.

Colour: When alive, test orange-red, spines pink or white, sometimes tipped with red; dried test pinkish-mauve, spines white.

Except for two features, the moderately deep gill slits and the irregularity of the radial pore series, the New Zealand specimens agree quite closely with descriptions of *T. gratilla* from other Indo-Pacific localities. Mortensen (1943) noted that specimens from Port Jackson, N.S.W., had gill slits which were shorter than usual for *T. gratilla*. This feature is very marked in the New Zealand specimens, the gill slits being less than half as long as those on a specimen of *T. gratilla* from Suva Bay, Fiji. The irregular outer pore series may be related to the large size of present tests—specimen two appears to be the largest on record, H. L. Clark (1946) having recorded the previous largest specimen (h.d. 145mm) from the Australian Barrier Reef.

When a better range of specimens of *T. gratilla* becomes available from New Zealand it may be desirable to re-examine the above features and perhaps class the Australasian forms as a separate variety.

Tripneustes gratilla is known from east Australia and the Indo-Pacific from East Africa to Hawaii and Southern Japan. Its occurrence in New Zealand is a new record, although the species has been reported from the Kermadec Islands (Mortensen, 1943). In New Zealand, it is known only from the Bay of Islands and the Poor Knights Islands at present, but there are reports of specimens having been collected at Whangaroa (35° S), and I have seen photographs of what appears to be this species taken at Mayor Island, Bay of Plenty.

Super-order ATELOSTOMATA Zittel, 1879

Order SPATANGOIDA Claus, 1876

Brissus gigas Fell

Fell, 1947, p. 145, figs. 1-2, Pls. 13-14. Mortensen, 1950, p. 518. Baker, 1965, p. 69, fig. 1, Pls. 1-2.

MATERIAL EXAMINED: 1965, Poor Knights Islands, 174° 44' E, 35° 28' S, 20-50m, six empty tests collected by Messrs K. Tarlton and W. Palmer. 12/1/67, South-west Island, Three Kings Group, 172° 3.5' E, 34° 10.5' S, 39m, one specimen, collected alive by Mr K. Tarlton.

REMARKS: The Three Kings specimen was located on a patch of broken shell and bryozoan debris in an area swept by strong currents, and is the first example of this species to be collected alive. It has the following dimensions: length, 83mm, breadth, 66mm, height, 47mm. Little can be added to descriptions of this endemic heart-urchin given by Fell (1947) and Baker (1965), except that the shape of the ambis is much too variable to be used as a distinguishing feature of the species as I suggested in 1965.

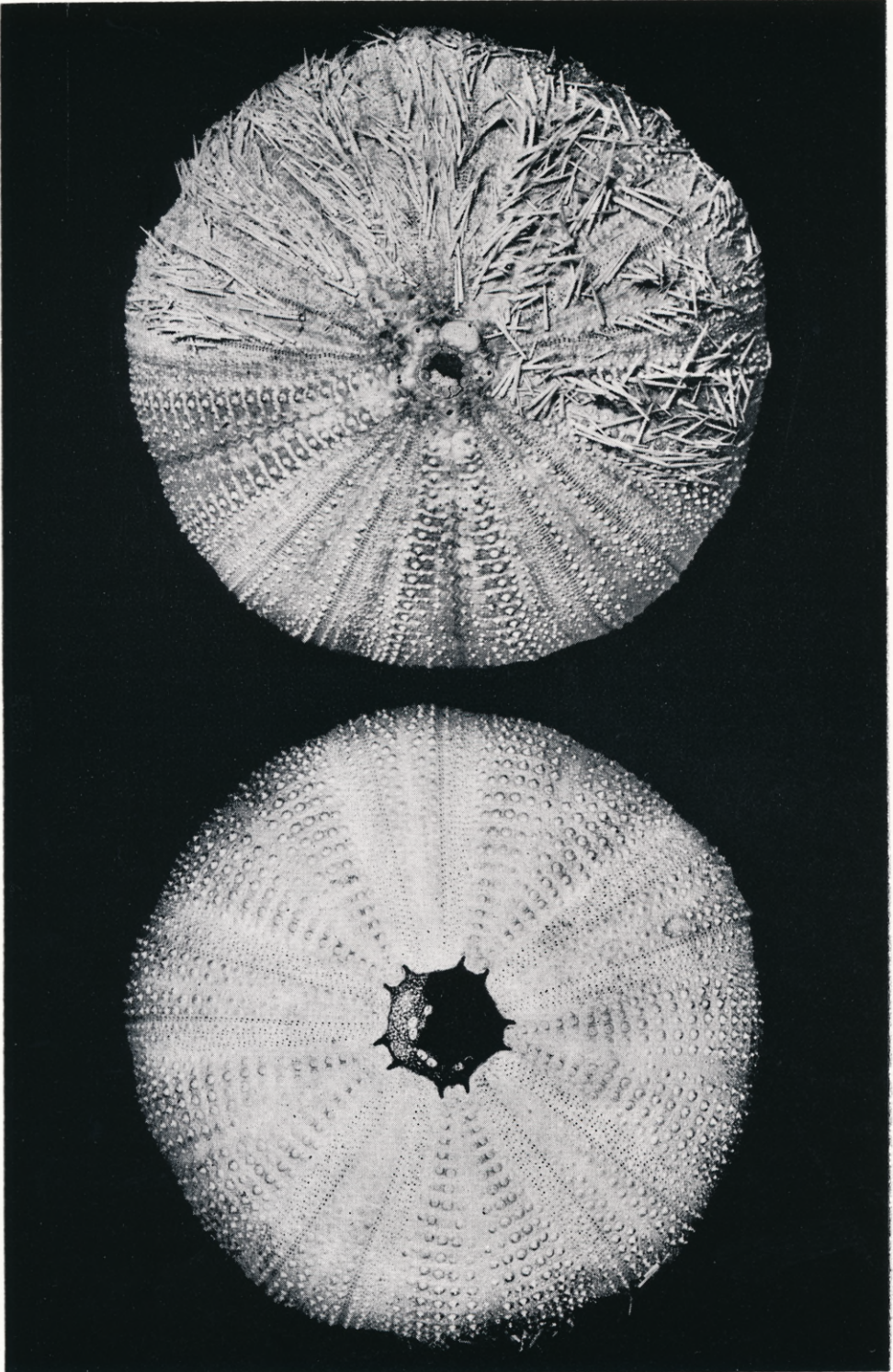
Two small bivalve molluscs, identified as *Coriarius* sp. (Mr W. F. Ponder, pers. comm.), were attached to the radioles on interamb five of the Three Kings specimen.

The known range of *B. gigas* is now Three Kings Islands south to Poor Knights Islands, although Fell (1947) reported fragments of a spatangoid, which may have been this species, from Great Barrier Island.

DISCUSSION

The discovery of *Tripneustes gratilla* and *Phormosoma bursarium* in northern New Zealand waters brings the number of echinoids known from that region to 29 (25 genera)—approximately 70 percent of the total echinoid fauna of New Zealand. Fourteen species are apparently restricted to the continental shelf, seven are archibenthal, and eight are eurybathic (Table I). On the East coast, 20 species are known only from north of East Cape. Of the remaining nine species, five (*Ogmocidaris benhami*, *Araeosoma thetidis*, *Phormosoma bursarium*, *Fellaster zelandiae*, and *Brissopsis oldhami*) range to the Cook Strait—Chatham Rise area, two (*Peronella hinemoae* and *Echinocardium cordatum*) have been recorded from near Foveaux Strait, and two extend south to the Snares and Auckland Islands (*Evechinus chloroticus* and *Apatopygus recens* respectively). Little is known of the west coast distribution of echinoids.

Thirteen of the 29 species known from northern waters are endemic to New Zealand, and nine of these are peculiar to the area north of East Cape (Table I). Among the endemics, such species as *Goniocidaris magi*, *G. corona*, *Diadema palmeri*, and *Brissus gigas* have very close relatives in the Australian-Indo-Pacific region. Twenty northern New Zealand genera are represented in Australian and Indo-Pacific waters, including ten species which are common to Australia and New Zealand, and eight species of wider Indo-Pacific distribution. These warm-water echinoids provide strong evidence for the suggestions that much of the echinoid fauna of New Zealand was derived from the Indo-West Pacific region, and that sub-



Tripneustes gratilla (Linnaeus), specimen from Poor Knights Islands, New Zealand; horizontal diameter 149mm. Upper—aboral aspect; lower—adoral aspect.—Photo: M. D. King.

TABLE I.—List of echinoids known from north of East Cape, New Zealand, with bathymetric and distributional data.

Northern N.Z. Echinoids	Depth Range (Metres)	Endermic Species	Restricted to Northern N.Z.	Kermadec Is. Gen. Sp.	Australia Gen. Sp.	Indo-Pacific Gen. Sp.
CIDAROIDA						
<i>Ogmocidaris benhami</i> Mortensen	200-720	x				
<i>Gonicidaris magi</i> Pawson	135-536	x	x		x	x
<i>Gonicidaris corona</i> Baker	14-132	x	x			
<i>Stereocidaris sceptriferoides</i> (Doderlein)	360-700		x		x	x
ECHINOTHURIOIDA						
<i>Araeosoma thetidis</i> (Clark)	125-360				x	x
<i>Asthenosoma gracile</i> Agassiz	1260	x	x		x	x
<i>Phormosoma bursarium</i> Agassiz	170-2340					
<i>Phormosoma rigidum</i> Agassiz	1200	x	x			x
DIADEMATOIDA						
<i>Diadema palmeri</i> Baker	10-54	x	x		x	x
<i>Centrostephanus rogersii</i> (Agassiz)	0-110		x		x	x
PEDINOIDA						
<i>Caenopodina novaezelandiae</i> Pawson	324-426	x	x			x
SALENIOIDA						
<i>Salenocidaris hastigera</i> (Agassiz)	370-2565		x			x
ARBACIOIDA						
<i>Coelopleurus</i> sp.	252-342		x		x	x
TEMNOPLEUOIDA						
<i>Holopneustes inflatus</i> Lutken	11-27		x		x	x
<i>Pseudechinus grossularia</i> (Studer)	179	x	x		x	
<i>Pseudechinus variegatus</i> Mortensen	65-120	x	x			
<i>Tripneustes gratilla</i> (Linnaeus)	0-75		x		x	x
ECHINOIDA						
<i>Evechinus chloroticus</i> (Valenciennes)	0-20	x				
<i>Heliocidaris tuberculata</i> (Lamarck)	0-54		x		x	x
CLYPEASTEROIDA						
<i>Clypeaster australasiae</i> (Gray)	0-220		x		x	x
<i>Echinocyamus polyphorus</i> Mortensen	9-536		x		x	x
<i>Fellaster zelandiae</i> (Gray)	0-5				x	
<i>Jacksonaster depressum</i> (Lesson)	0-40		x		x	x
<i>Peronella hinemoae</i> Mortensen	70-225	x			x	x
CASSIDULOIDA						
<i>Apatopygus recens</i> (Milne-Edwards)	10-162	x			x	
SPATANGOIDA						
<i>Brissus gigas</i> Fell	0-39	x	x			x
<i>Brissus agassizii</i> Doderlein	0-76		x			
<i>Brissopsis oldhami</i> Alcock	75-2736				x	x
<i>Echinocardium cordatum</i> (Pennant)	0-230				x	x

tropical echinoderms are still in the process of colonising the coasts of northern New Zealand after the passing of a post-Pliocene cool period (Fell, 1953, 1962).

It is thus firmly established that the echinoid fauna north of East Cape is markedly distinct from that of the rest of New Zealand, and its dominant feature is the presence of Australian and Indo-Pacific forms. Although some northern species such as *Goniocidaris* spp., *Diadema palmeri*, and *Brissus* spp. appear to have rather restricted distributions, more extensive sampling, particularly in the sublittoral zone, should reveal wider patterns of distribution. Most of the recently discovered echinoids have been collected by divers working in localities which provide consistently good diving conditions—the offshore islands; few collections have been made from the long stretches of mainland coastline between the widely scattered island groups.

Despite sketchy data on the distribution of echinoids within the northern region, it is evident that the East Cape area forms a definite southern boundary for most species. Pawson (1961, 1965b) concluded that the East Cape area constitutes an important barrier to the southward spread of some echinoderms, and suggested that the offshore movement of surface water in the southern Bay of Plenty might prevent northern planktonic echinoderm larvae from settling south of the Cape. Also, the cold, northward moving Canterbury Current, and local upwellings of cold bottom water near East Cape, could arrest the southern passage of pelagic larvae. Sub-tropical echinoids like *Centrostephanus*, *Holopneustes*, *Tripneustes*, and *Diadema* possess the kind of pelagic larvae which would be adversely affected by such water movements.

In view of the recent discovery of several sub-tropical echinoids off northern New Zealand, it seems likely that other warm-water forms, such as *Phyllacanthus*, *Prionocidaris*, and *Echinometra*, may also be present. Skin divers equipped with SCUBA will probably have the best chance of finding these shallow-water shelf echinoids; the habit of such striking species as *Tripneustes gratilla* and *Diadema palmeri* of living on or near steep-sloping rock faces in northern New Zealand, has no doubt prevented their earlier collection by conventional bottom sampling techniques.

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ALAN N. BAKER, B.Sc. (Hons.),
Marine Laboratory,
Department of Zoology,
Victoria University of Wellington,
P.O. Box 196, Wellington, New Zealand.