

## Marine Algae New to Florida, Including *Trichosolen molassensis* sp. nov. (Chlorophyta) and *Diplothamnion jolyi* var. *ecellulare* var. nov. (Rhodophyta)

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### SUMMARY

Eight species of marine algae, previously unrecorded for Florida, have been found on Molasses Reef, Key Largo, Monroe County, Florida. Two new taxa, *Trichosolen molassensis*, sp. nov., and *Diplothamnion jolyi* var. *ecellulare*, var. nov. are described from Molasses Reef. Two red algal species, known only from the Pacific, are now reported for the Atlantic Ocean; *Hypoglossum caloglossoides* Wynne and Kraft previously known from Australia, Samoa, and the S. Marshall Islands, and *Antithamnion percurrans* Dawson from Eniwetok, Solomon Islands, and Japan. Eight other taxa, reported from adjacent regions in the western Atlantic are new additions to the marine flora of the Florida Keys; *Anadyomene saldanhae*, *Sphacelaria novae-hollandiae*, turf form of *Padina santae-crucis*, *Gloioderma rubrisporum*, *Botryocladia spinulifera*, *Antithamnion ogdeniae*, *Antithamnionella elegans*, and *Diplothamnion jolyi* var. *jolyi*.

### Introduction

Molasses Reef (25° 00.7'N, 80° 22.4'W) is in the Key Largo National Marine Sanctuary, about 10 km off the Atlantic coast of Key Largo, Florida Keys (Fig. 1). On 4 August 1984 the freighter *Wellwood* ran aground on this reef, destroying a large area, over 5000 m<sup>2</sup>, of living habitat with adjacent areas further damaged during its removal (Fig. 2).

The algae studied herein represent a small portion of those collected following the 1984 grounding and were part of an ecological study [43] conducted to assess the damage of the *Wellwood* grounding to Molasses Reef. Although considerable floristic information exists for the Florida Keys [e.g., 21, 22, 30, 55, 56, 63], our survey of this small area (Fig. 2) revealed one new species, a new variety and eight species (1 Chlorophyta, 2 Phaeophyta, and 5 Rhodophyta) as new additions to the marine flora of Florida.

### Materials and Methods

Specimens were collected by M. M. Littler and R. H. Sims by SCUBA diving on 3–7 September 1984, a month after the grounding of the *Wellwood*, along transects ranging from 4.6 to 7.6 m depth in areas damaged by the freighter and in the adjacent undamaged areas at similar depths, unless otherwise noted. Specimens collected were preserved in 5% buffered Formalin/seawater and returned to the laboratory for taxonomic studies. Herbarium sheets of the algae were prepared, with accompanying liquid preserved portions and microscope slides. Small species of Chlorophyta and Phaeophyta were mounted whole on microscope slides in 20% Karo clear corn syrup with phenol added as a preservative. Specimens of Rhodophyta were stained with aniline blue [48] before mounting on microscope slides [60]. Specimens are deposited in the Algal Collection of the U.S. National Herbarium, Smithsonian Institution (US). Additional specimens of *Diplothamnion jolyi* var. *jolyi* and *Antithamnionella elegans* from Molasses Reef were borrowed from Harbor Branch Oceanographic Institution (HBFH). An isotype slide of *Hypoglossum caloglossoides* (US slide 4042), and the type slide of *Anti-*

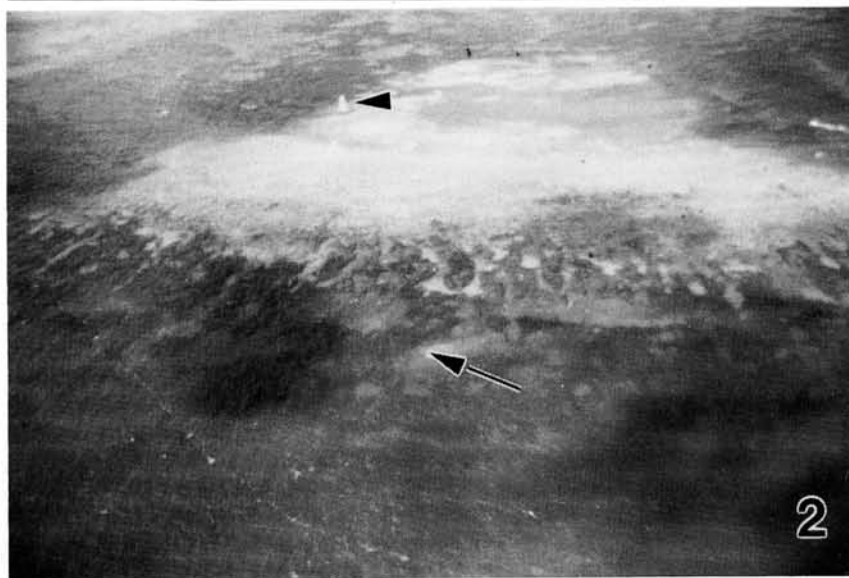
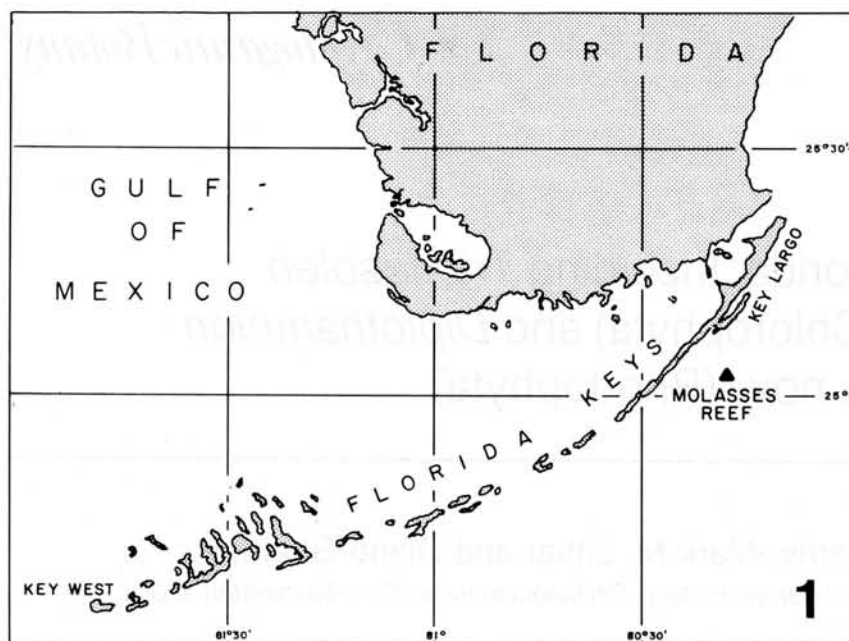


Fig. 1. The location of Molasses Reef in the Florida Keys. — Fig. 2. West aerial view of Molasses Reef, Key Largo National Marine Sanctuary, and the study site (grounding site of the freighter *Wellwood*) (arrow) and navigation light (arrowhead).

*thamnion ogdeniae* (US slide 4031) were examined. Herbarium abbreviations cited in the text follow Holmgren et al. [33]. The collection numbers cited with the prefix JN- refer to the field notebooks of J. N. Norris.

## Results

### Chlorophyta

#### SIPHONOCLADALES

*Anadyomene saldanhae* Joly et Oliveira Filho 1969:30.

Fig. 3.

Type Locality: "Banco Dogareza," Victoria, Espirito Santo, Brazil.

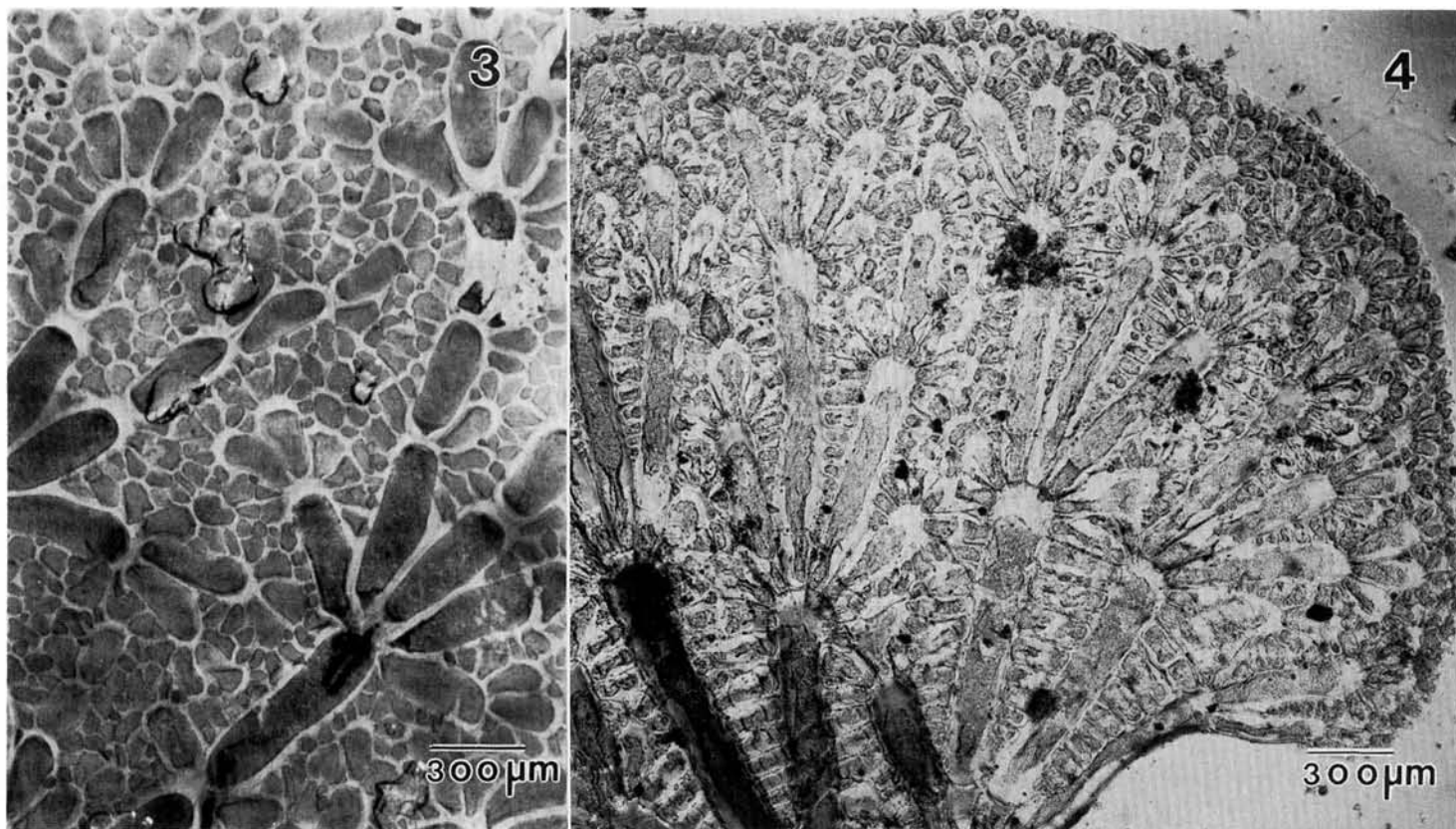
Holotype: SPF.

Distribution: ATLANTIC OCEAN—Molasses Reef, Florida Keys; Florida [28]; Brazil [39]. CARIBBEAN SEA—Colombia [14].

Specimen studied: JN-11977 (US), 7.3 m deep, Molasses Reef, Florida.

Remarks: Originally described from deep-water (85 m) off the east coast of Brazil [39], the intricate unistratose green blades of *Anadyomene saldanhae* were found in the undisturbed shallow (7 m) areas of Molasses Reef (deep areas were not collected). Recently *A. saldanhae* has been reported from both shallow and deep-water habitats from the Caribbean coast of Colombia [14], and from deep-water habitats off the east Florida continental shelf [23].

*Anadyomene saldanhae* differs from the other two species known from Florida [35, 56], *A. stellata* (Wulfen) C. Agardh and *A. menziesii* Harvey, in its pattern of blade construction. The ultimate interstices formed by the fan-shaped network in *A. saldanhae* are completely filled with small, irregular, mostly elliptical cells (Fig. 3), while these regions between the fan-like ribs of *A. stellata* are composed of cells in lateral (parallel) series (Fig. 4). The length of the cells in the main veins of *A. saldanhae* can be up to



Figs. 3–4. Comparison of species of *Anadyomene*. – Fig. 3, *Anadyomene saldanhae*, portion of frond with characteristic irregularly arranged elliptical cells between veins (JN-11977); – Fig. 4, *Anadyomene stellata*, portion of frond with characteristic cells in parallel series between long veins (JN-12168).

eight times their width, while the main vein cells of *A. stellata* can be much longer. *Anadyomene menziesii* is a much larger (to 25 cm diam.) and stouter plant from deep-water habitats [35]. *Anadyomene saldanhae* and *A. stellata* are usually 2–10 cm in diameter.

#### BRYOPSIDALES (= Caulerpales)

##### Bryopsidaceae

##### *Trichosolen molassensis* Bucher et J. Norris, *sp. nov.*

Figs. 5–9; Tables 1, 2.

Type Locality: on coral rubble, Molasses Reef, Key Largo National Marine Sanctuary, Monroe County, Florida.

Holotype: JN-11776 (US #98412) gametangial, 6.1 m depth, Molasses Reef, Florida, 4 Sept 1984, leg. M. M. Littler & R. H. Sims.

Paratype Specimens: JN-11842 (US), 5.8 m depth, Molasses Reef, Florida, 4 Sept 1984; JN-11882 (US) gametangial thalli, 4.9–6.1 m depth, Molasses Reef, Florida, 3 Sept 1984.

Distribution: ATLANTIC OCEAN—Molasses Reef, Florida Keys.

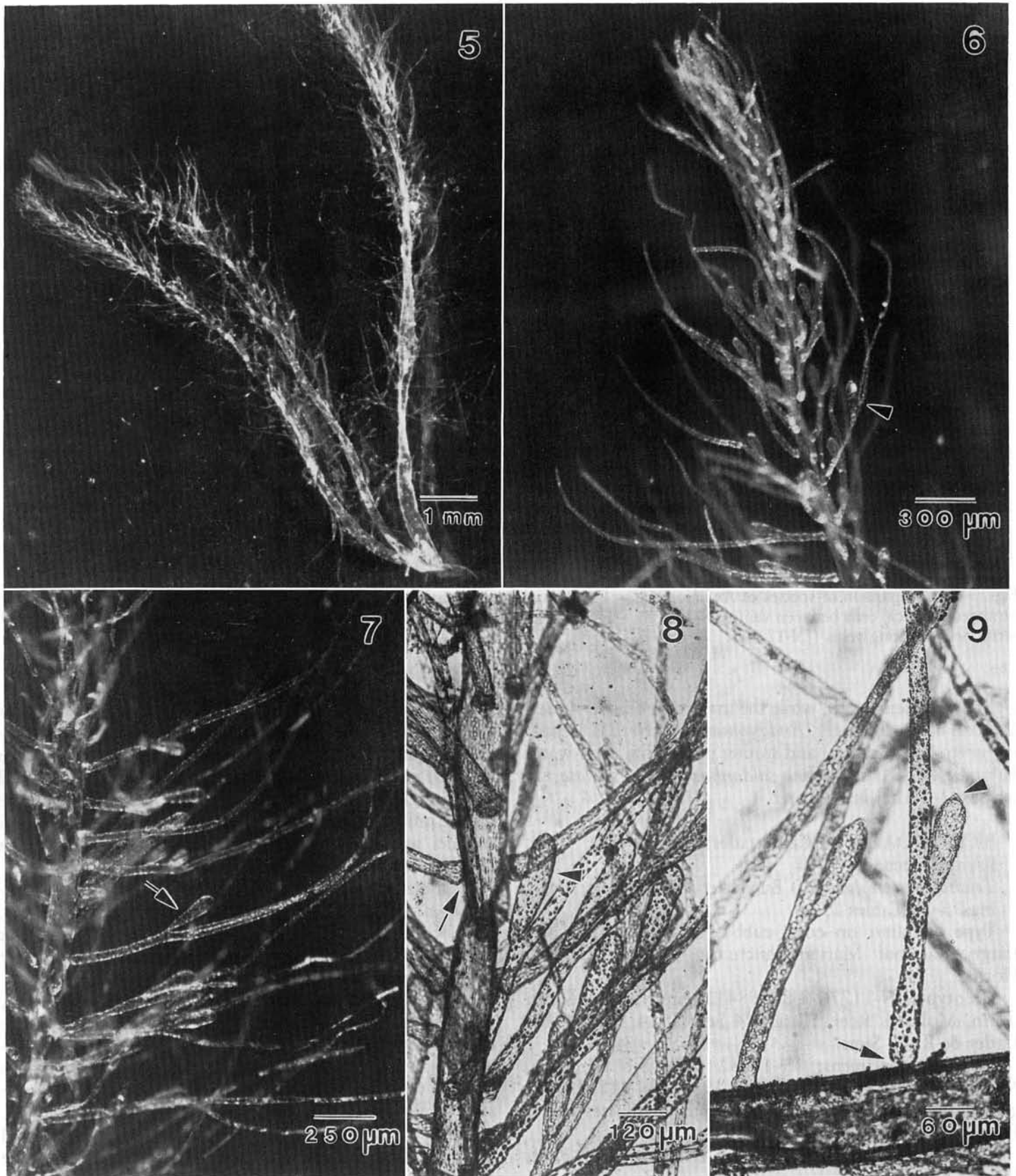
Description: Plantae parvae et tenues (Tab. 5), usque ad 17 mm altae, luteo-virides; aliquot axes erecti fasciculum unicum formantes. Fasciculus ad substratum multis rhizoideis affixus. Axes principales teretes plerumque simplices, aliquando divisi, usque ad 370 µm diametro infra, decrescentes usque ad 30 µm diametro ad apices obtusos. Rami irregulares, radiatim positi (Tab. 8) et dense tegentes

axes superiores, et rari ad basem. Rami leniter breviores prope apicem. Rami plerumque simplices, aliquando furcati; rami in axibus principalibus angusti ad basim (Tab. 9) et generatim leniter incurvati distaliter; usque ad 2 µm longi, 40 µm diametro ad basim, decrescentes usque ad 12 µm diametro ad apicem obtusum. Chloroplasti ovoidei usque ad fusiformes, 5–10 µm lati, 10–20 µm longi, pyrenoidem unicam continentes.

Gametangia singularia et sessilia, ad basim rami simplicis aut aliquando furcati adaxialiter portata (Tabs. 7–9). Gametangia elongata, ovoidea usque ad clavata et circa 185(–260) µm longa, 63 µm diametro, terminaliter portantia papillas apicibus rotundis.

Plants small and delicate (Fig. 5), up to 17 mm tall, yellow-green in color, several erect axes forming a single clump. Numerous short rhizoids attach the clump to substratum. Main axes mostly simple, occasionally divided, to 370 µm wide below, tapering to 30 µm diameter at obtuse apices, with irregular, radially placed branches (Fig. 8). Branches densely covering upper axes, and sparse toward the base. Branch lengths shortening slightly toward the apex (Fig. 6). Branches mostly simple but sometimes forked, often forked above gametangia (Fig. 7). Branches pinched basally (Fig. 9) and usually slightly incurved distally, to 2 mm long and 40 µm in diameter near their base, tapering to 12 µm diameter at the blunt tip. Chloroplasts ovoid to spindle-shaped, 5–10 µm wide, 10–20 µm long, containing a single pyrenoid.

Gametangia single and sessile, borne adaxial toward the



Figs. 5–9. Holotype of *Trichosolen molassensis* (US 98412); – Fig. 5, Habit of liquid preserved type specimen; – Fig. 6, Branches slightly shorter toward the apex, branches mostly simple but occasionally forked (arrowhead); – Fig. 7, Radially branched, with single gametangium (arrow) per branch; – Fig. 8, Irregular radial branches, pinched off main axes (arrow), and gametangia (arrowhead); – Fig. 9, Branches basally pinched (arrow) and bearing in their lower portion, single, adaxial, sessile gametangia with papillae (arrowhead).

base of a branch (Figs. 7, 8, 9). Gametangia elongate, ovoid to clavate, and about 185 (–260)  $\mu\text{m}$  long and 63  $\mu\text{m}$  wide. Gametangia contain papillae with rounded apices (Fig. 9).

Remarks: *Trichosolen molassensis* was commonly collected among all damaged areas of Molasses Reef. It was a major component of a short, soft, yellowish turf that developed on the scraped calcareous substratum within 2 1/2 weeks of the grounding [43]. This species may be a late summer to early fall opportunistic or early successional species in the Molasses Reef system. The small and wispy thalli of *T. molassensis* under normal conditions would be inconspicuous among the typical macroalgal community, but were quite noticeable after the grounding disturbance because of their large number and the absence of a long-established community.

The genus *Trichosolen* Montagne [45] and the similar appearing *Bryopsis* Lamouroux [40] are distinguished by their reproductive structures. Species of *Trichosolen* bear gametangia that are separate external structures, while in *Bryopsis* an entire vegetative branch functions as a gametangium [57].

The species of *Trichosolen* were compared by Diaz-Piferrer [28, as *Pseudobryopsis*], who summarized their distinguishing morphological features [see Table 1 in 25]. Of the 10 known species of *Trichosolen*, the Molasses Reef plants are most similar to *T. parva* (Dawson) Taylor [57] (see Table 1), a taxon originally described from Vietnam by Dawson [24] as *Pseudobryopsis parva*). *Trichosolen parva* has slender simple axes with irregular radially placed branches. Its axes are barren below and sparsely covered above. The gametangia are sessile, elongate, and

Table 1. Comparison of vegetative features of species similar to *Trichosolen molassensis*

Species	Distribution	Main Axes			Branches		
		Branching	Thallus height	Diameter	Shape	Base	Ultimate branch diameter
<i>T. parva</i> (Dawson) Taylor	Viet-nam	Several simple axes (non – branching)	5–7 mm	100 $\mu\text{m}$ base 15–20 $\mu\text{m}$ tip	Simple; slightly upcurved	Not basally swollen	20 $\mu\text{m}$
<i>T. molassensis</i> sp. nov.	Florida	Mostly simple, sometimes divided	17 mm	370 $\mu\text{m}$ base 30 $\mu\text{m}$ tip	Simple or forked; slightly curved upward	Basally pinched	40 $\mu\text{m}$ base; 12 $\mu\text{m}$ tip
<i>T. hainanensis</i> (Tseng) Taylor	China	Usually simple, occasional divided	22 mm	500 $\mu\text{m}$ base 100 $\mu\text{m}$ tip	Simple; subcylindrical	Narrowing	18–36 $\mu\text{m}$

Table 2. Comparison of gametangia and chloroplast features of species similar to *Trichosolen molassensis*

Species	Gametangia					Chloroplast		
	Number/ branch	Shape	Position	Apex	Size	Shape	Size	Pyrenoid
<i>T. parva</i> (Dawson) Taylor	One	Elongate	Adaxial, near base of branch; sessile	Papillate; subacute with terminal pore	Length: 190 $\mu\text{m}$ Width: 35 $\mu\text{m}$ base 50 $\mu\text{m}$ top	? oval- obovate	10 by 10–15 $\mu\text{m}$	? lacking
<i>T. molassensis</i> sp. nov.	One	Elongate; ovoid to clavate	Adaxial, near base of branch; sessile	Papillate; rounded	Length: 185(–260) $\mu\text{m}$ Width: 63 $\mu\text{m}$	Ovoid- spindle	10–20 by 5–10 $\mu\text{m}$	One
<i>T. hainanensis</i> (Tseng) Taylor	One	Obovate to spherical	Near base or branch; on short stalk	Papillate; mucronate	Length: 52–70 $\mu\text{m}$ Width: 36–52 $\mu\text{m}$	—	2–3 $\mu\text{m}$	With pyrenoids

usually borne singly and adaxially near the bases of branches. Thalli from Molasses Reef are similar in possessing irregular radially arranged branches and in the number and position of the gametangia, but differ in several features. The main axes of plants from Molasses Reef are occasionally divided, more densely covered with branches above, and sparsely covered below, as opposed to being barren (as is the case in *T. parva*). The Molasses Reef plants have taller (to 17 mm) and wider (to 370  $\mu\text{m}$ ) main axes, than *T. parva* from Vietnam, which range to 7 mm tall, and 100  $\mu\text{m}$  in diameter [24]. Branches of the Vietnam plants are simple, whereas those from Molasses Reef specimens are sometimes forked.

The gametangial shape and position are similar in both Vietnam and Florida specimens, being elongate, sessile, and usually borne singly and adaxially near the base of a branch (see Table 2). The gametangia of both species are papillate; however, the papillae in *T. molassensis* have rounded apices, while the apices in *T. parva* are subacute with terminal pores [24].

Because of these consistent morphological differences as well as the geographically disjunct distributions between Florida and Vietnam material, we propose a new species, rather than broadening the concept of the Pacific *Trichosolen parva*. However, we recognize the need to study the range of phenotypic variation in *T. parva* from Vietnam, should the opportunity arise. Culture and life history studies have proven to be essential to understanding species concepts in this family [50], and it would be interesting to conduct comparative culture studies of *T. parva* and *T. molassensis* as well.

The only other species that resembles *Trichosolen molassensis* in its small thallus size and in having a single gametangium near the base of a branch, is *T. hainanensis* (Tseng) Taylor [see Table 1 in 28]. However, *T. hainanensis* differs significantly in other respects, with broader main axes diameters, to 500  $\mu\text{m}$  basally and 100  $\mu\text{m}$  at the apices, and appears similar to an "*Enteromorpha* overgrown with delicate green epiphytes" [59, as *Pseudobryopsis hainanensis*]. The gametangia of *T. hainanensis* are stalked and shorter (52–78  $\mu\text{m}$ ), and its chloroplasts are smaller (2–3  $\mu\text{m}$ ) [59], than those of *T. molassensis*.

The other *Trichosolen* occurring in Florida, *T. duchassaingii* (J. Agardh) Taylor (54), is a much larger species (1–2 dm tall, main branches 7.5–1.25 mm wide) with larger gametangia measuring 105–150  $\mu\text{m}$  diameter by 160–345  $\mu\text{m}$  long, which in some cases also have stalk-like bases [57]. *T. duchassaingii* has dichotomously branched main axes, with branches closely surrounded by short delicate ultimate branchlets, while in contrast the axes of *T. molassensis* are usually simple and bear simple or once-forked branches.

## Phaeophyta

### SPHACELARIALES

#### Sphacelariaceae

*Sphacelaria novae-hollandiae* Sonder 1845: 50.

Fig. 10

Type Locality: Western Australia, probably near Fremantle.

Holotype: MEL.

Distribution: ATLANTIC OCEAN—Bermuda [56]; Molasses Reef, Florida Keys. CARIBBEAN SEA, Jamaica, Martinique, and Barbados [56]; Puerto Rico [6]; Aruba and Bonaire [62]. INDIAN OCEAN—Mauritius [65]. PACIFIC OCEAN—Australia, and the tropical Pacific [65].

Specimen Studied: JN-11981 (US), 7.3 m depth, Molasses Reef, Florida.

Remarks: *Sphacelaria novae-hollandiae*, with the characteristically stout propagule, containing a lateral cell divided into two (Fig. 10), was discovered attached to coral rubble. This small filamentous brown alga was found growing in both undamaged and damaged sites. It is a fast growing opportunistic early successional species [42] originally described from Australia by Sonder [54]. It is now reported from several widely spaced subtropical and tropical regions in the Indian Ocean, western Pacific, southern Australia and western Atlantic.

### DICTYOTALES

#### Dictyotaceae

Turf-form of *Padina sanctae-crucis* Børgesen 1914: 45.

Type Locality: Coakley Bay, St. Croix, U. S. Virgin Islands.

Holotype: C.

Distribution: ATLANTIC OCEAN—Molasses Reef, Florida Keys. CARIBBEAN SEA—Jamaica [16]; Belize [41].

Specimen Studied: JN-11975 (US), 6.1 m depth, Molasses Reef, Florida.

Remarks: The low growing, turf form, with its narrow, strap-like, non-calcified, irregularly branched fronds and growth by a single apical cell is so distinct from the erect fan-shaped foliose blades of *Padina*, that in the past it was considered to be a different genus, *Dictyerpa* Collins [16] in the Caribbean and *Vaughaniella* Børgesen [11] in the Pacific. Brown turfs of similar morphology have since been recognized to be forms of some species of *Padina* [12; 19], and similar dimorphic growth forms have been noted in several, but not all, *Padina* species in the Caribbean [56; 15; 41] and the Indo-Pacific [5]. Field experiments in the Caribbean by Lewis et al. [41] demonstrated that the distinct turf and foliose morphologies of Belizean *P. sanctae-crucis* (as *P. jamacensis*), observed in different habitats, were responses to different levels of herbivorous fish grazing.

Taylor (1960: 233) stated *Dictyerpa* Collins (1901: 251) was "misinterpreted by Collins" and was a growth form of *Padina*, thus making it a generic synonym of *Padina* Adanson [3], an interpretation followed by Papenfuss (1977: 271–272). Papenfuss [48], in citing Taylor (1960: 237), also considered the species, *Dictyerpa jamacensis* Collins [16], taxonomically the same as *Padina sanctae-crucis* (10), and giving priority to the earlier species name, made the combination *P. jamacensis* (Collins) Papenfuss.

However, Chapman [15] suggested that there might be two sets of material identified as *Dictyerpa*, some repre-

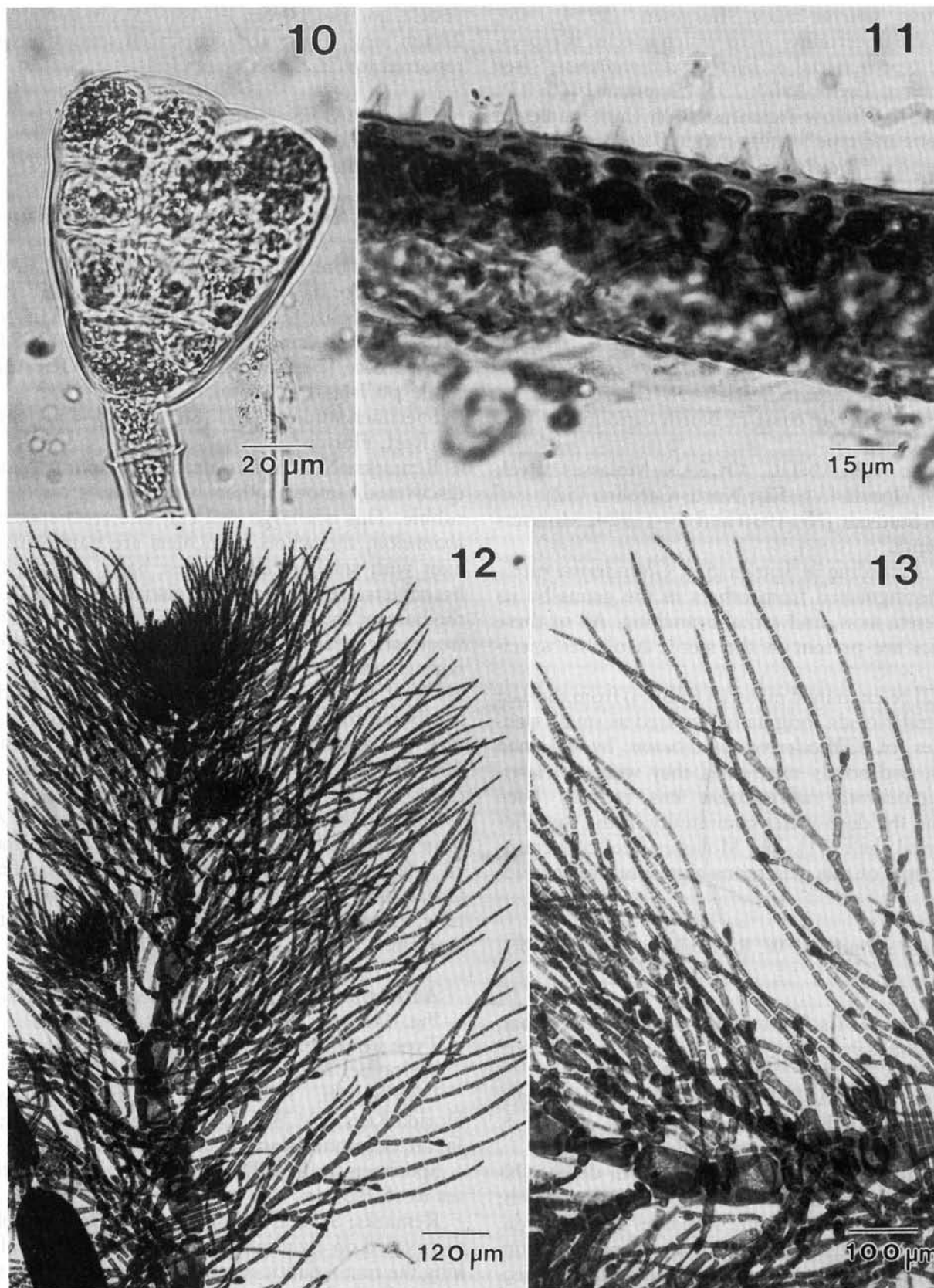


Fig. 10. Stout propagule of *Sphacelaria novae-hollandiae* (JN-11981). — Fig. 11. Spinulose surface of cortex, characteristic of *Botryocladia spinulifera* (JN-11921). — Figs. 12–13. *Antithamnion ogdenia* (JN-11887). — Fig. 12, Habit; — Fig. 13, Whorl branchlets of *A. ogdenia* with gland cells (JN-11887).

senting sterile rhizome portions of various members of the Dictyotales, e. g., *Dictyota*, *Padina*, and, following Howe [34], suggested the original fertile material may be a variety of *Dilophus guineensis* [we note however, that

Collins [16] stated his specimens lacked “any indication of fruitification”]. This points to the uncertainty as to which brown alga *Dictyerpa jamaciensis* is to be taxonomically linked. More recently, Silva et al. (1987: 78) chose to

retain *Padina sanctae-crucis* Børgesen (1914: 45), "because of the uncertainty as to which species is represented by the type material of *Dictyerpa jamaicensis*" (see also comments of Taylor 1960: 233, Chapman 1963: 23), and, thus, did not follow Papenfuss [48]. Until studies of type specimens and type locality material definitively connects *Dictyerpa jamaicensis* to a specific brown algal species, we too think it best to recognize *P. sanctae-crucis* as a separate taxon. The foliose form of *P. sanctae-crucis* has been found to occur at Molasses Reef in January [44].

## Rhodophyta

### RHODYMENIALES

#### Rhodymeniaceae

*Gloioderma rubrisporum* Searles 1984: 217.

Type Locality: off the coast of North Carolina.

Holotype: DUKE.

Distribution: ATLANTIC OCEAN—Molasses Reef, Florida Keys; Florida [31; 52]; North Carolina [52].

Specimens Studied: JN-11930 and JN-11974, Molasses Reef, 6 m depth.

Remarks: According to Searles [52], *Gloioderma rubrisporum* is distinguished from others in the genus by its small size, terete axes, and radial branching. All of these characteristics are present in the sterile Molasses specimens.

Searles [52] re-examined material (HBFH) from the east coast of central Florida, originally reported as small, slender examples of *Gloioderma atlanticum* by Eiseman (1979: 359), and briefly mentioned they were *G. rubrisporum*. *Gloioderma rubrisporum* has recently been reported from the deep-water community of the east Florida continental shelf [31]. The Molasses Reef collections extend the range of this gelatinous alga south to the Florida Keys.

*Botryocladia spinulifera* W. R. Taylor et Abbott 1973: 410.

Fig. 11.

Type Locality: Grass Point at Turner Hole, St. Croix, U.S. Virgin Islands.

Holotype: MICH.

Distribution: ATLANTIC OCEAN—Florida Keys, Molasses Reef. CARIBBEAN SEA—Bahamas and U. S. Virgin Islands [58]; Puerto Rico and Belize [8].

Specimens Studied: JN-11980 (US), 7.3 m depth; JN-11820 (US), 4.9 m depth; JN-11921 (US), 7.6 m depth; and JN-12015 (US), 8.2 m depth, Molasses Reef, Florida.

Remarks: Easily distinguished microscopically from other *Botryocladia* species by the tiny spine-like projections on its cortex (Fig. 11), several collections of this diminutive species were discovered on the undersides of coral rubble. This distinctive *Botryocladia* seems to prefer lower light habitats; it occurs in caves [58], under coral plates, and in deep water (40–49 m) [8], or as found on Molasses Reef on the undersides of rocks in shallow water reef habitats.

Two of the Florida specimens are tetrasporic, with tetrasporangia in sori towards the upper portion of the

vesicle, and range from 15–18(–25)  $\mu\text{m}$  in diameter and to 28  $\mu\text{m}$  long. These are identical in size to tetrasporangia reported for St. Croix plants [58].

## CERAMIALES

### Ceramiaceae

*Antithamnion ogdeniae* Abbott 1979: 218.

Figs. 12, 13.

Type Locality: Cane Bay, St. Croix, U.S. Virgin Islands.

Holotype: US.

Distribution: WESTERN ATLANTIC OCEAN—Molasses Reef, Florida Keys; Brazil [61]. CARIBBEAN SEA—St. Croix and Belize [1], Puerto Rico [6]. EASTERN ATLANTIC OCEAN—Canary Islands [7]. MEDITERRANEAN SEA—Greece [7]; Italy [13]. PACIFIC OCEAN—Penguin Bank, off Island of Molokai, Hawaii [4].

Specimen studied: JN-11887 (US), 5–6 m depth, Molasses Reef, Florida.

Remarks: New to Florida, *Antithamnion ogdeniae* was discovered among other turf algae growing on coral rubble. This is a large (1.2 cm) and erect species of *Antithamnion*, the whorl branchlets are paired off the main axes with smaller cells at their base, and the first order branchlets are alternate and distichous (Fig. 12). Toward the base of the whorl branchlet, the first order branchlets frequently bear 2–3 celled abaxial secondary branchlets with gland cells (Fig. 13). The whorl branchlets of Molasses Reef specimens are longer (up to 730  $\mu\text{m}$ ) than those attributed to the species, but re-examination of the holotype (#US-4031 slide), shows its whorl branchlets to be 400–650  $\mu\text{m}$  in length, longer than the 200  $\mu\text{m}$  originally cited [1].

Since its recognition in the Caribbean [1], *Antithamnion ogdeniae* has been found in the Canary Islands, Brazil, Mediterranean and [18]. Aegean Seas, and the Pacific Ocean [19]. This is a wide geographic range for so brief a time, and this species may eventually be shown to be pan-tropical.

*Antithamnion percurrens* Dawson 1957: 116.

Fig. 14.

Type Locality: Parry Island, Eniwetok.

Holotype: BISH.

Distribution: ATLANTIC OCEAN—Malasses Reef, Florida Keys. PACIFIC OCEAN—Eniwetok [25]; southern Japan, Solomon Islands [33]; Australia [20].

Specimen studied: JN-11969 (US), 7.6 m depth, Molasses Reef, Florida.

Remarks: Several fragments of this small epiphyte were discovered on algal material from Molasses Reef, establishing the first Atlantic record of this species. The specimens are sterile, but their branching pattern of distichous, oppositely paired lateral branches, including some that produce 1–3 short, 1–2 celled branchlets on the adaxial side, are distinctive (Fig. 14). The lateral branchlets are shorter near the base of erect axes. The Molasses Reef specimen agrees well with Dawson's [25] original description of the species from Eniwetok. No gland cells were noted [25] and none are present in Florida material. However, Itono [36] in reporting *Antithamnion percurrens* from southern Japan,

observed occasional gland cells as did Cribb [20] in Australian material. Itono [36] also noted that indeterminate axes could be produced from the basal cells of lateral branches of erect axes, but that these usually remained rudimentary. None were observed in the Florida fragments. Features of the prostrate axes illustrated by Itono [36: fig. 4 D–E] for Japanese material are also present in Molasses Reef plants.

*Antithamnionella elegans* (Berthold) Price et John in Price et al. 1986: 16. var. *elegans*.

Fig. 15.

Type Locality: Gulf of Naples, Italy.

Holotype: ?

Distribution: WESTERN ATLANTIC OCEAN—Brazil [37, 46, as *A. tristicum*]; North Carolina and South Carolina (51, as *A. breviramosa*); Florida [31, as *A. breviramosa*]; EASTERN ATLANTIC OCEAN—France, Portugal, Morocco, Canary Islands, Gulf of Guinea, South Africa, and the Mediterranean Sea [17]. PACIFIC OCEAN—California [2, as *A. breviramosa*]; Gulf of California, Mexico, and Costa Rica [27, as *A. breviramosa*]; Galapagos Islands, Hawaii, and Solomon Islands [64, as *A. breviramosa*]; Japan, Marshall Islands [17]. INDIAN OCEAN—Maldives Islands, Zanzibar, Karachi, and Mauritius [17].

Specimen studied: JN-11791 (US), 5–6 m, depth, Molasses Reef, Florida; 85–3–15–129–3 (HBFH), 4.7 m depth, Molasses Reef, Florida, 15 Mar 1985, leg. M. D. Hanisak, S. M. Blair, G. M. Burzycki, & M. A. Samuel.

Remarks: Cormaci and Furnari [17] recently considered *Antithamnion breviramosa* Dawson [23] to be a synonym of *Antithamnionella elegans*. Considering the wide distribution and described morphologies of specimens reported to be *Antithamnionella breviramosa* (Dawson) Wollaston in Womersley et Bailey [66], it is a widely variable species, with a substantial size range and variations in its whorl branchlets [e.g., 2; 36; 64; 66]. If *A. breviramosa* is correctly placed in *A. elegans*, this complex now includes even greater variation. In addition to *A. elegans* var. *elegans* (= *A. breviramosa*), Cormaci and Furnari [17] recognize three varieties, vars. *sublittoralis*, *decussata* and *boergeseni*, each separated on their whorl branchlet arrangements. Cormaci and Furnari [17] apparently did not examine the type specimen of *A. breviramosa* Dawson (type locality: Santa Catalina Island, California; LAM), although they examined and cited other specimens identified by Dawson as *A. breviramosa* none were from the type locality.

Western Atlantic specimens of *A. elegans* tend to be smaller [51] than robust Pacific material. *Antithamnion ternatum* Joly et Cordeiro was a small taxa from Brazil [37, 46] originally distinguished from *A. breviramosa* on its smaller cell size. Though Schneider [51] apparently never examined type material of *A. tristicum*, he considered it a synonym of *A. breviramosa*. Based on studies of North and South Carolina specimens, Schneider [45] reported *A. breviramosa* for the first time in the western Atlantic.

The Molasses Reef specimen (JN-11791, US) is small and compact (Fig. 15) growing to 1 mm tall, with erect

axes of cells to 18  $\mu$ m in diameter and 45–75  $\mu$ m in length, and the cells of the prostrate axes to 30  $\mu$ m diameter and 60  $\mu$ m long. The verticillate branchlets are mostly 4–8 cells long, and to 110  $\mu$ m in length, and often contain up to four orders of branching, with cells to 7  $\mu$ m in diameter.

Pacific plants of *A. elegans* (as *A. breviramosa*) are more robust having been reported to 2–3 mm tall, with cells of erect filaments 40–50  $\mu$ m in diameter, 160–250  $\mu$ m in length [26]. Whorl branchlets are 8–13 cells long, and 100–240  $\mu$ m in length, with cells 10–15  $\mu$ m diameter, and 20–45  $\mu$ m long [26, as *A. breviramosa*]. An additional specimen from Molasses Reef (85–3–15–129–3; HBFH), does have long whorl branchlets (up to 13 cells, and to 250  $\mu$ m long) but is composed of more slender, shorter cells, with axial cells 30  $\mu$ m diameter by 90  $\mu$ m long and branchlet cells 4–8  $\mu$ m diameter, 17–21  $\mu$ m long.

Schneider [51] pointed out the spermatangia on Pacific specimens arise from the lower portions of whorl branchlets [64, as *A. breviramosa*], while in the western Atlantic (North Carolina) specimens they occur on the distal portions of whorl branchlets [51, as *A. breviramosa*]. This difference in spermatangial position may be superficial. The spermatangia are consistently borne on the 2nd–5th segments, and their position appears proximal or distal dependent upon the branchlet length.

*Diplothamnion jolyi* van den Hoek 1978: 51

var. *ecellulare* Bucher et J. Norris, var. nov.

Fig. 16.

Type Locality: Molasses Reef, Key Largo National Marine Sanctuary, Florida Keys, Monroe County, Florida.

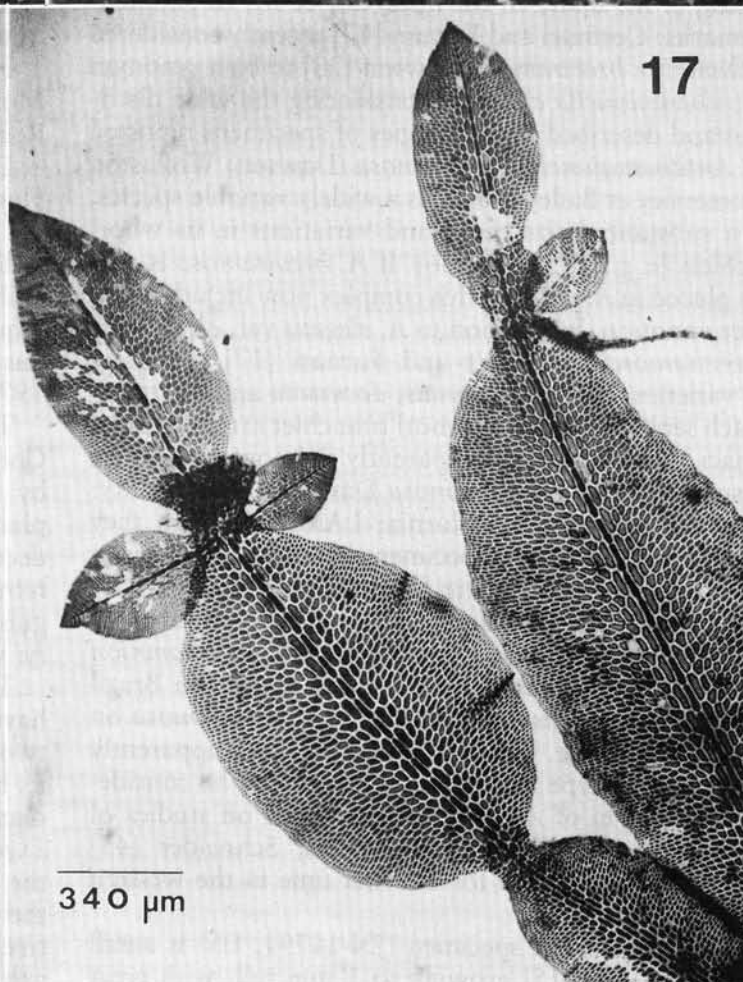
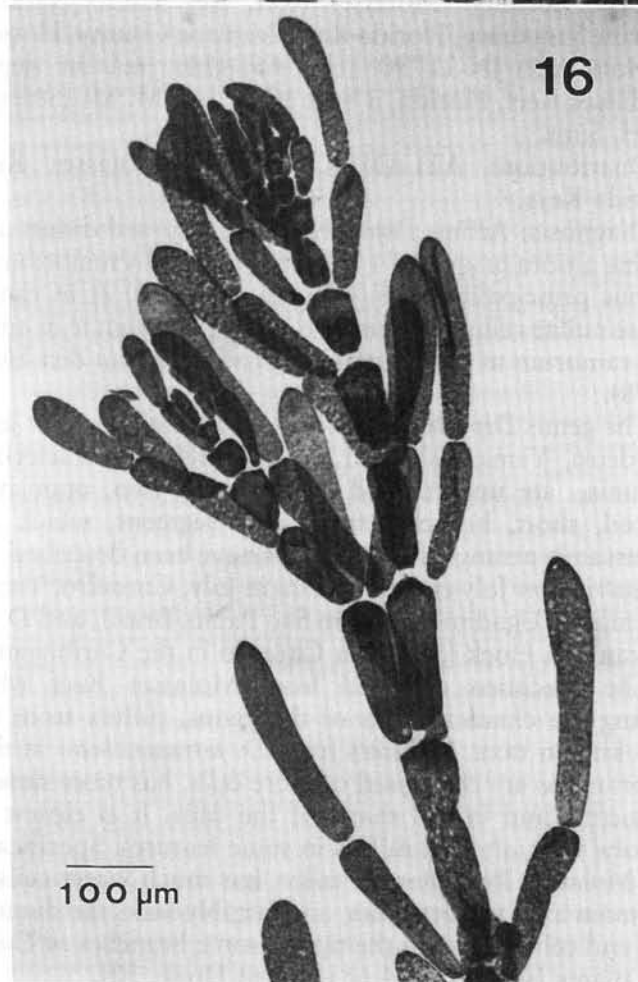
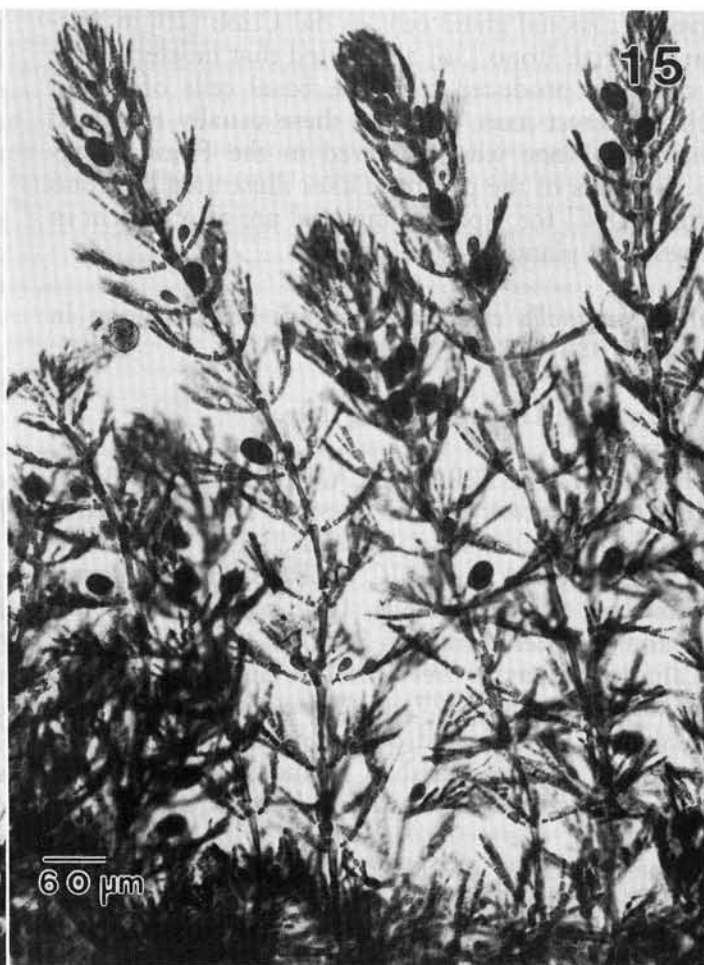
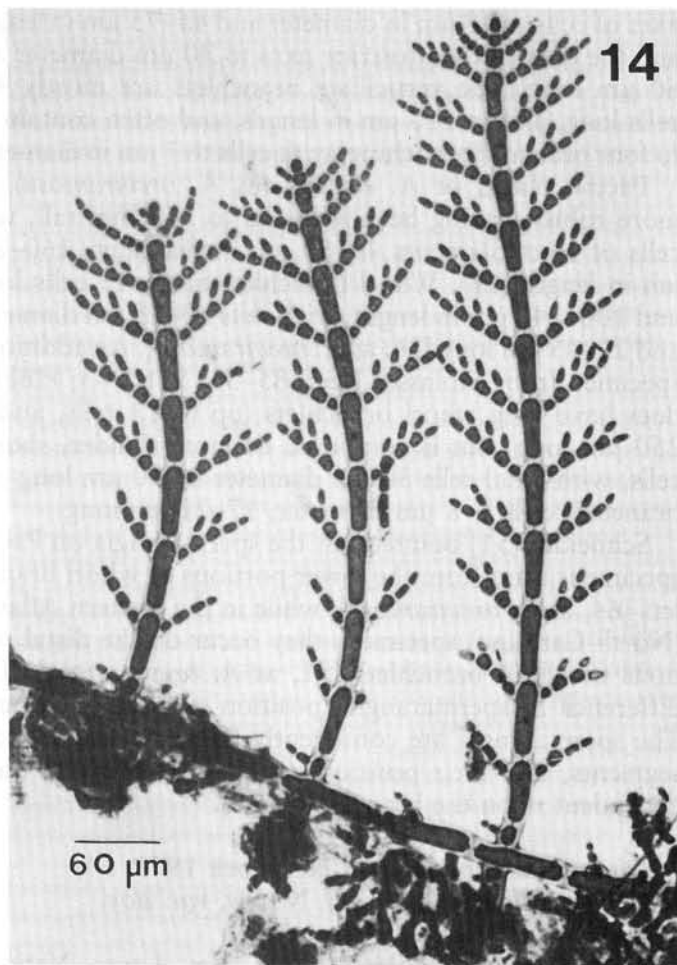
Holotype: JN-11790 (US #98411), 6.1 m depth, Molasses Reef, Florida, 3 Sept 1984, leg. M. M. Littler & R. H. Sims.

Distribution: ATLANTIC OCEAN—Molasses Reef, Florida Keys.

Diagnosis: Affinis *Diplothamnion jolyi* sed differt altitudine altiore (usque ad 1 mm altum), cellulis maioribus in axibus principalibus (75–110  $\mu$ m diametro) et in ramis; atque nullae cellulae diminutae extremae inventae in apicibus ramorum ut in varietate originali (vide van den Hoek 1978).

The genus *Diplothamnion* Joly and Yamaguishi in Joly, Cordeiro, Yamaguishi and Ugadim [38] is characterized by uniseriate uncorticated axes bearing two, oppositely placed, short, branches from each segment, which are decussately arranged. Two species have been described, *D. tetrastrichum* Joly et Yamaguishi in Joly, Cordeiro, Yamaguishi, and Ugadim [38] from Sao Paulo, Brazil, and *D. jolyi* van den Hoek [32] from Curacao in the Caribbean.

The specimen collected from Molasses Reef while having the characteristics of the genus, differs from the two known taxa. It differs from *D. tetrastrichum* in that its branches are composed of more cells, has more slender diameters and in the shape of the cells. It is closest to *D. jolyi* var. *jolyi* but differs in some features. Specifically the Molasses Reef plant is taller, has much larger cells in the main axis and branches, and notably lacks the diminutive end cells found on the tips of some branches of Curacao plants [see figs. 3–4 of van den Hoek, 32].



The Molasses Reef material is different enough to represent a new variety on the basis of its larger size and lack of the exceptionally small end cells (Fig. 16). Branch tips of Molasses Reef specimens are usually rounded or terminate abruptly in a sharp point. Florida specimens reach 1 cm in height with main axes 75–110  $\mu\text{m}$  diameter, while the Curacao plants are only half as tall (5 mm), with substantially smaller main axes, 20–45  $\mu\text{m}$  diameter. The lateral branchlets also differ in size with apical cells ranging between 30–54  $\mu\text{m}$  diameter in Florida plants and being smaller (25–40  $\mu\text{m}$ ) in Curacao specimens; basal cells are (rarely 18–) 30–54  $\mu\text{m}$  diameter in Florida thalli and only 18–30  $\mu\text{m}$  in diameter in Curacao plants. Occasionally, a single cell forms a lateral branchlet in the new variety, and rhizoids are sometimes issued from the distal end of an erect axial cell below the lateral branchlets; neither of these features were reported in *D. jolyi* var. *jolyi* [32].

*Diplothamnion jolyi* van den Hoek 1978: 51 var. *jolyi*.

Type Locality: Klein Piscadera (Curacao, Netherlands Antilles).

Holotype: GRO.

Distribution: Florida [31], Puerto Rico (9), Curaçao [32].

Specimen Studied: 85–3–15–133–1 (HBFH), 15 March 1985, 5 m depth, Molasses Reef, leg. M. D. Hanisak, S. M. Blair, G. M. Burzycki, & M. A. Samuel.

Remarks: A single specimen found on Molasses Reef (slide #85–3–15–133–1; HBFH), possesses the tiny cells at the tips of lateral branchlets (although rarely), and is small in diameter (35–55  $\mu\text{m}$ ), thus fitting the description of *D. jolyi* var. *jolyi* [32]. Therefore both the original and new variety occur in Florida.

The Molasses Reef specimens of *D. jolyi* var. *jolyi* and var. *ecellulare* are both from shallow waters (6.1 m). *Diplothamnion jolyi* var. *jolyi* was originally described from the deeper 10–55 m depth range in Curacao [32], and recently reported to be a common epiphyte in deep-water (17–24 m) off Puerto Rico [9], and in deep-water (26–42 m) off the east Florida continental shelf [31].

Delesseriaceae

*Hypoglossum caloglossoides* Wynne et Kraft 1985: 9. Fig. 17.

Type Locality: South Passage, Lord Howe Island, New South Wales, Australia.

Holotype: MELU.

Distribution: ATLANTIC OCEAN–Molasses Reef, Florida Keys. PACIFIC OCEAN–Lord Howe Island, Australia, Samoa, and the southern Marshall Islands [67].

Specimens Studied: JN-11817 (US) and JN-11818 (US), epiphytic on crustose corallines, 4.9 m depth, Molasses Reef, Florida.

Remarks: In habit, this diminutive *Hypoglossum* resembles *Caloglossa leprieurii* (Montagne) J. Agardh,

with a repeating pattern of blade constrictions, rhizoids, and paired branches at the constrictions (Fig. 17). The lateral branches may become indeterminate prostrate axes that continue the pattern of constrictions and paired branching once again. Plants can develop up to three orders of branching. The habit and vegetative features of the Molasses Reef specimens agree well in most respects to those described and illustrated for the holotype from Australia [(67)3], as well as an isotype slide (US #4042 slide) which was examined. The single notable disparity between these geographically disjunct collections is in size. The Molasses specimens are wider, with blades to 900  $\mu\text{m}$  diameter, and up to 2.7 mm between constrictions, rather than the 600  $\mu\text{m}$  diameter blade and 2 mm length originally recorded for Pacific thalli.

Tetrasporangia are 24–30  $\mu\text{m}$  in diameter and borne in several layers in sori toward the tips of blades, similar to tetrasporangial material from the Pacific [63].

*Hypoglossum caloglossoides* was observed creeping over and strongly adhering to crustose corallines in the undisturbed habitats on Molasses Reef, a similar habitat to that recorded in the Pacific [67]. It is difficult to remove the creeping system of these delicate blades without tearing them. This represents the first report of *H. caloglossoides* in the Atlantic and in the northern hemisphere.

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*Key words:* *Trichosolen molassensis*, *Diplothamnion jolyi* var. *ecellulare*, marine algae, Molasses Reef, Florida, Caribbean.