

A REDESCRIPTION OF *ASTROSCLERA WILLEYANA* LISTER, 1900
(CERATOPORELLIDA, DEMOSPONGIAE), A NEW RECORD FROM THE
GREAT BARRIER REEF

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Abstract

A large number of specimens of *Astrosclera willeyana* Lister 1900 were collected from amongst coral rubble and from caves and underhangs in depths of 4-53 m from Escape reef (15°50'S 145°49'E), one of the northerly reefs on the outer rampart of the Great Barrier Reef. This collection extends the known geographic distribution of the species and includes specimens far larger than those previously recorded. The characteristics of these large specimens are described. Examination of the spicule content in a wide range of different sizes of *A. willeyana* revealed that spicules were only present in small individuals. This variation in spicule content has led some authors to believe that two species may be involved rather than one. The present collection shows that *A. willeyana* cannot be split into two species and has enabled an unambiguous new description of the species.

Introduction

Astrosclera willeyana Lister 1900, was first found off the Loyalty and Tuvalu Islands (Lister, 1900) and has since been discovered off Madagascar (Vacelet and Vasseur, 1965, 1971; Vacelet et al., 1976), L'île Europa (Vacelet, 1967), Christmas Island (Kirkpatrick, 1910), New Caledonia (Vacelet, 1981), La Réunion and French Polynesia (Vacelet, 1977) and Guam (Hartman pers. comm.). The sponge lives in depths of 4-183 m, in small crevices and caves within the coral in front reef and lagoon habitats. All specimens reported have maximum head diameters of less than 25 mm but the largest specimens collected by Hartman reached 135 x 105 mm (Hartman pers. comm.). The spicule quantity and characteristics of reported specimens varies markedly. Vacelet (1977, 1981) suggests that this may be linked with geographic location. Described specimens from the Indian Ocean have numerous acanthostyli, often with regular spining, while those from New Caledonia have no spicules or a few fine spicules with irregular spining. No spicules were found in specimens from the Central Pacific (Stearn, 1972; Vacelet, 1977). The possibility has been raised that *A. willeyana* as hitherto understood may comprise two species, one with spicules and one without (Vacelet, 1981). The

present collection, which includes a good size range of specimens, has enabled a resolution of the seeming spicular differences reported previously. Using the present specimens a redescription of the sponge is given along with notes on habitat and ecology.

Methods

Specimens in caves could be picked off the substratum by hand while those living in coral rubble were collected with the aid of a crowbar to lever the rubble apart. Specimens were preserved initially in 90% alcohol and then three days later in 70% alcohol. Spicule mounts were made using 5.25% sodium hypochlorite (commercial bleach). Thin sections of the skeleton were prepared after impregnation with araldite. Histological sections were made from decalcified sections stained in Mallory's Triple Stain.

Description of the Species

Sub-class	Ceractinomorpha Lévi
Order	Ceratoporellida Hartman and Goreau
Family	Astroscleridae Lister
	<i>Astrosclera willeyana</i> Lister

Figure 1

- Astrosclera willeyana* Lister, 1900; 459, pls. 45-48, figs. A, B, C.
Astrosclera willeyana Kirkpatrick, 1910a: 380, pl. 11.
Astrosclera willeyana Kirkpatrick, 1910b: 83.
Astrosclera willeyana Vacelet and Vasseur, 1965: 115, pl. X, fig. 37.
Astrosclera willeyana Vacelet, 1967: 127, figs. 3, 6, 7, 8.
Astrosclera willeyana Vacelet and Vasseur, 1971: 116.
Astrosclera willeyana Vacelet, 1977: 346, pl. 1a, c.
Astrosclera willeyana Vacelet, 1981: figs. 1a, b, c.

Material: Specimens are deposited in the Australian Museum (A.M.), National Museum of Victoria (N.M.V) and the British Museum (B.M.).

- A.M. Z3894, diameter 95 mm, back reef, Escape Reef, 6 m, A. L. Ayling, 19.12.80;
 A.M. Z3893, diameter 105 mm, front reef, Escape Reef, 53 m, A. M. Ayling, 14.12.80;
 N.M.V. G3298, diameter 40 mm, front reef, Escape Reef, 12 m, A.L.A., 15.12.80;
 A.M. Z3891, diameter 60 mm, front reef, Escape Reef, 11 m, A.M.A., 15.12.80 (includes one 6 mm in diameter specimen and the tabulate sponge *Acanthochaetetes wellsii* Hartman and Goreau, A.M. Z3892);
 N.M.V. G3297, diameter 130 mm, outer reef, Escape Reef, 53 m, W. A. Starck, 13.12.80; (includes five specimens 6-15 mm in diameter);
 A.M. Z3890, diameter 4 mm, back reef under rubble, Escape Reef, 10 m, A.L.A., 22.12.80;
 B.M.N.H. 1982: 3:9:1-26: twenty-six specimens ranging in size from 7 to 50 mm in diameter, front reef cave, 12 m, A.L.A., 2.10.81;
 B.M.N.H. 1982: 3:9:27: diameter 130 mm, front reef cave, Escape Reef, 12 m, A.L.A., 2.10.81;
 B.M.N.H. 1982: 3:9:28-47: twenty specimens ranging in size from 1.5 to 14 mm in diameter, back reef under rubble, Escape Reef, 17 m, A.L.A., 27.10.81.

Colour: Very small specimens were pale pink in life while specimens above 5 mm maximum head diameter were salmon orange. Very large

sponges were orange sometimes shaded with a tinge of pink. The central mass of the sponge was white. Specimens turned a dark orange in preservative.

Growth form and dimensions: The specimens in the present collection range from 1.5 to 130 mm maximum head diameter and 1 to 55 mm in height. The largest specimen observed in the field was 165 x 115 mm in diameter but this was not collected. The smallest individuals are thinly encrusting and sometimes have finger-like processes spreading out over the substratum. With increase in size the sponge grows upwards into a cylindrical structure with the pedicel no wider than the head. The head is flattened in these young specimens, then gradually becomes rounded and larger than the pedicel until in the largest specimens the margin of the head has curved down to the substratum. In all specimens growth rings are visible. The surface of the sponges is usually smooth except in some large individuals where it becomes irregularly mammillate. Sponges were occasionally found with surfaces pitted by 0.8 mm wide holes of unknown origin.

Oscules: The oscules always occur on the mammillae where these are present but are otherwise regularly scattered over the surface at 2 to 5 per square centimetre. Oscules have 3 to 6 astrorrhizae extending from them and are deeply etched into the skeleton of the sponge covering an area of the surface of the sponge from 2 to 12 mm in diameter. The diameter of these oscular areas is independent of the size of the sponge. The structure of the astrorrhizae is discussed in Stearn (1975).

Mineral skeleton: The main skeleton of the sponge is formed of spherules of aragonite, 10 to 60 μm in diameter (mineralogy confirmed by Dr. W. Birch, NMV) which are loose at the surface but coalesce further down in the sponge to form short columns 100-550 μm in diameter (see Lister, 1900, for figures of the internal structure). These columns are quite distinct in larger specimens but in the smaller specimens they often join in a more lamellar pattern. In individuals less than 5 mm in maximum head diameter, the columns of spherules are so close together that they form an almost continuous

surface. Toward the interior of the sponge the columns gradually coalesce and become more distorted. The living tissues extend down to a depth of 8 mm.

Spicules: In living specimens up to 6 mm in maximum head diameter, some spicules could always be found although the number of spicules varied markedly. The range in spicule size from 80 measurements taken from a number of specimens is 29.2 to $98.1 \mu\text{m} \times 1.1$ to $5.3 \mu\text{m}$ and the mean and standard deviation is $56.4 \mu\text{m}$ ($12.2 \mu\text{m}$) \times $3.0 \mu\text{m}$ ($0.8 \mu\text{m}$). Most spicules have narrow heads followed by a swelling which tapers to a point (Fig. 1a). However, a few spicules have little or no narrowing of the head and lack the distinctive swelling (Fig. 1b).

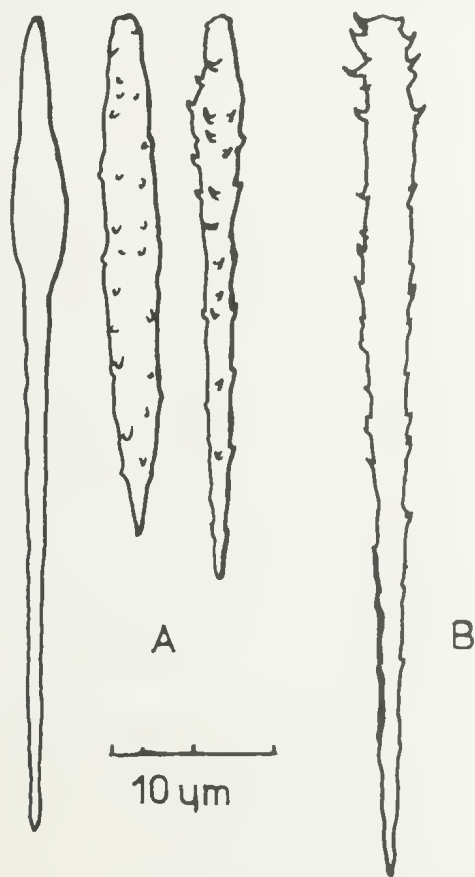


Fig. 1. Spicules from *Astrosclera willeyana*.
(a) common form,
(b) rarer form.

Most acanthostyli have barely perceptible spines or irregular short spines. However, in some specimens, especially those with spicules without narrowing of the head, spines are pronounced. These spicule forms and sizes are similar to previously described material.

In specimens from 7 to 18 mm in maximum head diameter, spicules are normally rare and sometimes absent. Above this size no spicules were found in the present collection. It is worth noting that spicules could rarely be found in dead or even roughly handled specimens.

Remarks: The discovery of *Astrosclera willeyana* on the Great Barrier Reef extends the known range of this species. The species is abundant at Escape Reef in shaded situations in caves and chimneys on the front reef (3.32 (SD 3.67) per quarter metre square) and under coral rubble (0.7 (SD 1.1) per quarter metre square). Small specimens were found on the undersurfaces of coral pieces up to 30 cm deep in coral rubble, under small ledges along the front reef and outer reefs, and deep within caves. These habitats were clear of silt and algae. The larger specimens were found in large open tunnels along the front reef where water movement from both currents and surge was constant and often strong. This suggests that this species grows to a large size only in certain situations. The size-frequency of the populations is shown in Fig. 2. Individuals between 5 and 20 mm in maximum head diameter on the front reef form 87.1% of the population while on the back reef 50% of the population are between 1 and 4 mm in maximum head diameter.

Apart from *Astrosclera willeyana*, two other coralline sponges were found to be common in the caves of Escape Reef; the tabulate sponge *Acanthochaetetes wellsi* Hartman and Goreau, and a living sphinctozoan species *Neocoelia crypta* Vacelet. In the coral rubble sclerospices were found associated with the brachiopod *Frenulina sanguinolenta* (Gmelin).

Oocytes were found in several specimens from 8 to 105 mm in maximum head diameter collected during the period November-December 1980/81. Oocytes measured up to $105 \mu\text{m}$ in maximum diameter.

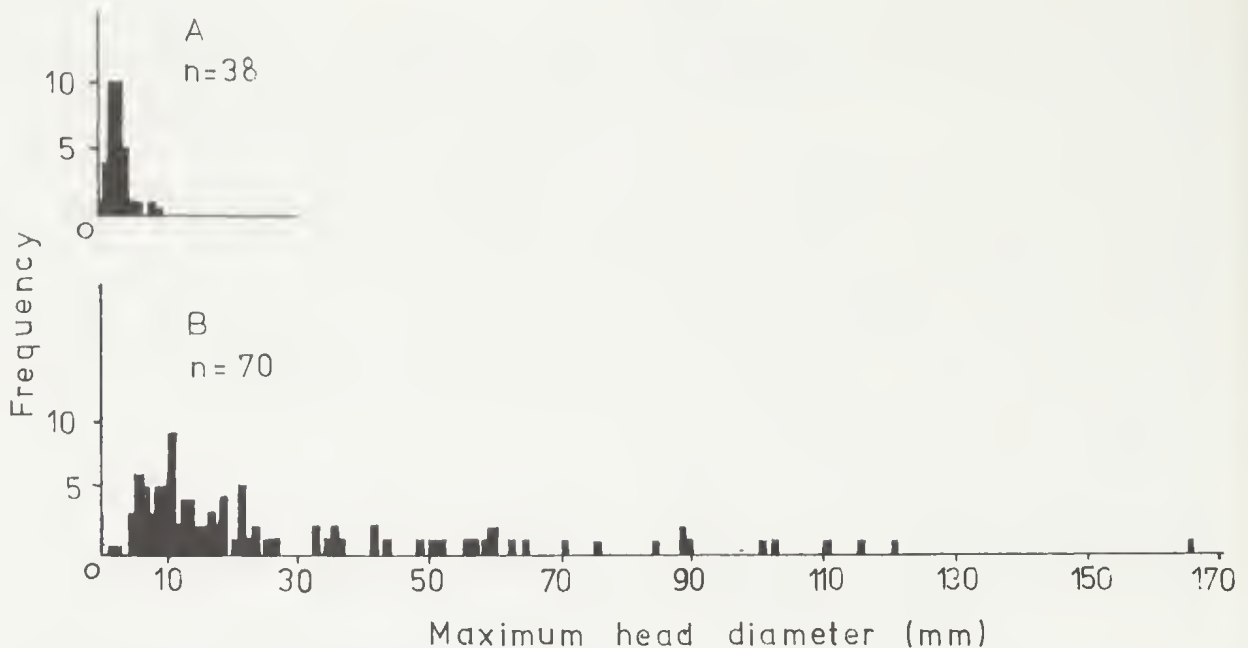


Fig. 2. Size-frequency of two populations of *Astrosclera willeyana* from Escape Reef.
(a) back reef coral rubble,
(b) front reef caves.

Conclusions

The large populations and range in size of the specimens of *Astrosclera willeyana* from the Great Barrier Reef allow the species to be more fully described and also provide useful information on the variability in spicule content of the sponge body. The variability in spicule content found in the present sponges due to size, individual variation and state of preservation of the specimens could account for the seeming geographic variation in this character reported by previous authors (see summary Vacelet, 1981), especially as these previously described specimens were all below a head diameter of 25 mm. In the present collection the only individuals found to have spicules consistently were those with a head diameter of less than 6 mm. After a head diameter of 18 mm is reached, the sponge either no longer produced spicules or the spicules may erode (Hartman and Goreau, 1970). Large *A. willeyana* appear only to develop in situations of strong water movement. These individuals, unlike the smaller sponges, have no visible pedicel as the head reaches down to the substratum and the surface is sometimes produced into mammillae.

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