Turbinaria sp. (Phaeophyceae, Sargassaceae) from Iwayama Bay, Palau Islands (Western Caroline Islands)

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Abstract

Turbinaria was collected from Iwayama Bay, Palau Islands (Western Caroline Islands) on 20 November 1986. From this locality, only *T. ornata* (TURNER) J. AGARDH had been reported. A second entity, *Turbinaria* sp. occurred intermixed with *T. ornata* and did not fit any describe taxon from the Indo-Pacific. Blades were spreading or erect, thin (-20 mm long, -10 mm broad), soft, hemi-peltate, and highly dentate with subterete or slightly triquetrous stalks. Taxonomic ranking was withheld as blades from fertile plants were similar to juvenile or cauline blades of *T. ornata*. Further field and laboratory investigations are warranted to determine intra- or inter-specific ranking.

Key words : *Turbinaria*, Palau, Phaeophyceae, Sargassaceae, cauline blades.

Introduction

Turbinaria LAMOUROUX is widely distributed in tropical and subtropical regions, usually associated with reef systems (BOLD and WYNNE 1985). TAYLOR (1964, 1966) had previously described the *Turbinarias* from the Indo-Pacific region. During the Kagoshima-Maru Expedition to the Western Caroline Islands, specimens were collected from Geruherugairu Passage, Iwayama Bay, Palau Islands, that differed from *T. ornata* and other Indo-Pacific species. Previous descriptions from the Caroline Islands (TRONO 1967), Geruherugairu Passage, Palau Islands (KANDA 1943), and Koror and adjacent islands (KANDA 1944) have only reported *T. ornata* (TURNER) J. AGARDH from this area. Herein, a description of a new entity is presented.

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Materials and Methods

Plants of *Turbinaria* were collected from Geruherugairu Passage, Iwayama Bay, Palau Islands (7°20'N, 134°30'E), located in the Western Caroline Islands (Fig. 1). The passage is

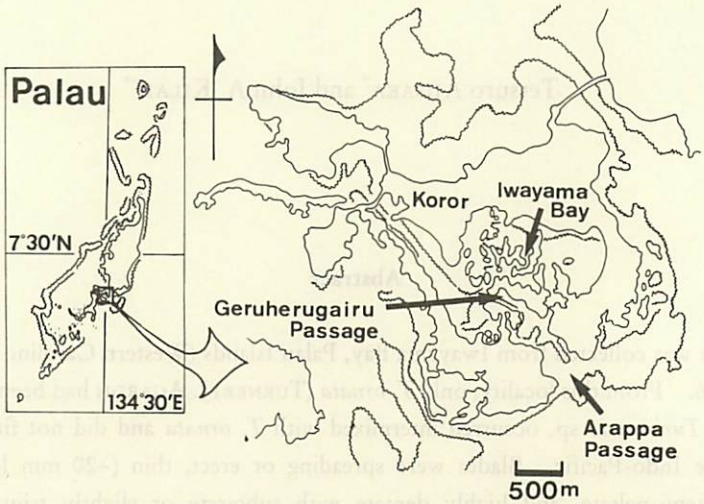

Fig. 1. Collection site at Geruherugairu Passage, Iwayama Bay, Republic of Palau.

connected to the Pacific Ocean through Arappa Passage in the west. Iwayama Bay borders the pass in the east. Geruherugairu Passage is shallow, 1-3 m depth, algal covered, predominately reef-flat environment (KANDA 1943, 1944). The seagrass *Enhalus acoroides* (LINNAE f.) ROYLE, the chlorophytes *Caulerpa*, *Halimeda*, and *Codium*, the phaeophyte *Dictyota*, and the rhodophyte *Gracilaria* are dominant members of this community.

Attached specimens of *Turbinaria* were collected haphazardly from dead-coral substrate and preserved in 10 % formaldehyde seawater. Upon return to Kyoto University, Japan, specimens were examined for vegetative and reproductive traits.

Results

Two entities of *Turbinaria* were recognized: T. *ornata* and *Turbinaria* sp. (Fig. 2 and Plate 1). TAYLOR (1964, 1966) had previously described *T. ornata*. The description of the second entity is as follows:

Plants ranged to 35 cm tall. The erect axes were generously branched, with lateral branchlets to 15 cm in length. Blades were spreading or erect, to 20 mm long, 10 mm broad at the distal ends, and the stalk portion subterete and sometimes slightly triquetrous. Marginal blades were thin, soft, dentate with large teeth, and hemi-peltate. The blade stalks were edentate. Upper blades were erect and lower ones descended along the stem. Vesicles were generally absent; when present, they occurred on basal parts of marginal blades.

Receptacles were racemose, about 3/4 as long as subtending blades, and attached to the slender portion of blade stalk.

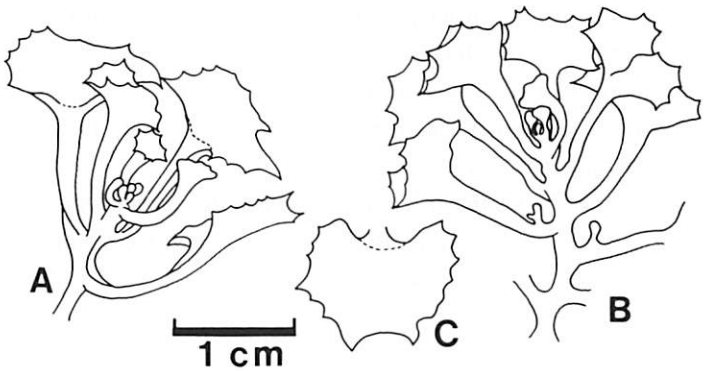

Fig. 2. Blades of *Turbinaria* sp. A, B = apical portions of lateral branchlets. C = distal, marginal blade.

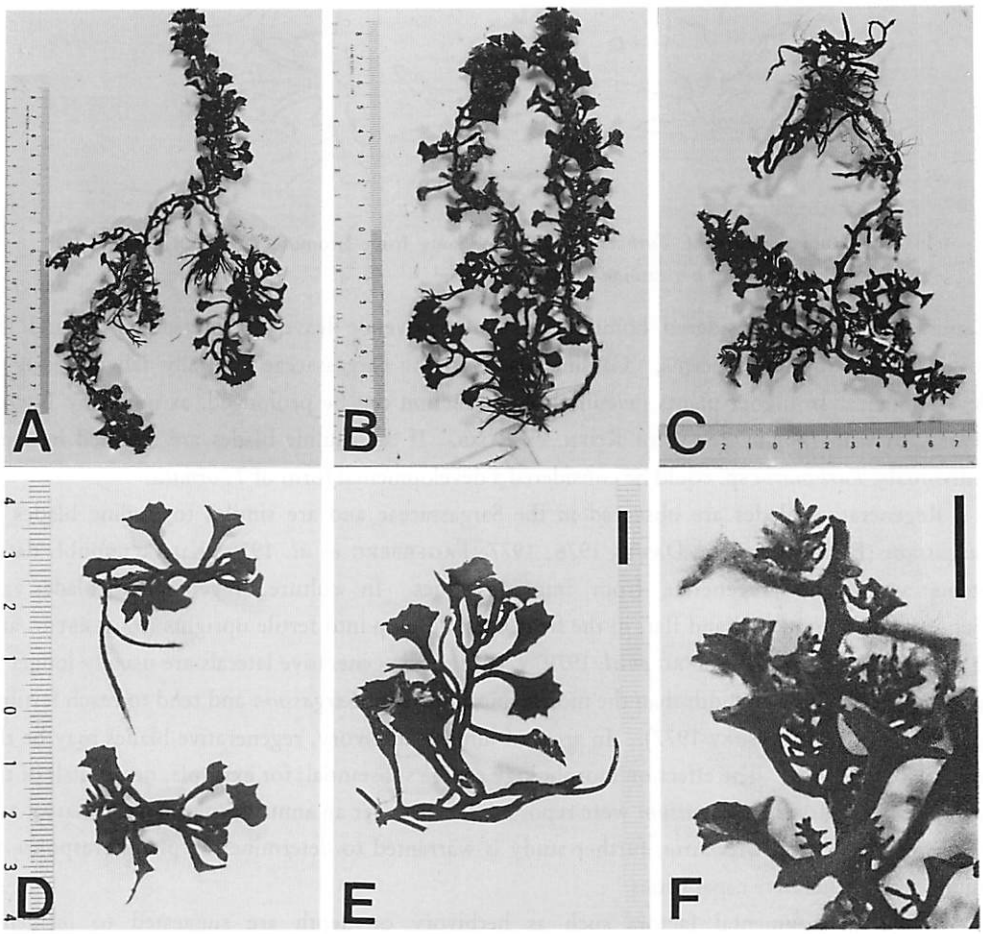

Plate 1. *Turbinaria* sp. A-C = mature plants with receptacles. D, E = juvenile plants. F = receptacles. (Scale equals 1 cm for E, F.)

Discussion

Turbinaria sp. from Palau has hemi-peltate blades that distinguish it from other species of *Turbinaria*. The plant occupied habitats similar to *T. ornata*, and the two forms were often found as intermixed populations. Blades are hollow but not differentiated into vesicles; hence, a member of the genus *Turbinaria* (Plants possessing differentiated blades and vesicles are considered members of the genus *Sargassum*).

It is easy to distinguish *Turbinaria* sp. from *T. ornate* in their general morphological features. It rather resembles *T. conoides* (J. AGARDH) KUETZING, which has complete peltate blades. However, the ordinal blades of *Turbinaria* sp. resemble the cauline blades of *T. ornata* (Fig. 3).

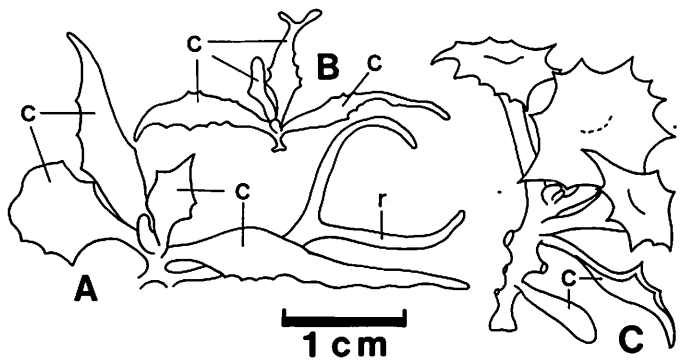

Fig. 3. Cauline blades of *Turbinaria ornata*. Plants from Iriomote (A), Ponape (B), and Okinawa (C). c = cauline blades. r = rhizoid.

Cauline blades are considered homologous to the juvenile leaves of pteridophytes and the cotyledons of the angiosperms. Cauline blades in the Sargassaceae typically fall off early in development. In higher plants juvenile leaf production can be prolonged, as noted by NJOKU (1956a, b) with *Ipomoea caerulea* KOEN. ex ROXB. If the cauline blades are retained in some individuals, *Turbinaria* sp. could be considered a developmental form of *T. ornata*.

Regenerative blades are observed in the Sargassaceae and are similar to cauline blades in *Sargassum* (FAGERBERG and DAWES 1976, 1977, FAGERBERG *et al.* 1979, KILAR unpubl. data). Stems and blades regenerate from injured tissues. In culture, regenerative blades are dichotomously branched and flat; in the field, they develop into fertile uprights (FAGERBERG and DAWES 1976, 1977, FAGERBERG *et al.* 1979). Blades of regenerative laterals are usually longer in length and narrower in width than the more typical blades of *Sargassum* and tend to reach fertility earlier (JEPHSON and GRAY 1977). In areas of intense herbivory, regenerative blades may be the only blades present. The effect on morphology can be substantial; for example, nearly half of the laterals of *Sargassum polyceratium* were reported damage over an annual growth cycle (KILAR and HANISAK 1988). In *Turbinaria*, further study is warranted to determine the plant's response to injury and regenerative capabirities.

While environmental factors such as herbivory or depth are suggested to influence morphology and reproductive periodicity (JEPHSON and GRAY 1977, PAULA and OLIVEIRA 1982, CRITCHLEY 1983, DEYSHER 1984, SOE-HTUN and YOSHIDA 1986), divergent morphologies may

be more genetically based. Mixed stands of phenotypes are common among higher plant populations but have only recently been ascribed to the algae. Divergent phenotypes of *Sargassum* occurred intermixed as distances of a few centimeters; 47 forms of *S. polyceratium* were isolated based on blade features and many more could be distinguished if other morphological characters were included (KILAR and HANISAK 1989). RUSSELL (1978) noted that the number of different phenotypes in a species may be limitless.

Dimorphism between sexes is another example of intraspecific variation. Receptacles on male plants are longer than those on female plants in *Sargassum pteropleuron* GRUNOW (PRINCE, personal communication) and on androgynous plants in *S. stenophyllum* (KILAR, unpubl. data). Sexual dimorphism is also reported in *S. hystrix*, with serrations on receptacles distributed according to sex (REINBOLD 1913, COLLINS and HARVEY 1917). Finally, the two froms may be independent species, examples of convergent or divergent evolution in blade features. Based on the overlap in morphological features between *Turbinaria* sp. and *T. ornata*, and limited field and laboratory date, it is premature to assign taxonomic status to this entity.

Acknowledgements

We would like to express our sincere gratitude to the members of the Kagoshima-Maru Expedition to the Western Caroline Islands --"the 5th Scientific Survey of the South Pacific", and the staff of Micronesian Mariculture Demonstration Center, Republic of Palau.

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(Accepted November 6, 1989)