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THE GENUS *GRIFFITHSIA* (RHODOPHYCEAE) IN HAWAII

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The small, inconspicuous plants of the genus *Griffithsia* (Ceramiaceae, Rhodophyceae) are usually missed in general collections of algae. For the most part they are microscopic as well as epiphytic and occur well-mixed with other algae. In the subtropical waters of the Hawaiian Islands, members of this genus are usually found in reef and rocky shore habitats. They do not occur in abundance.

Griffithsia is fairly well known from the Atlantic and Indian Oceans, Caribbean and China Seas, and little known from the Pacific. The first record of the genus in the Hawaiian group was made by Reed in 1907, with reference to the economic use of the plants by the native Hawaiians. The algae are one of nearly seventy which were used to supplement the diet of the Hawaiians. Some of the more common native names of members of this genus are limu (literally translated as edible algae) moopuna-a-ka-lipoa, and limu aupuu. The native names of this and other algae vary from island to island, and sometimes on a single island.

Reinbold (1907) has listed *Griffithsia thyrsgera* (= *G. tenuis*) from Hawaii. MacCaughey (1917) and Neal (1930) have mentioned *Griffithsia ovalis* Harvey as possibly being present in the Hawaiian Islands.

Five species of *Griffithsia* are recorded here from the Hawaiian group. Four are listed for the first time from the area, and the presence of *G. ovalis* is confirmed.

New extensions of ranges are listed for *Griffithsia Binderiana* Sonder, an Australian species, *G. tenuis* C. Agardh, a cosmopolitan species, *G. Metcalfii* Tseng, reported from China, *G. ovalis* Harvey from Australia, and *G. rhizophora* Grunow from Ceylon, China, and the Malay Archipelago.

Cystocarps of *Griffithsia tenuis* and *G. Binderiana* are studied for the first time.

The following key is based on characters which are present for the greater part of the life history of the plants in the Hawaiian Islands. Cystocarpic and spermatangial plants which furnish the best differences among the species are infrequently found.

KEY TO THE SPECIES

- A. Tetraspores between the articulations of the vegetative cells
- B. Involucre surrounding tetraspores arising from vegetative cells; cells microscopic, subcylindrical below, globose at tips 1. *G. ovalis*.

- B. Involucre attached to tetraspore pedicel; vegetative cells macroscopic and moniliform throughout 2. *G. Metcalfii*.
- A. Tetraspores borne on specialized branches, or at the tips of the filaments
 - C. Cells cylindrical, slender; all reproductive structures formed on lateral pedicels 3. *G. tenuis*.
 - C. Cells subcylindrical or globose
 - D. Reproductive structures in lateral, specialized branches, all involucre 4. *G. Binderiana*.
 - D. Tetraspores (other plants not seen) at the tips of globose cells; no involucre formed 5. *G. rhizophora*.

1. *Griffithsia ovalis* Harvey, Phycologia Australica 4:203. 1862.

PLATE I, FIGS. 1-4; PLATE II, FIGS. 1-2

Plants in well-formed tufts to 2 cm. in height, or creeping on other algae and having erect filaments. Cells at the tips are oval to globular, 50-100 μ in diameter. Cells directly below are moniliform to subspherical, and at the base are larger and subcylindrical to ellipsoidal, 500-700 μ in diameter. Branches are occasionally fastigate but predominantly dichotomous, with the tips slightly convergent. Rhizoids are commonly found throughout the plants which creep.

Tetrasporangia are borne between the articulations of the cells toward the tip, and are pedicellate with four or more sporangia on a pedicel. The mature tetrasporangia are about 40 μ in diameter. A slightly incurved involucre of 12-16 cells surrounds the tetraspores. No male or female plants have been collected.

Type locality: King George's Sound, Western Australia.

Distribution: Recorded previously only from Australia, and here recorded from the Hawaiian Islands.

Hawaiian specimens examined: **Oahu Island**: Kawela Bay, Abbott 770b, sterile on *Mesotrema*; Waimanalo, north of Makapuu Point, Abbott 911a, sterile on *Laurencia*; Diamond Head, below lighthouse, Abbott 899a, tetrasporic on *Halimeda*, Abbott 900, sterile on *Dictyosphaeria*; Waikiki, near marine laboratory, Abbott 396, 474, 492, 501 on *Sargassum*, Abbott 502, 504, all tetrasporic.

The plants seem to be members of the *Griffithsia rhizophora-Schousboei-coacta* complex, and although they have many vegetative characteristics in common, studies of the male and female plants would be greatly desired.

Except for the small size of *G. ovalis*, the Hawaiian specimens also seem related to *Griffithsia corallinoides* (L.) Batters (*G. corallina* (Lightf.) C. Ag.). The involucre tetrasporangial groups at the articulations are characteristic of both species.

The specimens have been collected on volcanic rock as well as on coral where they are much entangled with other small algae, chiefly *Centroceras clavulatum* (C. Ag.) Montagne and *Falkenbergia rufalanosa* Harvey. Although these collections have been made at different times of the year, only tetrasporic plants have been found.

2. *Griffithsia Metcalfii* Tseng, Papers Mich. Acad. Sci. Arts and Letters, 27:111-116. 1942.

PLATE II, FIGS. 3-6

Plant caespitose, to 5 cm. in height, the fronds free at the outer ends, subdichotomous in the upper parts of the filaments. Cells are conspicuously moniliform, spherical, 500–700 μ in the terminal cells, largest in diameter through the center of the filaments, and subspherical to subcylindrical basally. Attachment is by large, stout, basal rhizoids. Tenacular cells often connect branches near the base of the plant with each other. Hair clusters are present in young specimens, and are quickly deciduous.

Spermatangial clusters are crowded between fertile vegetative cells below the terminal ends of the branches, and are not involucrate. Tetrasporangia bear a few involucre cells on the common pedicel. No cystocarpic specimens were collected.

Type specimen: C. K. Tseng 938 in the herbarium of Tseng, from Yenkehai, Hainan Island.

Hawaiian specimens examined: **Oahu Island:** Laie Bay at Makahoa Point, *Abbott* 25, tetrasporic, *Abbott* 662, spermatangial; *Richard Cowan*, 3 specimens from Nana-kuli, tetrasporic; *Edna Fassoth*, from Waimanalo, sterile; *Reed*, without number, date, or locality, sterile.

This species compares very favorably with the type specimen. It is usually found with corallines in wave-swept areas about the Island of Oahu. The familiar *Griffithsia globulifera* Harvey of the Atlantic is related vegetatively to this species, but differs in branching and location of spermatangia. *Griffithsia rhizophora* Grunow of the Malayasian-Chinese coasts resembles *G. Metcalfii*, but is a smaller plant and has branches consistently convergent at the tips.

3. *Griffithsia tenuis* C. Agardh, Species Algarum 2(1):131. 1828.

Griffithsia thyrsigera (Thwaites) Askenasy, Algae, in Forschungsreise S.M.S. Gazelle 4:36, pl. 9, figs. 1–4. 1889.

Griffithsia sp. Neal, Hawaiian Marine Algae, Bishop Museum Bull. 67:73–74. 1930.

PLATE III, FIGS. 1–7

Plant in freely branching loose tufts to 5 cm. in height, or prostrate and creeping on other algae. The multinucleate filaments are irregularly dichotomous, narrow in aspect, and non-forcipate. In the Hawaiian specimens, subsecund branches rarely occur and thus this character, so prominent in specimens from the Caribbean and China areas, is not a good one here. Cells of the filaments are cylindrical to subcylindrical, 60–80 μ in diameter, becoming smaller at the tips where they are surrounded by two or more clusters of hairs, the lower one long and six or more times dichotomous, the upper one short and quickly deciduous.

The asexual plants are usually found to be separate from the sexual plants, but in one collection tetraspores are found on the same plant as the cystocarps (*Abbott* 472). Tetraspores occur in whorls of 4–12 at the nodes of the upper filaments, each on a clavate or pyriform pedicel. Deciduous involucre cells infrequently surround the tetraspores of the Hawaiian specimens.

Cystocarps are lateral on a one-celled pedicel, surrounded by an involucre of 12–16 cells. The auxiliary cell of the carpogonium is cut off by the supporting cell as reported for *G. corallina* by Kylin (1916), and *G. Metcalfii* by Tseng (1942). Carpospores are formed by the repeated division of the auxiliary cell on its outer face. They are pyriform and are massed. Spermatangia are stalked, subcapitate, subglobose, without involucre, on lateral specialized branches.

Type locality: Venice.

Distribution: Widely distributed in warm to subtropical waters; in the Pacific area at points on the China coast, Fiji, and at Tutuila Island, Samoa.

Hawaiian specimens examined: **Oahu Island:** Laie Bay, *Abbott 485*, sterile; *Abbott 486*, tetrasporic; Waimanalo, 3 miles north of Makapuu Point, *Abbott 907a* on *Dictyota*, tetrasporic; Halona, *Abbott 300*, on *Microdictyon Setchellianum*, tetrasporic; Hanauma Bay, *Abbott 50*, tetrasporic, spermatangial; Wailupe, east of fishpond, *Abbott 808a* on *Dictyota*, sterile; Kaalawai, *Abbott 642*, on *Sargassum echinocarpum*, tetrasporic; Waikiki near marine laboratory, *Abbott 472*, tetrasporic and cystocarpic; *Abbott 491*, spermatangial, cystocarpic, tetrasporic; *Neal 23*, carpogonial, tetrasporic; Diamond Head, below lighthouse, *Abbott 839*, sterile, *Abbott 896a* on *Dictyota*, sterile, *Abbott 897a* on *Liagora*, tetrasporic; *G. P. Andrews* without collecting data, tetrasporic; Kawela Bay, *Abbott 732b* on *Padina*, sterile. **Maui Island:** *E. Bailey 7*, 5 specimens of which two are tetrasporic, others sterile.

The persistent dichotomous branching of the Hawaiian specimens is a very misleading character since *Griffithsia tenuis* of other writers is taxonomically characterized by having lateral, secund branches. One collection of fifteen sets shows the secund habit of the species. These plants were epiphytic on a small *Sargassum echinocarpum*, and on *Champia* sp. The Hawaiian specimens appear to be more narrow in the size of the cells and have smaller tetraspores than the Atlantic and China specimens. The specimens collected at Hanauma Bay, in addition, show only four tetraspores in a whorl at the nodes and the pedicels are not typically clavate or pyriform as in the Waikiki specimens. These differences, however, may perhaps be attributed to the tide pool habitat of the former.

The appearance of tetraspores and cystocarps on the same plant is not rare for the Ceramiales (see Kylin, 1928, Drew, 1944), but is newly reported for *G. tenuis*. Unfortunately, I have not studied the species cytologically.

4. *Griffithsia Binderiana* Sonder, Bot. Zeit. 3:52, 1845.

Bornetia Binderiana (Sond.) Zanard., Iconogr. Phycol. Med.-Adr. 2:45. 1865 (cited by Børgeson, F. Danske Vidensk. Selsk., Biol. Medd. 19(10):16. 1945).

(See other references for this species by Sonder in literature cited.)

PLATE IV, FIGS. 1–7

Plants tufted, to 4 cm. in height, much branched, subdistichous, dichotomous, furcate at the tips. Cells are subcylindrical, 300–500 μ in width, 2.5 to 3 times as long in the central parts of the filaments, cells becoming gradually smaller toward the terminal ends. Tetraspores are

borne on characteristic cuneate or ovoid, solitary, second pedicels; the tetraspores are surrounded by a prominent incurved involucre. Tetraspores are 50–60 μ in diameter. Three or more tetrasporangia are clustered on a common stalk. Rhizoids occur chiefly in the basal parts, but in some ecological forms they may occasionally appear laterally throughout the plant.

Type locality: "ad litus occidentale Novae Holland."

Hawaiian specimens examined: **Oahu Island**: near Elk's club, Waikiki, *Abbott* 467, sterile; Laie Bay at Makahoa Point, *Abbott* 468, tetrasporic; *Abbott* 659, spermatangial; *Abbott* 660, cystocarpic; *Abbott* 661, tetrasporic; *J. T. Conover* at Barber's Point, tetrasporic; *R. S. Cowan* at Nimitz Recreation Beach, south Ewa, near Barber's Point, tetrasporic; *J. F. Rock* from Honolulu Harbor, sterile. **Maui Island**: Paia, *E. Bailey* without number, some tetrasporic, others sterile.

The prominent lateral branches bearing involucrate tetraspores are most characteristic of this species, and fortunately the cystocarpic and spermatangial plants also show this characteristic well. The development of the cystocarp follows that of *G. corallina*, *G. Metcalfii* and *G. tenuis*. Spermatangial and cystocarpic plants have been found in the winter months, the tetrasporic plants throughout the year. Spermatangial and cystocarpic plants are reported for the first time.

Griffithsia Binderiana seems to be related to the oriental *G. subcylindrica* Okamura, especially in the vegetative structure. The cells of the latter appear to be larger both in width and length. The Hawaiian plants compare favorably with Harvey's description of specimens of *G. Binderiana* from Rottneest.

5. *Griffithsia rhizophora* Grunow ex Weber-van Bosse, Siboga Expeditie. Monograph 59c:313. 1923.

PLATE I, FIGS. 5–9

Frond to 2 cm. in height, caespitose. Branches are convergent at the tips, otherwise subdichotomous and erect, or creeping. The cells are moniliform except at the base where they are subcylindrical. The central cells of the filaments are 400–500 μ in diameter with the same length. Terminal cells are somewhat less than 100 μ , basal cells 500 μ in diameter and twice as long. Tetraspores without involucre.

Type specimen: *Ferguson* 316, in Algae of Ceylon.

Distribution: Ceylon, Hainan, Malaya.

Hawaiian specimens examined: **Oahu Island**: Laie Bay, *Abbott* 466, tetrasporic; Waimanalo, 3 miles north of Makapuu Point, *Abbott* 909a on *Dictyota*, sterile; *Abbott* 910a on *Padina*, sterile; Wailupe, east of fishpond, *Abbott* 802a on *Dictyota*, sterile; Diamond Head, below lighthouse, *Abbott* 816a on *Sargassum*, sterile; Kaalawai, *Abbott* 663a on *Padina*, sterile; Kawela Bay, *Abbott* 715a on *Halimeda*, sterile.

The regular subdichotomous branching and the convergent tips of this species separate it vegetatively from *Griffithsia Metcalfii*. The latter plant is also larger. Of the Hawaiian species of *Griffithsia* studied, this

one is least known since only one fertile specimen was collected. The identification, therefore, should be considered to be tentative.

Griffithsia rhizophora was named by Grunow on a herbarium sheet (*nomen nudum*). Later, Madame Weber-van Bosse published it in the list of Siboga Algae, crediting it to Grunow. Article 48, section 7 of the International Rules states the ". . . name of the latter author must be appended to the citation with the connecting word *ex*." The listing of the species should be as above.

The writer wishes to thank Dr. George F. Papenfuss of the University of California who has helped greatly in checking literature she was not able to see.

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LITERATURE CITED

- Agardh, C. A.** Species Algarum. 2(1): 131. 1828.
- Askenasy, Eugen.** Algae in Forschungsreise S.M.S.Gazelle . . . 1874-bis 1876. 4: 36. pl. 9, figs. 1-4. 1889.
- Børgesen, F.** Marine algae of the Danish West Indies II. Dansk Bot. Arkiv. 3: 462-464. 1915-20.
- Drew, K. M.** Nuclear and somatic phases in the Florideae. Biol. Rev. Camb. Phil. Soc. 19: 113-117. 1944.
- Harvey, W. H.** Phycologia Australica 4: 203. 1862.
- Kylin, H.** Die Entwicklungsgeschichte von Griffithsia corallina (Lightf.) Ag. Zeit. f. Bot. 8: 99. 1916.
- . Entwicklungsgeschichtliche Florideenstudien. Lunds Univ. Arsskrift, N. F., 2: 24. 1928.
- MacCaughey, Vaughan.** The algae of the Hawaiian Archipelago. (Thrum's) Hawaiian Almanac and Annual for 1918: 154. 1917.
- Neal, Marie C.** Hawaiian marine algae. Bishop Museum Bull. 67: 73-74. 1930.
- Reed, Minnie.** The economic seaweeds of Hawaii and their food value. Hawaii Agr. Exp. Sta. Ann. Rept. for 1906: 87. 1907.
- Reinbold, Th.** Meeresalgen in Reehinger, K. Bot. und Zool. Ergebnisse einer wissenschaftlichen Forschungsreise nach den Samoainseln, dem Neuguinea-Archipel und den Salomonsinseln. 1: 10. 1907.
- Setchell, W. A.** American Samoa: Pt. 1. Vegetation of Tutuila Island. Carnegie Inst. Wash. 20: 159-160. 1924.
- Sonder, O. G.** Nova Algarum genera et species quas in itinere ad oras occidentalis Novae Hollandiae collegit L. Preiss, Ph. Dr. Bot. Zeit. 3: 52. 1845.
- . in Lehmann, Johann Georg C. Plantae Preissianae, sive enumeratio Plantarum quas in Australasia occidentali et meridionali-occidentali annis 1838-41 collegit L. Preiss. 2: 168. 1846-47.
- . in Plantae Preissianae (reprint with different pagination, referred to by J. Agardh) p. 21.
- Tseng, C. K.** Studies on Chinese species of Griffithsia. Papers Mich. Acad. Sci., Arts, and Letters, 27: 111-116. 1942.
- Weber-van Bosse, Anna.** Liste des algues du Siboga. Siboga Expeditie. Monographie 59c (3): 313-314. 1923.

PLATE I

All figures are drawn with the aid of a camera lucida. Each unit of scale A equals 200 μ ; scale B, 100 μ ; scale C, 50 μ ; scale D, 10 μ .

Griffithsia ovalis Harvey. Figs. 1-4.

1. Vegetative cells with involucrate tetrasporangia between the articulations. (Scale B)
2. Habit of repent specimen showing rhizoid. (Scale A)
3. Involucrate tetrasporangia near tip of plant. (Scale B)
4. Mature tetrasporangium on a pedicel. (Scale D)

Griffithsia rhizophora Grunow ex Weber-van Bosse. Figs. 5-9.

5. (Upper figure) Mature tetrasporangia. (Scale D); (lower figure) tetrasporangia on pedicel. (Scale C)
6. Habit of typical specimen with forcipate tips. (Scale B)
7. Habit of repent specimen with rhizoids. (Scale C)
8. Tetrasporic plant. (Scale C)
9. Habit of specimen with nearly straight tips. (Scale B)

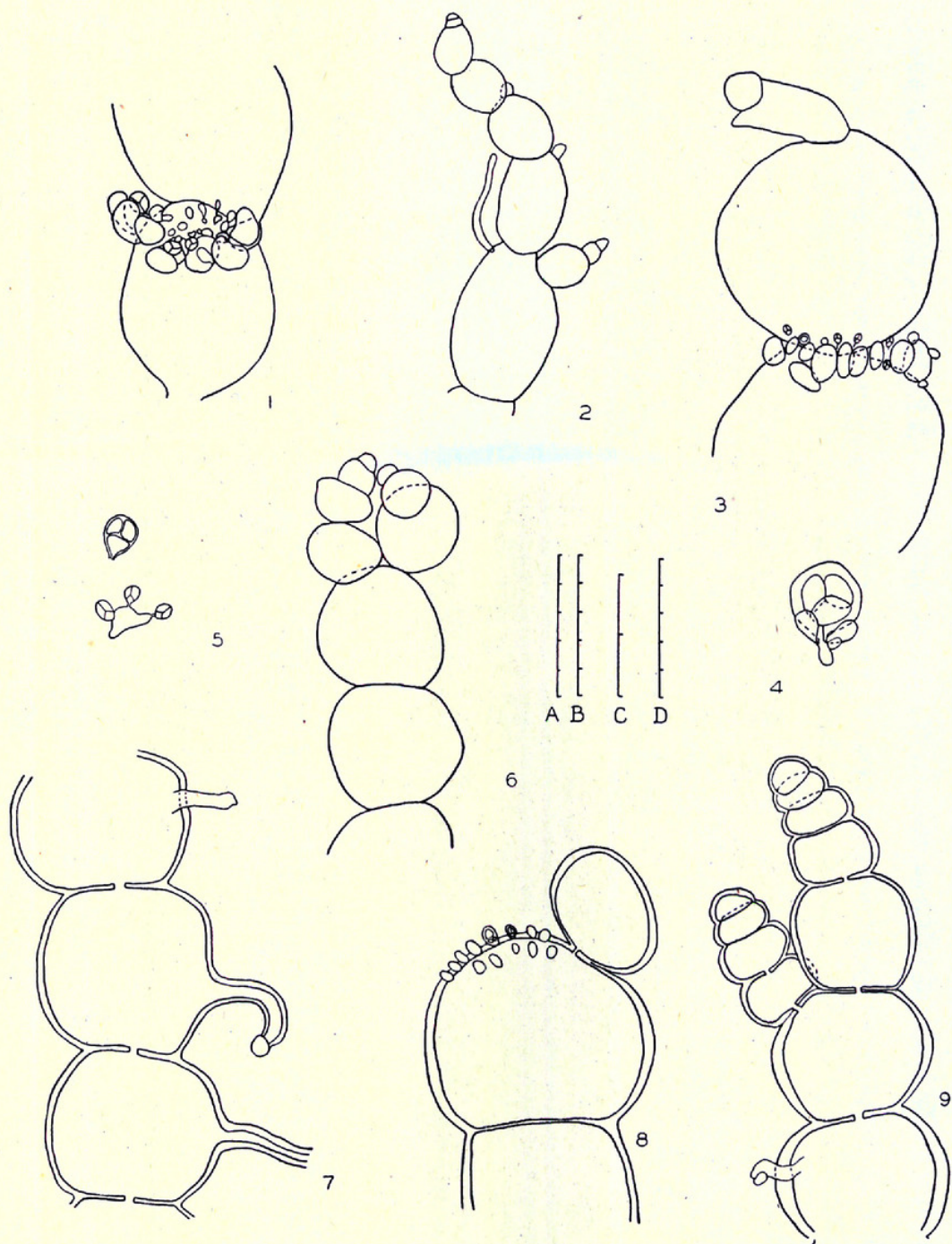


PLATE I

PLATE II

All figures are drawn with the aid of a camera lucida. Each unit of scale A equals 200 μ ; scale B, 100 μ ; scale D, 10 μ .

Griffithsia ovalis Harvey. Figs. 1-2.

1. Habit of erect specimen showing fastigiate branching. (Scale A)
2. Habit of creeping specimen showing secund branching. (Scale A)

Griffithsia Metcalfii Tseng. Figs. 3-6.

3. Tetraspores between articulations of vegetative cells. (Scale B)
4. Tip of a frond. (Scale B)
5. Spermatangial cluster. (Scale D)
6. Tetrasporic cluster. (Scale D)

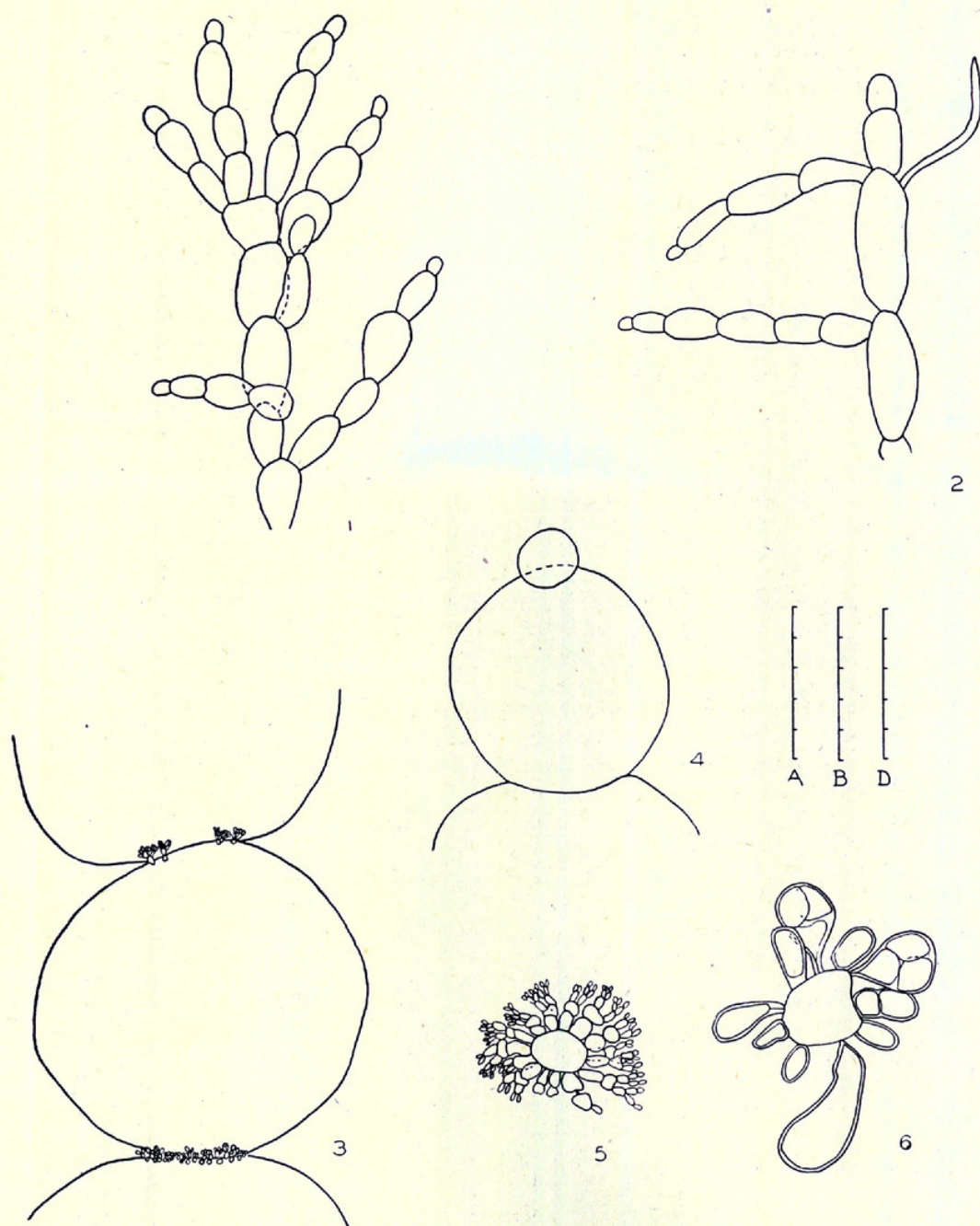


PLATE II

PLATE III

All figures are drawn with the aid of a camera lucida. Each unit of scale B equals 100 μ ; scale C, 50 μ ; scale D, 10 μ .

Griffithsia tenuis C. Agardh. Figs. 1-7.

1. Whorl of four tetrasporangia. (Scale C)
2. Habit of specimen with male cluster. (Scale B)
3. Spermatangial cluster. (Scale D)
4. Habit of robust specimen, showing young tetraspore. (Scale C)
5. Part of cystocarp, showing supporting cell derivatives and pyriform carpospores. (Scale D)
6. Involucrate cystocarp on lateral pedicel. (Scale C)
7. Young gonimoblast with involucre. (Scale D)

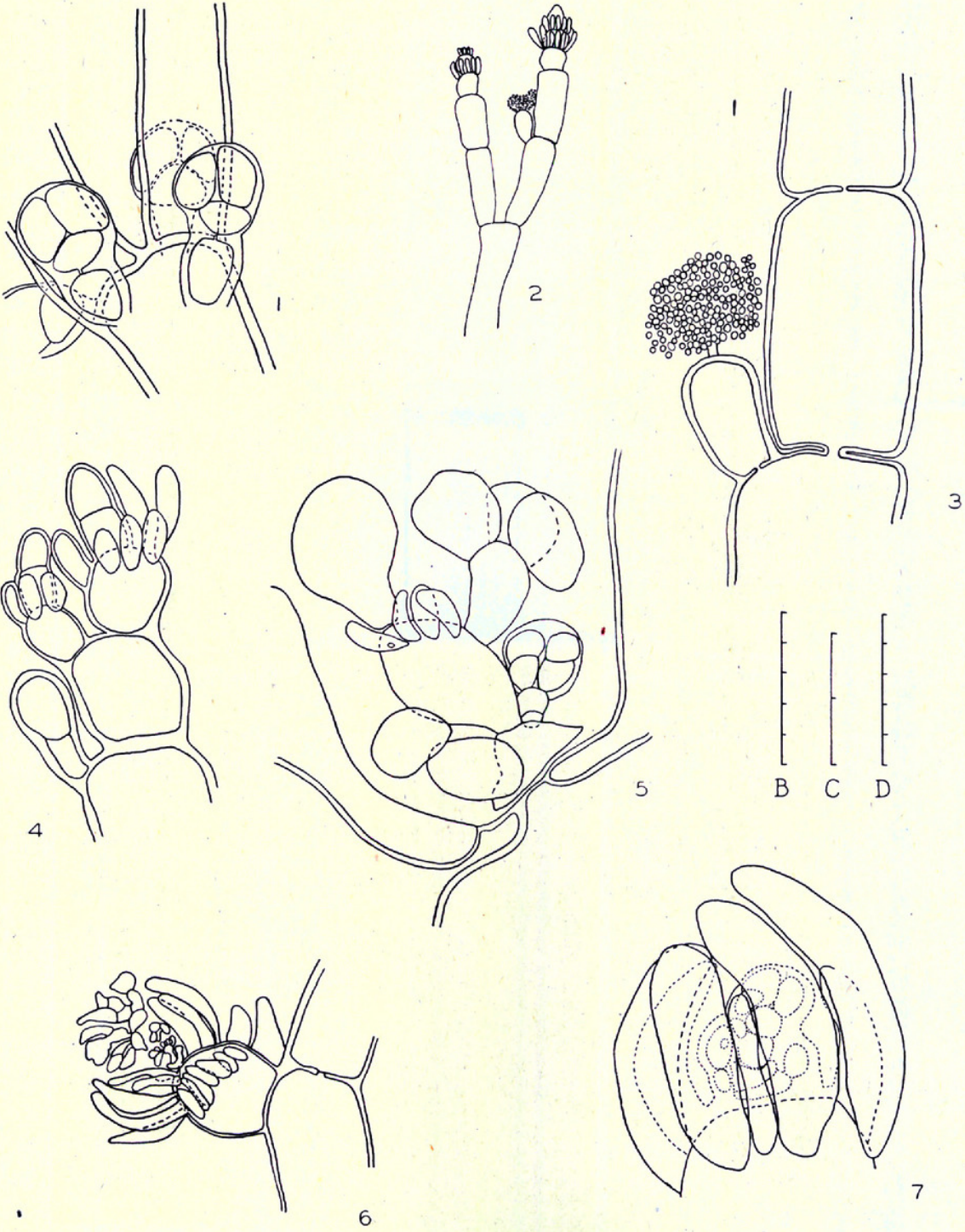


PLATE III

PLATE IV

All figures are drawn with the aid of a camera lucida. Each unit of scale B equals 100 μ ; scale C, 50 μ ; scale D, 10 μ .

Griffithsia Binderiana Sonder. Figs. 1-7.

1. Habit of portion of tetrasporic plant. (Scale B)
2. Spermatangial cluster with young involucre. (Scale D)
3. Spermatangial cluster on lateral pedicel, with surrounding involucre cells. (Scale B)
4. Detail of mature cystocarp showing a few carpospores. (Scale C)
5. Tetrasporic plant with involucre tetrasporangia. (Scale B)
6. (a) Young tetraspore; (b) mature tetrasporangium showing pedicel. (Scale D)
7. Position of cystocarp with regard to involucre on a lateral pedicel. (Scale B)

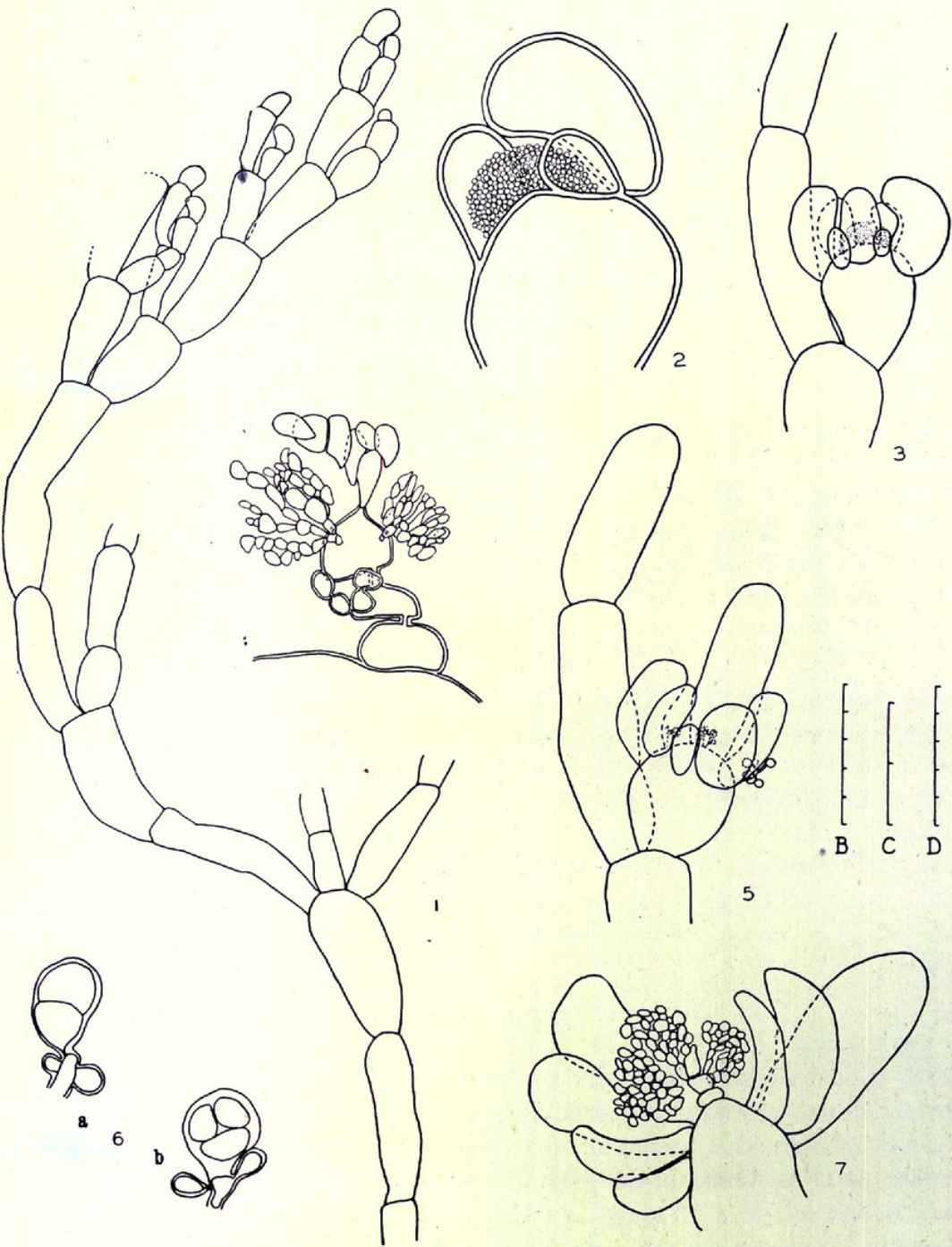


PLATE IV



Abbott, Isabella A . 1946. "The Genus Griffithsia (Rhodophyceae) in Hawaii." *Farlowia :a journal of cryptogamic botany* 2(4), 439–453.
<https://doi.org/10.5962/p.316014>.

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