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# AN INTERESTING *CAULERPA* FROM THE ANDAMAN SEA

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SUMMARY

*A new variety of* Caulerpa filicoides *from the Andaman Sea is described.*

Among the specimens of *Caulerpa* (Chlorophyceae: Siphonales) submitted to me for study by the Smithsonian Oceanographic Sorting Center after the International Indian Ocean Expedition, one in particular stands out because of its very striking morphological peculiarities. It was reported as collected by Dr. R. E. Norris at Station 29 of Cruise 1 on the expedition's ship "A. Bruun" from a depth of 37 fathoms (67 m) at 10° 23′ N Lat., 93° 31′ E Long., which places it a little northeast of Richie's Archipelago of the Andaman Island group.

The plants are tiny things, creeping and bearing single whorls of branchlets at the tops of short, erect stalks. These are borne 1–4 nearly or quite together, and some or all of them fork once dichotomously near the base, though all branch 2-3-pinnately above. Fig. 1 shows one side of a small blade from its dichotomy to the tip. A notable peculiarity is the conspicuous circinnate vernation by which the blades unroll as they develop. Perhaps this occurs in the typical species with which I propose to associate these Andaman plants as a variety, but I could not confirm it from the dried specimens available. While many terminal ramelli are minutely mucronate, some, perhaps those potentially able to grow and divide further, are not. Another peculiarity is found on the erect stems and rhizomes, for these may be densely covered with short, sharp aculei. These projections are not always numerous nor always short and sharp, for along the ventral line of the rhizomes a few become longer, serving attachment functions. In one type attachment is accomplished by a terminal disk which is formed by repeated branching of the tip of the descending strand into very short, fine divisions crowded in a plane. This apparently serves for anchorage on a continuous surface, for flakes of some smooth membrane were still adherent to the disks. A still longer attachment organ was seen, but even less often. It is similar to the rhizophores of *C. sertularioides* and many other species in the genus, terminating in numerous branched filaments and serving for anchorage in a soft substrate.

These plants are similar to *Caulerpa filicoides* Yamada (*2,3*), collected by him at Audo I. first, and then at Mikayo and Naha (Nawa) in the Ryu-kyu Islands. For the loan of specimens from Mikayo I., I am indebted to Professor G. F. Papenfuss (University of California, Berkeley), and for a specimen from Ant I., near Ponape, Caroline Islands, to Professor Y. Yamada (Tokyo) himself. Those from the Andaman Sea are much smaller plants, with shorter erect stems and only one whorl of foliar branches. Less distinctively, they have densely spinose rhizomes and erect stems, a character not mentioned in Yamada's diagnosis but present in some degree in his specimens. These are features sufficient to distinguish these plants from each other, coming as they do from localities about 4,000 km apart, about 34° longitude, and with a large land mass between. Prof. G. H. Hollenberg (Redlands) in 1948 collected a fragment at Bikini in the Marshall Islands, an equivalent distance to the east, of what seems to be nearer the species in size and form, but smaller than the Ant I. material. It was also loaned by Prof. Papenfuss for comparison. Of course, further collections may establish intermediate forms, but first time and opportunity must permit further field work.

Yamada's plants from Ant I. are the best examples of *C. filicoides* in the original sense available. The rhizomes, 0.6 mm diam, do show some acute projections, but longer filiform ones are most common, as are the rhizophores. The erect stems reach an individual length of 5–8 mm, so the clusters are correspondingly broader than in the Andaman material. Their main leaf costae are notably zigzag, which is

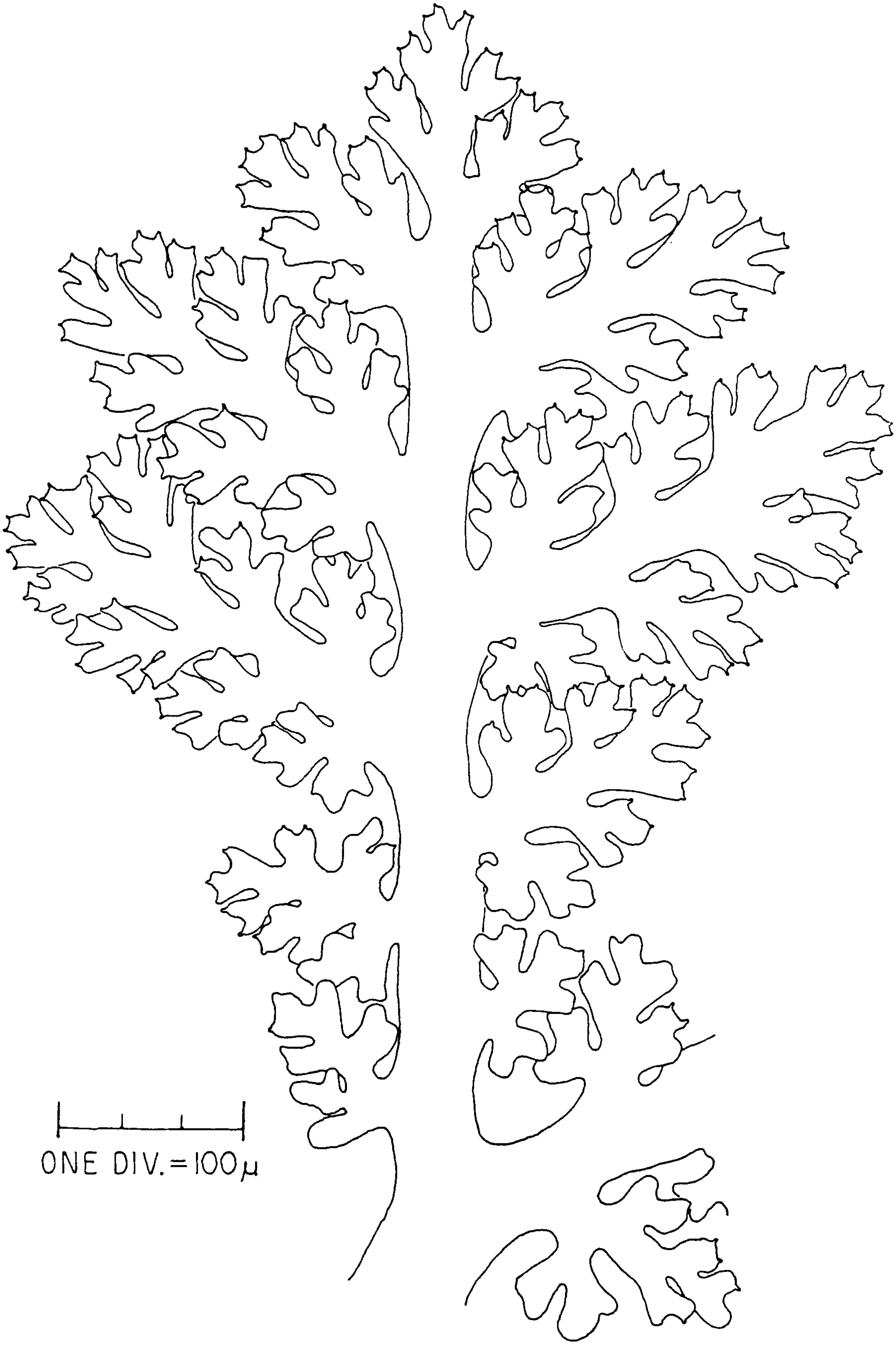


FIG. 1. One half of a small leaf of *Caulerpa filicoides* var. *andamanensis* to show pinnate branching.

not the case in the Andaman plants, and the lateral branching is much looser. Yamada's figure 31 (*1*, p. 63) shows basically dichotomous branching throughout the foliar clusters and is correctly labelled as *C. verticillata* J. Ag., although the spinous processes suggested on the rhizome are not a characteristic of that species. His detailed figure 32 is, however, surely not of *C. verticillata*, but apparently of the plant he here alludes to as n. fa. *acuta*, though it is not so labelled, and the text provides but minimal characterization. In 1944 (*4*, p. 34) he raised the form to species rank, but meanwhile (*2*, p. 135) had established the name *C. filicoides* for what is surely the same thing, using the name again in 1941 (*3*, p. 97) with a good illustration, and the name *filicoides* is, of course, the valid one.

*Caulerpa filicoides* Yamada n. var. *andamanensis*. Plants with rhizomes reaching a length of 6 cm, a diameter of 165–230 μ, sparingly or very closely beset with indurated aculei about 65 μ long, these occasionally intergrading with hapteral filaments about 400 μ long ending in terminal disks, or sometimes longer and rhizoidal. Erect stems widely spaced, simple, 0.17–2.0 mm tall, smooth or with numerous aculei, at the summit divided into broad foliar divisions, each simple or once dichotomous near the base, the divisions with a distinct, essentially straight costa about 175 μ in maximum diam and 2.8–4.3 mm in length. Branching of each division on these costae plane, close, alternate to 2–3, rarely 4°, the ultimate ramelli to 45 μ diam, terminally retuse, obtuse, or mucronate. Type in the herbarium of the U.S. National Museum, Washington; isotype in that of the University of Michigan, Ann Arbor (Fig. 1).

*Caulerpa filicoides* Yamada n. var. *andamanensis*. Plantae minimae, rhizomata spinosa, aculeis c. 65 μ long., aut ramos adfigentes parcos habentes. Stipites erecti leves spinosive, ad 0.17–2.0 mm alt., in culmine 1–4 divisiones foliares, ad 2.8–4.3 mm long habentes; omnes divisiones simplices aut ad basim semel dichotomae, supra, a costis rectis, 2–3 arcte alterne ramosae, ramellis ultimis saepe mucronatis. Plantae typicae ex aqua c. 67 metrorum profunda, Lat. Sept. 10°, Long. Orient. 93° 31′, in regione inter septentriones et orientem Insularum Andaman dictarum, a R. E. Norris d. 28, m. Mar., a. 1963 subductae (Fig. 1).

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# GLUCOSE-6-PHOSPHATE UTILIZATION BY MARINE ALGAE[1]

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## SUMMARY

*A good relationship was found between the amount of phosphatase present at the surface of marine unicellular algae and their ability to utilize glucose-6-phosphate (G-6-P) as a phosphorus source. Algae did not take up the whole molecule of G-6-P; those with phosphatase hydrolyzed the ester extracellularly and assimilated the $PO_4$. The phosphatases were usually phosphate-repressible, and they usually showed optimum activity at pH > 7. Algae lacking phosphatases that could act on external substrates did not assimilate G-6-P; they became phosphorus-deficient and stopped growing. Of 13 species studied, only* Cyclotella cryptica *was capable of assimilating glucose for cell growth in darkness.* Cyclotella *utilized both the glucose and the phosphate of G-6-P, but only after hydrolysis by the alkaline phosphatase at the cell surface.*

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## INTRODUCTION

Many species of algae can obtain phosphorus from esters in order to grow when orthophosphate is absent (*4,9,14,15,18*). *Chlorella pyrenoidosa*, in the presence of pyrophosphate, was shown to produce an enzyme associated with the cell wall and capable of hydrolyzing this substrate (*6*). Overbeck (*17*), however, showed that *Scenedesmus quadricauda* took up