Pacific Science (1980), vol. 34, no. 2

Early Collections of Hawaiian Marine Algae[1]

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ABSTRACT: A group of specimens representing 40 taxa of Hawaiian marine algae has come to light and is among the earliest collections of Hawaiian algae. Though only 24 of the specimens can be tallied with a list of 112 marine plants published by J. E. Chamberlain in 1880 and 1881, they answer a great need for verification of published names. Sixteen of the previously named taxa are changed because of taxonomic opinion or nomenclature. Sixteen taxa are added from the collection that were not included in the Chamberlain list. The specimens are now housed in the B. P. Bishop Museum in Honolulu.

THOUGH SOME MARINE ALGAE were included among the early records of Hawaiian plants, for example, Gaudichaud's (1826–1830), Hawaiian algae were in general neglected until 1880 when a list (published also without change in 1881) by J. E. Chamberlain was reported. Encouraged by Asa Gray, Chamberlain sent the specimens he had collected to Harvard University and Yale University for identification by W. G. Farlow and D. C. Eaton, respectively. Portions of Chamberlain's collections, some of which I have seen, may be found at the Farlow Herbarium (FH) of Harvard University, Field Museum of Natural History (F), Chicago, and the University of California (UC), Berkeley, though complete collections that match his published list are not available at any of these herbaria. Chamberlain's list contains 112 species of marine plants (not all algae).

A few years ago, George F. Papenfuss, professor emeritus, University of California (Berkeley), sent to me a small collection of dried Hawaiian algae for identification. The package was marked in the handwriting of W. A. Setchell: "property of Bishop Museum, sent by C. N. Forbes, April, 1910. To be named and returned." I did not appreciate the historical importance of the 76 specimens until I started to work on them. This group of algae represents about 30 percent of the taxa named by A. B. Seymour (Harvard University) in an unpublished list that Harold St. John gave me in 1946. St. John thought that the algae were probably determined by Farlow. The list contains 112 species names and a note that 23 additional specimens were not identifiable at that time. These particular algae were collected by George P. Andrews of Honolulu, and pencilled-in numbers on the specimen cards correspond to numbers on the Seymour list. The specimens were sent to Cambridge on 20 April 1891, though they had been collected about 25 years previously. Apparently when identified they were returned to Honolulu and given to the Bishop Museum. In 1910 C. N. Forbes, then curator of the herbarium at the Museum, sent to Setchell a portion of the Andrews collection and included also some algae collected by the Rev. Edward Bailey of Wailuku, Maui. Some Andrews specimens bear 1876 as the date—Bailey's, 1874 and 1876.

This collection is particularly important to students of Hawaiian algae because of the large number of published names for which we have not been able to locate early specimens upon which the names were given. In such a situation, there are two options: (1) carry the lists without being able to evaluate them; (2) disregard them. The first option has been followed by some (Reed 1907, MacCaughey 1918) and the second by others (Abbott 1947). Eubank (1946) was able to clarify the status of certain of Chamberlain's names because some of his specimens were located at the Farlow Herbarium, Harvard

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University. It is not known how many specimens were originally collected, nor precisely where they are housed. However, the collections upon which this paper is based appear to contain about one-fourth of the total number of the species in Chamberlain's list and may be used as supporting material for Chamberlain's voucher specimens that may never be found. Sixteen other taxa that are not listed by Chamberlain but were collected by Andrews and Bailey in the same period are added. A continual search for specimens named in the old lists must be maintained.

Most of the algae have notes in the handwriting of (and signed by) Minnie Reed; some of these notes indicate that the algae had been sent to A. B. Seymour for identification, and hence without doubt are the same specimens included in this paper. Five of the specimens are identified by Setchell in his handwriting. The Rev. Bailey apparently made good use of the weekly Wednesday afternoon excursions to the beach (near Kahului, Maui) of his charges at the Wailuku Female Seminary (Dibble 1909), and later he occasionally went to Paia, some miles distant, by way of the beaches (Laura C. Green, personal communication, ca. 1937) in connection with Maunaolu Seminary. No specimens from Paia are found in the present collection, but I have seen and cited some earlier (Abbott 1946).

Whether Reed annotated the collection at Setchell's request or intended to include them with her own larger collection is not known, but it is possible that some of these specimens represent her own published (1907) records. Thus when her collections (mostly at the University of California, Berkeley) are critically examined in the future, it will he necessary to study these Andrews and Bailey algae again. Some specimens are marked "duplicate," implying that there are others elsewhere.

RESULTS

Table 1 shows an inventory of the collection with the names published by Chamberlain (1880, 1881), gives unpublished identification by others since this may help future workers to understand the origin of some of the species names used in Hawaiian literature,[3] and finally shows the current classification of the species. All of these specimens will be housed in the Bernice Pauahi Bishop Museum in Honolulu.

The table is supplemented by an annotated list of 16 other taxa present in the collection but not referred to by either Chamberlain (1880) or Reed (1907). These constitute the earliest known Hawaiian specimens of some species that have been subsequently reported by others. Andrews's specimen numbers tally with the Seymour list and are so used; Bailey did not use numbers.

Reed's comments, where appropriate, are added. Since she rarely used author's names on binomials, I have no idea whether she obtained the name she used through an original reference or from a secondary source. I have therefore put her names in quotes. On the other hand, Seymour used authors with binomials and I use his determinations without quotes.

ANNOTATED LIST

Chlorophyta

Cladophora socialis var. *hawaiiana* Brand, 1905, p. 182. Gilbert 1965, p. 489.

Reed notes: "somewhat resembles the structure of *Cladophora nuda* especially its branching and long slender cells and much elongated slender upper ramuli." The specimen compares well with some of those collected by Gilbert in Hawaii, where he says the species is of wide distribution.

Collected by G. P. Andrews, Oahu, without number or date. There are 4 entries for *Cladophora* in the Seymour list.

[3] A particularly trying use of unpublished names of algae is to be found in some of the entries in the Hawaiian Dictionary (Pukui and Elbert 1971). Although it is laudable that the Hawaiian common name is linked to a scientific name, if the latter is unknown as occurring in Hawaii and there are no voucher specimens, to resolve the identification becomes difficult if not impossible.

Codium arabicum Kützing, 1856, p. 35. Silva in Egerod, 1952, p. 382.

Although this is a common species in Hawaii, it is not included in the Chamberlain list, but *Codium tomentosum* is listed. The latter name, as applied to Hawaiian specimens, is *Codium edule* Silva (Silva in Egerod, 1952, p. 394). Silva examined the *Codium tomentosum* of Chamberlain's list and assigned it to *C. edule*.

Collected by E. Bailey, Kahului, Maui, and by G. P. Andrews (#29) on Oahu, identified by Seymour as *C. adhaerens* C. Ag. but both thought by Reed to be "*Codium spongiosum*."

Enteromorpha clathrata var. *clathrata* (Roth) Greville, 1830, p. 181. Gilbert, 1965, p. 482.

Andrews's #10, identified by Seymour as *E. erecta* J. Agardh and by Reed as "*Enteromorpha plumosa*," was collected at Waikiki, Oahu.

Enteromorpha plumosa Kützing, 1843, p. 300. Gilbert 1965, p. 482.

Thought to be "*E. ramulosa*" by Reed, but in *E. ramulosa*, the ultimate branchlets are spinelike, whereas the specimen shows long branchlets, similar to those of *E. plumosa*.

Collected by G. P. Andrews (#11) at Waikiki, Oahu, identified by Seymour as *E. hopkirkii*, now accepted as a synonym of *E. plumosa*.

Microdictyon japonicum Setchell, 1925, p. 107. Egerod, 1952, p. 363.

Andrews's #14 shows annulate thickening, a characteristic of this species.

Collected by G. P. Andrews (#14) (#15 also cited by Seymour but not in this collection) as *Microdictyon agardhianum* Decaisne.

Siphonocladus tropicus (Crouan & Crouan) J. Agardh, 1887, p. 105. Egerod, 1952, p. 356.

Casually reported by Setchell and Gardner (1930) from Honolulu, and reported upon in detail by Egerod, this is surely the oldest known Hawaiian specimen.

Collected by G. P. Andrews (#34) on Oahu, identified as *Siphonocladus*?

Phaeophyta

Endarachne binghamiae J. Agardh, 1896, p. 26.

This may be the *Phyllitis fascia* (= *Petalonia fascia* [Müll.] Kuntze) that appears in Chamberlain's list, but until a specimen is found that more clearly shows a resemblance to *Petalonia* than to *Endarachne*, it seems best to recognize the densely intertwined medullary filaments of the specimens as belonging to *Endarachne binghamiae*. Miss Reed's note indicates that the center was hollow but I did not see this.

Collected by E. Bailey, perhaps on Oahu, 1876.

Rosenvingea orientalis (J. Ag.) Bøgesen, 1914, p. 182.

Identified by Reed as "*Cutleria*?," this specimen was collected by E. Bailey, perhaps on Oahu, in 1876. Its irregular, slender branches and hollow axis characterize the species.

Rhodophyta

Gracilaria sp.

Reed annotated her #24 as "*Dumontia*?" (a red alga occurring in temperate and boreal seas), and under it, in Dr. Setchell's handwriting and initials, "*Eucheuma nudum*?" (a red alga common to the west and southwest of Hawaii, but not of natural occurrence in Hawaii). Cross sections show somewhat compressed medullary cells (therefore not *Dumontia* which is uniaxial, and not *Eucheuma* which has elongate filaments in the medulla). The specimen further lacks the verticillately placed laterals that constitute the cortex in *Dumontia* and the very much thickened cell walls of cells of the outer cortical layers of *Eucheuma*. *Eucheuma nudum* J. Agardh was recorded by MacCaughey (1918, p. 145) but whether his identification is based on Setchell's determination of the specimen cited here, or is from his own specimen which has not been located, is not known. It is highly unlikely that *Eucheuma* occurred in Hawaii in 1876.

Without reproductive structures, it is not possible to give a species name to this frag-

TABLE 1

INVENTORY OF HAWAIIAN ALGAE COLLECTED IN 1874 AND 1876

PUBLISHED NAMES (CHAMBERLAIN 1880)	LOCALITY	COLLECTOR (A. = ANDREWS; B. = BAILEY)	COLLECTION NUMBERS	UNPUBLISHED IDENTIFICATIONS (REED OR OTHERS)	CURRENT SCIENTIFIC NAME (AUTHOR'S IDENTIFICATIONS)
Amansia glomerata	Maui	B.	n	*Nitophyllum* sp.?	*Amansia glomerata* J. Ag.
Bryopsis plumosa	Lanai	B.	#28	*Bryopsis plumosa*	*Trichosolen oahuensis* (Egerod) Taylor*
Caulerpa clavifera	Oahu	B.	#11	*Caulerpa*	*Caulerpa racemosa* var. *macrophysa* (Kütz.) Tayl.
Centrocerus clavulatum	Oahu	A.	n	(mixed with *Ceramium*)	*Centroceras clavulatum* (C. Ag.) Mont.
Ceramium (many var. undetermined)				13 specimens	(not identified to species)
Chondria baileyana	Oahu	B.	#6	*Chondria dasyphylla*	*Chondria baileyana* (Mont.) Harvey
Cladophora	Oahu	A.	#7, 8, n	*Cladophora fascicularis*	*Cladophora fascicularis* (Mert.) Kütz.
Cladhymenia†	Maui	B.	#2	*Caliblepharis*?	*Cladhymenia pacifica* Setch.
Desmia ambigua	Oahu	A.	#80(2)	*Desmia coccinea* of Seymour	*Chondrococcus hornemannii* (Mert.) Schmitz
	Maui	B.	(5)	*Chondrococcus harveyi* of Reed	*Chondrococcus hornemannii* (Mert.) Schmitz
Dictyota cronulata	Oahu	A.	#21	*Dictyota dichotoma* var. *intricata*	*Dictyota crenulata* J. Ag.
	Oahu	A.	#A	*Dictyota dichotoma*	*Dictyota crenulata* J. Ag.
Dictyota sandwicensis	Oahu	A.	#19	*Dictyota acutiloba* var. *distorta*	*Dictyota acutiloba* J. Ag.
	Oahu	A.	#26	*Dictyota furcellata*	*Dictyota acutiloba* J. Ag.
Galaxaura marginata	Maui	B.	#13(2)	*Galaxaura adriatica*	*Galaxaura fastigiata* Decaisne
Gracilaria coronopifolia	Oahu	A.	#36	*Gracilaria coronopifolia*	*Gracilaria coronopifolia* J. Ag.
	Oahu	A.	xy	*Sphaerococcus corallinus*	*Gracilaria coronopifolia* J. Ag.
Griffithoia	Oahu	A.	#86	*Corynospora australis*	*Corynospora pedicellata* (Smith) J. Ag.
Hypuea nidifica	Oahu	A.	#68	*H. nidifica* of Setchell, Reed	*Hypnea cervicornis* J. Ag.
H. pannosa	Oahu	A.	#77	*H. armata* of Reed; *H. cervicornis* of Setchell	*Hypnea cervicornis* J. Ag.
H. divaricata	Oahu	A.	#83	*H. armata* of Reed	*Hypnea cervicornis* J. Ag.
H. corinta	Hawaii	A.	#25	*H. nidifica* of Reed	*Hypnea nidifica* J. Ag.
	Hawaii	A.	#28	*H. pannosa* of Setchell; *H. nidifica* of Reed	*Hypnea nidifica* J. Ag.
Hallyseris australis	Oahu	A.	#H	*Haliseris pardalis*	*Dictyopteris australis* (Sond.) Ask.
Halimeda tuna	Oahu	A.	#33		*Halimeda discoidea* Decaisne

Laurentia paniculata	Oahu	A.	#58	*Laurencia paniculata* of Seymour	*Laurencia nidifica* J. Ag.
L. nidifica	Oahu	A.	#60, 62	*Laurencia pinnatifida* of Reed	*Laurencia nidifica* J. Ag.
	Hawaii	A.	#21	*Laurencia ceylanica* J. Ag. of Setchell	*Laurencia parvipapillata* Tseng
Martensia flabelliformis	Maui	B.	n	*Martensia flabellulata* (6 specimens)	*Martensia fragilis* Harvey
Spiridia spinella	Oahu	B.	#22	*Spyridia spinella*	*Spyridia filamentosa* (Wulf.) Harv.
S. filamentosa	Oahu	A.	#85(2)	*Spyridia spinella*	*Spyridia filamentosa* (Wulf.) Harv.
	Oahu	A.	#38	*Spyridia spinella* of Reed	*Spyridia filamentosa* (Wulf.) Harv.
				S. filamentosa of Seymour	*Spyridia filamentosa* (Wulf.) Harv.
Taonia solierii	Maui	B.	n		*Spatoglossum solierii* (Mont.) J. Ag.
Vidalia obturiloba	Oahu	B.	#15	*Vidalia volubilis* of Reed	*Vidalia fimbriata* (Brown) J. Ag.
				Vidalia obtusiloba of Setchell	*Vidalia fimbriata* (Brown) J. Ag.
	Hawaii	A.	#111	*Vidalia obtusiloba*	*Vidalia fimbriata* (Brown) J. Ag.

NOTE: Published names given in original spelling. Collection numbers preceding Reed's name are hers except when collected by Andrews, then his; n signifies no number.

* Basionym: *Pseudobryopsis oahuensis* Egerod, U. C. Publ. Bot. Vol. 25, p. 372, 1952. *Trichosolen* Montagne 1860 has priority (Article 11, ICBN) over *Pseudobryopsis* Berthold in Oltmanns, 1904.

† *Cladhymenia pacifica* leg. J. E. Chamberlain #66, 1879 (without location); UC 940272; det. II. 1953 by M. S. Doty.

ment. Collected by E. Bailey in 1876, perhaps on Oahu.

Callithamnion byssoides Arnott in Hooker, 1833, p. 432.

The soft, globose thallus with pinnate branches and tetrasporangia about 30 μm diameter identify this species.

Collected by G. P. Andrews (#101) on Oahu, with no date, as *Callithamnion* sp.

Dasya bailouviana (Gmelin) Montagne, 1841, p. 161.

Tetrasporangial stichidia linear, with an acute apex, the stichidia about 118 μm wide and mature tetrasporangia 39–44 μm diameter. This collection under Reed (#19) and identified by her as "*Dasya ocellata*" is the biggest surprise of all the specimens in the early collections. The species has never been collected again in Hawaii. It is widely distributed in the North Atlantic and both American tropics.

Collected by E. Bailey, perhaps on Oahu, in 1876.

Dasya sp.

Reed's #18 is a common species of *Dasya* growing in Hawaii, particularly in bays on Oahu and as an epiphyte. Since the Hawaiian species have not been studied, there is no specific name as yet for this species.

Collected by E. Bailey, perhaps on Oahu, 1876.

Heterosiphonia sp.

Identified by its somewhat compressed thallus and alternately distichous branching, this species was epiphytic on *Hypnea*. As with the preceding species, members of this red algal family have not been studied in Hawaii.

Collected by G. P. Andrews on Oahu (#94) without date. The Seymour list identifies #94 as *Chondria tenuissima* var. *baileyana* Farl.

Laurencia spp.

Two different *Laurencia* specimens, one collected by G. P. Andrews (without number) on Oahu, and the other by E. Bailey at Kahului, Maui, are not identifiable at this time.

Drouetia sp. Dawson, 1949, p. 11.

A fairly common species belonging to the Rhodymeniales, with a short, solid stipe and circular to irregular blades, that is still without a specific name. All recent specimens that have been examined are either tetrasporangial or cystocarpic, but the specimen here shows both carpospore masses and cruciately divided tetrasporangia on the same plant. Reed did not note the cystocarps but did sketch the tetrasporangial sori and labelled the specimen *Halymenia*, a genus that does not have tetrasporangia in sori.

Collected by G. P. Andrews (#180) "not now to be determined," on Hawaii Island.

Porphyra sp.

Called "*Porphyra laciniata*" or "*P. leucostica*" by Reed, this specimen was collected by E. Bailey at Kahului, Maui, without date. I am not able to give this specimen a specific name. A *Porphyra* species has been reported from the Hawaiian Islands a number of times, as the species is one of those eaten by Hawaiians (Abbott and Williamson 1974).

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