Growth Rate, Toxicity, and Distribution of the Encrusting Sponge *Terpios* sp. (Hadromerida: Suberitidae) in Guam, Mariana Islands[1]

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Abstract

An encrusting marine sponge, thought to be a new species of *Terpios*, encrusts both living and non living substrates on Guam. Growth rate, toxicity, and distribution of the sponge were studied. The sponge grew an average of 23 mm per month over a live colony of *Porites lutea*. Sponge growth over live corals was significantly faster ($P \leq 0.025$) than growth over non living substrate. Pieces of the sponge placed on specimens of *Fungia echinata* killed some of the coral tissue and caused retraction of the tentacles and closure of the stomodaea. The most extensive encrustations of *Terpios* sp. were found along the southeast side of Guam on the reef terraces and also on the western side near Anae Island. In one area the sponge dominated most of the reef terrace for nearly a kilometer.

A common marine sponge, believed to be a new species of the genus *Terpios* (P. R. Bergquist and W. D. Hartman, personal communication), encrusts both living and non living substrates. This study was designed to yield information on the growth rate, toxicity, and distribution of this *Terpios* which is presently exhibiting a dramatic increase in areal coverage on some of the reefs of Guam. The sponge is usually less than 1 mm thick and has a skeleton composed of small hexactine-like spicules similar to those described for *T. fugax* by de Laubenfels (1954). Its color ranges from a light to dark, sometimes irridescent, gray and the surface is characterized by having distinct astrorhizae at the oscules (Fig. 1). In areas of reduced light intensities the organism is thinner, dark reddish brown, and the surface lacks astrorhizae. The sponge is generally not found on the undersides of coral heads and in crevices.

Growth of *Terpios* sp. was monitored at intervals from October, 1971 to March, 1973 as it encrusted a colony of *Porites lutea*, approximately 630 mm in length and 360 mm high. This colony is located on the south side of Anae Island in 10 m of water. The sponge grew along the living coral interface at an average rate of 23 mm per month (Fig. 2). Benthic algae (*Dictyota* and *Asparagopsis*) and spirorbid

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Figs. 1. *Terpios* sp. encrusting a coral colony of *Millepora* (center). Note the distinct astrorhizae on the sponge and the feeding scars on the right side of the colony near the sponge-coral interface.

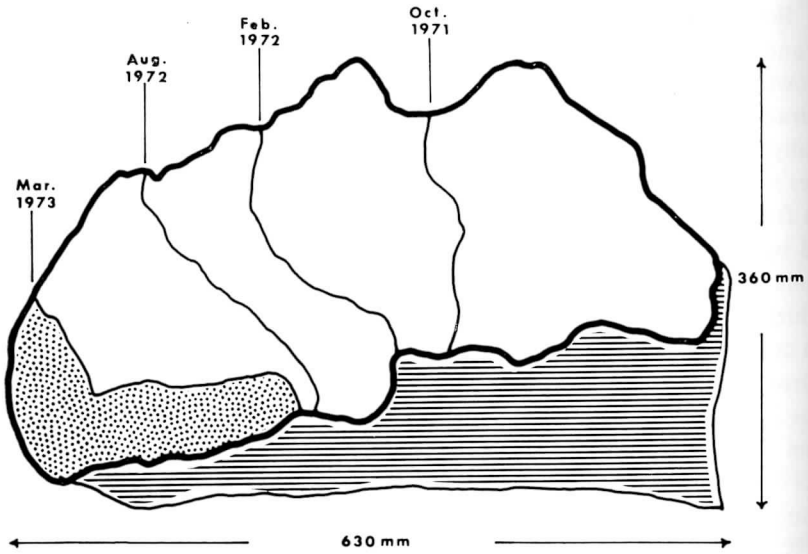

Fig. 2. Growth increments of *Terpios* sp. encrusting a live colony (stippled) of *Porites lutea* at Anae Island over a 17 month period beginning October 1, 1971. Lined area represents the dead basal part of the colony.

worms residing on or in the coral head were not encrusted, possibly because of their mechanical movements.

The south side of Anae Island (Fig. 3) which was nearly dominated by the sponge in October, 1971, had little sponge left by March, 1973 and most of the corals were dead. Benthic algae-*Microcoleus*, *Feldmania*, *Dictyota*, *Gelidium* and *Jania* are

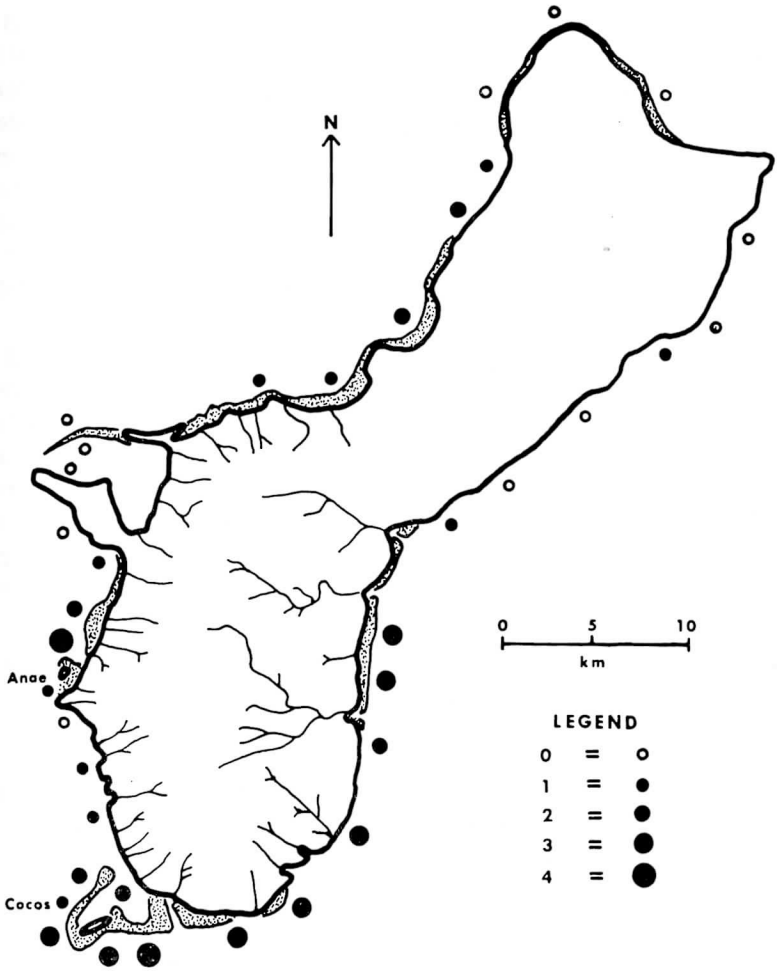

Fig. 3. Density distribution of *Terpios* sp. on the reefs of Guam as of November, 1972. Numbers in legend refer to abundance, as cited in text.

now dominant. Conversely, the north side of Anae, which had little sponge in October, 1971, is now nearly sponge dominated and the organism appears to be presently spreading over the shallow submerged reef areas toward the shoreline.

Growth rates of *Terpios* sp. were also studied in an area near Cocos Island on the western barrier reef (Fig. 3). Sponge growth over live corals (11 stations) and

sponge growth over non living substrate (10 stations) were marked with small numbered floats in water 10 m deep. A cross was carved at each station several centimeters in front of the growing edge of the sponge. The distance from the cross intersect along the cross axis normal to the leading edge of the sponge was measured and recorded on March 22 and again eight days later on March 30. The difference between the two values indicate growth of the sponge normal to the substrate-sponge interface. Growth of the sponge over live corals averaged (mm) 6.5 ($\pm$2.2 SE) or 0.8/day, while growth over non living substrate averaged 1.4 ($\pm$0.9 SE) or 0.2/day. Growth over live corals was significantly faster than growth over non living substrate ($P \leq 0.025$). This experiment was repeated in April at a depth of 30 m over a 15 day period but with only four live coral stations and three non living substrate stations. In these results, growth over live coral averaged (mm) 14.5 ($\pm$6.1 SE) or 1.0/day. There was no measurable growth over non living substrate. The results seem to indicate that at both depths *Terpios* sp. has a much faster rate of growth over live coral than over non living substrate. Whether the sponge is deriving some nutritive value from the coral is unclear.

The distribution of the sponge around the island was closely monitored during 1972 in conjunction with *Acanthaster planci* surveys. A final survey was conducted in October and November, 1972. Actual counts of the number of sponge patches seen per 10 minute tow or swim were made and depths recorded. A rating system for estimating sponge abundance was applied: 0=no sponge seen; 1=uncommon (less than five patches seen); 2=common (five or more patches seen); 3=abundant (patches too numerous to count or sponge is continuous over large areas); 4=dominant (sponge dominating reef substrate). Figure 3 shows the distribution and density of *Terpios* sp. on Guam as of November, 1972.

Terpios sp. was most abundant along the southeast side of the island, where in one area along the eastern barrier reef of Cocos lagoon it dominated most of the reef terrace for nearly a kilometer in length at depths up to 32 m. The sponge extended around Cocos Island along the western barrier reef of Cocos lagoon at depths of 5–25 m. It was dominant on the north side of Anae Island about 8 m deep. Most of the areas having abundant or dominant sponge encrustment are typified by substrates of massive reef development with irregular relief and supporting a relatively rich coral fauna. Except for the north side of Anae Island, these areas have not experienced plague populations of *A. planci* (Tsuda, 1972).

On Guam, *Terpios* sp. has been observed growing over most scleractinian coral genera, *Acropora, Astreopora, Coscinaraea, Diploastrea, Favia, Fungia, Galaxea, Goniastrea, Leptoria, Lobophyllia, Montipora, Pavona, Platygyra, Pocillopora,* and *Scapophyllia.* It also encrusts *Heliopora* and occasionally *Millepora.* Neither the size of the coral polyps nor the toxicity of their nematocysts seems to restrict the encrusting growth of the sponge. The sponge also encrusts certain calcareous algae, e.g., *Porolithon, Amphiroa,* and *Halimeda*; shells, e.g., *Trochus* and *Tridacna*; and inorganic compounds, e.g., limestone, aluminum, tin, glass, and lead. The sponge has not been found encrusting alcyonaceans, although alcyonacean spicules

have been found embedded in the sponge tissue. Recently the sponge was found growing on the inside surface of a clear softdrink bottle at a depth of about 25 m. This habitat would probably severely restrict water exchange necessary to carry nutrients to sessile filter feeding organisms. The sponge also grows well on the sides of clear closed system plastic aquaria. Topsent (1900) found symbiotic microorganisms of the genus *Beggiatoa* living within *T. fugax*. Such microorganisms could potentially provide nutritive value to sponges.

Toxicity of *Terpios* sp. to living coral was tested by placing small pieces (less than 5 mm) on three specimens of *Fungia echinata* in aquaria with running sea water. This caused immediate withdrawal of the expanded tentacles and closure of the stomodaea. Within 24 hours, tissue under and around the sponge pieces died. Upon removal of the sponge pieces, the corals regenerated new tissue within several weeks.

In many instances, particularly when *Terpios* sp. encrusts colonies of *Porites lutea* and *P. australiensis*, the living coral area directly in front of the sponge-coral interface turns a mild red color. There is usually a mucus granulation border along the sponge-coral interface, often composed partly of large colonial protozoans and microcrustaceans.

Scars on the sponge, sometimes two or three centimeters in length and about one-half a centimeter in width, are probably caused by browsing fish feeding deliberately rather than incidentally, since the scars are not random but clumped. Bakus (1964) emphasized the importance of grazing reef fishes as controlling agents for shallow-water reef sponges at Fanning Island, although Randall and Hartman (1968) concluded that fish predation was probably not a limiting factor in sponge distribution in the West Indies.

It appears that *Terpios* sp. can indiscriminately thrive on almost any type of substrate (excluding sand). Most sessile organisms seem to have no effective defensive mechanisms to retard the encrusting growth of the sponge other than motor or mechanical movements. The faster growth rates over living corals observed in this study may imply that the sponge is nutritionally benefitting from the coral.

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