Zoological Studies **34**(2): 117-125 (1995)

Zoological Studies

# Distribution of *Spirobranchus giganteus corniculatus* (Hove) on the Coral Reefs of Southern Taiwan

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*(Accepted February 27, 1995)*

**Chang-Feng Dai and Hsiao-Pei Yang (1995)** Distribution of *Spirobranchus giganteus corniculatus* (Hove) on the coral reefs of southern Taiwan. *Zoological Studies* **34**(2): 117-125. The distribution of *Spirobranchus giganteus corniculatus* (Hove), a widely distributed tube-building serpulid, on the coral reefs of southern Taiwan was studied by the transect sampling method. Two reef sites in Nanwan Bay, one with a high degree of physical disturbance and the other with a lower degree of disturbance, were surveyed. The spatial distribution of *S. giganteus corniculatus* on coral colonies was also analyzed using distance to nearest neighbor. The results show that *S. giganteus corniculatus* is distributed nonrandomly among coral species. Four species, *Porites lutea, P. lobata, P. lichen, Montipora informis*, are frequently colonized by the worm. About 30 species are occasionally colonized and many coral species are not colonized. Coral species which are frequently colonized by the worm are competitively subordinate. The spatial distribution of *S. giganteus corniculatus* on a coral colony is related to the number of worms with a tendency toward clustering with increasing number of worms per colony. In addition, most worms were found at intermediate depths (6-17 m) where the reef surface was flat and there were more colonizable scleractinians. The distribution and abundance of *S. giganteus corniculatus* in different reef areas is likely affected by environmental factors and the availability of colonizable substrate.

**Key words:** Reef serpulid, Distribution pattern, Reef ecology.

The distribution and abundance of benthic marine organisms are often determined by complex interactions between biotic and abiotic processes (Grosberg 1981, Jackson 1986, Pawlik 1992, Rodriguez et al. 1993). Studies on the distribution patterns of benthic organisms in different environments are basic to a better understanding of the effects of these complex interactions.

The serpulid polychaete *Spirobranchus giganteus* (Pallas) which occurs worldwide in tropical and subtropical seas is an obligate associate of live coral. It has been divided into two subspecies (Hove 1970), *S. giganteus giganteus* in the Atlantic and *S. giganteus corniculatus* in the Pacific. The worm builds its calcareous tube on the surface of the coral colony to protect its soft body. As the coral grows, the tube is covered by coral up to its opening.

The relationship between *S. giganteus* and its host coral is still poorly known. Strathmann et al. (1984) and DeVantier et al. (1986) suggested that the coral-worm relationship is mutualistic, the coral provides the worm with support and protection, and the worm enhances water circulation for coral feeding and provides a refuge for polyps adjacent to the tube.

*S. giganteus* is a dioecious broadcast spawner with a planktonic larval stage of 9-12 d (Hunte et al. 1990a). Larvae exhibit active preference in the laboratory for the coral species most heavily colonized in the field (Marsden 1987, Marsden et al. 1990). However, during the planktonic stage, environmental factors such as water flow, light intensity, chemical cues and properties of the substrate may have a great influence on larval dispersion and settlement (Rodriguez et al. 1993). Thus these factors may play an important role in the distribution and abundance of *S. giganteus*.

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A series of studies on the distribution and habitat preferences of *S. giganteus* in the Caribbean (Marsden 1984 1986, Hunte et al. 1990a, b, Marsden and Meeuwig 1990, Marsden et al. 1990) have shown that *S. giganteus* is not randomly distributed among coral species; that worm density is higher on some corals than on others. The nonrandom distribution is probably related to larval preference before settlement (Marsden et al. 1990) and differential mortality following settlement (Hunte et al. 1990b). Little is known about the distribution of *S. giganteus* in the Indo-Pacific where coral diversity is much higher and coral species are different from those in the Atlantic (Veron 1986).

In this study, we investigate the distribution patterns of *S. giganteus* at two reef sites with different environmental regimes in Nanwan Bay of southern Taiwan. The purpose of this study is to demonstrate the habitat preferences of *S. giganteus* on a Pacific reef and differences in colonization patterns between reef sites.

## MATERIALS AND METHODS

### Study sites

The study area, Nanwan Bay, is located on the southern tip of Taiwan (Fig. 1). The bay is surrounded by well-developed fringing reefs with a highly diverse coral fauna. Previous studies have shown that there are significant differences in environmental regime and coral fauna between the east and west sides of Nanwan Bay (Dai 1990). The benthic community on the west side is exposed to both tidal currents and typhoon disturbances, and is dominated by alcyonacean corals. The east side, protected from both tidal currents and typhoon disturbances, has a benthic community dominated by scleractinians (Dai 1993).

Two sites, Maobitou (MBT) on the west and Tiaoshi (TS) on the northeast of Nanwan Bay, were selected for this study. At MBT, the reef surface in shallow water is irregular with terraces and slopes cut by deep surge channels, and huge blocks of coral rock are scattered at depths below 15 m. Alcyonaceans comprise more than 70% of the total coral cover. The scleractinians that occur in this area are mainly species of the Faviidae. At TS, the reef surface in shallow water (<5 m) is composed of ridges and grooves that extend to a wide terrace at a depth of 8-16 m. Below this, there is a reef slope which ends in a sandy bottom at approximately 25 m. The coral community at TS is dominated by scleractinians with branching *Acropora* spp. abundant in the shallow water area and foliaceous corals such as *Merulina ampliata* and *Mycedium elephantotus* dominating the reef slope (Dai 1993). Approximately 230 species of scleractinians and 40 species of alcyonaceans have been recorded from this area (Dai 1990).

### Methods

Eleven transects at MBT and thirteen transects at TS were established from the shallow (ca. 3 m) reef flat to the edge of the reef (ca. 25 m deep) at approximately 15 m intervals. Each transect was 30 m long and ran parallel to the depth contour. A strip 2.5 m wide on each side of the transect (i.e., 150 $m^2$) was surveyed for each sample and the total areas surveyed were 1,650 $m^2$ at MBT and 1,950 $m^2$ at TS. All *S. giganteus* occurring in this area were counted. Coral colonies bearing worms were identified to species and the diameters of each colony were measured in two perpendicular dimensions. Whenever coral species identification was uncertain, a small piece of coral sample was taken for further identification in the laboratory.

Surface area of a coral colony was calculated following the realistic estimation developed by Dahl (1973). Coral colonies were classified into massive, encrusting, foliaceous, branching, and ridge-like forms, and different conversion factors were applied for each category. The average of two diameters in perpendicular directions was used

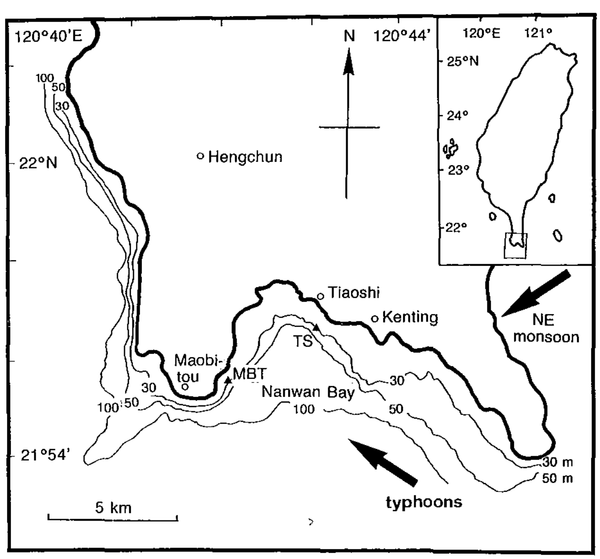


**Fig. 1.** Nanwan Bay showing locations of the two study sites (TS, MBT).

to estimate the surface area of encrusting and foliaceous forms. The surface area of massive corals was estimated as $2\pi r^2$, where r is the average diameter of a coral colony. For corals of branching and ridge-like forms, the projective area of each colony was calculated and then multiplied by the conversion factors 3 and 5.6, respectively, to estimate their surface areas (Dahl 1973).

Spearman's rank correlation analyses were used to determine whether the degree of colonization of coral species was correlated with their abundance or their colony size (Zar 1984). Data of the relative abundance of coral species was adopted from Dai (1988) whose study was conducted in the same area. Colony size was represented by the estimated surface area of a colony.

The spatial distribution of *S. giganteus* on individual coral colonies was analyzed by distance to nearest neighbor method (Clark and Evans 1954). Thirty-five colonized coral colonies, including *Porites lobata* (16), *P. lutea* (14), *Montipora informis* (3), *M. monasteriata*, (1) and *M. foveolata* (1), were randomly selected in situ. On each coral colony, the distance from each worm to its nearest neighbor was measured. All worms on any one coral colony were included when the total number of worms was less than forty; only forty worms were randomly selected for those colonies bearing more than forty worms. The average distance to nearest neighbors for all worms on a colony represents the observed mean distance ($r_o$). The expected mean distance ($r_e = 1/(2\sqrt{\rho})$, $\rho$ is the number of worms per unit of area) to nearest neighbor was also calculated based on the assumption that all the worms were randomly distributed on a coral colony (Clark and Evans 1954). The ratio of $r_o$ to $r_e$ was then normalized and the c value ($c = (r_o - r_e)/\sigma_{r_e}$, where $\sigma_{r_e} = 0.26136/\sqrt{N\rho}$, N is the number of worms) was derived. The c value serves as the measure of the departure from randomness. The c values greater than +1.96 represent a uniform distribution and those lower than −1.96 represent a clustered distribution at the 5% level of significance for a two-tailed test.

## RESULTS

A total of 1,747 worms on 32 species of scleractinians and 237 worms on 18 species of scleractinians were recorded at TS and MBT respectively (Table 1). All *S. giganteus corniculatus* were found on hard corals, none was found on soft corals, sand, or bare rocks. The degree of colonization varied among coral species. Coral species most frequently colonized by *S. giganteus* at both sites were *Porites lutea, P. lobata, P. lichen* and *Montipora informis.* More than 50% of the worms recorded were found on *Porites lutea* and *P. lobata* colonies. The number of colonized *Montipora informis* colonies was relatively high (fourteen colonies at TS and nineteen colonies at MBT) but the average number of worms per unit area was low (< 1.0 worms per $10^3$ cm$^2$). A few species, such as *M. grisea, M. monasteriata, M. spongodes, M. spumosa, Favia speciosa, Cyphastrea serailia*, and *Millepora platyphylla* were moderately colonized (3-8 colonized colonies). Other species such as *Acropora* spp., several faviids, *Mycedium elephantotus* and *Merulina ampliata* were occasionally colonized (1-2 colonized colonies). The number of coral species colonized by *S. giganteus* was greater at TS than at MBT (Fig. 2). Fewer worms were found at MBT, and the corals with worms were those species frequently colonized by *S. giganteus.*

At both sites, the number of *S. giganteus* on a given coral species and the relative abundance of that species were not correlated (Table 2; Spearman's rank correlation coefficient, at TS: $r_s = 0.18$, $p > 0.3$; at MBT: $r_s = 0.04$, $p > 0.7$) indicating

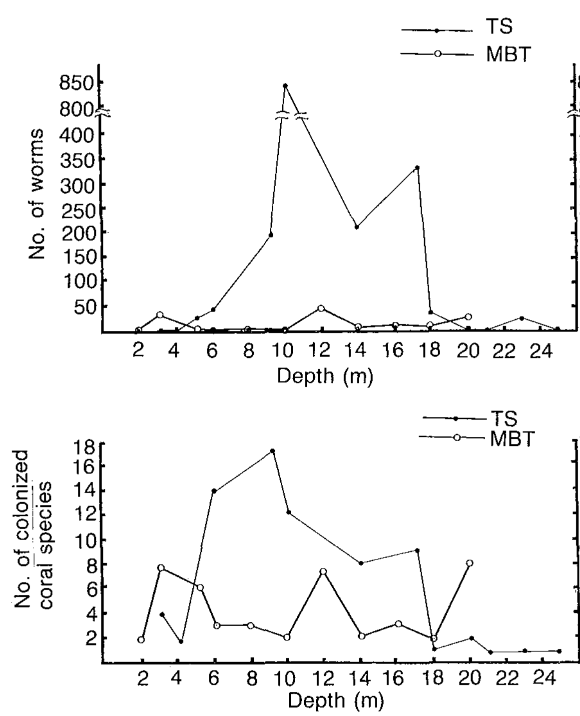


**Fig. 2.** Bathymetric distribution of number of *Spirobranchus giganteus corniculatus* and number of colonized coral species at Tiaoshi (TS) and Maobitou (MBT) in Nanwan Bay, Taiwan.

**Table 1.** Coral species colonized by *Spirobranchus giganteus corniculatus*, total number of colonies, total surface area, total number of worms, and number of worms per unit area of colonized corals at the two study sites in Nanwan Bay, Taiwan

**Tiaoshi (TS)**

| Coral species | No. of colonized colonies | Total surface area ($cm^2$) | Total number of worms | No. of worms per $10^3$ $cm^2$ |
|---|---|---|---|---|
| *Porites lutea* | 29 | 146,803 | 1,123 | 7.65 |
| *Porites lobata* | 27 | 76,143 | 333 | 4.37 |
| *Montipora informis* | 14 | 22,515 | 19 | 0.84 |
| *Porites lichen* | 13 | 12,394 | 116 | 9.36 |
| *Montipora spongodes* | 5 | 12,174 | 25 | 2.05 |
| *Montipora spumosa* | 4 | 12,549 | 18 | 1.43 |
| *Montipora monasteriata* | 4 | 1,569 | 6 | 3.82 |
| *Montipora venosa* | 3 | 6,648 | 6 | 0.90 |
| *Favia specioa* | 3 | 2,832 | 3 | 1.06 |
| *Cyphastrea serailia* | 3 | 2,119 | 3 | 1.42 |
| *Favites abdita* | 3 | 1,928 | 3 | 1.56 |
| *Montipora foveolata* | 2 | 12,455 | 28 | 2.25 |
| *Montipora tuberculosa* | 2 | 32,166 | 8 | 0.25 |
| *Montipora grisea* | 2 | 1,939 | 6 | 3.09 |
| *Montipora aequituberculata* | 2 | 550 | 3 | 5.45 |
| *Montipora foliosa* | 2 | 6,473 | 2 | 0.31 |
| *Millepora platyphylla* | 2 | 29,750 | 2 | 0.67 |
| *Acropora loripes* | 1 | 4,104 | 9 | 2.19 |
| *Galaxea astreata* | 1 | 5,468 | 8 | 1.46 |
| *Porites rus* | 1 | 1,655 | 6 | 3.62 |
| *Favia pallida* | 1 | 924 | 5 | 5.35 |
| *Seriatopora hystrix* | 1 | 1,473 | 3 | 2.04 |
| *Stylocoeniella armata* | 1 | 490 | 3 | 6.12 |
| *Montipora verrucosa* | 1 | 140 | 1 | 7.14 |
| *Acropora digitifera* | 1 | 3,108 | 1 | 0.32 |
| *Porites annae* | 1 | 220 | 1 | 4.54 |
| *Cyphastrea microphthalma* | 1 | 364 | 1 | 2.75 |
| *Astreopora cucullata* | 1 | 1,026 | 1 | 0.97 |
| *Barabatoia amicorum* | 1 | 1,321 | 1 | 0.76 |
| *Mycedium elephantotus* | 1 | 253 | 1 | 3.95 |
| *Merulina ampliata* | 1 | 1,696 | 1 | 0.59 |
| *Stylophora pistillata* | 1 | 4,357 | 1 | 0.23 |
| Total | 135 | 407,606 | 1,747 | 4.28 |

**Maobitou (MBT)**

| Coral species | No. of colonized colonies | Total surface area ($cm^2$) | Total number of worms | No. of worms per $10^3$ $cm^2$ |
|---|---|---|---|---|
| *Montipora informis* | 19 | 80,093 | 34 | 0.46 |
| *Porites lutea* | 11 | 7,896 | 15 | 1.90 |
| *Porites lobata* | 8 | 30,168 | 117 | 3.88 |
| *Porites lichen* | 8 | 4,891 | 18 | 3.68 |
| *Montipora monasteriata* | 3 | 3,957 | 4 | 0.10 |
| *Millepora platyphylla* | 3 | 2,302 | 4 | 1.74 |
| *Montipora grisea* | 2 | 41,907 | 12 | 0.29 |
| *Montipora undata* | 2 | 31,811 | 6 | 0.19 |
| *Montipora foveolata* | 2 | 6,420 | 6 | 0.93 |
| *Montipora spumosa* | 2 | 3,221 | 3 | 0.93 |
| *Montipora spongodes* | 1 | 3,710 | 1 | 0.27 |
| *Porites nigrescens* | 1 | 5,382 | 2 | 0.37 |
| *Millepora tenera* | 1 | 9,024 | 3 | 0.33 |
| *Cyphastrea chalcidicum* | 1 | 170 | 1 | 0.59 |
| *Acropora humilis* | 1 | 720 | 1 | 1.39 |
| *Acropora hyacinthus* | 1 | 408 | 1 | 2.45 |
| *Coeloseris mayeri* | 1 | 640 | 1 | 1.56 |
| *Favites pentagona* | 1 | 434 | 1 | 2.30 |
| Total | 68 | 233,154 | 230 | 0.99 |

that coral species are not randomly colonized by *S. giganteus*. Among corals colonized by *S. giganteus*, the surface area of the colony was positively correlated with the number of worms per colony (Spearman's rank correlation coefficient, at TS, $r_s = 0.517$, $p < 0.001$; at MBT $r_s = 0.375$, $p < 0.05$). Thus the larger the surface area of a colonizable coral colony, the more worms can be expected.

Bathymetric distributions of *S. giganteus* at the two study sites were different (Fig. 2). At TS, most *S. giganteus* were found at intermediate depths between 6-17 m with fewer worms in the shallow reef flat as well as the deep reef slope. At MBT, more worms were found on the underwater terrace and the flat surfaces of large blocks.

Among the 35 coral colonies surveyed, the distribution of worms was random on fifteen colonies, clustered on nineteen colonies, and uniform on one colony (Table 3). In addition, the number of worms on a coral colony was positively correlated to the c values ($r = 0.794$, $p < 0.001$) indicating that the distribution of *S. giganteus* tends to be clustered as the number of worms per colony increases.

## DISCUSSION

*S. giganteus corniculatus* is not distributed randomly among coral species in Nanwan Bay. Only four scleractinian species are frequently colonized, some are occasionally colonized, and many more species were not colonized by the worm. Similar distribution patterns were found in the Caribbean (Hunte et al. 1990a) although the coral species colonized by *S. giganteus* are different in the two oceans.

The nonrandom distribution of *S. giganteus* on corals could result from larval habitat selection before settlement or from post-settlement mortality (Connell 1985, Hunte et al. 1990a). Studies of preferences of planktonic *S. giganteus* larvae from the bank reef of Barbados (Marsden et al. 1990), from Heron Island in Australia (Marsden 1987) and from the fringing reef in Barbados (Marsden and Meeuwig 1990) suggest that pre-settlement larvae may be attracted by water-borne exudates of certain coral species. However, the preferences of the planktonic larvae may only represent an early expression of the preferences of the settling larvae and additional stimuli are probably needed to effect settlement (Marsden and Meeuwig 1990). An early preference for some corals could result in

**Table 2.** Relative abundance (% coral cover) and the total number of worms on each coral species at TS and MBT

**Tiaoshi (TS)**

| Coral species | Relative abundance (% cover)[a] | Total number of worms |
|---|---|---|
| *Merulina ampliata* | 14.58 | 1 |
| *Mycedium elephantotus* | 2.81 | 1 |
| *Porites lobata* | 3.81 | 333 |
| *Montipora foliosa* | 2.90 | 2 |
| *Montipora informis* | 2.60 | 19 |
| *Platygyra lamellina* | 2.53 | 0 |
| *Platygyra daedalea* | 2.18 | 0 |
| *Favia speciosa* | 2.09 | 3 |
| *Echinophyllia aspera* | 2.08 | 0 |
| *Montipora spumosa* | 1.94 | 18 |
| *Goniastrea australiensis* | 1.90 | 0 |
| *Acropora tenuis* | 1.88 | 0 |
| *Favites abdita* | 1.87 | 3 |
| *Porites rus* | 1.87 | 6 |
| *Favites flexuosa* | 1.82 | 0 |
| *Seriatopora hystrix* | 1.68 | 3 |
| *Porites lutea* | 1.60 | 1,123 |
| *Oxypora lacera* | 1.59 | 0 |
| *Astreopora cucullata* | 1.58 | 1 |
| *Goniopora djiboutiensis* | 1.48 | 0 |
| *Platygyra pini* | 1.46 | 0 |
| *Porites nigrescens* | 1.38 | 0 |
| *Hydnophora exesa* | 1.19 | 0 |
| *Montipora spongodes* | 1.16 | 25 |
| *Porites lichen* | 1.03 | 116 |
| *Stylophora pistillata* | 0.90 | 1 |
| *Montipora foveolata* | 0.83 | 28 |
| *Favia pallida* | 0.73 | 5 |
| *Galaxea astreata* | 0.70 | 8 |
| *Montipora aequituberculata* | 0.64 | 3 |
| *Montipora monasteriata* | 0.62 | 6 |
| *Montipora verrucosa* | 0.44 | 1 |
| *Montipora grisea* | 0.41 | 6 |
| *Acropora digitifera* | 0.37 | 1 |
| *Porites annae* | 0.33 | 1 |
| *Cyphastrea microphthalma* | 0.28 | 1 |
| *Barabatoia amicorum* | 0.26 | 1 |
| *Cyphastrea serailia* | 0.22 | 3 |
| *Montipora venosa* | 0.18 | 6 |
| *Stylocoeniella armata* | 0.18 | 3 |
| *Acropora loripes* | 0.16 | 9 |
| *Montipora tuberculosa* | 0.16 | 8 |
| *Millepora platyphylla* | 0.15 | 2 |

**Table 2.** (cont.)

**Maobitou (MBT)**

| Coral species | Relative abundance (% cover)[a] | Total number of worms |
|---|---|---|
| *Favia speciosa* | 5.20 | 0 |
| *Platygyra lamellina* | 4.92 | 0 |
| *Porites lobata* | 4.65 | 117 |
| *Platygyra daedalea* | 4.43 | 0 |
| *Pachyseris speciosa* | 4.42 | 0 |
| *Merulina ampliata* | 4.32 | 0 |
| *Favites abdita* | 4.12 | 0 |
| *Diploastrea heliopora* | 3.80 | 0 |
| *Montipora informis* | 3.59 | 34 |
| *Porites lichen* | 3.32 | 18 |
| *Montipora foveolata* | 2.85 | 6 |
| *Hydnophora exesa* | 2.08 | 0 |
| *Leptoria phrygia* | 1.97 | 0 |
| *Montipora hispida* | 1.86 | 0 |
| *Favia pallida* | 1.68 | 0 |
| *Porites rus* | 1.67 | 0 |
| *Pachyseris rugosa* | 1.50 | 0 |
| *Millepora tuberosa* | 1.40 | 0 |
| *Pocillopora verrucosa* | 1.34 | 0 |
| *Platygyra pini* | 1.33 | 0 |
| *Montipora spumosa* | 1.29 | 3 |
| *Goniastrea pectinata* | 1.29 | 0 |
| *Porites lutea* | 1.25 | 15 |
| *Favites complanata* | 1.23 | 0 |
| *Goniastrea australiensis* | 1.21 | 0 |
| *Porites solida* | 1.05 | 0 |
| *Favia favus* | 1.04 | 0 |
| *Favites pentagona* | 0.94 | 1 |
| *Acropora humilis* | 0.87 | 1 |
| *Millepora platyphylla* | 0.84 | 4 |
| *Montipora grisea* | 0.81 | 12 |
| *Cyphastrea chalcidicum* | 0.80 | 1 |
| *Montipora monasteriata* | 0.73 | 4 |
| *Montipora undata* | 0.53 | 6 |
| *Montipora spongodes* | 0.43 | 1 |
| *Porites nigrescens* | 0.14 | 2 |
| *Millepora tenera* | 0.06 | 3 |

[a]Data adopted from Dai (1988). Coral species with relative abundance lower than 1% and no worms were not included.

**Table 3.** Spatial distribution of *Spirobranchus giganteus corniculatus* on coral colonies as analyzed by the distance to nearest neighbor method

| Coral species | No. of worms | Surface area ($cm^2$) | c | Distribution pattern[a] |
|---|---|---|---|---|
| *Porites lutea* | 279 | 49,490 | −9.63 | c |
| *P. lobata* | 194 | 13,880 | −4.95 | c |
| *P. lutea* | 124 | 22,244 | −7.54 | c |
| *P. lutea* | 73 | 30,788 | −4.49 | c |
| *P. lutea* | 53 | 17,483 | −1.07 | r |
| *P. lobata* | 50 | 43,680 | −4.30 | c |
| *P. lobata* | 42 | 8,718 | −0.71 | r |
| *P. lutea* | 36 | 8,143 | −4.17 | c |
| *P. lobata* | 36 | 11,618 | −5.01 | c |
| *P. lobata* | 35 | 15,708 | −4.80 | c |
| *P. lutea* | 31 | 21,687 | −1.96 | c |
| *P. lobata* | 27 | 10,691 | −2.16 | c |
| *Montipora informis* | 26 | 3,498 | −2.73 | c |
| *P. lobata* | 17 | 12,026 | −3.81 | c |
| *P. lobata* | 15 | 1,103 | −2.97 | c |
| *P. lobata* | 15 | 1,925 | −2.13 | c |
| *M. informis* | 15 | 1,131 | −1.83 | r |
| *P. lutea* | 13 | 5,580 | −2.95 | c |
| *P. lobata* | 12 | 7,479 | −2.23 | c |
| *P. lobata* | 11 | 4,488 | −0.71 | r |
| *P. lutea* | 11 | 7,697 | 0.55 | r |
| *M. foveolata* | 10 | 2,100 | 1.46 | r |
| *P. lutea* | 8 | 10,691 | −2.71 | c |
| *P. lobata* | 6 | 6,720 | −1.56 | r |
| *P. lutea* | 5 | 6,334 | −2.26 | c |
| *P. lobata* | 4 | 78,465 | −2.19 | c |
| *P. lobata* | 4 | 1,980 | −1.07 | r |
| *M. monasteriata* | 4 | 15,072 | −0.99 | r |
| *P. lutea* | 3 | 4,360 | −0.54 | r |
| *P. lutea* | 3 | 792 | 0.78 | r |
| *P. lobata* | 3 | 905 | −1.34 | r |
| *P. lutea* | 2 | 2,641 | 0.42 | r |
| *P. lutea* | 2 | 3,927 | 1.39 | r |
| *P. lobata* | 2 | 628 | −1.18 | r |
| *M. informis* | 2 | 462 | 3.70 | u |

[a]Distribution pattern, r: random; u: uniform; c: clustered.

differences in colonization patterns only on corals that provide preferable substrate for adult worms.

In this study, coral species frequently colonized by the worms such as *Porites lutea, P. lobata* and *Montipora informis* are competitively subordinate in terms of aggressiveness (Dai 1990). Very few coral species with high aggressiveness such as *Mycedium elephantotus, Merulina ampliata* and *Galaxea astreata* were successfully colonized by the worms. These facts indicate that planktonic larvae of *S. giganteus* may be susceptible to the nematocysts of aggressive corals. The preference of *S. giganteus* for less aggressive corals may be related to the lower mortality during postsettlement on such corals. In addition, coral species frequently colonized by *S. giganteus*, in both the Caribbean (Hunte et al. 1990a) and the Pacific (this study), are of massive form. Larvae of *S. giganteus* colonizing a massive coral would have sufficient space to build their tubes as the coral grows. Besides, massive corals usually have longer life spans, and worms inhabitating these corals might have higher fitness (Jackson 1985, Hunte et al. 1990b). Mortality among adult *S. giganteus* includes not only mortality among worms on intact coral, but also mortality due to natural destruction of coral (Lewis 1991, Marsden 1993). Since foliaceous and branching forms often experience a higher rate of mortality than the massive form during natural disturbances (Connell 1973), the latter provides better protection for the worms. Hunte et al. (1990b) and Marsden et al. (1990) have shown that worms were larger on those corals which were preferred by worm larvae in the laboratory and most heavily colonized by worms in the field. This suggests that *S. giganteus* increases its fitness by larval selection for suitable coral substrate.

*S. giganteus corniculatus* is much more abundant at TS than at MBT. At MBT, there are both fewer worms and lower number of coral species colonized by the worm (Table 1). The adult abundance of sessile marine invertebrates with a planktonic stage is basically determined by two processes, recruitment and post-recruitment mortality (Rodriguez et al. 1993). Recruitment depends on the abundance of larvae ready to settle, the survival of juveniles, and the availability of suitable substrate for settlement (Hunte et al. 1990a, Marsden et al. 1990, Marsden 1993). The planktonic trochophore of *S. giganteus* is positively phototactic (Marsden 1984 1986 1987) and must consequently tend to stay near the surface. However, it is important that larvae not be swept offshore away from the suitable substrate for settlement (Pawlik and Butman 1993). The current speed at MBT (85% between 8 and 13 cm $s^{-1}$) is much higher than that at TS (80% between 0 and 5 cm $s^{-1}$), especially during spring and ebb tides (Liang et al. 1978). Swimming speeds of *S. giganteus* trochophores vary from 1.7-2.5 mm $s^{-1}$ (Marsden 1984) and it seems obvious that such small larvae cannot swim against strong tides and currents. Therefore, the availability of larvae of *S. giganteus* at MBT is possibly much lower than at TS. The availability of suitable substrate for settlement is presumably another factor limiting the distribution of *S. giganteus* at MBT. The coral community at TS is dominated by scleractinians, thus providing more suitable substrate for the settlement of *S. giganteus* larvae. While at MBT, the coral community is dominated by soft corals and less substrate is available.

Bathymetric distribution of *S. giganteus* within a reef area is also likely to be influenced by the availability of larvae and suitable substrate for settlement (Marsden 1993). Larvae of *S. giganteus* are photopositive and their horizontal dispersion is probably determined by water current movement, however, larvae may exert some control over vertical distribution (Marsden 1984). A preference by young *S. giganteus* larvae for the exudates diffusing from coral, acting together with positive phototaxis, may help to maintain larvae in surface waters over the reef and in the vicinity of a specific coral until they are old enough to settle (Marsden 1987). On the submarine terrace at intermediate depths where the displacement of larvae by tidal currents is low, the probability of larvae to remain in the vicinity of suitable substrate increased at the time of onset of competence for metamorphosis. In addition, more massive *Porites* colonies which provide more suitable substrate for the settlement of *S. giganteus* larvae were found at depths of 6-17 m.

Planktonic presettlement larvae of *S. giganteus* have been found to respond positively to waterborne exudates of coral commonly colonized by the worm (Marsden and Meeuwig 1990). However, the clustered distribution of *S. giganteus* on a coral colony suggests that larvae of *S. giganteus* may also respond to chemical cues from conspecific adults (Pawlik 1992). Such a distribution pattern is particularly evident as more worms were found on a coral colony. The clustered distribution is considered to increase the probability of fertilization, hence enhances the reproductive success, and to ensure that physical conditions are appropriate for survival (Woodin 1986, Pawlik et al. 1991, Rodriguez et al. 1993).

**Acknowledgements:** We thank Mr. Yung-Chun Tsay and Deng-Sung Chen for their assistance in diving. We would also like to thank Dr. Hwey-Lian Hsieh and Dr. Chang-Po Chen at the Institute of Zoology, Academia Sinica for their advice and valuable discussions. This study was partly supported by grants from the National Science Council, R. O. C. (NSC 82-0209-B-002A-013 and NSC 83-0115-C002-01-217B).

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# 大旋鰓蟲(*Spirobranchus giganteus corniculatus*)在臺灣南部珊瑚礁之分布

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大旋鰓蟲是在珊瑚礁上築管而居的多毛類動物，本文報導以橫截線取樣法，調查大旋鰓蟲在臺灣南端南灣海域珊瑚礁的分布型態，調查地點爲海流環境和珊瑚群聚特徵具有明顯差異的貓鼻頭和跳石兩地。調查結果顯示大旋鰓蟲在各種珊瑚上的分布並非逢機，只有四種珊瑚(包括：*Porites lobata*，*P. lutea, P. lichen* 和 *Montipora informis*)經常有大旋鰓蟲附著；約三十餘種珊瑚(如：*Montipora* spp., *Acropora* spp., *Favia* spp.)偶而有大旋鰓蟲著生，大多數的珊瑚未被該蟲著生；而且經常被著生的珊瑚種類都屬於競爭劣勢種。大旋鰓蟲在珊瑚群體上的空間分布與蟲數有關，當蟲數愈多時，愈趨於聚集分布。此外，大旋鰓蟲在珊瑚礁區的分布和豐富度，則可能和當地的環境條件及可供附著基質的多少有關；大旋鰓蟲的數量和密度，皆在水流平緩的跳石海域較多，而且大多數的蟲體分布在水深6-17公尺的珊瑚礁平台上，該處的地形平坦，可供附著的珊瑚群體也較多。

**關鍵字**：大旋鰓蟲, 分布型態, 珊瑚礁生態。

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