

# Some new species and new combinations of marine red algae from the central Pacific

Isabella A. Abbott<sup>1</sup>

<sup>1</sup>Department of Botany, University of Hawai'i, 3190 Maile Way, Honolulu, HI 96822 USA and B.P. Bishop Museum, PO Box 19000-A, Honolulu, HI 96817 USA

## SUMMARY

Six new species in five genera of Rhodophyta are described. A new combination for *Polyopes hakalauensis* is also proposed. These taxa were encountered while preparing a manual of marine red algae of the Hawaiian Islands. Among the Halymeniales, two blade-like species of *Halymenia*, *H. cromwellii* sp. nov. and *H. stipitata* sp. nov., are distinguished from other species by habit and anatomical differences, including the possession of a stipe by the second. *Halymenia hakalauensis* Tilden 1902 is transferred to *Polyopes* as *P. hakalauensis* (Tilden) Abbott, replacing *P. hawaiiensis* Kajimura which is considered a synonym. A new species of *Prionitis*, *P. corymbifera* sp. nov., shows a corymbose branching pattern different from the mostly pinnate to subdichotomous branching of Japanese and Californian species. In the Gigartinales, *Chondracanthus okamurae* Abbott is named for a specimen which Okamura included in his understanding of *Gigartina* (now *Chondracanthus tenellus*), but which has terete axes, differing from *C. tenellus* (Harvey) Hommersand which is complanate throughout. *Chondracanthus intermedius* (Suringar) Hommersand is placed in synonymy with *C. tenellus*. The occurrence of *C. tenellus* in Hawai'i is a new distribution record from Asia. Three new species are added to the Ceramiales, *Ceramium tranquillum* Meneses (Ceramiales), *Dasya kristeniae* sp. nov. and *Dasya murrayana* Abbott & Millar (Dasyaceae). Distinctive features of *Ceramium tranquillum* are internodes that are three to five times longer than the height of nodes, and nodes that never project beyond the diameter of the internodes, giving straight margins except when fertile. *Dasya kristeniae* is a diminutive epiphyte which is nearly ecorticate, with tetrasporangial stichidia that are rectangular having apices that are curved or nodding, and cystocarps that have flaring ostioles above a constricted pericarp. *Dasya murrayana* was earlier misidentified with *Dasya iyengarii* Børgesen, and re-examination of those plants show continuous cortication throughout, where cortication is almost completely lacking in *D. iyengarii* except near the base. *Dasya murrayana* has a tufted habit, with indeterminate branches about the same sizes as the main axes, the plants grow-

ing on rock, whereas plants of *D. iyengarii* are not tufted, with indeterminate branches attenuate, and an epiphytic habit.

**Key words:** *Ceramium*, *Chondracanthus*, *Dasya*, *Halymenia*, *Polyopes*, *Prionitis*.

## INTRODUCTION

In preparing a manual (Abbott 1998) on the marine red algae of the Hawaiian Islands, several papers have been published on certain members of the family Ceramiaceae (R.E. Norris and Abbott 1992; Abbott and Norris 1993; J.N. Norris *et al.* 1995; Meneses 1995) clearing the way for a book useful to all marine biologists. Abbott (1996) has also treated taxa in families other than the Ceramiaceae, and this paper has a similar goal. This account deals with four species of the family Halymeniaceae, one of the Gigartineae, one of the Ceramiaceae and two of the Dasyaceae. The red algal flora is proving to be richer and more diverse for the subtropics of Hawai'i than had been expected, with 133 genera and 326 species now reported for the Hawaiian Islands.

The geographical location of the Hawaiian Islands, with no island closer than about 600 km and no continental land mass closer than 5000 km, poses many questions about where the nearest immigrants and/or propagules have come from. Amassing a species list and trying to correlate the direction from which propagules could have come to contribute to the diversity of marine algae in the mid-north-Pacific has been a long-term study. Despite the richness of species, no clear biogeographic affinities are evident at this time, mostly because similar intensive studies of Pacific tropical and subtropical Rhodophyta are not available. Several conspicuous taxa (such as *Predaea* and *Gibsmithia*) are shared between the Great Barrier Reef (Kraft 1984; Kraft 1986, respectively), and Hawai'i, as are *Acrosymphyton* (Millar and Kraft 1984) and *Dudresnaya* (Robins and Kraft 1985). *Ossiella* (Millar and Abbott 1997), a

Communicating editor: R. King.

Received 27 August 1997; accepted 15 January 1998.

member of the Ceramiaceae, is a new genus shared between Norfolk Island and the Hawaiian Islands. Other genera such as *Callidictyon* J.N. Norris *et al.* (1995), and *Peleophycus* (Abbott 1984) do not have close relatives anywhere.

Continuing collections in the Hawaiian Islands are adding many new species to an already species-rich flora. Smith (1992) provided new additions from basalt habitats on Hawai'i Island that showed interestingly different community structures than those occurring on eroded coral of older islands (i.e. Kaua'i and O'ahu). Other collections from basalt on Maui Island (Hodgson and Abbott 1992) confirmed the observations that a newly explored kind of substratum offers many species not found in coral reef areas. An earlier study by Abbott (1989) of algae from intertidal to very deep subtidal (to as much as 75 m depth) in the North-west Hawaiian Islands showed species not present in the main, geologically younger Hawaiian Islands, but also provided information on very deep taxa seemingly restricted to the geologically older islands. Additionally, a nearly continuous north-west to south-east distribution of more than a dozen species of small red algae at depths of more than 25 m along the nearly 2200 km chain have been recorded.

## MATERIALS AND METHODS

Field collections were preserved and stored in 4% buffered formaldehyde/seawater and mounted on microscope slides following the methods of Tsuda and Abbott (1985). One of the specimens, a holotype, is *Chondracanthus okamuræ* in Hokkaido University Herbarium (SAP). All other specimens are Hawaiian and types have been placed in Bishop Museum (BISH). Both herbarium specimens and microscope slides labeled IA followed by a number are in collections of I. Abbott at the University of Hawai'i with the intention of transferring them to the Bishop Museum in Honolulu.

## RESULTS AND OBSERVATIONS

### Family Halymeniaceae (Order Halymeniales)

#### *Halymenia cromwellii* Abbott sp. nov. Figs 1–3

Plants arising from fleshy holdfasts with relatively short leathery stipes about 5 mm long, gradually broadening into simple blades with lacerated margins (Fig. 1) or strap-like lobes with large or small teeth which are remnants of shed lateral lobes; blades 7–12 cm long, 1–3 cm wide; later lobes to 4 mm wide, some lobes simple, others pinnately cleft. In cross-section, blades 250–400  $\mu\text{m}$  thick, the medulla (Fig. 2) with many anticlinal filaments crossing from one cortex to the other, the cells of filaments about 10  $\mu\text{m}$  in diameter, five to eight times longer than wide; cortex with densely

branched outer filaments, the inner cortex with frequent stellate cells whose many arms form a plexus; tetrasporangia attached to basal cell of last-formed two-celled cortical filament, 15  $\mu\text{m}$  in diameter, 20–24  $\mu\text{m}$  long, scattered over the surface; spermatangia unknown; cystocarps numerous, 80–100  $\mu\text{m}$  in diameter, scattered over the surface, nearer one surface (perhaps upper) than the other in cross-section, surrounded by numerous ampullar filaments at the base, but with few filaments around the periphery (Fig. 3).

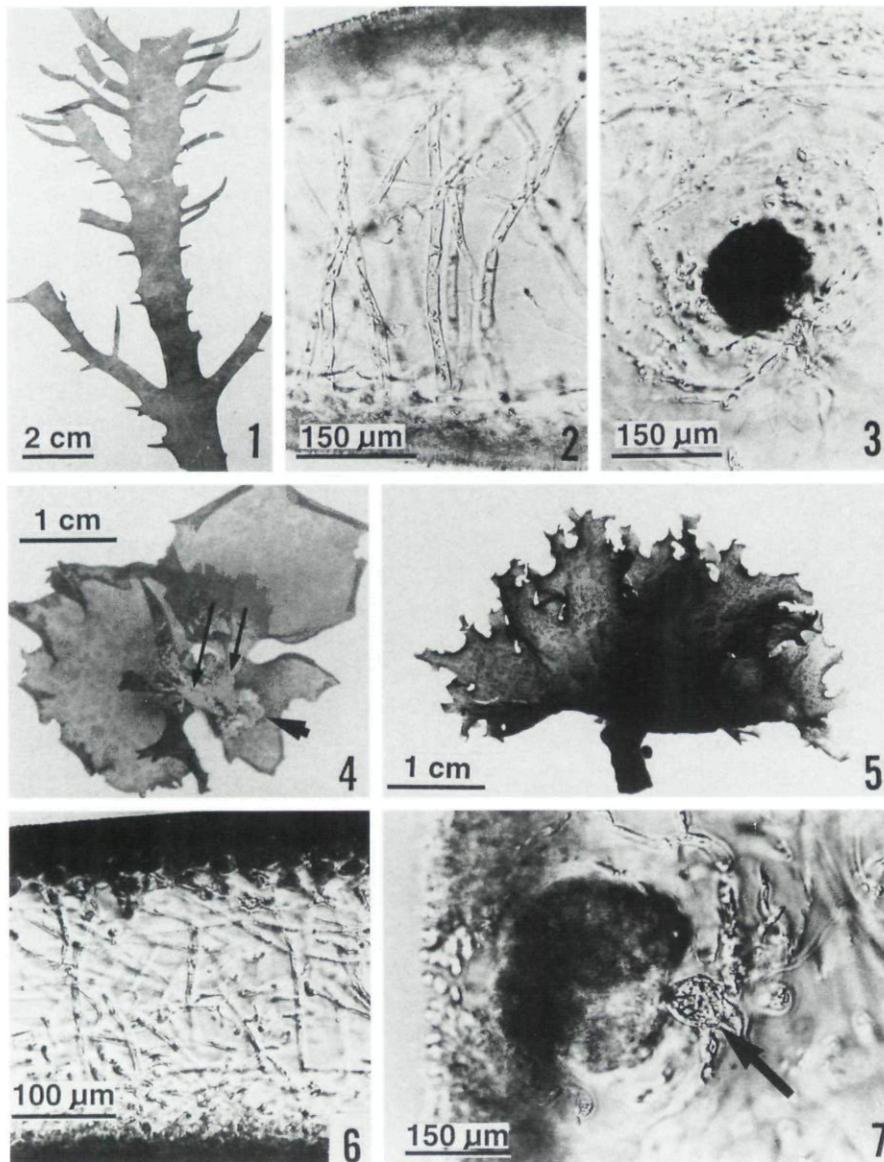
*Plantae carnosae hapteris exorientes stipitibus coriaceis relative brevibus circa 5 mm longis, gradatim latescentes, laminas simplices cientes marginibus laceratis vel ligulatis lobis lateralibus; margines dentibus magnis vel parvis qui vestigia loborum lateralium exutorum sunt; laminae 7–12 cm longae, 1–3 cm latae; lobi laterales usque 4 mm lati, alii lobi simplices, alii pinnatifidi. In sectione transversa, laminae circa 250–400  $\mu\text{m}$  crassae, medulla filis multis anticlinatis ex altero cortice ad alterum currentibus, cellulae filorum circa 10  $\mu\text{m}$  diametro, 5–8 plo longiores quam latiores; cortex filis exterioribus spisse ramosis, cortex interior densis cellulis stellatis, quarum multa brachia plexum formant; tetrasporangia ad basalem cellulam postremifacti bi-cellularis filii corticalis affixa, 15  $\mu\text{m}$  diametro, 20–24  $\mu\text{m}$  longa, in pagina dispersa; spermatangia incognita; cystocarpia plurima, 80–100  $\mu\text{m}$  diametro, in pagina conspersa, propinquiora ad alteram paginam (forsan superiorem) quam alteram in sectione transversa, numerosis filis ampullae basi circumnexta, sed paucis filis circum peripheriam.*

Holotype: dredged by R.V. *Townsend Cromwell* at 40 fathoms (75 m) on coral rubble between La'nai and Molo'ka'i Islands, Hawaiian Islands, 21°09'41'N, 157°18'08'W, December 5 1990, Cruise 90–26, Station 25 (BISH 625754).

Other material examined: dredged by R.V. *Townsend Cromwell* Cruise 90–10, Station 16, October 1990, at the same location but a different station and date from the holotype. Both dredge hauls contained five specimens of the new species.

Etymology: Named in memory of Dr Townsend Cromwell, a distinguished oceanographer after whom an important deep equatorial undercurrent in the Pacific is named. I also wish to honor the research vessel of the National Marine Fisheries Service (the RV *Townsend Cromwell*) from which I have received and studied many superb collections of marine algae from the North-west Hawaiian Islands (NWHI).

Discussion: *Halymenia cromwellii* shows a leathery surface to its strap-like pinnately divided or lacerated frond, a very prominent anticlinal arrangement of medullary filaments reaching from one cortex to the other, and a deep subcortex, with densely branched filaments. No other Hawaiian species has a leathery surface and,



**Figs 1–3.** *Halymenia cromwellii* Abbott. 1. Holotype showing strap-like blade with lacerated laterals. 2. Cross-section of blade showing prominent anticlinal medullary filaments. 3. Cystocarp with mixture of several delicate ampullar and sterile filaments. (BISH 625754). **Figs 4–7.** *Halymenia stipitata* Abbott. 4. Holotype, shown from bottom to display hold-fast (arrowhead) and branched stipe (arrows) (BISH 649008). 5. Lateral view showing lacerated margins on peltate blade and sturdy stipe below (IA 17683). 6. Cross-section of blade showing many periclinal and few anticlinal filaments in medulla (BISH 649008). 7. Cystocarp showing enlarged post-fertilization cells formed from auxiliary cell and adjacent filaments (arrow). (IA 21072.)

indeed, the genus is usually said to be 'soft and mucilaginous' (Womersley and Lewis 1994) and none is strap like. Anticlinally arranged medullary filaments characterize the type species of the genus, *Halymenia floresia* (Clem.) J. Agardh (Codomier 1974), and other species have either an equal number of anticlinal and periclinal medullary filaments, or a predominance of periclinal filaments. I have examined *Halymenia floresia* specimens from the warm Pacific in UC and US, and none is as thick and leathery as *H. cromwellii*, nor are the plants monocious (Womersley and Lewis 1994). Of the Hawaiian species, only *H. cromwellii* has a deep subcortex containing densely branched filaments. A few other species of *Halymenia* have been described from subtidal situations, such as *H. actinophysa* Howe from the Gulf of California, but none from as deep as *H. cromwellii*.

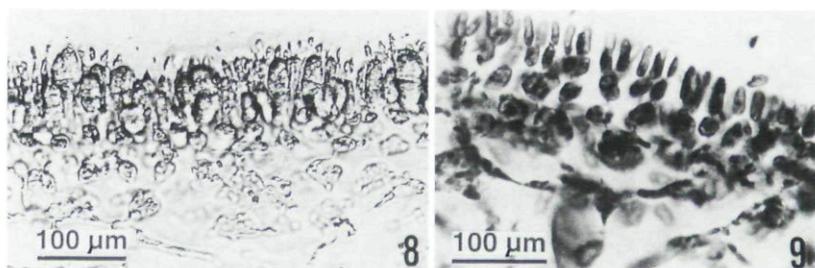
Until very recently, *Halymenia formosa* J. Agardh was thought to be the only species of the genus in Hawaii.

It is moderately common, and eagerly sought as a fresh salad ingredient by many ethnic groups. In the manual mentioned above (Abbott 1998), however, *H. actinophysa* Howe has been added, as well as *Halymenia chiangiana* Abbott & Kraft in Kraft and Abbott (1997), and adding the two species in this paper brings the total number of *Halymenia* species for Hawai'i to five. All five species have some morphological features that make them easy to distinguish, but as with all blade-like *Halymenia* their critical distinctions are best seen in microscope slide preparations.

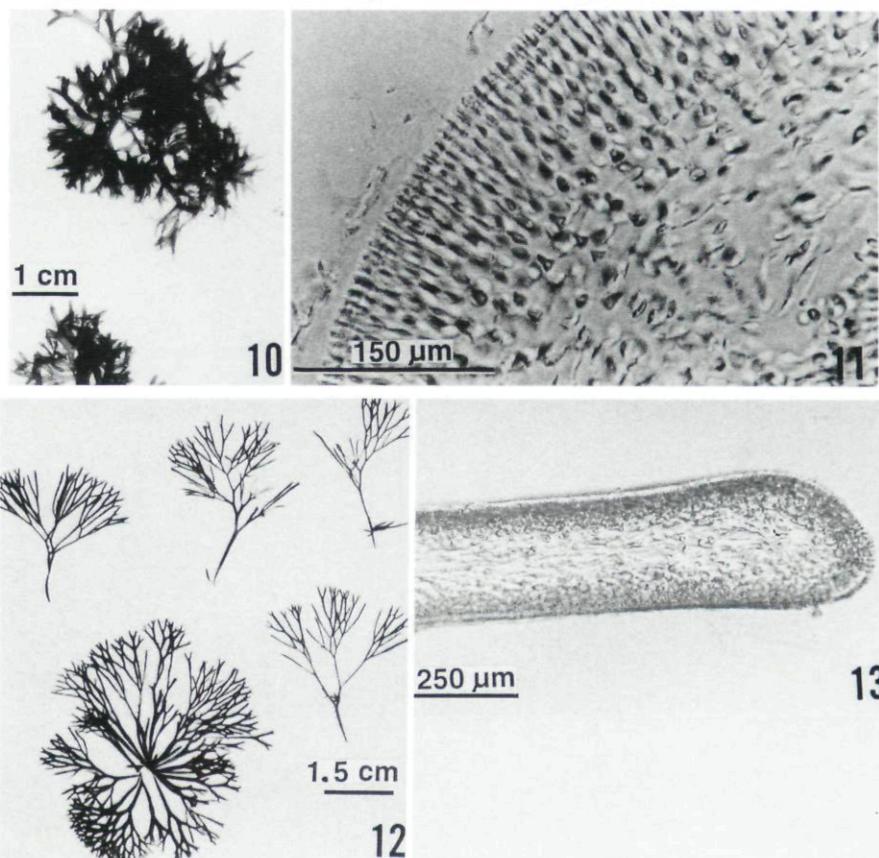
*Halymenia stipitata* Abbott, sp. nov. Figs 4–9

*Halymenia maculata sensu* Abbott, *Pac. Sci.* 50, p. 153, Fig. 24, 1996 non J. Agardh, *Lunds Univ. Arsskrift* 21 (8); p. 12, 1885.

Plants 5–7 cm tall, brownish red, attached by a conspicuous cartilaginous or inflexible stipe (Figs 4,5) less



**Figs 8,9.** *Halymenia stipitata* Abbott. 8. Cross-section of tetrasporangial sorus showing two-layered subcortical cells joining periclinal filaments (BISH 649008). 9. Three-celled cortical layer with outer cortical cells elongated (BISH 649008). **Figs 10,11.** *Polyopes hakalauensis* (Tilden) Abbott. 10. Habit of clusters of flattened branching fronds. 11. Cross-section through cortex and part of medulla, showing cortical cells in deep straight rows. (Both, US 56541). **Figs 12,13.** *Prionitis corymbifera* Abbott. 12. Habit showing corymbose clusters of branches, and a few detached branches showing branching in detail. 13. Cross-section of frond showing medulla to be about twice the size of the combined cortices. (Both, BISH 649023.)



than 1–2 cm long, or with the lower part thickened but not stipitate. If stipe is branched (Fig. 4) or unbranched (Fig. 5), then blades arising in funnel shape, becoming peltate (Fig. 5), simple or cleft, tearing and growing irregularly with advanced age, with crenulate or fringed margins; if stipe is lacking but holdfast is scutate and thickened, then blades not peltate, but blade thickening and tearing apply; surfaces of blades not leathery, and while slippery is not soft. When tetrasporangial or cystocarpic, surfaces may be mottled. In cross-section (Fig. 6), blades 250–400 µm thick; cortex with three layers of cells, the outermost cells elongate like rabbit ears (Fig. 9) with a mean measurement of  $2 \times 26$  µm (range = 1.8–2.3 µm by 24–28 µm,  $n = 20$ ) and the inner two layers grading into a subcortex of three layers of broadly triangular cells 25–30 µm in diameter, these attached to each other and to periclinal filaments (Fig. 8) about 3 µm thick except at ganglionic junctions where four to five filaments join to form a centre 8 µm in diameter; arms of such stellate cells may reach

500 µm; anticlinal medullary filaments (Fig. 6) infrequent, about 5 µm in diameter; periclinal filaments beneath subcortex, usually not in central medulla. Tetrasporangial sori (Fig. 8) clearly visible, more numerous on the ventral than dorsal surfaces, sporangia 13–15 µm wide, 28–39 µm long; spermatangia not seen; cystocarps inconspicuously scattered, 250–300 µm in diameter in section when mature, composed of two to three gonimolobes (Fig. 7) each maturing in turn; spore mass surrounded by conspicuous network of sterile filaments, the lowermost cells of the ampullar network (Fig. 7, arrow) shortened and thickened to twice the diameter (10 µm) of other cells of the network.

*Plantae 5–7 cm altae, rubiginosae, affixae per conspicuos stipites cartilagineos vel non flexibiles usque 1 cm longos, 0.5 diametro, vel inferiore parte incrassata autem non stipitata. Laminae simplices vel fissae, aetate provecta scindentis et crescentes*

*irregulariter, marginibus crenulatis vel fimbriatis; superficies laminarum lubricae, si tetrasporangiferae tumetiam masculatae. In sectione transversa, laminae 250–400  $\mu\text{m}$  crassae; cortex tribus stratis cellularum, extimae cellulae elongatae instar auricularum leporis, duo strata interiora in subcorticem transientia; subcortex 2–3 stratis cellularum late triangularium 25–30  $\mu\text{m}$  diametro, cellulae subcorticis affixae in filis periclinatis circa 3  $\mu\text{m}$  crassis praeter juncturas ganglioneas ubi 4–5 fila jungunt formare centrum 8  $\mu\text{m}$  diametro. Sori tetrasporangiorum sine magnificatione visibiles, plus numerosi paginis dorsalibus quam ventralibus, sporangia 13–15  $\mu\text{m}$  lata, 28–39  $\mu\text{m}$  longa; spermatangia non visa; cystocarpia 250–300  $\mu\text{m}$  diametro ubi matura, ex duobus vel tribus gonimolobis maturescentibus invicem constata; massa sporarum conspicuo plexu filorum sterilium circumnixa, infimae cellulae plexus abbreviatae et incrassatae ad bis diametrum (10  $\mu\text{m}$ ) aliarum cellularum plexus.*

Holotype: I. Abbott 19023 (BISH 649008), Waikiki, off Queen's Surf, O'ahu Island, Hawaiian islands, leg. Jane Lewis, Jan. 18 1989. Tetrasporangial.

Habitat: Low intertidal under shady ledges with considerable water motion to about 2 m depth.

Etymology: Named for the conspicuously tenacious stipes, or the very thickened scutate holdfast. Other material examined: O'ahu I.: between Moku o Loe and Mkapu Peninsula, leg. M.S. Doty (Doty 8762), March 23 1951; Waikiki, IA 18515, leg. Jane Lewis, October 4 1987; Ka'alawai, IA 17683, leg. W. H. Magruder, February 17 1986; same place and date, IA 17684, leg. W. H. Magruder & K. McDermid (three young plants showing conspicuous stipes). Maui I.: Waiehu, IA 21072, leg. Audrey Asahina, Oct. 1992; Kanaha Beach Park, IA 22688, leg. I.A. Abbott & L.M. Hodgson, Nov. 23 1995 in drift; Launiupoko, IA 14670, leg. D. P. Abbott & I.A. Abbott, August 31 1976; Honokowai, IA 22020, leg. L. M. Hodgson, October 22 1994.

Discussion: *Halymenia stipitata* is unique in *Halymenia* in having a conspicuous, tough stipe, similar to that of *Constantinea* (Dumontiaceae) of the central to north-west Coast of North America and the northern coasts of Japan (Abbott and Hollenberg 1976) and not known in other species of *Halymenia*. In cross-section, the outer cortex consists of two to three-celled filaments, the outermost having nearly linear shapes, and the inner cortex of two to three-celled filaments having irregularly shaped but mostly triangular cells which gradually grade into occasional stellate cells with elongate arms becoming periclinal filaments which are more common than anticlinal filaments. Unlike *H. cromwellii* and *H. floresia* (Clem.) J. Agardh, there are relatively few anticlinal filaments in the medulla. Unlike other species of *Halymenia* in the Pacific, the auxiliary cell

and adjoining cells enlarge considerably beneath the carposporangial mass.

This species was mistakenly allied to *H. maculata* (Abbott 1996), owing to the similar torn and lacerated margins seen in Fig. 5 and especially to the 'rabbit-ear' cells of the outer cortex seen in Fig. 9 which had been previously illustrated by Børgeesen (1950; Fig. 3) for that species. In critically examining an isotype of *H. maculata* from Mauritius, and other specimens from Vietnam (Dawson 1954b), the plants were four or more times larger than *H. stipitata*, the large blades bearing deep, irregular fringes unlike those of *H. stipitata*, and while the outer cortical cells were very similarly elongate, the subcortex was thin, being only about two layers thick. The main distinction was the lack of a stout stipe that characterizes *H. stipitata*.

*Polyopes hakalauensis* (Tilden) Abbott, comb. nov.  
Figs 10, 11

Basionym: *Halymenia hakalauensis* Tilden, American Algae exsiccatae no. 506 1902.

Synonym: *Polyopes hawaiiensis* Kajimura, *Bot. mar.* 33:127–131 1990.

Plants 2–3 cm tall, forming dense maroon imbricate fronds in flattened clusters (Fig. 10); holdfasts discoid, frequently laterally joined to adjacent holdfasts; stipes short, compressed, the fronds lightly compressed below, more strongly compressed above; about 500  $\mu\text{m}$  wide at mid-frond, 200  $\mu\text{m}$  thick at mostly blunt apices; branching repeatedly subdichotomous, with occasional adventitious laterals or proliferations in upper portions of plant; in cross-section, medullary filaments delicate, between 3 and 5  $\mu\text{m}$  in diameter, anastomosing, the cells relatively short, often only three times longer than their diameters; cortex (Fig. 11) occupying more than one-half of the thickness of cross-sections, cortical filaments dense, little-branched, composed of straight lines of 20–22 cells, the terminal ones slightly longer than those below.

Tetrasporangia cruciately divided, in nematocia on both flattened surfaces of plant; spermatangia terminating ultimate cortical cells, single or in short chains of two to three cystocarps forming random dark spots near axils, spreading slightly, one to several per cross-section; cystocarp embedded in medulla, with several gonimolobes arising from a fusion cell formed by the auxiliary cell and nearby ampullar cells; sterile filaments few.

Lectotype: Tilden (*American Algae* no. 506), collected at Hakalau, Hawai'i Island, about 16 km north-east of Hilo, 'on boulders, constantly washed by waves at low tide', J. E. Tilden, July 1900. (US 56541).

Isotypes (at least one specimen of the same number in the two copies of *American Algae exsiccatae* in UC; also no. 506 in Herb. MINN). It is assumed that other specimens under this number may be the same species,

but the three specimens that were examined are not identical externally, and sections should be made and compared microscopically before identification.

Habitat: Low intertidal, usually at the bases of large basalt boulders; common north and south-west of Hilo, to Punalu'u, Hawai'i Island.

Etymology: Professor Tilden probably named *Halymenia hakalauensis* for the locality where she found the species, at the mouth of Hakalau stream on the east coast of the island of Hawai'i, Hawaiian Islands.

Other Hawaiian material: Hawaiian islands: Maui I. Honomanu, IA 21722. Hawai'i I.: Wailuku River Bridge, BISH 525262, 525263; Hilo, BISH 515509; near Hilo, UC 622577; Richardson's Bay, IA 22176, IA 22558; Kea'au IA 14508, IA 17611; Punalu'u Beach, BISH 519244, 519255. The distribution of this species is roughly on the eastern and southeastern shores of the island, while the distribution of *Polyopes hawaiiensis* Kajimura was reported from Hilo, and at Punalu'u, south-west of Hilo. Steep cliffs that plunge directly into the sea are characteristic of the area between Hilo and Punalu'u, as well as north of Hilo. The Maui specimen came from the same kind of basaltic substratum.

Discussion: *Halymenia hakalauensis* has not been reported in the Hawaiian literature since its original description. Unlike known *Halymenia* species, *H. hakalauensis* is not bladelike, shows no modified inner cortical cells that are irregular in shape and conspicuous, and has no medullary filaments that are either anticlinal or periclinal arranged. It is thus misplaced in *Halymenia*. It is more appropriately placed in *Polyopes*, as demonstrated on reproductive grounds by Kajimura (1990) when he described *P. hawaiiensis* as a new species. On vegetative grounds, as shown by Womersley and Lewis (1994) the structure of the medulla in *Polyopes* is very different from that known for *Halymenia* species, comprising dense, thin-walled anastomosing medullary filaments that have no arrangements like those shown by all *Halymenia* species.

*Prionitis corymbifera* Abbott, sp. nov. Figs 12,13

Plants to 12 cm tall, complanate, in mid-frond 3–4 mm wide; branching subdichotomous (Fig. 12), lower dichotomies 3–4 cm apart, successive intervals shortening distally, with ultimate three to four divisions of equal length, forming rounded corymb of branches on most specimens; apices of most branches with acute tips; mature plants inflexible, young plants frequently showing inflated branches; proliferations frequent, clustered, most abundant at lower dichotomies; cross-sections of mature axes 300–400  $\mu\text{m}$  thick, 0.9–1.2 mm wide, the medulla two to four times thicker than the surrounding cortical layers (Fig. 13), composed of dense intertwining filaments just under 2  $\mu\text{m}$  diameter, resembling rhizoids with very thickened walls; cortex of

tightly appressed filaments with small cells, a three to four-layered inner cortex of cells of different sizes and shapes than cells of outer cortex connected to at least one layer of periclinal medullary filaments which soon mingle with other indistinguishable medullary filaments; cystocarps aggregated in main axes between dichotomies, occasionally invading younger branches, up to four cystocarps seen in a given cross-section, each about 250  $\mu\text{m}$  in diameter with carposporangia arranged in discrete gonimolobes; sterile filaments sparse and inconspicuous; stalk cell not seen. No spermatangial or tetrasporangial material seen.

*Plantae usque ad 12 cm altae, complanatae. Dichotomiae inferiores 3–4 cm distantes. Spatia successiva celeriter breviora divisionibus ultimatis 3–4 aequalibus longitudine, corymbos rotundos ramorum in speciminibus plurimis formantia. Proliferationes fasciculatae, abundae ad dichotomias inferiores. Crassae 300–400  $\mu\text{m}$  in sectione transversa visae, usque ad 1.2 mm latae. Medulla crassior 2–4 plo quam omnes stratea corticalia combinata, e filamentis densis et implicatis composita. Filamenta in sectione transversa et longa minus quam 2  $\mu\text{m}$  diametro, parietibus crassis inclusis. Cortex e filamentis confertis appressis et cellulis parvis. Cystocarpia in axibus principalibus inter dichotomias aggregata, aliquando ramos juniores invadentia. Cystocarpia 1–4 in sectione transversa,  $\approx$  250  $\mu\text{m}$  diametro. Carposporangia in gonimolobis disposita. Filamenta sterilia sparsa et inconspicua. Cellula stipitis non visa. Materiae spermatangi et tetrasporangii non visae.*

Holotype: I.A. Abbott 17220, O'ahu I., Kai'aka Bay near Waialua River mouth, leg. Earl Zablackis, May 8 1985 (BISH 649023). The specimen is cystocarpic. Two isotype sheets under the same number have been distributed to Hokkaido University (SAP) and the U.S. National Herbarium (US).

Habitat: low intertidal to 4 m depths on lava rock and around bases of large boulders.

Etymology: This *Prionitis* is named for the corymbose appearance of the shortening branches, an uncommon shape for species in this genus. Other material examined (in BISH): Maui I., I.A. Abbott 22002, Napili Bay, 3–5 m depths on boulders, leg. Donna Liddicote, Aug. 10 1994. Hawai'i I., I. A. Abbott 17611, Kea'au, intertidal lava bench, leg. Heather Fortner, Sept. 19–21 1975.

Discussion: *Prionitis corymbifera* in the Hawaiian flora is distinct because of its narrow, flattened fronds with adventitious or proliferous branchlets near dichotomies. In cross-sections, the frond is clearly filamentous in construction of cortex and medulla and, in general, with reproductive structures similar to other Halymeniaceae. However, in structural details of the medulla where the filaments are very numerous and congested, it is unlike all other Hawaiian Halymeniaceae where medullary fil-

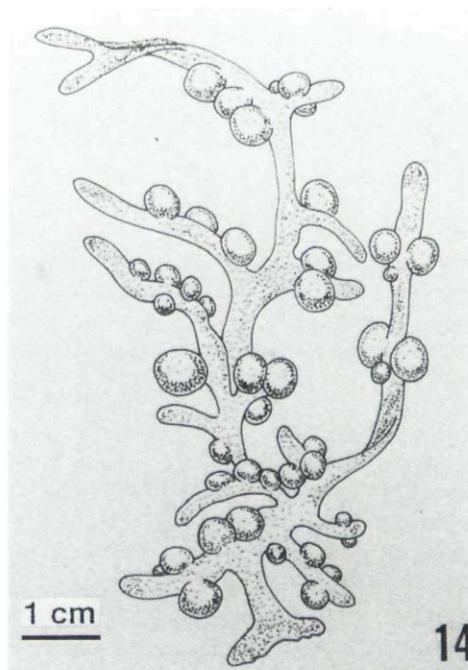
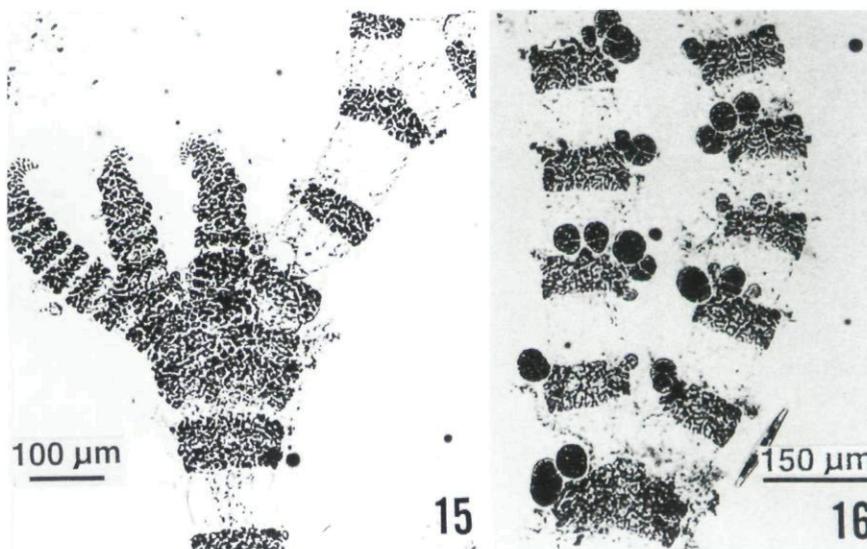


Fig. 14. *Chondracanthus okamurae* Abbott. Habit of holotype in Okamura herbarium (SAP). Figs 15, 16. *Ceramium tranquillum* Meneses. 15. Cystocarp attached to axis which continues growth, and surrounded by shortened sterile branches (BISH 649009). 16. Mid-portion of fronds showing that internodes and nodes are of similar lengths, that internodes do not project beyond nodal bands, and that tetrasporangia are not involucrate (Meneses 785).



aments are easily separable from their neighbors. The details of cystocarp development in this species are not significantly different from those of *Prionitis lanceolata* (Harvey) Harvey, the generitype (Chiang 1970). *Prionitis* species are numerous from the cool-water coastlines of Pacific North and South America (Dawson 1954a; Abbott and Hollenberg 1976) to the subtemperate to temperate waters off Japan (Kawaguchi 1989), but usually are not associated with the tropics. Similar taxa in the subtropics or tropics of Japan and nearby islands were placed in *Carpopeltis* by Okamura (1899), but recently Kawaguchi (1989) removed three of them to *Prionitis*. One of them, *P. divaricata* (Okamura) Kawaguchi is similar to *P. corymbifera* in gross morphology of tufted plants showing flattened subdichotomously divided branches, but fronds are wider and branching more continuous from base to apex than in *P. corym-*

*bifera*. The development of the cystocarp in *P. divaricata* is different in having an elaborate fusion cell (Kawaguchi 1989; Fig. 27(E)-(F) which is lacking in *P. corymbifera*.

#### Family Gigartinaceae (Gigartinales)

*Chondracanthus okamurae* Abbott, sp. nov. Fig. 14

*Gigartina intermedia sensu* Okamura (1909, pp. 172–173, pl. 35, Figs 1–5), non Suringar *et al.* 17 B 1870 [*Chondracanthus tenellus* (Harvey) Hommersand].

Fronds forming low, pulvinate clumps, with individual fronds overlapping, up to 3 cm long; bases crowded, each frond arising from primary holdfasts with secondary holdfasts forming from repent subcylindrical axes; erect axes subcylindrical to compressed, unilaterally to

pinnately or irregularly branched, apices broadly oblanceolate to acuminate; in cross-section axes 170–185  $\mu\text{m}$  diameter, with pigmented cortex occupying about half of width, the basal cells of the cortical filaments about 5  $\mu\text{m}$  diameter, decreasing to about half over the penultimate and ultimate cells; cortical filaments very dense; medulla of irregular mostly periclinial, often anastomosing, colorless filaments. Cystocarps almost globular, sessile, often a few aggregating together along margins of fronds. No spermatangia or tetrasporangia seen.

*Plantae caespites humiles pulvinatosque formantes. Frondes singulae imbricatae, usque ad 3 cm longae. Bases confertae. Omnis planta ex hapteronibus primariis exoriens, hapteronibus secundariis ex axibus repentibus subcylindricis. Axes erecti subcompressi, unilateraliter ad pinnatim aut irregularieter ramosi. Apices oblanceolati ad acuminatos. Cystocarpia paene globosa, sessilia, pauca saepe per margines frondium aggregata. Alia fecundatio ignota.*

Holotype: the specimen illustrated in Fig. 3 of Okamura (1909; pl. 35) as *Gigartina intermedia*. It is housed in the Okamura herbarium (SAP).

Etymology: named for the pioneering and distinguished Japanese phycologist, Kintaro Okamura, whose contributions to the marine algae of Japan are legendary.

Other material examined: The specimen illustrated here (Fig. 14) is in the Okamura herbarium (SAP) and while its collection locality is not specifically stated, it may be taken to be from central Honshu as are the few other specimens in the folder. In Hawai'i, it has been collected on O'ahu Island at 'Ewa Beach, IA 1035 and on Maui Island at Hana Bay, IA 14558, IA 14562a, all in BISH.

Discussion: This description applies only to a single specimen which is illustrated by Okamura (1909; pl. 35, Fig. 3), and which was examined in SAP, in an effort to find a specimen with which Hawaiian material could be associated. The folder in which it was found was labeled *Gigartina intermedia* Suringar. The purpose of singling out this specimen is to emphasize the subcylindrical repent axes, not at all like *Chondracanthus tenellus* (Harvey) Hommersand (= *Gigartina tenella*) examined in SAP and UC where all plants are flattened, and often canaliculate, a feature common to flattened fronds on drying. Millar (1990) associated his Australian plants with *Gigartina intermedia* Suringar (now *Chondracanthus intermedius* (Suringar) Hommersand) and suggested that specimens he had examined from Japan, Taiwan, and Australia resembled some from the Atlantic where *Gigartina acicularis* (Wulfen) Lamouroux (now *Chondracanthus acicularis* (Roth) Fredericq) was the name used. He further stated that should all of these species be conspecific, this name must be used because of priority. Until such a time, *Chondracanthus*

*tenellus* (Harvey) Hommersand (basonym: *Gigartina tenella* Harvey 1859) is suggested for Pacific specimens, using Okamura (1909; pp.159–160, pl. 33, Figs 1–8) as the point of reference.

Removing *C. okamurae* from association with *C. tenellus* allows evaluation of *C. tenellus* itself. Hawaiian material of *C. tenellus* is identical with material from the Ryukyus and southern Japan which was examined in SAP and UC.

According to Hommersand *et al.* (1993), in *Chondracanthus*, the female reproductive structures are borne on ordinary branches, pinnules or papillae as shown in Okamura (1909; pl. 35, Fig. 3) for *C. okamurae* and that gonimoblasts penetrate the envelope filaments. Sections made from the Okamura specimen fractured upon sectioning and it was not possible to determine this in the 95-year-old specimen.

The type locality of *Gigartina tenella* is in the Ryukyu Islands, about the same latitude north of the Equator as are some of the Hawaiian Islands. While the marine flora of the Hawaiian Islands is better known at present than are the marine algae of the Ryukyus, an increasing list of similar species is being recorded from both archipelagos.

## Order Ceramiales, family Ceramiaceae

### *Ceramium tranquillum* Meneses, sp. nov. Figs 15,16

Plants erect, up to 3.5 cm tall, pseudodichotomously divided, both forks of a dichotomy developing more-or-less equally (Fig. 15), successive forks eight to 11 nodes apart, apices incurved, usually overlapping, often with short, unilateral branchlets crowding behind them; axes 70–80  $\mu\text{m}$  diameter except at basal parts of mature plants where axes may be up to 250  $\mu\text{m}$ ; cortical bands up to 25  $\mu\text{m}$  long, non-protuberant; internodal gaps up to five times filament width; corticating band with seven periaxial cells each with two acropetal and two basipetal filaments, distal and proximal nodal margins straight; primary cells of both acropetal and basipetal filaments often forming short filaments in opposite directions and partially covering periaxial cells. Rhizoids from ventral side of decumbent proximal parts of branches, one per ventral periaxial cell, often several per node; the rhizoids multicellular, unbranched. Tetrasporangial and male plants frequently bearing reproductive nodes over the entire lengths of their axes; tetrasporangia rounded to ellipsoidal, cruciately divided, 50–55  $\mu\text{m}$  diameter, four to six per node on both abaxial and adaxial sides, without involucre (Fig. 16). Male plants with spermatangia incompletely covering nodes. Cystocarps (Fig. 15) near apices of indeterminate branches, abaxial, subtended by two to four modified vegetative branches which may be dichotomously divided. Several cystocarps may be formed linearly, up to six being seen within nine consecutive nodes.

*Plantae erectae, usque ad 3.5 cm altae; ramificatio ad nodum 8–11, pseudodichotome divisa, saepe longitudinalinis aequantis. Apices incurvati, plerumque imbricati. Axes usque ad 70  $\mu\text{m}$  diam; taenia corticalia usque ad 25  $\mu\text{m}$  longa, latitudinem filamenti non superantia; internodia latiora usque ad 5-plo latitudine filamenti; taenium corticale cellulis 7 periaxialibus quarum omnis filamenta 2 acropetalia et 2 basipetalia habent. Rhizoidea e latere ventrali partium decumbentium proximaliumque ramorum, unum rhizoideum per cellulam periaxiale, et saepe aliquot per nodum, multicellularia, non ramosa et cum aliis filamentis implicata. Plantae tetrasporangiales et maculae per totam longitudinem axium organa reproductionis ferentes. Tetrasporangia rotunda usque ad ellipsoidea, cruciatim divisa, usque 55  $\mu\text{m}$  diam., usque 4 per nodum in latere abaxiali et adaxiali, sine involucri. Spermatangia in plantis masculis nodos non omnino tegens. Cystocarpia ad apices in ramis indeterminatis, abaxialia, filamentis 2–4 involucribus subtenta, aliquando dichotome ramosa.*

Holotype: I. Meneses 766, from shallow reef flat around Moku o Loe, Kane'ohe Bay, O'ahu I., leg. I. Meneses, March 1988. The holotype is on a microscope slide, deposited as BISH 649009 and is cystocarpic. Isotype and other slides are also in BISH.

Habitat: Low intertidal on eroded coral in calm water, inside a reef.

Etymology: named for the calm and quiet habitat which may be responsible for allowing relatively long dichotomies in the branches to develop, an erect habit, and nodes not very different in width from adjacent internodes, the nodes with strict cellular boundaries.

Discussion: Among the 19 species of Hawaiian *Ceramium*, several of them can be distinguished as erect, more than 2.5 cm tall, and with regularly divided branching. These are *C. aduncum*, *C. clarionensis*, and *C. tranquillum*. The nodes of all three species are well developed with six to 11 periaxial cells, lacking pseudoperiaxials, and nodal cortication projecting slightly beyond the axial cell in *C. aduncum*, seven to eight periaxial and seven to eight pseudoperiaxial cells and nodal cortication constricted in *C. clarionensis*, while *C. tranquillum* shows seven periaxial cells, no pseudoperiaxials and nodal cortication not projecting beyond the axial cell margins. These three species are among the more robust species of *Ceramium* in the Hawaiian flora, their proximal filaments frequently more than 250  $\mu\text{m}$  in diameter. The architecture of the upper parts of the fronds of all three species is generally similar, each species having forcipate tips which, while common in many species of *Ceramium*, is a habit in the minority among the Hawaiian species. So far, *C. tranquillum* has only been found in the relatively calm waters around Moku o Loe (Coconut Island) in Kane'ohe Bay (Meneses 1990), whereas the two other species are widely dis-

tributed in Hawaiian waters, including habitats with greater water motion. One of its most distinctive features is the linear position of cystocarps within the same frond; usually cystocarps terminate in the indeterminate branch that bears them but, in this species, axes continue to elongate and form more cystocarps.

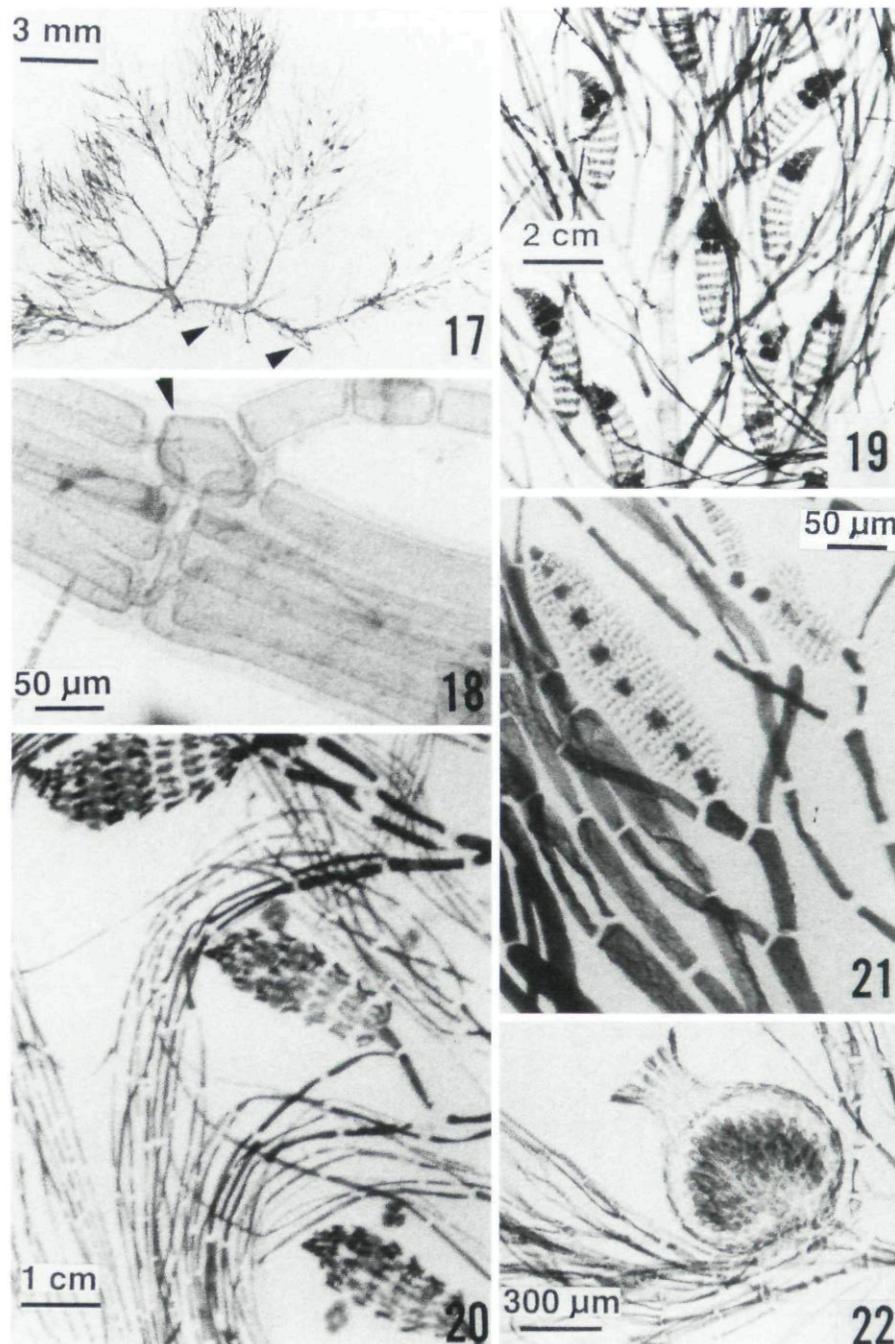
Although many species of *Ceramium* that Meneses (1990) had included in her PhD dissertation were later reported and confirmed by Norris and Abbott (1992), indicating that they were common, *C. tranquillum* was not one of them, and remains rare.

## Order Ceramiales, family Dasyaceae.

### *Dasya kristeniae* Abbott, sp. nov. Figs 19–22

Plants epiphytic from a creeping base, giving rise to several erect and partly decumbent axes (Fig. 17); erect axes often becoming detached from base, forming erect axes and one to several short, digitate holdfasts (Fig. 17, arrowheads), the basis of individual plants; plants between 3 and 5 mm tall common, those between 1.5 and 2 cm rare; plants producing indeterminate branches irregularly, some axes having none; main axes 150–180  $\mu\text{m}$  in diameter common, 200–250  $\mu\text{m}$  in diameter rare; pericentral cells four, with L/D three to four; plants lightly corticated in lower portions, distal parts of plants to about mid-frond level totally ecorticate; axes sparingly branched with branching near apices, the apices describing a corymb with long, slender tips of pseudolaterals extending well beyond the apices; pseudolaterals (monosiphonous filaments) in 2/5 spiral arrangement, basal cell (Fig. 18) large and conspicuous, rounded with angular corners, about 60  $\mu\text{m}$  in diameter the pseudolaterals frequently more than 1 mm long, divided five to six times (more numerous divisions in fertile plants), with as many as 20 cells beyond the last division, thus forming slender clusters around and above the apices; lower cells of pseudolaterals (Fig. 18) 25–35  $\mu\text{m}$ , gradually becoming more slender proximally; distal parts of laterals slightly to never incurved. Tetrasporangial stichidia nearly as long as wide with five to six tiers when first forming tetrasporangia (Fig. 20), becoming 280–300  $\mu\text{m}$  long by 100  $\mu\text{m}$  wide (Fig. 19) and with more than 15 tiers, with four sporangia per segment; apices of tetrasporangial stichidia usually slightly curved downward (Figs 19,20) but straight when fully mature. Spermatangial branchlets 200–300  $\mu\text{m}$  long, 50  $\mu\text{m}$  wide, occasionally in pairs, sessile or with one-celled stalk (Fig. 21); cystocarps urceolate when young, 500  $\mu\text{m}$  long, 525–600  $\mu\text{m}$  wide, the broad base occupying two to three segments; pericarpic cells twice as long as broad, the ostiolar cells shorter and broader; about one out of four of the cystocarps seen show a constriction below a flaring ostiole (Fig. 22).

*Plantae epiphyticae, 1–2 axibus erectis vel partim decumbentibus usque 2 cm longis, hapteris digitatis*



**Figs 17–22.** *Dasya kristeniae* Abbott. 17. Habit of tetrasporangial plant with decumbent branch forming erect axes opposite secondary holdfasts (arrowheads) which will become detached, forming separate plants (IA 21423). 18. Large and angular basal cell of pseudolateral (arrow) and lower portion of this monosiphonous filament (IA 21417). 19. Tetrasporangial plant showing pseudolaterals and tetrasporangial stichidia (IA 21417). 20. Three young tetrasporangial stichidia that are beginning to form tetrasporangia amid pseudolaterals (IA 21417). 21. Two spermatangial stichidia forming as one of a pair at dichotomies (IA 21769). 22. Mature cystocarp with flaring lip on ostiole (BISH 624025).

*exorientibus; axes principales 150–250 diametro, cellulis pericentralibus quatuor; plantae leviter corticatae prope basim, cetera ecorticatae. Plantae paucis ramis parte inferiore, plerumque ramosae parte superiore, apicibus corymbum facientibus; rami pseudolaterales in 2/5 spiram dispositi, cellula basali magna et prominenti, circa 60 μm diametro; partes distales ramorum pseudolateralium parum vel nunquam incurvatae. Stichidia tetrasporangiorum 300 μm longa, 100 μm lata, ordinibus instar maenianorum usque 10, quatuor sporangiis in quoque segmento, Ramuli spermatangiorum 200–300 μm longi, 40 μm lati, plerumque binatim. Cystocarpia urceolata, 500 μm longa, usque 600 μm lata, basi lata 2–3 swegmenta*

*occupanti; cellulae pericarpium rectangulares, cellulae ostioli breviores et latiores. Ostiola cystocarpiorum plene maturorum labia patula habent.*

Holotype: on a microscope slide, BISH 624025, dredged by RV *Townsend Cromwell* near Necker Island, 7 July 1991, 34.8 m depth, epiphytic on *Padina* sp. and *Halimeda* sp. The holotype is cystocarpic. Isotypes, containing spermatangial and tetrasporangial plants, are on four other slides from the same collection.

Habitat: Relatively uncommon in low intertidal and shallow subtidal (to 10 m depths), the bulk of the specimens have been dredged to depths of 148 m. The type locality, Necker Island, is near 23.5° N Lat.

Etymology: *Dasya kristeniae* is named for my colleague Kristen Schlech who introduced me to the intricacies of the Dasyaceae, which would have taken me much longer to learn on my own. I am glad to acknowledge her teaching and friendship.

Other material examined: NWHI: Pearl & Hermes Reef, Lisianski I., Laysan I.; Maro I., and 14 collections from Necker I., the type locality, all dredged by RV *Townsend Cromwell* from 14 to 74 fathoms depth (38–148 m depths). The low intertidal and shallow subtidal main Hawaiian Islands collections were in the range of 1–10 m depths. O'ahu I.: Makapu'u Pt., IA 22030 L. Moloka'i I.: Penguin Bank, Doty 19140–21. Maui I.: Hokuula, IA 14830; south of Launiupoko, IA 21565; Wahikuli, IA 21454, 21526, 21532; Kahekili Park, IA 21946; Honokowai, IA 21883, IA 21769; Honokaena Cove, IA 21417, 21420, 21423. Hawai'i I.: 1.5 km north of Kawaihae, IA 18620, 18744. The bulk of these collections is on microscope slides in Bishop Museum.

Discussion: *Dasya kristeniae* is similar to *D. iyengarii* Børgesen (1937), first described from India, and more recently by Millar (1990) and Price and Scott (1992) from Australia. The two taxa share several features in common: (i) the plants are nearly ecorticate; (ii) the basal cell of the pseudolaterals is conspicuous in both its large size and angular shape; and (iii) lateral indeterminate branches are disposed irregularly. *Dasya kristeniae* differs from *D. iyengarii* Børgesen in that: (i) the pseudolaterals are dichotomously branched up to five times whereas in *D. iyengarii* they are divided once or twice in the illustrations of Millar (1990; fig. 58B), and Price and Scott (1992; fig. 53A,B); (ii) the tips of the pseudolaterals are strongly incurved in *D. iyengarii* as shown by Millar (1990; fig. 58B) and Price and Scott (1992; fig. 53A,C), whereas in *D. kristeniae* they are not incurved; (iii) the tetrasporangial stichidia do not bear sterile tips as mentioned by Børgesen (1937; Fig. 17), nor continue elongation as illustrated by Millar (1990; fig. 58F); and (iv) spermatangial stichidia do not have two-celled stalks, nor do they have sterile terminal cells as shown by Price and Scott (1992; fig. 53D). In *D. kristeniae*, both tetrasporangial (Fig. 20) and spermatangial (Fig. 21) stichidia are borne at a dichotomy of a pseudolateral filament, or on an epibasal cell that functions as a one-celled stalk that is half of the dichotomous pairing. While occasionally spermatangial stichidia are paired, no paired tetrasporangial stichidia were observed. A significant feature of *D. kristeniae* is the formation of secondary holdfasts below decumbent branches (Fig. 17, arrows), thus providing for detachment as separate, independent plants. These plants are strikingly different from Børgesen's (1937; fig. 16) illustration of *D. iyengarii* which shows a single cluster of delicate monopodial axes without decumbent branches, and Millar's *D. iyengarii* (Millar 1990; fig. 58A) shows a much-branched, squarrose

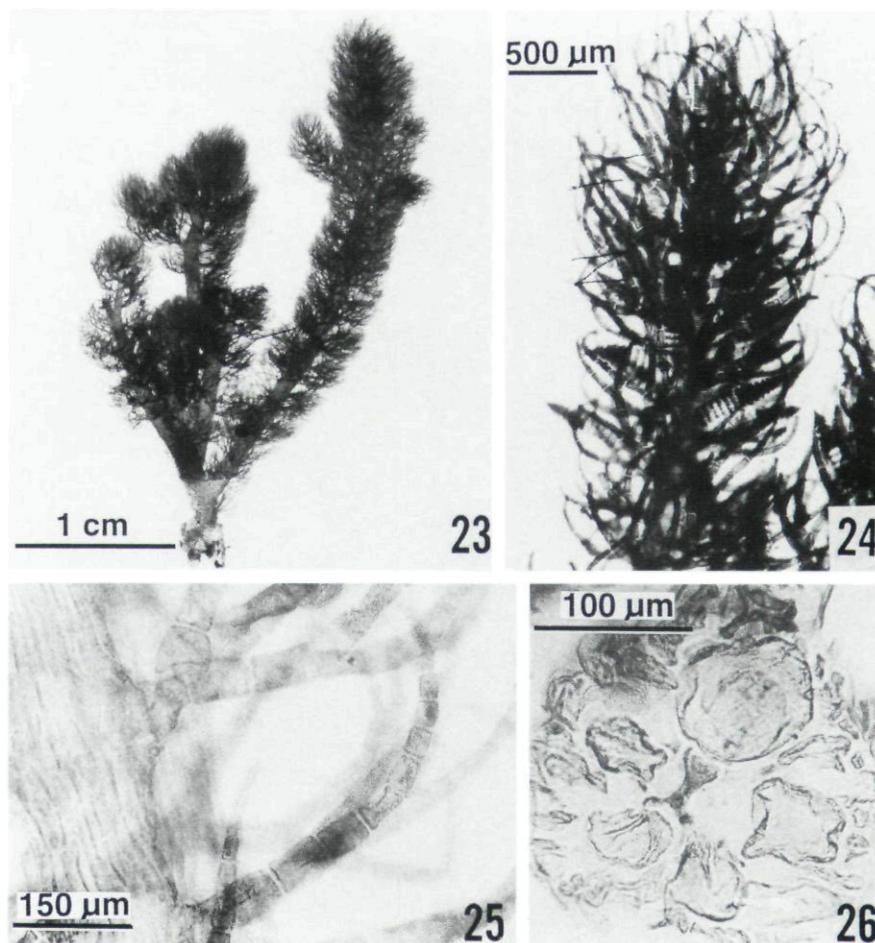
plant, neither resembling the habit shown in Fig. 17, nor the Børgesen plant. Another difference between *Dasya kristeniae* and most species of *Dasya* is the possession of four pericentral cells instead of five, but as is common in many species of the genus, this new species has three postsporangial cover cells. However, Millar (1990) and Price and Scott (1992) described Australian specimens of *D. iyengarii* to have five tetrasporangia per segment, each with two cover cells, further supporting the differences between these two species.

*Dasya murrayana* Abbott & Millar, sp. nov. Figs 23–26

*Dasya iyengarii sensu* Schlech & Abbott, *Pac. Sci.* 43: 339–340, figs 11–16 1989, non Børgesen, *J. Ind. Bot. Soc.* 16 (6): 345 1937.

Plants clumped and tufted, 1–2 cm tall, stupose, holdfast discoid, giving rise to a stipe which branches soon and, in turn, produces one to several sparingly and irregularly branched axes (Fig. 23); pseudolaterals forming distinct whorls less than 2 mm long, forming corymbose heads at branch apices, the filaments in the clusters about 35–45  $\mu\text{m}$  in diameter at their attachment to the basal cell, retaining that width until near their apices, then abruptly tapering through three to five cells to an acute tip (Fig. 25), their lengths varying from 125  $\mu\text{m}$  basally, becoming gradually shorter distally to about 30  $\mu\text{m}$ ; pseudolaterals one per segment, divided subdichotomously four to five times with Y-shaped junction at the axils; axes 260–450  $\mu\text{m}$  in diameter nearly completely corticated by rhizoidal filaments that obscure five pericentral cells (Fig. 26). Tetrasporangial stichidia (Fig. 24) on a one to two-celled pedicel, single or paired, about 540  $\mu\text{m}$  long, with 22–25 tiers, the stichidium oblong-lanceolate to lanceolate, five sporangia per tier, each with three cover cells. Male gametophytes with one to six clusters of spermatangial branches forming at base of branched filament, strongly incurved, between 150 and 200  $\mu\text{m}$  long. Cystocarps sessile, subspherical, ranging between 600 and 750  $\mu\text{m}$  diameter, 1.0–1.5 mm long, the pericarp flask shaped.

*Plantae caespitosae, 1–2 cm altae; hapteron discoideum ex quo unus aut plures axes parce et irregulariter ramosi exorientes. Pseudolateralalia verticilla distincta quae capitula corymbosa ad apices ramorum formant. Pseudolateralalia unum per segmentum, subdichotome 4–5plo divisa, ramosa Y-formiter. Axes 260–350  $\mu\text{m}$  diam., paene omnino filamentis rhizoideis corticati et cellulas 5 pericentrales occultantes. Stichidia in tetrasporis oblonga ad lanceolata, cellulis 3 obtegentibus per sporangium. Gametophyta mascula ramis spermatangialibus basi filamenti ramosi formantibus, fasciculata 1–6, valde incurvata, 150–200  $\mu\text{m}$  longa. Cystocarpia sessilia, sphaerica. Peri-*



**Figs 23–26.** *Dasya murrayana* Abbott et Millar. 23. Tuft of axes on a short stipe (BISH 554804). 24. Tetrasporangial stichidia among shaggy pseudolaterals (BISH 554828). 25. Pseudolaterals, showing acute, curving apices; continuously corticated axis to the left (BISH 554836). 26. Cross-section of axis showing five pericentral cells. (Schlech 264).

*carpium ampulliforme*, 600–750  $\mu\text{m}$  diam., 1.0–1.5 mm longa.

Holotype: Schlech 283, leg. G. Daida, at Lawai Kai, Kaua'i Island, intertidal on lava bench (saxicolous), 0.3–2 m depth (BISH 554836). Isotypes from same collection (BISH 554838).

Habitat: low intertidal on exposed basalt rock, and in shallow tide pools constantly washed by waves; in exposed turf.

Etymology: named in honor of Murray J. Parsons, of Landcare Research, Lincoln, New Zealand, whose contributions to the systematics of the Dasyaceae are without peer.

Other material examined: Kaua'i I.: Lawai Kai, Kaua'i Island IA 15348, leg. Gordon Daida, March 1979 (BISH 554804), IA 15024, leg. G. Daida, November 1978 (BISH 554828, 625718); Kipukai, Schlech 298. O'ahu I.: IA 14869, Kaloko, Sept. 21961. Maui I.: Ohe'o Gulch, HMA 734, Nov. 1978. Hawai'i I.: Schlech 204, Richardson's Bay, *n.d.* (all in BISH).

Discussion: The diagnostic features of *D. murrayana* are its markedly tufted habit, relatively short size, axes that are almost completely corticated by rhizoidal filaments that obscure the pericentral cells, and the pseudolaterals that form corymbose heads at branch apices. In the disposition of its monosiphonous laterals, this

species is of the *Dasya naccarioides* type (Parsons 1975; p. 580, fig. 5) but differs from all described species in that group by the combination of the above-named features.

The name *Dasya iyengarii* was mistakenly applied to these plants by Schlech and Abbott (1989) and, in contrast to a conspicuous feature that aids in the recognition of *D. murrayana*, namely cortication, *D. iyengarii* is a nearly completely uncorticated species, except near the bases.

## ACKNOWLEDGEMENTS

There are many persons who have made collections available to me and, in particular, I thank the National Marine Fisheries Service of NOAA for collections from the RV *Townsend Cromwell*, W. H. Magruder, Lynn Hodgson, Kristen Schlech, Jane Lewis, Karla McDermid, Isabel Meneses, Earl Zablackis, and Audrey Asahina. I further thank Tadao Yoshida, Hokkaido University, James Norris and Robert Sims of the US National Museum, Paul Silva and Richard Moe of the UC herbarium, and Jack Fisher of the Bishop Museum for loans of specimens within their care. I record here my appreciation to Alan Millar and Gerald Kraft for their thoughts upon my interpretations of these species. Dr Millar's experience with the species of *Dasya* was in-

strumental in my critical re-examination of the misidentified material. I acknowledge the support of NSF Grant BSR 8709623 to Dr Magruder and myself for some of the illustrations used in this paper. Others who contributed illustrations were I. Meneses, Kristen Schlech, L. M. Hodgson, Robert Sims and myself. I thank Angela Shipman and Karla McDermid for the Latin translations.

## REFERENCES

- Abbott, I. A. 1984. *Peleophycus multiprocarpium* gen. et sp. nov. (Gloiosiphoniaceae, Rhodophyta). *Pac. Sci.* **38**: 324–32.
- Abbott, I. A. 1989. Marine Algae of the Northwest Hawaiian Islands. *Pac. Sci.* **43**: 223–33.
- Abbott, I. A. 1996. New species and notes on Marine Algae from Hawai'i. *Pac. Sci.* **50**: 142–56.
- Abbott, I. A. 1998. *The Marine Red Algae of the Hawaiian Islands*. Bishop Museum Press, Honolulu, Hawai'i (in press).
- Abbott, I. A. and Hollenberg, G. J. 1976. *Marine Algae of California*. Stanford University Press, Stanford, California, 827pp.
- Abbott, I. A. and Norris, R. E. 1993. New species of Ceramiaceae (Rhodophyta) from the Hawaiian Islands. *Phycologia* **32**: 451–61.
- Agardh, J. 1885. Till Algernes Systematik, Nya Bidrag. (Fjerdeafdel.) *Lunds University Årskrift, Afd. Math. och Naturvetenskap* **21** (8), 117pp., 1pl.
- Børgesen, F. 1937. Contributions to a south Indian marine algal flora II. *J. Indian Bot. Soc.* **16**: 311–57.
- Børgesen, F. 1950. Some marine algae from Mauritius. Additions to the parts previously published. II. *Kgl. Danske Vidensk. Selskab Biol. Meddel.* **18**: 1–45.
- Chiang, Y. M. 1970. Morphological studies of red algae of the family Cryptonemiaceae. *University Calif. Publ. Bot.* **58**: 1–83, 10pls.
- Codomier, L. 1974. Recherches sur la structure et le développement des *Halymenia* C. Ag. (Rhodophycées Cryptonemiales) des côtes de France et de la Méditerranée. *Vie Millieu* **14**: Sér. A:1–42.
- Dawson, E. Y. 1954a. Marine red algae of Pacific Mexico II. *Cryptonemiales (cont.) Allan Hancock Pacific Exped.* **17**: 241–397, 44pls.
- Dawson, E. Y. 1954b. Marine plants in the vicinity of the Institut Océanographique de Nha Trang, Viêt Nam. *Pac. Sci.* **8**: 372–470.
- Harvey, W. H. 1859. Characters of new algae, chiefly from Japan and adjacent regions, collected by Charles Wright in the North Pacific Exploring Expedition under Captain John Rodgers. *Proc. Am. Acad. Arts Sci.* **4**: 327–34.
- Hodgson, L. M. and Abbott, I. A. 1992. Nearshore benthic marine algae of Cape Kinau, Maui. *Bot. mar.* **35**: 535–40.
- Hommersand, M. H., Guiry, M. D., Fredericq, S. and Leister, G. L. 1993. New perspectives in the taxonomy of the Gigartineae (Gigartinales, Rhodophyta). *Hydrobiologia* **260/261**: 105–20, figs. 1–40.
- Kajimura, M. 1990. A new species of *Polyopes* (Halymeniaceae, Rhodophyta) from Hawaii. *Bot. mar.* **33**: 127–31.
- Kawaguchi, S. 1989. The genus *Prionitis* (Halymeniaceae, Rhodophyta) in Japan. *J. Fac. Sci., Hokkaido University, ser. V* **14**: 193–257.
- Kraft, G. T. 1984. The red algal genus *Predaea* (Nemastomataceae, Gigartinales) in Australia. *Phycologia* **23**: 3–20.
- Kraft, G. T. 1986. The genus *Gibsmithia* (Dumontiaceae, Rhodophyta) in Australia. *Phycologia* **25**: 423–47.
- Kraft, G. T. and Abbott, I. A. 1997. *Platoma ardreanum* (Schizymeniaceae, Gigartinales) and *Halymenia chiangi* (Halymeniaceae, Halymeniales), two new species of proliferous, foliose red algae from the Hawaiian islands. *Cryptogamie/Algologie* **18**: 97–116, figs. 1–27.
- Meneses, I. 1990. Taxonomy and morphological variation of the genus *Ceramium* (Rhodophyta, Ceramiales) in Hawai'i. PhD thesis, University Hawaii, Hawaii, 412pp. 15 pls.
- Meneses, I. 1995. Notes on *Ceramium* (Rhodophyta, Ceramiales) from the Hawaiian Islands. *Pac. Sci.* **49**: 165–74.
- Millar, A. J. K. 1990. Marine red algae of the Coffs Harbour region, northern New South Wales. *Austral. Syst. Bot.* **3**: 292–593.
- Millar, A. J. K. and Abbott, I. A. 1997. The new genus and species *Ossiella pacifica* (Griffithsiaeae, Rhodophyta) from Hawai'i and Norfolk Island, Pacific Ocean. *J. Phycol.* **33**: 88–96.
- Millar, A. J. K. and Kraft, G. T. 1984. The red algal genus *Acrosymphyton* (Dumontiaceae, Cryptonemiales) in Australia. *Phycologia* **23**: 135–45.
- Norris, J. N., Abbott, I. A. and Agegian, C. R. 1995. *Callidictyon abyssorum* gen. et sp. nov., a new deep-water, net-forming alga (Rhodophyta). *Pac. Sci.* **49**: 192–201, figs. 1–8.
- Norris, R. E. and Abbott, I. A. 1992. New taxa of Ceramieae (Rhodophyta) from Hawai'i. *Pac. Sci.* **46**: 453–65.
- Okamura, K. 1899. Contributions to the knowledge of the marine algae of Japan III. *Bot. Mag. Tokyo* **13**: 2–10, 35–43.
- Okamura, K. 1909. *Icones of Japanese Algae* Vol. 1. Author, Tokyo, 258pp., 50pls.
- Parsons, M. J. 1975. Morphology and taxonomy of the Dasyaceae and the Lophothalieae (Rhodomelaceae) of the Rhodophyta. *Austral. J. Bot.* **23**: 549–713.
- Price, I. R. and Scott, F. J. 1992. *The turf algal flora of the Great Barrier Reef, Part 1, Rhodophyta*. James Cook University, Townsville, 266pp.
- Robins, P. A. and Kraft, G. T. 1985. Morphology of the type and Australian species of *Dudresnaya* (Dumontiaceae, Rhodophyta). *Phycologia* **24**: 1–34.
- Schlech, K. E. and Abbott, I. A. 1989. Species of Dasyaceae (Rhodophyta) from Hawaii. *Pac. Sci.* **43**: 332–50.
- Smith, C. M. 1992. Diversity in intertidal habitats: an assessment of the marine algae of select high islands in the Hawaiian archipelago. *Pac. Sci.* **46**: 466–79.

- Suringar, W. F. R. 1870. *Algae japonicae*. Musei Bot. Lugduno-Batavi. Heredum Loosjes, Harlem, The Netherlands, 39pp., 25pls.
- Tilden, J. E. 1902. *American Algae* [Exsiccatae]. Century 6, nos. 501–600.
- Tsuda, R. T. and Abbott, I. A. 1985. Collection, handling, preservation, and logistics. *In* Littler M. M. and Littler D. S. (Eds). *Handbook of Phycological Methods: Ecological Field Methods*. Cambridge University Press, New York, pp. 68–86.
- Womersley, H. B. S. and Lewis, J. A. 1994. [Family Halymeniaceae in]: *The marine benthic flora of Southern Australia. Rhodophyta – Part IIIA*. Austral. Biol. Resources Study, Canberra, pp. 167–218.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.