The systematic position of *Gelidiopsis* and *Ceratodictyon* (Gigartinales, Rhodophyceae), genera new to South Africa

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Since its original description by Schmitz in 1896, *Gelidiopsis* has been in insecure systematic positions, mostly placed in close association with *Gelidium* or in the Gracilariaceae, positions remote from one another in red algal systematics. The general form of the plants strongly resembles species of *Gelidium* but the multiaxial thallus and lack of rhizine-type filaments negates close phylogenetic association with the Gelidiales. Association of *Gelidiopsis* with the Gracilariaceae, using characters of growth, anatomy and reproduction, including information on what is the first report of carpogonial branch structure for the genus, is substantiated. Recent investigations on *Ceratodictyon* show it to be a thallus form similar to *Gelidiopsis* and the two genera are combined, species of the latter genus transferred to *Ceratodictyon*.

Sedert die oorspronklike beskrywing deur Schmitz in 1896, was die sistematiese status van *Gelidiopsis* baie onseker. Dit is meestal geplaas in *Gelidium* of in die Gracilariaceae wat baie ver van mekaar verwyder is in die huidige rooialgtaksonomie. Die algemene voorkoms van *Gelidiopsis* stem baie ooreen met die van *Gelidium*, maar die veelassige tallus en die afwesigheid van risientipe-filamente skakel 'n noue filogenetiese verwantskap met die Gelidiales uit. 'n Ondersoek na die groei, anatomie en voortplanting asook die eerste verslag dat die genus 'n karpogoniale takstruktuur het bevestig die noue assosiasie met die Gracilariaceae. Onlangse ondersoeke op *Ceratodictyon* dui daarop dat die tallusvorm ooreenstem met die van *Gelidiopsis* en die twee genera word gekombineer en die spesies van *Gelidiopsis* word oorgeplaas na *Ceratodictyon*.

Keywords: *Ceratodictyon, Gelidiopsis*, Gracilariaceae, Rhodophyceae, South Africa

Introduction

Probably because of the outward resemblance of species of *Gelidiopsis* Schmitz to those of *Gelidium* Lamouroux, they are often classified in the Gelidiales (Dawson 1953; Taylor 1960; Lawson & John 1982; and others). Schmitz (1896), in the original description of *Gelidiopsis*, related it more closely to *Ceratodictyon* Zanardini, a member of the Gracilariaceae in the Gigartinales, rather than to *Gelidium* Lamouroux (Gelidiales), a relationship that has not been closely followed since that time except by Kylin (1956), Dawson (1961), Joly (1965), Womersley & Bailey (1970) and a few others.

Schmitz (1896), in describing *Gelidiopsis*, with *G. variabilis* (Greville) Schmitz as the type species, gave a clear description of the material he had at hand from Dar es Salaam and Ceylon. Specimens in the latter collection were cystocarpic, the cystocarps having, according to Schmitz, a structure identical to those of *Ceratodictyon*. Schmitz also considered the anatomy of *Gelidiopsis* to be the same as that of *Ceratodictyon*, a red algal genus in which the thallus form was interpreted as reticulate and known to occur only in symbiotic association with a sponge. The only reason that Schmitz did not place species of his new genus, *Gelidiopsis* into *Ceratodictyon* was because of the reticulate thallus form believed to be present in the latter genus compared with the more irregular non-reticulate branching of the thallus in *Gelidiopsis*.

A recent publication by Price *et al.* (1984) demonstrates that the algal component of the symbiotic association with a sponge, from which *Ceratodictyon spongiosum* Zanardini was described, does not have a basically reticulate thallus but, instead, one comprised of separate axes beset with narrower, determinate branchlets. Reticulate thalli, such as described by Schmitz (1896) for this species, probably develop from secondarily formed anastomosing branches, a system that may develop as a result of the association with a sponge and one that was not found in cultures by Price *et al.* (1984).

As mentioned by Schmitz (1896), anatomical characteristics of *Ceratodictyon* are similar to those of *Gelidiopsis*, a genus in which two species, *G. intricata* (C. Agardh) Vickers and *G. pannosa* (Grunow) Schmitz, are reported to have anastomosing branches. All species in each genus have a small-celled outer cortex with progressively larger cells internally. The inner cortex and outer medulla are a pseudoparenchymatous tissue having rounded cells that are elongate in relation to the thallus axis. The innermost medulla in each genus, however, is usually comprised of narrower cells that are more elongate in the direction of the thallus axis. It should be pointed out that there is also great difficulty in separating sterile plants of *Gelidiopsis* from certain other red algal genera in the Gigartinales such as *Wurdemannia* and *Trematocarpus* (see Searles 1969, 1972), genera that can be separated from *Gelidiopsis* on reproductive characteristics. According to Schmitz (1896) the cystocarps of *Gelidiopsis* and *Ceratodictyon* are also much alike, several being embedded near branch tips that are enlarged and verrucose.

Comparative studies on the anatomy and taxonomy of *Gelidiopsis* was reviewed by Feldmann (1931) who recognized six species, and Yamada (1957) who included eight species in the genus. *Gelidiopsis* has not been previously recorded in South Africa (Seagrief 1984), and its recent discovery on the coast of Natal has promoted investigation of its systematics. Clarification and modification of the status of this genus amongst the red algae is proposed.

Materials and Methods

Specimens have been found in intertidal localities in Natal. Some specimens were preserved in formalin and retained in the liquid preservative in storage for preparation of microscope slides. Other parts of collections were dried on herbarium sheets. Parts of four collections were placed into unialgal culture, the plants being easily cultivated and propagated from thallus fragments. These thalli are grown at air-conditioned room temperature (temperatures varying in the vicinity of

22°C) in shaded windows receiving no direct sunlight. The culture medium in which they are maintained is one-half concentration of ES (McLachlan 1973). Slides were prepared according to the aniline blue method of Min-Thein & Womersley (1976).

Results

At the present time it is possible to distinguish two species of *Gelidiopsis* in Natal:

1. Gelidiopsis intricata *(C. Agardh) Vickers*, a stoloniferous species having a very narrow cylindrical thallus (Figure 10) usually without a tendency to flatten but with branches often united in several places by short branches, probably from secondary anastomosing. Cells of interior tissues are loosely packed. Medullary cells are long and narrow whereas cells of the inner cortex are broad and not much elongated (Figure 11). Found only once in Natal at Kosi Bay.

2. Gelidiopsis variabilis *(Greville* in *J. Agardh) Schmitz.* Apparently two forms exist of this, a widespread *Gelidiopsis* in Natal, both forms are stoloniferous and form colonies on intertidal rocks (Figures 1, 6, 12 & 13). Neither form has branches commonly united by anastomosing branches and the narrower form generally has longer medullary cells than are present in broad parts of thalli. Tissues are more densely packed than in *C. intricata*.

Discussion

Characteristics used to separate species in *Gelidiopsis* are variable, a conclusion already inferred by Steentoft (1967) and by John & Lawson (1974). My observations on cultures and other specimens from Natal gives good support to this conclusion. It is difficult to know exactly which characters may be useful in separating the species, if, indeed, several species exist in the genus. I have compared cell sizes and shapes in different tissues, including the meristems, as well as diameter of branches for a wide variety of plants. Comparison of extreme forms, especially from field-collected material, gives the impression that these characters may differ enough to be useful in distinguishing the forms as species. Analysis of these characters in intermediate forms as well as in cultures, however, shows that they seem to be much too flexible to be useful in taxonomy.

As mentioned above, two forms of *G. variabilis*, having broader and narrower branches, are found in Natal but intermediate types are usually present in most collections. Both forms have been isolated into culture but broader branches tend to produce branches characteristic of the narrower form under culture conditions, an observation, in addition to the wide variation in form of plants found in natural populations, that supports the concept that *G. variabilis*, as its specific name implies, is highly variable in its form and structure.

The narrower form of *G. variabilis* (Figures 1 & 12), has cylindrical branches up to 10 cm long and up to 0,5 mm broad, branches that sometimes may be slightly compressed. The other form (Figures 6 & 13) is up to 10 cm long and 1 mm broad, and often is quite flat, particularly in middle regions of the thallus. Some specimens also have more broadly flattened distal parts of branches. Specimens have been observed in Natal that have broad flattened thalli from which emerge very narrow cylindrical branches. Both forms have an outer cortical layer of small cells (5 × 10 µm), an intermediate layer of large cells (15 × 35 µm) and an inner core of narrower cells (10 × 50 µm) (Figures 2 & 3). There is a tendency for the central core of longer and narrower medullary cells not to be present in cross sections of the broader form (Figure 7). Both forms have been found producing distal tetrasporangial sori (Figures 8 & 9) in which there seem to be no differentiating characteristics.

The narrow form of the widespread *Gelidiopsis* in Natal could be classified as *G. gracilis* (Kützing) Vickers whereas the broader form, having flattened branches, particularly in mid-regions, may be classified as either *G. variabilis* (Greville) Schmitz or *G. planicaulis* (Taylor) Taylor. I have examined a specimen of *G. variabilis* from Ceylon collected by Harvey (UC 77138) and a specimen of *G. planicaulis* [UC 949835, from Ilha Govendor, Brazil (*Schmitt no. 63*), cited by Taylor (1943) in his original description of *Wurdemannia miniata* var. *planicaulis*] and can find no real difference between the two. Both are somewhat irregularly and sparsely branched and both are approximately the same size. Cordeiro-Marino (1978) discussed the similarities between *G. planicaulis* and *G. gracilis*, concluding that the former species does not occur in Brazil. A specimen of *G. tenuis* Setchell et Gardner was also examined (*Dawson no. 648* from near Guaymas, Mexico) and it is considered to have structure and form within the variability recognized for *G. variabilis*.

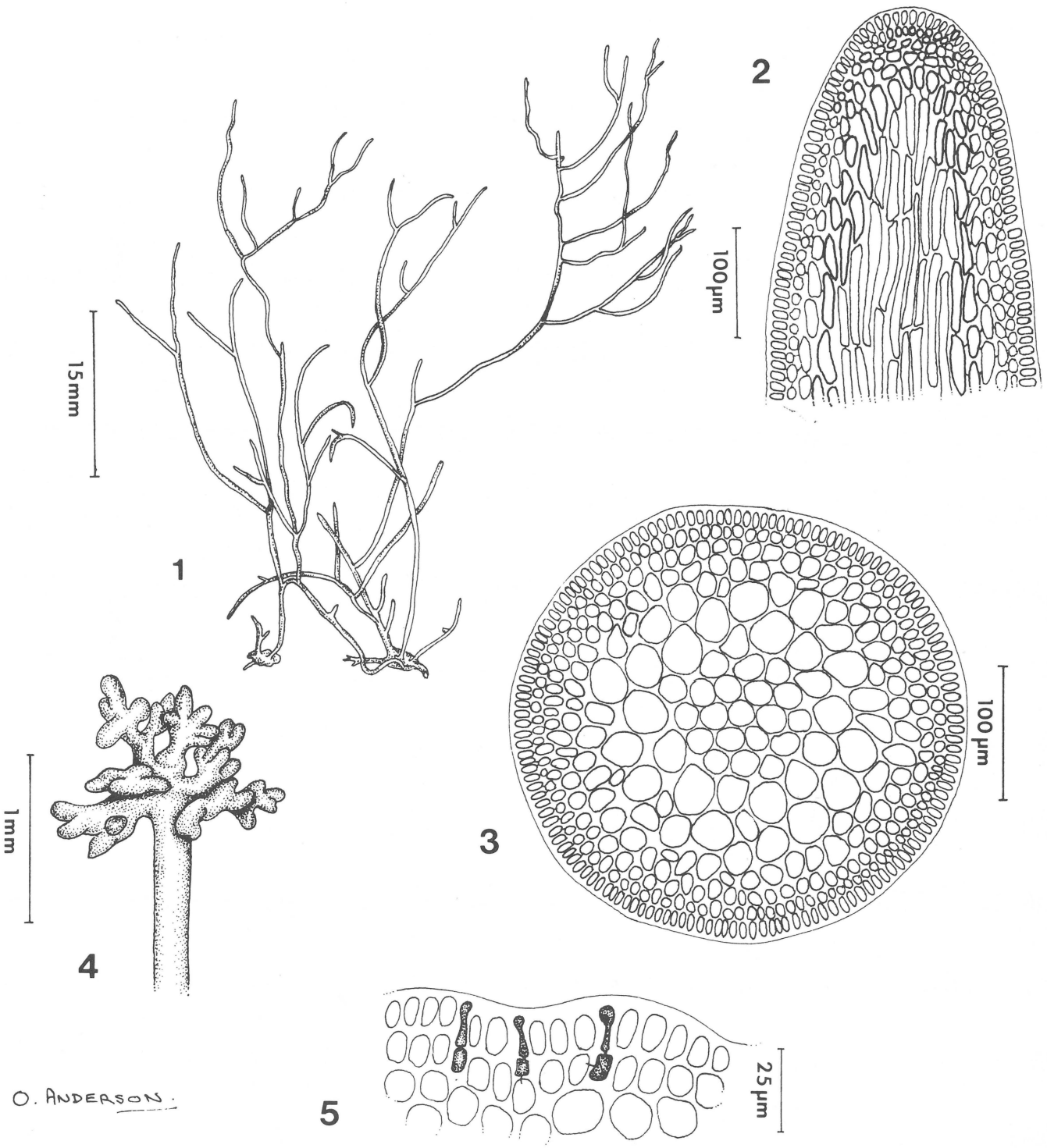
The narrow, widely distributed form in Natal, especially from field-collected plants, in addition to being like *C. gracilis*, is similar to *G. intricata* (C. Agardh) Vickers. Analysis of the latter species in a literature survey as well as from herbarium specimens, cited below, has shown that the Natal thalli of the narrow form of *G. variabilis* are consistently broader and longer than those of *G. intricata*. Also, as mentioned above, *G. intricata* produces short adventitious branches that adhere to adjacent branches (Figure 10) often producing a mat-like, reticulate mass of branches. *Gelidiopsis variabilis* never produces such adhering branches and seems, instead, to have a growth form of separate branches usually having prostrate and erect branch systems.

Tetrasporangial sori in the Natal specimens of *G. variabilis* are always in distal tips of branches which are swollen in all directions and not particularly flattened (Figure 8), having large cruciately divided tetrasporangia surrounded by small-celled (3 µm dia.) filaments forming an interstitial tissue (Figure 9). Cruciately divided tetrasporangia, however, are difficult to find in the Natal specimens, most sporangia remaining undivided or irregularly divided, some probably being released as monospores. Sporangia are approximately 25 × 50 µm. The distal branch tips bearing tetrasporangial sori usually are unbranched and terminate long unbranched segments of the plant. Such terminal tetrasporangial sori were also illustrated by Kützing (1868) for *Acrocarpus capitatus*, a synonym of *G. intricata* according to Dawson (1954), and for *G. intricata* by Jaasund (1976), a condition that contradicts the description by Tsuda (1976) who described intercalary tetrasporangial 'stichidia' for that species [Tsuda (1968) also mentioned the same intercalary position of tetrasporangial sori in another collection, *Gelidiopsis* sp., a species that is probably the same as the one he later named *G. intricata*]. In both collections Tsuda mentioned that haptera-like organs attached the branches to one another. In another collection from the mid-Pacific Tsuda (1964) mentioned terminal 'stichidia' being present in *G. intricata*. It seems possible, therefore, that position of the tetrasporangial sorus, either terminal or intercalary, may be a distinguishing characteristic for species resembling *G. intricata* and that both types are present in floras of the Pacific, the plants having intercalary tetrasporangial sori possibly being a new species. It should be recognized, however,

that *G. intricata* may have nomenclatural problems as already mentioned by Steentoft (1967) who also concluded that *G. intricata* may not be a species distinct from *G. variabilis*.

As a result of these comparisons and deliberations, the present conclusion on species of *Gelidiopsis* in Natal is that there are two taxa, one found so far only in the Kosi Bay region, a narrow form having anastomosing branches which can be classified as *G. intricata*. The other taxon is present in at least two growth forms, neither of which seems to be characteristic for *G. intricata*. It occurs throughout Natal and I conclude that it is *G. variabilis*, a species that seems to be greatly variable in form as well as in some aspects of anatomy. I also conclude that *G. gracilis* (Kützing) Vickers, *G. planicaulis* (Taylor) Taylor, and *G. tenuis* Setchell et Gardner are the same taxon as *G. variabilis* (Greville in J. Agardh) Schmitz and synonymy of these species is proposed.

Gelidiopsis variabilis in culture (*Nat 1704*) produced terminal coralloid growth of its branches (Figure 4) in a subculture started in the early autumn, the distal regions becoming thickened and verrucose. Sections of these regions showed the presence of many two-celled carpogonial branches (Figure 5), the terminal cell having a long slender projection with a bulbous tip, the trichogyne. The supporting cell of the carpogonial branch is indistinguishable from other cortical

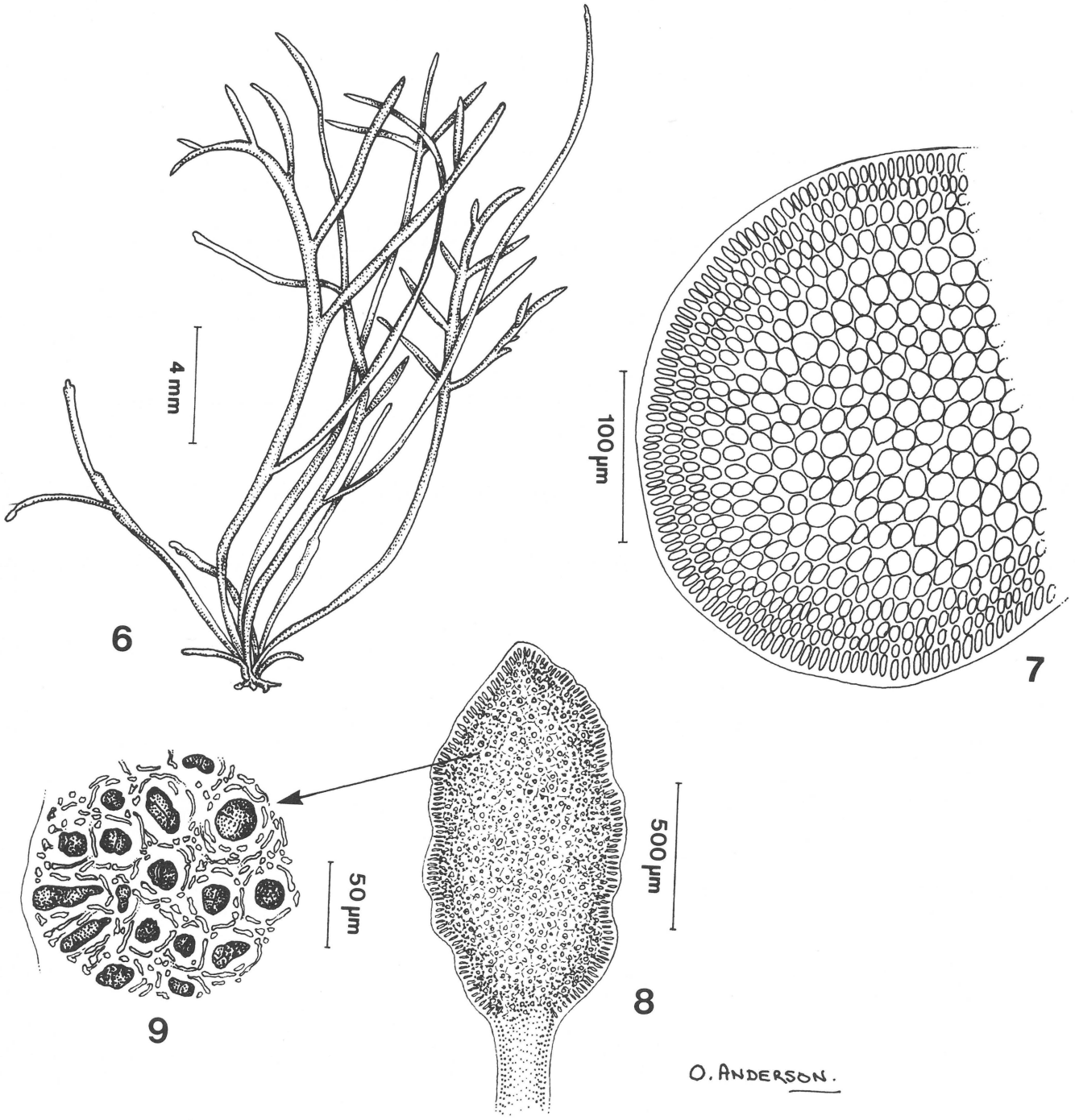


Figures 1 – 5 *Ceratodictyon variabilis*. **1.** Part of a plant with narrow prostrate and erect branches. Note the irregular branching pattern. **2.** Longitudinal section through a branch apex. **3.** Cross section of a mature region of an erect branch. **4.** A coralloid branch tip, occurring on a cultured plant, in which carpogonial branches were found. **5.** Section through a coralloid branch showing two-celled carpogonial branches (stippled).

cells. Carpogonial branches were observed only in the coralloid branch tips of this plant. Subculturing of this plant in late winter produced branches of normal vegetative growth form, not forming the coralloid distal branches, indicating that fertility in this plant is stimulated by environmental factor(s), in this case very likely to be the onset of short day length. It is unfortunate that male plants were not available to induce cystocarps in these cultured plants so that post-fertilization stages could be analyzed. Schmitz (1896) mentioned that cystocarps occur on similar branches in *Gelidiopsis* as well as in *Ceratodictyon*. Schmitz also mentioned that both genera produce tetrasporangial sori in distal more or less swollen branch tips.

There are two records of male reproductive structures for *Gelidiopsis*, one by Dawson (1954) who showed spermatangia covering the surface of a distal swollen part of a branch in *G. intricata*. Egerod (1971) confirmed Dawson's observations in showing that the same species in Thailand has similar male reproductive branches.

Because of the recent revelation (Price *et al.* 1984) that *Ceratodictyon spongiosum* has monopodial branches that remain free from one another in culture instead of forming a reticulate thallus, a main character used by Schmitz to separate *Ceratodictyon* from *Gelidiopsis*, and recognizing that anastomosing branches are known for thalli of at least two species of *Gelidiopsis*, *G. intricata* and *G. pannosa* (Grunow 1874), I favour combining the two genera into one. There are no presently known characters of reproduction separating



Figures 6 – 9 *Ceratodictyon variabilis*. **6.** Part of a plant with narrow prostrate but broader upright branches. **7.** Cross section of a mature region of an erect branch in which the central medullary cells are approximately the same diameter as the surrounding inner cortical cells. **8.** A tetrasporangial sorus terminating an upright branch. **9.** Part of the tetrasporangial sorus more highly magnified to show sporangia and interstitial narrow-celled filaments.

these two genera. Neither *Gelidiopsis* nor *Ceratodictyon* has been previously reported from South Africa (Seagrief 1984). The following emended description of *Ceratodictyon* is recommended:

Ceratodictyon *Zanardini* Phyceae papuanae novae vel minus cognitae. Nuovo giorn. bot. ital. 10:36 (1878). Type species *C. spongiosum* Zanardini (*loc. cit.*).

Branched cartilaginous plants often having prostrate stoloniferous branch systems and erect branches that have variable form, but usually are cylindrical to narrowly flattened. Branches in a few species adhering to one another forming a reticulate or anastomosing mass of branches. Several species often grow in close association with sponges. Tissues of the thallus comprised of a small-celled cortex, the cells gradually increasing in size toward the interior where the inner cortex and medulla are indistinguishable, forming a compact tissue of larger pseudoparenchymatous cells that are more or less elongated in the direction of the thallus axis. An interior core of cells having a smaller diameter and sometimes with wide intercellular spaces, the medulla, often is present comprised of cells that have a comparatively greater length than the cells in intermediate positions. Tetrasporangial sori in distal regions of branches, usually swollen and having small interstitial cells in filaments located between the tetrasporangia. Female branches producing coralloid distal regions where carpogonial branches are formed. Cystocarps sometimes clustered or single in the branch tips, small, protuberant and usually having a beaked ostiole. Cystocarps having a central fusion cell surrounded by at least a few pseudoparenchymatous cells. The filamentous gonimoblast is directed outwards toward the ostiole. Carposporangia are borne in short terminal chains on the gonimoblast filaments. The pericarp wall is comparatively thick. Male plants have spermatangia in sori similar to those producing tetrasporangia, forming a continuous surface over enlarged branch tips.

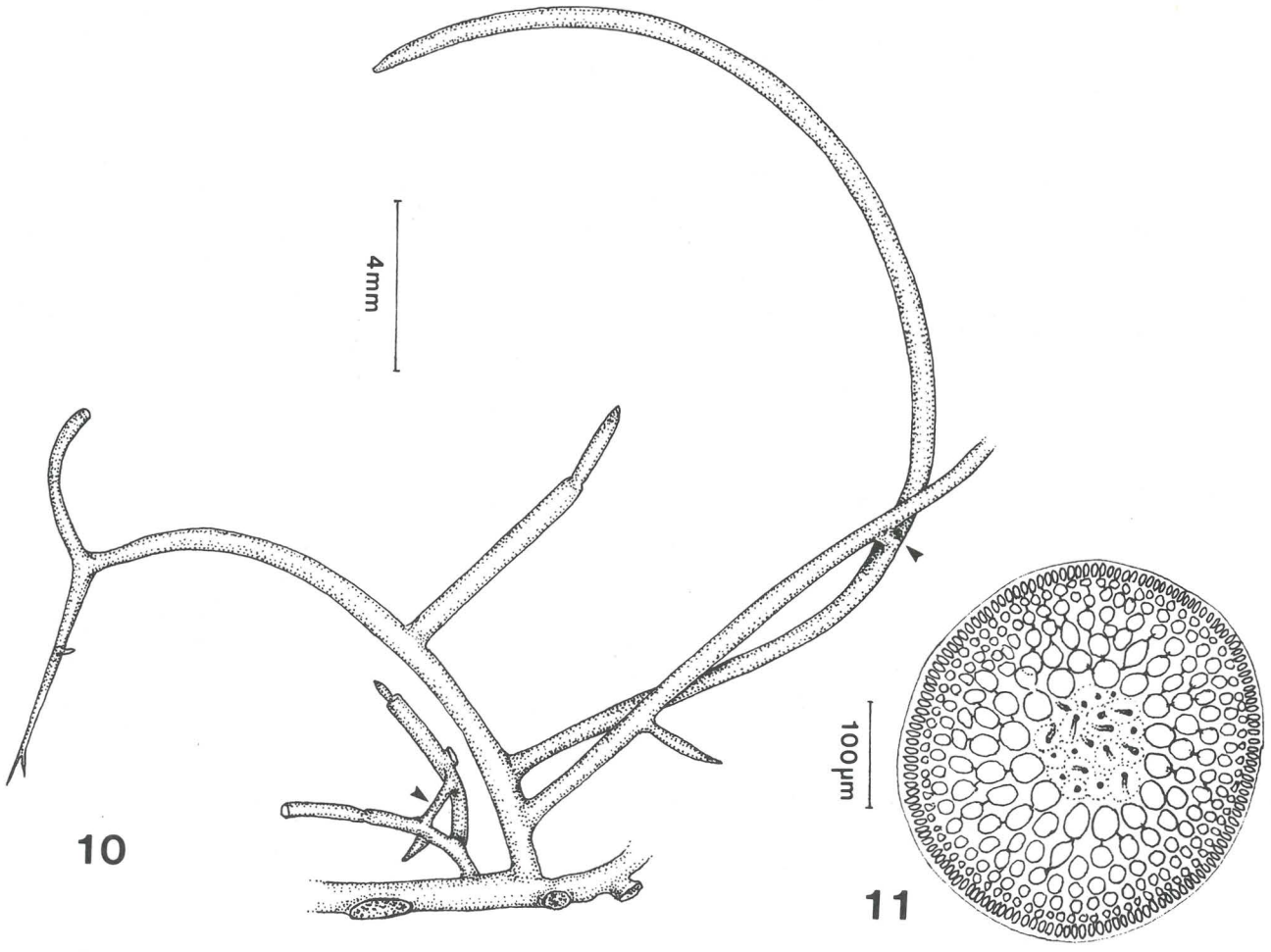
It is of particular interest that not only the type species of *Ceratodictyon, C. spongiosum*, usually lives in association with a sponge, but *G. scoparium* is also known to often have sponge covering on the thallus (Montagne & Millardet 1862).

New Combinations

1. Ceratodictyon variabilis *(Greville ex J. Agardh) R.E. Norris*, comb. nov.

Basionym: *Gelidium variabile* Greville *ex* J. Agardh, Sp. Gen. et Ordines Florid. 2(2):468 (1852); Kützing, Tab. Phyc. XIX:9 (1869).

Gelidiopsis variabilis (Grev. *ex* J. Agardh) Schmitz in Engler's Bot. Jahrb. 21:148 (1896); Weber-van Bosse, Siboga Exped. 4(3):426 (1928); Feldmann in Trav. cryptog. déd. L. Mangin, p. 6 (1931); Bφrgesen in K. Danske Vidensk. Selsk., Biol. Meddel. 18(11): 15 (1950); Dawson in Allan Hancock Pac. Exped. 3(10): 265 (1944), 17(1): 86 (1953); Yamada in Bull. Jap. Soc. Phycol. 5: 62 (1957); Durairatnam in Fish. Res. Sta., Dept. Fish. Ceylon, Bull. no. 10: 64 (1961); Lee in New Asia College Acad. Ann. 7: 81 (1965);



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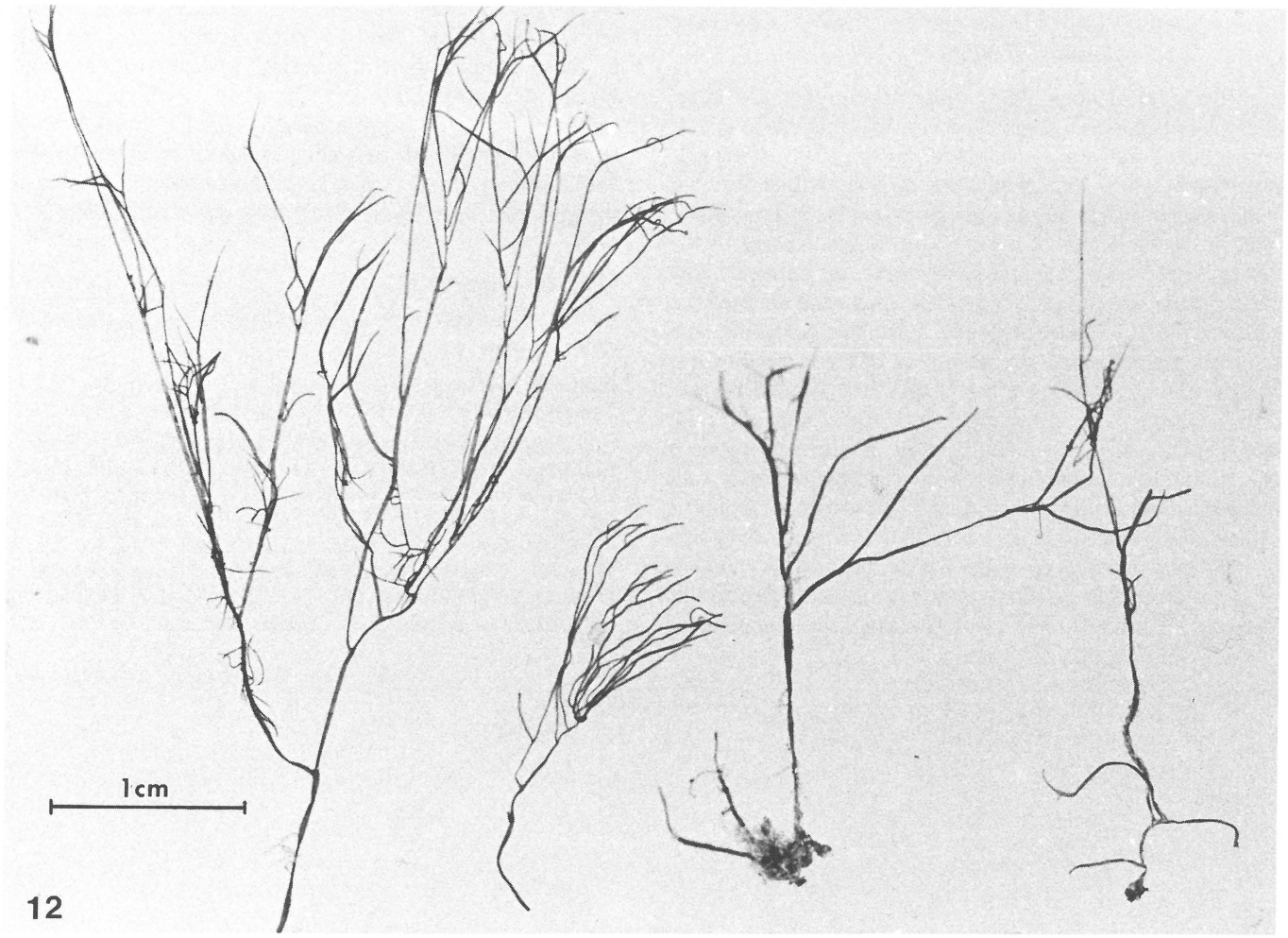
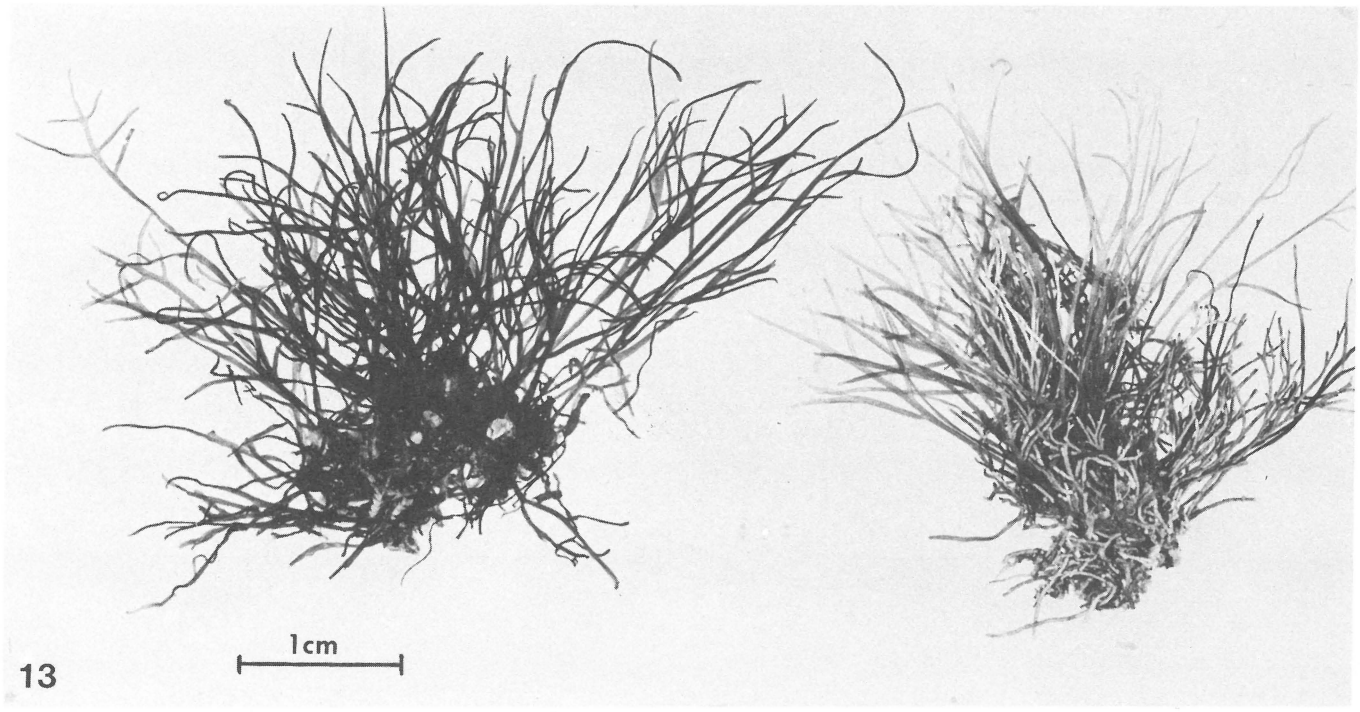
Figures 10 & 11 *Ceratodictyon intricatum.* **10.** Habit of part of plant showing branchlets fusing larger branches together (arrowheads). Note also broken attaching branchlets on the lower branch. **11.** Cross section of a branch having exceptionally narrow cells in the medulla.

Steentoft in J. Linn. Soc. (Bot.) 60: 125 (1967); Womersley & Bailey in Phil. Trans. Roy. Soc. Lond., B. Biol. Sci. 259(830): 318 (1970); Jaasund, Intertidal Seaweeds in Tanzania p. 87 (1976); John & Lawson in Bot. Mar. 20: 131 (1977); Cordero, Studies on Philippine Marine Red Algae, p. 122 (1981) [as *G. repens* (Grev.) Schmitz]; Lawson & John in Beih. Nova Hedwigia 70: 174 (1982); Tseng, Common Seaweeds of China p. 100 (1983) [as *G. intricata* (Ag.) Vickers].





Figures 12 & 13 *Ceratodictyon variabilis*. **12.** A field-collected plant having a narrow form. Collected intertidally at Reunion Rocks, Durban, 16 – IV – 1984 (NU 9226). **13.** Field collected plants having a broad form. Collected intertidally at Mtwaluma, Natal, 1 – IX – 1985 (NU 8116).

Gelidiopsis gracilis (Kützing) Vickers in Ann. Sci. Nat. Bot., ser. 9, 1: 45 (1905); Feldmann in Trav. cryptog. déd. L. Mangin p. 7 (1931); Yamada in Bull. Jap. Soc. Phycol. 5: 62 (1957); Taylor, Mar. Alg. E. Trop. & Subtrop. Coasts Amer. p. 352 (1960); Joly in Bol. Fac. Fil., Ciênc. Let., Univ. Sâo Paulo, no. 294: 158 (1965); Cordeiro-Marino in Rickia 7: 65 (1977).

Acrocarpus gracilis Kützing, Tab. Phyc. 18: 12 (1868). [Holotype specimen examined, (L, no. *0122*)].

Gelidiopsis planicaulis (W.R. Taylor) W.R. Taylor, Mar. Alg. of the East. Trop. and Subtrop. Coasts of the Americas p. 353 (1960); Chapman, The Marine Algae of Jamaica, Pt. 2, p. 185 (1963); Joly in Bol. Fac. Fil., Ciênc. Let. Univ. Sâo Paulo, Bot., no. 294: 158 (1965); Richardson in Bull. Brit. Mus. (Nat. Hist.) Bot. 5(3): 112 (1975); John & Lawson in Bot. Mar. 17: 252 (1974), 20: 131 (1977); Lawson & John in Beih. Nova Hedwigia 70: 174 (1982). [Specimen cited by Taylor (1943) examined (*Schmitt 63*, from Brazil, UC 949835)].

Wurdemannia miniata (Draparnaud ex de Candolle) Feldmann et Hamel var. *planicaulis* Taylor in Pap. Mich. Acad. Sci., Arts, & Lett. 28: 158 (1943). [Holotype specimen examined (MICH, Bartlett no. *17896*)].

Gelidiopsis tenuis Setchell et Gardner, Proc. Cal. Acad. Sci. iv, 12(29): 749 (1924); Dawson in Allan Hancock Pac. Exped. 17(1): 84 (1953). [Specimen examined (*Dawson 648*, near Guaymas Mexico)].

Specimens examined

—**2832** (Mtubatuba): On intertidal rocks at Cape Vidal (– BB), 25 – IX – 1984, *Nat 2238* (NU 8865).
—**2930** (Pietermaritzburg): Intertidal at Reunion Rocks (– DD), 16 – IV – 1984, *Nat 1817, 2055, 2058* (NU 8115, 9376, 9398, 9410, 9473); Intertidal at Rocky Bay, Park Rynie (– BC), 18 – IX – 1982, *Nat 0218, 0330*; 9 – IX – 1983, *Nat 1429, 1430, 1454*; 2 – VII – 1984, *Nat 2469, 2497*; 28 – VIII – 1984, *Nat 2119*; 23 – IV – 1986, *Nat 3917* (in culture).
—**2931** (Stanger): On intertidal rocks S. of Mvoti River mouth (– AD), 16 – IV – 1984, *Nat 1634* (NU 8332), *1704* (in culture).
—**3030** (Port Shepstone): intertidal rocks at Mtwalume (– BC), 1 – IX – 1985 *Nat 3118* (in culture); intertidal rocks at Palm Beach (– CD), 15 – V – 1983, *Nat 1488*; 24 – V – 1985 *Nat 4010* (in culture).

2. Ceratodictyon pannosum *(Grunow) R.E. Norris,* comb. nov.

Basionym: *Gelidium pannosum* Grunow in J. Mus. Godeffroy 3: 40 (1874).

Gelidiopsis pannosum (Grunow) Schmitz in Engler's bot. Jahrb. 21: 148 (1896); Feldmann in Trav. cryptog. déd. L. Mangin p. 6 (1931).

3. Ceratodictyon scoparium *(Montagne et Millardet) R.E. Norris*, comb. nov.

Basionym: *Gelidium scoparia* Mont. et Millard. in Notes sur l'Ile de la Réunion (ed. L. Maillard), p. 14 (1862); Kützing, Tab. Phyc. 18: 16 (1868).

Gelidiopsis scoparia (Mont. et Millard.) Schmitz in Engler's bot. Jahrb. 21: 149 (1896); Feldmann in Trav. crypt. déd. L. Mangin, p. 7 (1931); Womersley & Bailey in Phil. Trans. Roy. Soc. Lond., B. Biol. Sci. 259(830): 318 (1970).

4. Ceratodictyon intricatum *(C. Agardh) R.E. Norris*, comb. nov.

Basionym: *Sphaerococcus intricatus* C. Agardh Sp. Alg. 1(2): 333 (1822).

Gelidium intricatum (C. Ag.) Kützing Sp. Alg. p. 767 (1849); Grunow in J. Mus. Godeffroy 3: 40 (1874); Setchell in Univ. Calif. Publ. Bot. 12: 98 (1926).

Acrocarpus intricatus (C. Ag.) Kützing Tab. Phyc. 18: 12 (1868) [Specimen examined (L, no. *0122*)].

Acrocarpus capitatus Kützing Tab. Phyc. 18: 12 (1868).

Gelidiopsis intricata (C. Ag.) Vickers in Ann. Sci. Nat., Bot. ix, 1: 61 (1905); Weber-van Bosse in Alg. de l'Exp. danoise aux îles Kei, p. 140 (1926); Siboga Exped. 4(3): 425 (1928); Feldmann in Trav. crypt. déd. L. Mangin, p. 7 (1931); Yamada & Tanaka in Sci. Pap. Inst. Algol. Res., Fac. Sci. Hokkaido Imp. Univ. 2(1): 74 (1938); Bφrgesen in K. Danske Vidensk. Selsk., Biol. Meddel. 19(1): 53 (1943); Dawson in Pac. Sci. 8: 423 (1954); Yamada in Bull. Jap. Soc. Phycol. 5: 62 (1957); Taylor, Mar. Alg. E. Trop. & Subtrop. Coasts of the Americas p. 353 (1960); Tsuda in Atoll Res. Bull. no. 105, p. 9 (1964); May in Contr. N.S.W. Nat. Herb. 3(6): 391 (1965); Womersley & Bailey in Phil. Trans. Roy. Soc. Lond., B. Biol. Sci. 259(830): 318 (1970); Egerod in Phycologia 10: 131 (1971); Jaasund, Intertidal Seaweeds in Tanzania p. 87 (1976); Tsuda in Rev. Algol., N.S. 11: 329 (1976); Cordero in Fish. Res. J. of the Philippines 3: 21 (1978); Cordero, Studies on Philippine Marine Red Algae, p. 119 (1981); Schnetter & Bula Meyer in Biblioth. Phycolog. 60: 141 (1982); Cribb, Mar. Alg. S. Great Barrier Reef, I. Rhodophyta p. 56 (1983).

Specimens examined

—**2632** (Bela Vista): On intertidal rock platforms S. of entrance to Kosi Bay (– DD), 16, 17 – XI – 1982, *Nat 0526*.

5. Ceratodictyon repens *(Kützing) R.E. Norris*, comb. nov.

Basionym: *Gelidium repens* Kützing Tab. Phyc. 18: 21 (1868).

Gelidiopsis repens (Kützing) Schmitz in Engler's bot. Jahrb. 21: 148 (1896); Weber-van Bosse, Siboga Exped. 4(3): 425 (1928); Okamura in Bull. Biogeo. Soc. Jap. 2: 113 (1931); Yamada & Tanaka in Sci. Pap. Inst. Algol. Res., Fac. Sci., Hokkaido Imp. Univ. 1(1): 74 (1938); Yamada in Bull. Jap. Soc. Phycol. 5: 62 (1957); Durairatnam in Fish. Res. Sta., Dept. Fish, Ceylon, Bull. no. 10: 64 (1961); Chihara, Gakken Illust. Nat. Encyclopedia, The Seaweeds of Japan p. 138 (1975); Cordero in Fish. Res. J. of the Philippines 3: 22 (1978); Cordero, Taxonomy and Distribution of Philippine Useful Seaweeds, p. 54 (1980); Cordero, Studies on Philippine Marine Red Algae, p. 121 (1981).

Gelidium acrocarpum Harvey Ceylon Alg. 34 (nom. nud.); Kützing, Tab. Phyc. 19: 8 (1869); Grunow in J. Mus. Godeffroy 3: 39 (1874); Hauck in Hedwigia 25: 89 (1886).

Gelidiopsis acrocarpa (Harv.) Schmitz in Engler's bot. Jahrb. 21: 148 (1896); Feldmann in Trav. cryptog. déd. L. Mangin p. 7 (1931); Bφrgesen in K. Danske Vidensk. Selsk. (Biol. Medd.) 22(4): 18 (1954), 23(4): 28 (footnote) (1957); May in Contrib. N.S.W. Nat. Herb. 3(6): 391 (1965); Jaasund, Intertidal Seaweeds in Tanzania p. 89 (1976).

6. Ceratodictyon hachijoensis *(Yamada et Segawa) R.E. Norris*, comb. nov.

Basionym: *Gelidiopsis hachijoensis* Yamada et Segawa in Rec. Oceanog. Works in Japan (N.S.) 1:112 (1953); Yamada in Bull. Jap. Soc. Phycol. 5: 62 (1957); Segawa, Coloured Illust. of the Seaweeds of Japan (Revised Ed.) p. 90 (1957); Chihara, Gakken Illust. Nat. Encyclopedia, The Seaweeds of Japan p. 138 (1975).

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