

# **New records of *Sargassum hawaiiensis* Doty and Newhouse (Sargassaceae, Phaeophyta), a deep water species**

ROBERT E. DE WREEDE

*School of Graduate Studies, Botany Department, University of Hawaii,  
Honolulu, Hawaii 96822, U.S.A.*

AND

EVERET C. JONES

*Fishery Biologist, National Marine Fisheries Service, Southwest Fisheries Center,  
Honolulu Laboratory, P.O. Box 3830, Honolulu, Hawaii 96812, U.S.A.*

Accepted January 10, 1973

*Sargassum hawaiiensis* Doty and Newhouse was described in 1966 from a fragmentation specimen dredged from a depth of 50 m off Oahu, Hawaii. Until recently, no further collections have been available for study. In 1968 and 1971 new material was collected from Penguin Banks off Molokai, Hawaii, during shrimp trawling operations by the National Marine Fisheries Service vessel "Townsend Cromwell". The specimens were obtained from depths of 183 and 200 meters.

A complete description of the species is given, which differentiates it from the three other species of *Sargassum* recognized from Hawaii. *Sargassum hawaiiensis* is distinguished by a combination of characteristics, these being: simple spines on some branches, terete vesicle petioles, mucous and spherical vesicles and bifurcate receptacles with narrow sterile bridges.

Phycologia, 12(1/2): 59-62, 1973

## **Introduction**

Three species of *Sargassum* are commonly encountered in Hawaii, i.e., *S. echinocarpum* J. Ag., *S. obtusifolium* J. Ag., and *S. polyphyllum* J. Agardh. A fourth species, *S. piluliferum* C. Ag., is reported (Howe, 1934) only from Pearl and Hermes Reef, at the northwestern end of the Hawaiian chain. A fifth species, *S. hawaiiensis* Doty and Newhouse, has recently (Doty and Newhouse, 1966) been described from fragmentary dredged material. New collections from 183 and 200 m have now enabled a more complete description to be given of *S. hawaiiensis*, the subject of this paper.

A number of other species have been attributed to the Hawaiian Islands over the years but are now considered to be either misidentifications or synonymous with the previously described forms. Thus, *S. densum* Dickie (Dickie, 1877) is considered a synonym (Grunow, 1916) of *S. polyphyllum*. *Sargassum cymosum* C. Ag. has been attributed to Hawaii by Tilden (1902) and Chamberlain (1881), but the name appears to have been applied to what is recognized in Hawaii as *S. obtusifolium*. From the available descriptions, *S. cymosum* and *S. obtusifolium* appear to be

Atlantic and Pacific forms of the same species, but until types and field collections can be compared no decision can be made as to their relationship.

The entire genus *Sargassum* is in need of a monographic treatment based on studies of the type collections and on plants in nature. In view of the over 250 species attributed to the genus, such a work will undoubtedly be a long time in coming. Recent critical evaluations of selected species of the genus by Womersley (1954) and Womersley and Bailey (1970) have resulted in a number of species being placed in synonymy. Studies underway by the first author (R. DeW.) also suggest that a number of Pacific species of *Sargassum* have been described from insufficient material. As a consequence, the high degree of variation of members of the genus has not been fully taken into account, resulting in the description of forms as species.

Although we recognize this problem, we believe that *Sargassum hawaiiensis* Doty and Newhouse should be reconfirmed in the literature and more completely described from the new, more complete material recently collected. The species was described from thalli dredged from a depth of 50 m off Kaneohe

Bay, Oahu, Hawaii, near Lat. 21° 31.3' N, Long. 157° 48.3' West. New collections consist of a number of complete and attached thalli which are fertile and have all structures needed for a critical evaluation of the species.

A number of authors (Reinbold, 1913; Setchell, 1936) have pointed out that the sex of the thallus may determine receptacle morphology in some species. The original description does not include data on the presence or absence of oogonia and/or spermatangia within the receptacles. The material now available has enabled us to obtain this information. In view of the scarcity of previous collections (one only), the fragmentary nature of the Holotype and the uniqueness of the habitat, *i.e.*, from 50–200 m, it seems worthwhile to elaborate on the original description of *S. hawaiiensis*.

#### *Sargassum hawaiiensis*

The present thalli of *S. hawaiiensis* were obtained by the second author (E.C.J.) while bottom trawling for shrimp. They were obtained at 183 m on May 4, 1968, at station 21, during cruise 36 of the "Townsend Cromwell". The trawling track ran along a course of 21° 09.7' N from 157° 24.8' W Long. to 157° 37.0' W Long. Additional collections were made on September 23, 1971, at 200 m, on the "Townsend Cromwell" cruise 54, at station six. This trawl track ran from Lat. 21° 10.0' N and Long. 157° 30.0' W, to Lat. 21° 09.8' N and Long. 157° 29.5' West. A number of thalli were collected whole, with holdfasts attached to the shell fragments of a bivalve mollusc *Atrina* sp. The material was preserved in formalin. Exsiccata specimens of this material have been deposited in the herbariums of the Smithsonian Institution, Washington, D.C., the B. P. Bishop Museum, Honolulu, Hawaii, and in the herbarium of M. S. Doty, University of Hawaii, Honolulu, Hawaii.

The ecology of *S. hawaiiensis* and the other algae collected in the trawling hauls will be the subject of a later paper. What follows is a comparison of the newly collected material with the only previous collection, the Holotype specimen numbered "M. S. D. 19134" deposited in the B. P. Bishop Museum in Honolulu, Hawaii.

#### LEAF FORM

The newly collected material varies in height from 120–650 mm, with leaves (Fig. 1) up

to 60 mm long and 10 mm wide. Leaf margins are irregularly dentate or here and there entire. A midrib is present and extends to just below the apex. The leaf apex is obtuse to irregularly indented. Cryptostomata are scattered over the surface. Leaves tend to be sessile. These features are as described for the Holotype.

One notable variation of the newly collected material from the Holotype is the absence of the furcate leaves illustrated by Doty and Newhouse. The new material, as illustrated in Figure 1, shows one incipient furcation. Such an absence of furcate leaves is not unknown in species of *Sargassum* described as possessing them. Similarly, *Sargassum obtusifolium*, also from Hawaii, can be found with or without such furcate leaves. Causes of this variation in leaf morphology are not known.

#### HOLDFAST, STEM AND BRANCH FORM

The holdfast of the new material is smooth, disc-shaped and often furrowed. The stem arises from the holdfast, varying in length from 20–50 mm, with primary branches arising predominantly from its apex. Such branches also arise from lower portions of the stem, but these are lost as the alga matures and their points of origin give rise to the bumpy appearance of the stem.

The stem is verrucose and more or less circular in cross-section. The branches are also

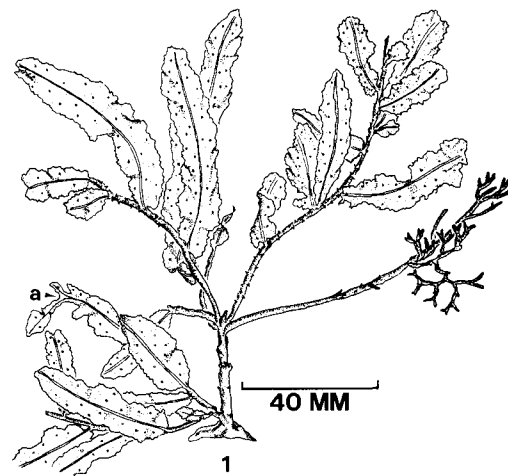


FIG. 1. Habit sketch of *Sargassum hawaiiensis*; note the simple spines on some of the branches and the single leaf bifurcation (a).

circular in cross-section and some show the prickles described for the Holotype material. These prickles, more descriptively termed simple spines to distinguish them from the more complex, often furcate, spines of *Sargassum polyphyllum*, are loosely distributed over some of the branches. The origin of the simple spines is not clear, as their position suggests that they are not remnants of either receptacles or branches. The appearance and position of the complex spines alluded to above suggests that some at least may be remnants of vesicles that have sloughed off.

A number of branches show some degree of flattening toward the apex, a feature not mentioned in the original description. Where flattening occurs, it is often accompanied by a twisting of the branch.

#### VESICLE AND VESICLE PETIOLES

As with the Holotype material, vesicles are closely associated with the fertile branches. The vesicles are spherical, from 3–7 mm in diameter, smooth, mucous, and without any teeth or wings. The vesicle petiole is terete and about as long as the vesicles. The above agrees closely with the Holotype material.

#### RECEPTACLES

The receptacles of the Holotype material are described (Doty and Newhouse, 1966) as forming a loose cluster of cylindrical branches 0.2–0.3 mm in diameter when dry, with individual branch segments at times slightly exceeding 10 mm in length. In addition, the receptacular clusters are described as devoid of leaves and located apically. The newly collected material includes one specimen (Fig. 1) with the receptacular cluster likewise devoid of leaves, but other specimens (Fig. 2) show the more usual position for such clusters, *i.e.*, in the axils of leaves. Formalin and sea water preserved material indicates the receptacles to have diameters of 1 mm.

A number of other features concerning the receptacles should be noted. As illustrated in Figure 2, it is common for the receptacles to show a more or less dichotomous branching which extends even to their apices. This feature was also observed in the Holotype material. Also distinctive, is the narrow sterile bridge found between the fertile portions of the receptacles. No determination of sex was made on the Holotype material, but examination of

the new material shows the majority to have both oogonia and antheridia present in the same receptacle. All receptacles show an identical morphology. There appears to be no sexual differentiation of thalli in this species.

Although the preserved material included no germling stages of *Sargassum hawaiiensis*, the presence of both spermatangia and oogonia on individuals collected from 183 to 200 m suggests that the species may reproduce at these depths. Of course, it is not known whether the reproductive bodies were viable before preservation.

#### Conclusions

*Sargassum hawaiiensis* may prove to be unique within the genus in its depth of occurrence. Since the plasticity of the genus with variation in environment is not well known (though it appears to be considerable), the species may be the modified offspring of a fertilized egg of one of the inshore species which drifted into deep water. Further studies may also indicate that currents are sweeping the material down from a shallower depth. How-

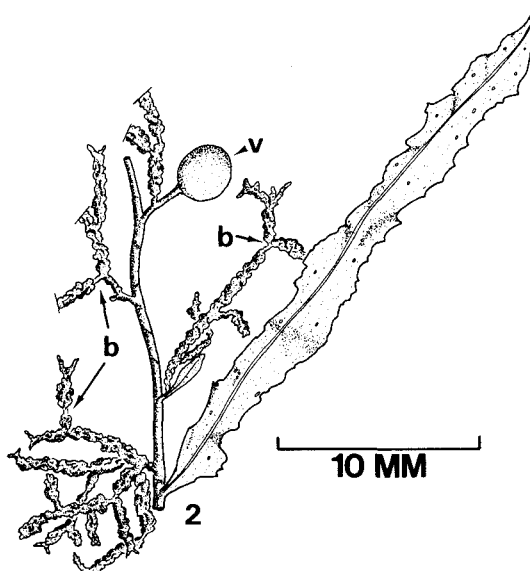


FIG. 2. Portion of a primary branch of *Sargassum hawaiiensis* showing receptacles with narrow sterile bridges (*b*) and bifurcate growth habit, a spherical and mucous vesicle (*v*), and the general leaf morphology.

ever, the fact that the thalli are attached, fertile, and to all appearances healthy, indicates that the alga can survive and possibly grow at 200 m.

Regardless of the depth range of reproducing individuals, *S. hawaiiensis* is a distinct species, as that term is understood and currently put into practice with the algae. As is the case with the other species of *Sargassum*, no single feature can be used to differentiate them. For *S. hawaiiensis* the combination of simple spines loosely scattered over some of the branches, the terete vesicle petioles, muticous vesicles, elongated, lax and bifurcate receptacles with sterile bridges, and the general leaf morphology differentiate this species from all others known.

#### Literature Cited

- CHAMBERLAIN, J. E. 1881. Algae of the Hawaiian Islands. *Thrum's Hawaiian Annual and Almanac*, 7: 32-33.
- DICKIE, G. 1887. Notes on algae collected by H. N. Moseley, M.A. of H.M.S. "Challenger", chiefly obtained in Torres Straits, Coasts of Japan and Juan Fernandez. *J. Linn. Soc., London*, 15: 446-486.
- DOTY, M. S., AND NEWHOUSE, J. 1966. Three new species of the Phaeophyta from Hawaii. *Occ. Papers of B. P. Bishop Museum, Honolulu, Hawaii*, 23(9): 139-146.
- GRUNOW, A. 1915-1916. Additamenta ad Cognitionem Sargassorum. *Verhandl. k. k. Zool.-Bot.-Ges.*, 65: 329-448; 66: 1-48, 136-185.
- HOWE, M. A. 1934. Hawaiian algae collected by Dr. P. C. Galtsoff. *J. Wash. Acad. Sci.*, 24(1): 32-42.
- REINBOLD, T. 1913. *Sargassum*. In Weber van Bosse, A. Liste des algues du Siboga. *Siboga Exped. Monogr.*, 59: 150-174.
- SETCHELL, W. A. 1936. Hong Kong seaweeds. V. *Natural. Suppl.*, 2: 1-20.
- TILDEN, J. E. 1902. Collection of algae from the Hawaiian Islands. *Thrum's Hawaiian Annual and Almanac*, 28: 106-113.
- WOMERSLEY, H. B. S. 1954. Australian species of *Sargassum*, subgenus *Phyllotrichia*. *Aust. J. Bot.*, 2(3): 337-354.
- WOMERSLEY, H. B. S., AND BAILEY, A. 1970. Marine algae of the Solomon Islands. *Phil. Trans. Roy. Soc. London, B, Biol. Sci.*, 259(830): 257-352.