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THE *SCINAIA* ASSEMBLAGE

BY

WILLIAM ALBERT SETCHELL

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I. INTRODUCTION

The genus *Scinaia* was established by Baron Antonio Bivona-Bernardi in 1822. The description and plate were evidently published at Palermo in some journal, or other ephemeral publication, entitled *L'Iride* (cf. J. G. Agardh, 1851, pp. 420, 421). It seems to be a very rare publication at present, but the writer was enabled to consult the three unnumbered pages and the single unnumbered plate at the British Museum of Natural History at South Kensington through the kindness of Mr. A. Gepp. There can be no doubt that the genus was founded on the common Mediterranean plant which has usually been referred to as *Scinaia furcellata*. A condensed account of the new genus was published in *Flora* in 1824 (cf. Bivona, 1824), but without the figures. The name *Scinaia*, however, was lost sight of for a series

of years, but was brought to the attention of algologists by J. G. Agardh (1851, p. 420) who clearly defined it and established its prior right over the two genera, *Ginnania* of Montagne and *Myelomium* of Kuetzing. The genera *Endymonema* and *Schestedtia* of Schousboe were probably never published except as synonyms (cf. Bornet, 1892, p. 265).

The genus *Ginnania* was apparently suggested as a genus but not named by Lamouroux (1813, p. 45), but was published by Montagne (1840, p. 162) to receive the plant of the Atlantic Coast of southern Europe and of northern Africa. The name has been spelled in all the various ways possible, e.g., *Ginannia* Montagne (1842, p. 257, 1844–46, p. 60, and 1856, p. 436), *Ginnannia* J. G. Agardh (1876, p. 510) and the correct spelling, *Ginnania* Montagne (1840, p. 162) and Kuetzing (1866, p. 24). Montagne held to his own name even after J. G. Agardh brought forward *Scinaia* and (1856, p. 436) explains his reasons in the sentence: "non qui modo nominat, sed qui characterem enucleat, is verus generis fundator existimari debet." It is certainly true that Bivona gave no diagnosis or discussion of *Scinaia* as a genus. *Ginannia* and *Ginnania* have each been proposed once or twice, also, for genera of flowering plants, but in every case have been relegated to the categories of synonyms so far as the writer has been able to determine.

The third genus, *Myelomium,* was proposed by Kuetzing (1843, p. 393), who seemed unaware of the existence of either *Scinaia* or *Ginnania,* although he includes as a species *Myelomium undulatum,* citing as a synonym *Halymenia undulata* J. Ag., but without citing any definite reference. This species had been described by Montagne in 1842 (p. 257) without any synonym but, from Montagne's statement in connection with his description (*loc. cit.*) and the references of Kuetzing (1843, p. 393) and of J. G. Agardh (1851, p. 422), it seems a proper inference that the specific name was first applied, though not published, by J. G. Agardh.

The type of the genus *Scinaia* is the *Ulva furcellata* of Dawson Turner (1801, p. 301), variously referred as may be seen from the synonymy quoted later. The type locality is Sheringham, in Norfolk on the eastern shore of England, i.e., on the North Sea. It has been customary to refer all slender and even broader specimens of *Scinaia* to this species, until its recorded distribution is practically world-wide. Even certain constricted forms have been referred to this species, e.g., *Scinaia furcellata* var, *subcostata* J. Ag. (1851, p. 422). Montagne

(1842, p. 393) proposed a species from the western coasts of South America, *Ginannia undulata,* which Agardh reduced to a variety of *Scinaia furcellata* (1851, p. 422) and Kuetzing (1849, pp. 715, 716) referred to *Ginnania* (as he correctly transcribed Montagne's name) five species. One of these, viz., *G. irregularis* has been later referred to *Nemastoma dichotoma* J. Ag. (1842, p. 91). It is evidently not a member of the genus *Scinaia* (cf. Kuetzing, 1866, pl. 69, *a-c*), while his *G. furcellata, G. pulvinata,* and *G. undulata* have usually been considered as all appertaining to *Scinaia furcellata.* Concerning the "*Ginnania undulata*" of Kuetzing, it may be noted here that the later figure of this plant published by Kuetzing (1866, pl. 69, *d-f*) seems more like a *Callophyllis* or some such plant than like *Scinaia* in structure. This point will be taken up again later. The fifth species of Kuetzing, *G. Salicornioides* from Port Natal in South Africa, is abundantly different in habit and structure (cf. also Kuetzing, 1866, pl. 70) from *Scinaia furcellata.* It is a regularly constricted form and so different in certain details of structure from the type of the genus *Scinaia,* that J. G. Agardh (1861, p. 423) refers it to *Scinaia* with a query ("?").

In 1866 (p. 30, pl. 83) Kuetzing described and figured under the name "*Ginnania carnosa*" a plant from Ceylon which existed in Herb. Sonder under the unpublished name of *Scinaia carnosa* Harv. This is undoubtedly the plant issued by W. H. Harvey under No. 38 of his Algae of Ceylon (Exsicc.), with printed label, but without diagnosis. The plant is fairly close to *Scinaia Salicornioides* (Kuetz.) J. Ag. in habit and structure and its status will be discussed later on.

In 1876, J. G. Agardh (p. 512) described a var. *australis* of *Scinaia furcellata,* to receive a plant from New Zealand. In 1876 J. G. Agardh, then, recognized three varieties of *Scinaia furcellata* besides the type, viz: var. *undulata* (Mont.) J. Ag., var. *australis* J. Ag., and var. *subcostata* J. Ag.,—besides *Sc. carnosa* Harv. and *Sc. Salicornioides* (Kuetz.) J. Ag. He also separated from the genus *Scinaia* (*loc. cit.,* p. 510), under the name *Gloiophloea Scinaioides,* a plant from Australia which had previously been referred to *Scinaia furcellata.* Finally, in 1884 (p. 72), J. G. Agardh made his final addition to the genus *Scinaia,* in the form of *Scinaia moniliformis,* a very distinct, regularly constricted plant from Port Phillip, Australia, collected by J. Bracebridge Wilson.

In later years, only two additions have been made to the genus *Scinaia.* In 1901, F. S. Collins distributed a plant from Florida under

No. 836 of Fascicle XVII, of the Phycotheca Boreali-Americana, under the name of *Scinaia furcellata* forma *complanata.* He states that: "The frond is flattened throughout even when quite fresh" and suggests that it may possibly be the same as *Isymenia angusta* J. G. Agardh (1899, p. 66). Collins (1906, p. 110) reprinted the diagnosis and remarks later in a botanical journal. Cotton (1907, p. 260) raised this variety to a species.

The last species to be added to the genus is a plant from the Gulf of California to which M. A. Howe (1911, p. 500, fig. 1 and pl. 28) has given the name of *Scinaia latifrons.* It is a large and broad, flattened species with cystocarps largely marginal.

At present, then, the genus *Scinaia* is credited with six species and three varieties, as follows: *Sc. furcellata* with varr. *undulata, subcostata,* and *australis, Sc. complanata, Sc. latifrons, Sc. carnosa, Sc. Salicornioides,* and *Sc. moniliformis.* It is the intention of the writer to examine into the structure and the status of each of these so far as possible.

II. MATERIALS AND TECHNIQUE

The writer has been gathering together materials of what usually passes for *Scinaia* for many years in connection with a study of the puzzling forms of the California coast. His impressions have varied from those of recognizing a few widely distributed species to those of very considerably multiplying the number of species to be recognized. Comparatively little study, however, had been made of the details of structure until very recently, partly because of the difficulty of obtaining good results from dried material. Most of the materials at hand consist of dried specimens and it is difficult to make specimens resume their original form after being dried under even slight pressure. The material is mostly Californian, on which coast there are four or five well-marked species or varieties of *Scinaia*-like plants, only one of which has been seen in living condition by the writer. The writer has also collected considerable living material of *Scinaia* in the vicinity of Woods Hole, Massachusetts, and has received dried specimens from others. There is a fair amount of dried material available from Florida and from the Mediterranean. Other specimens are individual and scattering, but there are available good dried and formalin specimens from the Hawaiian Islands. Practically all of this material has

been examined. Some work has also been done on certain type specimens in different herbaria, but most of such work was necessarily superficial.

The general method of procedure, in the case of herbarium specimens, has been, after moistening first with 95 per cent alcohol and then with water, to remove a sufficient portion for examination. The selected portion was then soaked for some time in water, passed through a strong solution of potassic hydrate, three separate and prolonged washings in water, 10 per cent hydrochloric acid, then three more washings in water, and finally preserved in 70 per cent alcohol to which a trace of formalin had been added. The specimens were finally sectioned on a freezing microtome. Through an ingenious adaptation of the freezing device of Osterhout (1896, p. 195), Dr. N. L. Gardner has modified it so as to use it on the Minot rotary microtome, thus making it possible to cut very thin and uniform sections. Most of the sections used have been 5μ or 10μ thick and were cut by Dr. Gardner or by Dr. T. H. Goodspeed. The stain used was Fuchsin S. (Grübler's) in acidified alcohol.

In spite of the treatment with swelling reagents, none of the specimens was brought back absolutely to its original shape, although in most cases it was possible to determine whether the specimens were either cylindrical or else at least not very much flattened.

III. MORPHOLOGY

In dealing with the general matters of structure before taking up the special morphology and taxonomy, it seems desirable to speak of a *Scinaia* assemblage, because it was found on careful study that no less than three genera are represented among the plants usually referred to *Scinaia* and have the external form of that genus as well as some of the histological characters.

In habit and color there is general agreement among all the plants, but there are some differences which assist in distinguishing the species at sight. In general the plants arise from a discoid holdfast from which one or more short, solid stipes arise which branch dichotomously and fairly regularly and repeatedly, to produce a more or less ample frond anywhere from 4 to 30 cm. in height. The tips are even or uneven in height according, apparently, to the conditions of

development and are as a rule blunt rather than acute, though more or less abruptly tapering. The color varies from a delicate pink through shades of red to a very dark red or reddish purple. The diameter of the branches is nearly the same throughout and varies from 2 mm. up to 12 mm. The branches are cylindrical in most species and in some are constricted more or less regularly, giving a moniliform appearance, while in certain species the branches are evidently decidedly flattened or complanate. In many of the species the branches are evidently or obscurely narrowed below, while in a few the branches are conspicuously of the same diameter below as above. The number of dichotomies varies in different species but less so in individuals of the same species, and seems to be a diagnostic character of value.

At the tips of the branches are one, or usually two, circular, shallow sunken areas which from growth proceeds by a multitude of filaments exactly as in *Galaxaura* (Kny, 1872, p. 704; Oltmanns, 1904, p. 556), but in one species of *Scinaia* the growing region seems convex (cf. p. 102 of text). Below the tip is to be found an axile strand, stouter or more slender according to the species and composed of few to many coarser filaments longitudinally parallel or somewhat intertwined. From these are given off slender, more or less horizontal filaments, dichotomously branched and ending in the closely connecting cells of the continuous cortex. Between the axile strand and the cortex is, in the fresh condition, a sort of watery jelly filling the interior of the branches.

The structure of the cortex in *Scinaia furcellata* has been subject to some discussion which is outlined admirably by Bornet and Thuret (1876, p. 19) and generally consists of one or more layers of colored cells under an external compact layer of colorless cells. It is the existence of this colorless epidermal layer that is said to distinguish the genus *Scinaia* from *Gloiophloea* J. Ag.

The epidermal layer of colorless cells was not recognized by the earlier algologists and there seems to be differences of opinion as to its structure. Bornet and Thuret (1876, p. 20) describe the epidermal layer as made up of colorless cells scattered between which are small colored cells, but this structure is not shown in their figure (*loc. cit.*, pl. VI). Kuetzing, however, does show it (1866, pl. 68, *b*) in the way it appears to the writer, and Crouan (1867, pl. H, f. 118, 6) also shows the general appearance of colored and colorless cells in surface view. The horizontal filaments from the axile strand end in corymbs of short

cells, the central one of each corymb being enlarged and colorless. This is particularly true of *Scinaia furcellata* but is found to some extent in other species of *Scinaia.* In extra-European plants, hitherto referred without question, the relation of colored and colorless cells is different, as will appear during the discussion below. Berthold (1882, p. 697) speaks of the development of the colorless outermost layer of cells and says that they do not divide after they are formed but as the thallus develops, the under cells push out through and become enlarged and hyaline. Berthold looks on this colorless layer as a protection against high light intensity. J. G. Agardh (1880, p. 61) also treats of this layer of utricles in *Scinaia.*

The colorless epidermal cells, or utricles as they may be called, vary in size and proportions in the different species and also as to the admixture or absence of colored cells, affording trustworthy evidences of specific difference, as will be shown later.

In the new genus, *Pseudoscinaia,* to be proposed below, the outer layer is made up of utricles as in *Scinaia,* but in the genus *Gloiophloea* of J. G. Agardh the outer layer is described as being made up of fasciculate moniliform dichotomo-fastigiate filaments. An examination shows, however, as will be indicated below, that the same cymose-corymbose structure prevails as in *Scinaia,* i.e., the central cell of the corymb ceases to grow, enlarges, becomes hyaline and thus changes into a utricle. The surrounding cells of the corymb, however, grow on and repeat the process at a higher level, branching corymbosely in turn, forming a utricle in the center, while the lateral branches grow on and finally form a complete series of fasciculate moniliform anticlinal filaments. The utricles are thereby hidden and usually collapse sooner or later, becoming inconspicuous and often difficult of detection. This is particularly true of the antheridial areas. In cystocarpic plants, especially when younger, the appearance is much that of *Scinaia,* except that the colored cells surrounding the utricles are unusually numerous.

At the base, in the disk and the stipe, the structure is more solid than above in the branches and the colorless epidermal cells are practically absent. The hypodermis, that is, the layer or layers of colored cells under the colorless "epidermis," varies in number, arrangement and size of cells in the different species. The number of layers varies from one to three, the size varies considerably, and the arrangement in some species is looser than in others.

Within the hypodermis of the cortex and more or less closely

applied to it, running longitudinally downwards, are very slender filaments. These filaments vary in abundance in the different species and in flattened species are more abundant just within the margins. This layer will be referred to as the "corticating layer." In the center of the frond is an axis of intertwined longitudinal filaments of two sorts, coarser and finer. The coarser filaments originate from the apical meristem, the finer are corticating filaments. This axial strand varies in coarseness even in the same species, but in different species the difference may be sufficient to attract attention. This happens when it is invisible in pressed specimens of one species and visible in others. Some discussion has arisen in this connection (cf. Harvey, 1846, pl. LXIX, J. G. Agardh, 1851, p. 423, Bornet et Thuret, 1876, p. 20, etc.) and it is not possible even yet to separate species definitely according to whether the axis shows in the dried (and pressed) specimens or not. Something, however, may be said, as will be seen below in the discussions under the separate species recognized in this paper.

Antheridia and cystocarps are known in *Scinaia,* but as yet no tetrasporangia have been detected.

The antheridia of *Scinaia furcellata* have been briefly described by Bornet and Thuret (1876, p. 20) as forming very small bouquets disseminated between the peripheral cells of the frond, which renders them difficult of detection. Antheridia have been seen in almost all of the species of *Scinaia* described below and in all species of *Gloiophloea* and of *Pseudoscinaia.* In all the species of *Scinaia* and *Pseudoscinaia* they occur scattered single, or in small groups, and probably always on the same plant with the cystocarps. In *Gloiophloea* the antheridia cover extensive areas, either on the same plant with the cystocarps or on separate plants. They occur singly or in twos on longer or shorter supporting cells which grow out between the utricles in all three genera.

Although it is not so stated by any authority, so far as the writer is aware, *Scinaia furcellata* is monoecious and bears the antheridia singly or in small fascicles, as Bornet describes, between the colorless epidermal cells. Possibly all the species of *Scinaia* are monoecious, but in a few species described below the writer has not been able to demonstrate this to his own satisfaction because of the lack of abundant material. The writer suspects that a certain group of species, in which the colored cells in the epidermal layer are scanty, may possibly be dioecious. Farther discussion may be left until the conditions in the individual species are taken up.

The cystocarp in *Scinaia furcellata* has been the subject of considerable controversy which is so well summed up by Bornet and Thuret (1876, p. 19). It is a pyriform structure borne just under the cortex through which it opens by a distinct carpostome. The point in dispute was the possession of a cellular envelope. This was pointed out by Montagne (1842, p. 257) but was either passed over in silence (Kuetzing, 1849, p. 715, 1866, pl. 68, *b*, Harvey, 1846, pl. 69, figs. 3 and 7) or denied (J. G. Agardh, 1851, p. 421, and 1876, p. 512). Later it was acknowledged and made plain (Harvey, 1853, p. 136; Thuret, 1855, p. 155; Crouan, 1867, pl. 17, no. 118, fig. 4; Bornet and Thuret, 1876, p. 19, pl. 6, fig. 6, 7,; Schmitz, 1896, p. 337, fig. 206, *b;* J. G. Agardh, 1880, p. 245) so that there remains no reason for doubt. In some species, however, it seems fairly certain that the envelope consists of fairly distinct filaments whose points are neither enlarged nor combined (consequently) into a pseudoparenchymatous structure. In dealing with dried specimens, however, it is often difficult to settle such a question entirely satisfactorily.

Concerning the cystocarps in other species of *Scinaia* little has been said except as to position in the frond (M. A. Howe, 1911, p. 500), yet, as will be shown later, the shape, size and peculiarities of the enveloping tissue show sufficient and constant variations, to afford valuable diagnostic characters.

Two species have been found which in external appearance have such close resemblance to *Scinaia furcellata* (as generally conceived) that they would ordinarily be referred to that species, whose cystocarps are not strictly of the *Scinaia*-type, but are more of the *Galaxaura* type, in that the gonimoblasts, instead of all rising or radiating from a more or less distinct cellular placenta and being free, have some free while some adhere to the walls of the periderm and line the lower half to two thirds of the cystcarpic cavity (cf. pl. 16, fig. 61). It has seemed necessary to remove these two species from *Scinaia* and even to create a new genus (*Pseudoscinaia*) to receive them, since the vegetative characteristics are distinctly scinaioid. In all the species of *Scinaia* and *Gloiophloea,* on the other hand, the gonimoblasts in the cystocarps, both of *Scinaia* and of *Gloiophloea,* arise from a small, but varying placenta, and are all free from the periderm.

The development of the cystocarp in *Scinaia furcellata* has been thoroughly described and illustrated by Bornet and Thuret (1876, p. 20, pl. 6, figs. 1–7). The procarps are always formed in the apical

region of a branch and consist of a three-celled branchlet bearing the carpogonium with the long trichogyne at its apex. The sporogenous tissue is produced directly from the apical cell, i.e., the carpogonium, the middle cell, even before fecundation of the carpogonium, begins to send out processes which become filamentous and later grow up around the sporogenous mass as it develops. The filaments are at first separate, but become pressed together so tightly that when their individual cells enlarge the whole growth of filaments forms a sort of parenchymatous envelope surrounding the sporogenous tissue in a pyriform cavity which opens out above, forming a narrow carpostome. The basal cell of the procarpic branch enlarges to form a more or less conspicuous stalk-cell or pedicel. Nothing is known, apparently, of the germination of the carpospore and of the early stages of any of the species of *Scinaia*.

Each of the points connected with the cystocarp needs much further discussion than is possible even after an examination of all the material at the present disposal of the writer.

Nearly all the specimens of *Scinaia* proper, accessible to the writer, show cystocarps in the adult stage and as a rule very plainly in the pressed condition. They form, to the naked eye, more or less conspicuous, larger or smaller dots of a decidedly darker color than the frond. In almost all the species they are scattered over the surface of the frond in no regular order. In two species, however, *Scinaia latifrons* Howe (1911, p. 500, fig. 1, pl. 28) and *Scinaia Cottonii* sp. nov., the cystocarps show a decided tendency to aggregate themselves along the margins of the flattened fronds.

IV. TAXONOMY

In taking up the matter of the systematic arrangement it will also be possible to amplify the preceding statements about general structure as the special morphology of each genus and species is considered. In the following account is taken up each and every specimen accessible to the writer for examination and study, and an attempt is made to place each one as accurately as possible. As will be seen, considerable differences are brought out and a considerable number of new names proposed. It is hoped that they may be justified and made clear in the following account.

SCINAIA Bivona

The two particular characteristics of this genus within the Chaetangiaceae are the cystocarp and the epidermis consisting largely of swollen colorless cells or utricles. As at present recognized it has been credited with six species as well as three varieties. In the present account, all these species have been retained and one of the varieties has been elevated to specific rank but has been removed, however, from *Scinaia* to *Gloiophloea*. The remaining two varieties remain as in previous accounts because of lack of accessible material for investigation. Five new species have been proposed, and certain plants which have the habit and vegetative structure of *Scinaia* have been the basis for proposing a new genus on account of differences in the structure of the cystocarp. As represented here, then, *Scinaia* is a genus of eleven species and two varieties.

I. Cylindrical, Normally Unconstricted Species

To this section of the genus three species and two varieties are referred. The members of this section are fairly readily to be distinguished from those of the other two sections, although there are difficulties. In the first place, dried specimens, particularly those dried under pressure, do not fully recover their shape. Such specimens and especially specimens dried under any considerable pressure are not always to be readily distinguished from those in which the frond is naturally complanate. In the second place, while the characteristic plants are lacking in any regular constrictions and show such only when proliferating after injury, there are two cases, seemingly closely related here, in which the forms are constricted. They may be and probably are, however, of only occasional appearance. In spite of these two difficulties, it seems to the writer that this is a natural group, sufficiently sharply delimited to deserve special mention.

The cylindrical group may be again segregated into two subgroups of one or two species each, by the structure of the utricles or colorless cells of the epidermal layer. In the first subgroup the outer ends of the utricles are convex outwardly and bulge somewhat, giving a superficial view of bluntly rounded polygonal cells not closely packed together, while in the second subgroup, the outer ends of the utricles are flattened and give, in surface view, the hexagonal appearance of honeycomb.

1. **Scinaia furcellata** (Turner) Bivona

Plate 10, figs. 1–12; plate 14, figs. 41–43.

Scinaia furcellata Bivona, l'Iride (with pl.) 1822; Flora, vol. 1, p. 135;
J. G. Agardh, Spec. Alg., vol. 2, 2, p. 422, 1851, *ibid.*, vol. 3, 1, p. 512, 1876;
Harvey, Ner. Bor.-Amer., part 2, p. 136, 1853 (in part);
Thuret, Mem. Soc. Nat. Cherbourg, vol. 3, p. 155, 1855;
Crouan, Fl. Finist., p. 146, pl. 17, f. 118, 1867;
Kny, Botan. Zeit., vol. 30, p. 704, 1872;
Farlow, Proc. Amer. Acad., vol. 10, p. 367, 1875; Rept. U. S. Fish Comm. for 1876, p. 699, 1876; Mar. Alg. New England, p. 118, 1881;
Bornet et Thuret, Notes Algol., p. 18, pl. 6, 1876;
Le Jolis, List Alg. Mar. Cherbourg, p. 108 (1864), 1880;
Berthold, Pringh. Jahrb., vol. 13, p. 697, 1882;
Ardissone, Phyc. Medit., p. 269, 1883;
Schmitz, Befrucht. Florid., p. 15, pl. 5, f. 5, 1883;
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Holmes and Batters, Ann. Bot., vol. 5, p. 88, 1890;
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Engl. Bot., pl. 1881;

Ulva interrupta Poiret, Encyc. Meth., vol. 8, p. 171, 1808;
De Candolle, Fl. Franc., vol. 6, p. 3, 1815;

Fucus pseudocrispus Clemente, Ensayo, p. 311, 1807 (*fide* C. A. Agardh);

Fucus Stackhousei Clemente, Ensayo, p. 312, 1807 (*fide* C. A. Agardh with a query);

Dumontia interrupta Lamouroux, Dict. class. d'hist. nat., vol. 5, p. 645, 1824;
Duby, Bot. Gall., pars. 2, p. 941, 1830;

Dumontia triquetra Lamouroux, Essai, p. 45, 1813;

Halymenia furcellata C. Agardh, Spec. Alg., vol. 1, p. 212, 1821, Syst. Alg. p. 244, 1824;

Greville, Alg. Britt., p. 163, 1830;

Hooker, Brit. Flora, vol. 2, part 1, p. 308, 1833;

Harvey, *in* Mackay, Fl. Hibern., part 3, p. 189, 1836, Man. Brit. Algae (1st edn.), p. 52, 1841, Man. Brit. Algae (2nd edn.), p. 149, 1849;

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Rabenhorst, Deutschl. Krypt.-Flora, bd. 2, abth. 2, p. 149, 1847;

Harvey, Phyc. Brit., pl. 69, 1846;

Kuetzing, Spec. Alg., p. 715, 1849, Tab. Phyc., vol. 16, pl. 68, fig. II, 1866;

Myelomium pulvinatum Kuetzing, Phyc. Gener., p. 393, 1843;

Myelomium furcellatum Kuetzing, Phyc. Gener., p. 393, pl. 73, fig. 1, 1843;

Ginannia pulvinata Kuetzing, Tab. Phyc., vol. 16, pl. 68, fig. *a, b,* 1866;

Fucus succosus Schousboe, *in* Bornet, Alg. Schousb., p. 265, 1892 (as synonym);

Schestedtia humilis Schousboe, *in* Bornet, Alg. Schousb., p. 265, 1892 (as synonym);

Endymonema massiliense Schousboe, *in* Bornet, Alg. Schousb., p. 265, 1892 (as synonym);

Schestedtia purpurea Schousboe, *in* Bornet, Alg. Schousb., p. 265, 1892 (as synonym);

Exsiccatae.

Lloyd, Alg. Ouest., No. 112 (under *Scinaia furcellata*).

Crouan, Alg. Mar. Finist., No. 225 (under *Scinaia furcellata*).

Desmazières, Pl. Crypt. de France, No. 1288 (under *Dumontia interrupta*).

Wyatt, Alg. Danm., No. 79 (under *Halymenia furcellata*).

Plant rosy red to red purple, 2–8 cm. high, 3–9 (usually 7–8) times dichotomous, slender (0.75–3.0 mm. diam. dried), cylindrical, continuous, branches slightly attenuated downwards, apices blunt to slightly acute; axis very obscure (dried) as a rule; monoecious; cystocarps minute, barely visible to the naked eye, scattered; — axial strand broad, of a few larger filaments and many slender filaments loosely applied and intertwined; ascending filaments obscure downwards; epidermal layer of large colorless cells or utricles surrounded by numerous slender colored cells; utricles oblong or obovate, 13–22μ (T) and 22–24μ (R), commonly 13μ (T) by 22μ (R), with outer ends rounded and decidedly convex; colored cells of epidermis about 22μ (R) by 3μ (T), single or fascicled, very abundant, loosely encircling the colorless cells, and each finally bearing antheridia which project beyond the colorless external cuticula; hypodermal cells in 2–3 layers, oblong or obpyriform, 6–18μ (T); corticating layer (within hypodermis) broad, loose, of slender intertwined filaments; antheridia single or double, borne successively on single or slightly fasciculate slender colored cells among the colorless cells of the epi-

dermis; cystocarps narrow or broadly pyriform (according to age), 135–195μ (T & R), broad and rounded at the base and tapering gradually from just below the middle to the carpostome; gonimoblasts slender, numerous, crowded, radiating upwards and inwards from a placental group of a few large cells, forming a dense pyriform mass, abjointing oblong spores in succession; pedicel distinct; periderm of 2–3 layers, coarsely pseudoparenchymatous below, separating into distinct filaments above.

The structure of *Scinaia furcellata* is of importance, since this species is the type of the genus and all considerations as to generic agreement or disagreement must be settled, or at least discussed, on a basis of comparison with *Sc. furcellata.* The axis of the frond in the various specimens examined is comparatively broad and made up of a few larger filaments, parallel to one another or very loosely entwined, surrounded by few to many very slender, more or less intricately entwined corticating filaments. The horizontal, later "ascending" filaments are numerous above but more scanty below. The cortex is made up of three layers, the epidermal layer, the hypodermal layer, and a layer of corticating filaments. The corticating layer is fairly broad and made up of slender filaments, arising from the cells of the ascending filaments as well as from those of the hypodermal layer. These slender filaments are vertical, oblique, or nearly horizontal in their course and loosely entwined. The hypodermal layer is made up of two to three layers of colored cells of various shapes according to situation in the plant (i.e., according to age and development). When younger (i.e., above) they are spherical to ovoid, becoming elongated and obovate or clavate with age (i.e, below). The epidermal layer is composed of cells which are colored or very nearly alike at first, but soon begin to differentiate. Certain of these cells, regularly placed, enlarge and become lighter colored, until, at maturity, they are swollen and seemingly devoid of solid contents. Their shape varies according to age and development. At first globular (cf. fig. 2, pl. 10), or very nearly so (cf. fig. 3, pl. 10), they later become larger and flattened (cf. fig. 5, pl. 10) or oblong (cf. fig. 5, pl. 10), then elongated and narrowed more or less above (cf. fig. 4, pl. 10), but at maturity they agree in being obovate or inversely pear-shaped (cf. figs. 6–11, pl. 10), the outer end being obtusely rounded and the inner end contracted. These large hyaline cells of the epidermal layer are the so-called utricles. Among them are scattered elongated, slender, colored cells, which later bear the antheridia. In *Scinaia furcellata,* so far as the material examined

shows, these slender colored cells of the epidermal layer are abundant. Crouan (1867, pl. 17, fig. 118) and Bornet and Thuret (1876, p. 20) indicate that they also find them abundant. The growth of the peripheral filaments in *Scinaia,* and also in the related genera to be considered in this account, is corymbose and cymose. The central cell of the cluster ceases to grow and becomes a utricle, while the lateral cells grow on into the slender, colored cells (cf. also Bornet and Thuret, *loc. cit.*). A similar growth is to be found in species of the genus *Gloiophloea* J. Ag. as will be shown below, but in the species of the latter genus the process proceeds farther than it does in species of *Scinaia.*

The antheridia are developed from the slender, colored cells of the epidermal layer. These cells bear one to four antheridial cells, or may bear one to four branches, each of which, in turn, bears one to four antheridial cells (cf. figs. 1, 6, 7, and 8 on pl. 10). It is difficult, as Bornet and Thuret say (1876, p. 20), to make out the exact antheridial structure and it was only in the thinnest sections that the details could be at all clearly perceived. In vigorous plants of *Scinaia furcellata* they are very abundant.

The structure and development of the cystocarp in *Scinaia furcellata* must also be carefully considered because this species is the type of the genus. The development has been carefully and most accurately described by Bornet and Thuret (*loc. cit.,* p. 20, pl. 6, figs. 1–5). The carpogonium gives rise to a glomerule of cells from which the gonimoblasts arise, while the cells of the carpogonial branch immediately below the carpogonium send out a dense circle of bracteoid filaments which grow up around the developing gonimoblasts. As these bracteoid filaments develop, the cells of the lower two-thirds become swollen and are consequently pressed together and adhere to form a pseudoparenchymatous periderm, while the cells of the upper third remain distinct and filamentous, in the region of, and surrounding, the carpostome. The filaments of the periderm send off slender free branches into the cavity of the cystocarp. The gonimoblast filaments branch and form a broader or narrower ovoid and very compact mass. The spores are elongated ellipsoidal successively abjointed above.

The type locality of *Scinaia furcellata* is Sheringham, in Norfolk, England, on the North Sea, whence it was described by Turner (1801) as *Ulva furcellata.* Through the kindness of the Director of the Royal Botanical Gardens at Kew, a search for the type specimen was made by Mr. A. D. Cotton, at my request, and what seems, in all

probability, to be it has been found. It is evidently a Turner specimen and is labelled "U. furcellata . . . (specimen drawn) . . . Sept. 1800." It does not agree in every detail with Turner's figure (1801, pl. 1, fig. A), but it does correspond to parts of it and it seems likely that portions only of the specimen were drawn. The specimen, moreover, has the base complete while the drawing lacks the base. It seems allowable to consider this specimen as the type since its agreement with the figure is as close as in certain other undoubted types and drawings of Turner. Through the kindness of the Director, Dr. Prain, and of Mr. Cotton, I have been able to make a microscopical examination of the type, and a section through the cortex is represented in figure 1 on plate 10. The details of structure are the same as in all the other European plants I have been able to examine and I have little hesitation in referring them all to one and the same species (cf. figs. 1–10, pl. 10). The question whether there is one species in Europe, or more than one, must still be left for future investigation. That there is reason for suspecting that there may be more than one species will appear from the fact that Harvey (1841, p. 52; 1846, pl. 69, and 1849, p. 149) speaks of larger specimens (up to half an inch in diameter) than normal and the writer has seen a specimen from Gibraltar in the Herbarium of the British Museum of Natural History which is 6 mm. broad. Mere size may not indicate a different species, but it may also be associated with histological differences. Unfortunately, at present, it is not possible to make any study of the structure of the specimens mentioned.

The distinguishing features of the European specimens, all of which seem to be identical with the type of *Scinaia furcellata* in structure, are the low slender habit, the turgid tips of the utricles and the large number of colored cells usually present in the epidermis.

Scinaia furcellata var. **subcostata**

J. G. Agardh, Spec. Alg., vol. 2, 2, p. 422, 1851, *ibid.*, vol. 3, 1, p. 513, 1876;
Crouan, Fl. Finist., p. 146, 1867;
De Toni, Syll. Alg., vol. 4, sect. 1, p. 105, 1897;
Holmes and Batters, Ann. Bot., vol. 5, p. 88, 1890;
Batters, Journ. of Botany, vol. 29, p. 274, 1891;
Bornet, Alg. Schousb., p. 265, 1892.

Halymenia furcellata var. *subcostata* J. G. Agardh, Alg. Med., p. 98, 1843.
Ginnania furcellata var. *subcostata* Harvey, Phyc. Brit., vol. 1, pl. 69, 1846.

The plant described by J. G. Agardh as var. *subcostata* under the species is unknown to me except from the description. Agardh

emphasized particularly the strong (i.e., visible) axis which, in pressed specimens, has the appearance of a midrib. This character will vary in prominence according to the condition of the specimen and the method of preparation. The second character emphasized by Agardh is the constrictions of the upper portion of the frond into cylindrical segments. Agardh does not say how regular this may or may not be. If regular, I am inclined to separate the plant from *Scinaia furcellata*. The description of Agardh also indicates a more robust plant than typical *Scinaia furcellata*. Both Harvey and the Crouan brothers mention the greater diameter, the brighter color, and the midrib effect, but say nothing as to the constrictions. The status of the plants included under this reference cannot be settled, therefore, until the various specimens can be examined critically. These statements, however, together with my impressions of certain broader specimens seen in the Herbarium of the British Museum of Natural History (but not sectioned), lead me to believe that here may be at least two species on European coasts additional to *Scinaia furcellata* as limited to type.

Scinaia furcellata var. **australis**

J. G. Agardh, Spec. Alg., vol. 3, 1, p. 512, 1876;
De Toni, Syll. Alg., vol. 4, sect. 1, p. 105, 1897.

Scinaia furcellata Hooker & Harvey, Flora New Zealand, vol. 2, p. 245, 1855 (*fide* J. G. Agardh, *loc. cit.*); Handbook of the Flora of New Zealand, p. 691, 1867.

The var. *australis* is unknown to me except from Agardh's description. The plant has a firmer wall and the branches are more evidently fasciculate fastigiate. Agardh does not discuss any possible relationship to be suspected between this plant and his *Gloiophloea Scinaioides* earlier described (1870, p. 29) from South Australia, except as he queries whether all the austral *Scinaia furcellata* may not be referred under *Gloiophloea Scinaioides*. The fact that he later established the var. *australis* seems to indicate that he considered the latter plant to be a true *Scinaia*. As will be shown below, J. G. Agardh in his account of the New Zealand algae (1877, p. 26) includes *Scinaia furcellata* without comment and cites the references of Harvey and Hooker (1845) which he in the "Epicrisis" (1876, p. 512) has cited under the var. *australis*. I have been able to examine a specimen from the Bay of Islands in the North Island of New Zealand collected

by Berggren and named and cited by Agardh under the above reference (J. Ag., 1877, p. 26). As I shall show later, this is a *Gloiophloea* and, as I assume, identical with *Gloiophloea Scinaioides* J. Ag. However, a specimen collected at Port Phillip Heads near Melbourne, Australia, by J. Bracebridge Wilson and distributed by him under the name of *Scinaia furcellata,* is, in my opinion, neither a *Scinaia* nor a *Gloiophloea,* but a member of a new genus which later on in this paper I have named *Pseudoscinaia.* This may prove to be identical with the *Scinaia furcellata* var. *australis* J. Ag. It seems questionable, therefore, whether there exists any species of cylindrical, unconstricted *Scinaia* on the Australian or New Zealand coasts.

The distribution of typical *Scinaia furcellata* as limited to what seems to be strictly its proper specific limits, must be stated, in the light of my investigations, as confined to the North Atlantic Ocean and Mediterranean and Adriatic Seas. In the Mediterranean, it seems to be more or less abundant on the northern coasts, but thus far I have no certain knowledge as to its occurrence either on the eastern or on the southern shores. It certainly occurs on the French coasts of the English Channel, in the southern half of the North Sea, in the Irish Sea and on the southwestern Atlantic coasts of Ireland. It is reported from the Canary Islands (Vickers, 1896, p. 302). It also occurs on the southern coasts of New England (Massachusetts and Rhode Island). It does not seem desirable to quote all the localities whence I have examined specimens, but I may note that, besides the type specimen, I have been enabled through the kindness of Dr. Paul Kuckuck to examine a series collected at Helgoland, as well as a number from the northwestern shores of France. I have also studied a number of specimens collected on the western shores of Italy, kindly supplied by Dr. Angelo Mazza and by Miss Minnie Reed, and from the southeast coast of France collected by Dr. W. G. Farlow. The New England specimens are largely of my own collecting in the neighborhood of Woods Hole, Massachusetts, and of Watch Hill, Rhode Island. They differ slightly but apparently not essentially from those of Europe.

In the second subgroup of the cylindrical, continuous species, the colorless cells of the epidermis, or utricles, are flattened on the outer ends and closely pressed together, so that a surface view (tangential section) shows them as polygonal (5–7-gonal) areas of fairly uniform

size, of a honeycomb-like appearance. Both the species referred here are North Pacific Ocean as to their distribution and have fewer colored cells scattered through their epidermis than the species here taken to be true *Scinaia furcellata*. Both species, also, are decidedly more robust than *Scinaia furcellata*.

Scinaia Johnstoniae sp. nov.

Plate 11, figs. 14, 15.

Scinaia furcellata var. *undulata* M. A. Howe, Bull. Torrey Botan. Club, vol. 38, p. 502, 1911 (not *Ginnania undulata* Mont.).

Plants dark red purple, 8–12 cm. high, 7–8 times dichotomous, cylindrical, continuous, broad, 3–5 mm. in diameter (dried); branches attenuated downwards; axils narrow; axis obscure (dried); cystocarps minute but visible, scattered; — axial strand loose, broad, of a few larger filaments and a loose diffuse admixture of slender filaments; epidermis of large colorless flat-topped cells, or utricles, with few, scattered colored cells in groups of one to four; utricles flattened outwards, closely pressed together, 5–7-gonal in surface view (T), fairly uniform in size, square or slightly flattened (in sections), 21–25μ (T) and 20–21μ (R), thin walled; colored cells of epidermis scanty, scattered, 1–4 together; hypodermal cells in a single layer, scattered, orbicular, 16–28μ in diameter; corticating layer thin, loose, of straggling slender filaments; antheridia sparse, 1–4 together or in small clusters; cystocarps broadly pyriform, abruptly narrowed into a short neck, 180–265μ (T) and 128–170μ (R); gonimoblasts slender, very numerous, radiating from a small stalked, cellular placenta, forming a broadly reniform sporogenous mass, abjointing successively ellipsoidal spores; periderm thin, of about 4 layers of pseudoparenchymatous cells.

The type specimen of *Scinaia Johnstoniae* is a specimen collected at San Pedro, California, by Mrs. H. D. Johnston (Herb. Univ. Calif., No. 96356) and the species is, therefore, gratefully dedicated to Mrs. H. D. Johnston, not only in acknowledgment of her discovery of this specimen, but also in recognition of her valuable services in collecting and donating interesting algae from Southern California. Mrs. M. S. Snyder has also collected this species at La Jolla, California, for the use of the writer. The writer also feels safe in referring here the *Scinaia furcellata* var. *undulata* of M. A. Howe (1911, p. 502) from La Paz, California Baja, Mexico, after examining a fragment (Vives 11d) kindly communicated by Dr. Howe. The type of *Ginnania undulata* Mont., as has been stated above, has been found to be a *Gloiophloea* rather than a *Scinaia*. *Scinaia Johnstoniae*, therefore,

ranges along the coasts of Lower (Baja) California and Southern California from La Paz to San Pedro, and may be expected as far north as Santa Barbara, California, at least.

Scinaia Johnstoniae is a robust, thin-walled species, differing in aspect from the preceding species. The epidermal layer and the hypodermis, both distinguish the species from others in this same subgroup but are much like those of *Scinaia latifrons. Scinaia Johnstoniae,* however, appears to be cylindrical and the cystocarps are scattered through the superficial layers of the frond. The differences between *Scinaia Johnstoniae* and *Scinaia japonica,* referred to this same subgroup, will be discussed under the latter.

Scinaia japonica sp. nov.

Plate 11, figs. 16–18.

Scinaia furcellata Okamura, Icones of Japanese Algae, plate III, 1907 (not *Ulva furcellata* Turner).

Plant of a dark red opaque color, 15 cm. high, 9–11 times dichotomous, moderately broad, 1–3 mm. in diameter (dried); axils narrow; substance dense (in appearance) cartilaginous; axis invisible (dried); cystocarps invisible (dried); — axial strand stout, of numerous large filaments and few slender filaments; epidermis of large colorless cells, or utricles, and very scanty slender colored cells; utricles large, uniform, closely placed, with flattened outer ends, 5–7-gonal in surface view (T), palisade-like in section, 30μ (R) by 8–12μ (T), with radial walls finely wrinkled thus showing delicate striae (in sections of dried specimens well treated with KOH); hypodermis of 2–4 layers of globular cells; corticating layer thin of sparse slender filaments; antheridia not seen; cystocarps globular-pyriform with short, abruptly tapering, very short neck, 400μ (T) by 300–350μ (R); gonimoblasts very numerous, slender, radiating from a distinct cellular placental tissue, abjointing successively oblong spores; periderm of 5–7 layers, pseudoparenchymatous.

Scinaia japonica is founded on a single specimen (Herb. Univ. Calif., No. 90835) collected at Misaki, Bay of Tokyo(?), Japan, by K. Yendo, in April, 1900, and referred by the collector to *Scinaia furcellata.* It seems also to be the same plant as the one figured by K. Okamura in his *Icones of Japanese Algae* (1907, pl. III) under *Scinaia furcellata.* It is not, however, represented by the specimen distributed by Okamura in his Algae Japonicae Exsiccatae under No. 2, at least, so far as the copy in the writer's

possession is concerned. That will be referred to later under *Gloiophloea.*

Scinaia japonica is a dark opaque red, fairly robust plant, seemingly thick and cartilaginous, nearest in appearance and structure to *Scinaia Johnstoniae* and *Sc. articulata,* but is longer, more branched, with distinctly palisade epidermal layer and a greater number of layers in the hypodermis. It approaches *Scinaia articulata* in structure but *Scinaia articulata* has less elongated colored cells in the epidermis, fewer layers in the hypodermis, and smaller cystocarps than *Scinaia japonica.* Both, however, show the delicate and regular tangential crinklings of the radial walls of the colorless cells of the epidermis in sections of dried specimens however much swollen by reagents (KOH) ; these may be artefacts but show regularly and constantly in each form (cf. pl. 11, fig. 17).

As to the extent of the distribution of *Scinaia japonica* along the coast of Japan, it will be necessary to have more data. According to Okamura (1907, p. 11) *Scinaia furcellata* extends along the Pacific coast of Japan from Nagasaki to Province Hitachi and on the west coast in Province Idzumo, but, as already stated above, there has been confusion with a species of *Gloiophloea.* Probably *Scinaia japonica* has an equally wide distribution, but more specimens must be examined before the matter can be considered as definitely settled.

II. Flattened or Complanate Unconstricted Species

To this section of the genus three species are to be referred, viz., *Scinaia complanata* Cotton (*Scinaia furcellata* var. *complanata* F. S. Collins, 1901, No. 836 and 1906, p. 110), *Scinaia Cottonii* sp. nov., and *Scinaia latifrons* M. A. Howe (1911, p. 500). One of these has been observed to be flattened even in the living condition (cf. Collins, *loc. cit.*) and the other two have structural peculiarities definitely indicating flattened structure (cf. Howe, *loc. cit.* and *Cotton,* 1907, p. 260). While it is very difficult to be certain whether any of the forms are cylindrical or slightly flattened because of the failure of specimens dried under pressure to fully recover their shape, there is sufficient evidence, it seems to the writer, to be certain that these three forms are at least complanate and that the rest of the species of *Scinaia,* as here limited, are very nearly if not quite cylindrical. A character of importance here is the axis, which is not visible in dried specimens and when investigated microscopically is found to be distinct only just

below the apices of the branches but which soon broadens and becomes diffuse below.

It is to be noted that one of the species included in this group is found in Florida, one in the corresponding latitudes of the Pacific Coast, in Southern and Lower (Baja) California, and the third on the coast of Japan.

Scinaia complanata (F. S. Collins) Cotton

Plate 11, figs. 19–22.

Cotton, *in* Kew Bulletin, No. 7, p. 260, 1907 (excl. Japanese plant).

Scinaia furcellata var. *complanata* F. S. Collins, *in* Phyc. Bor. Am., Fasc. 17, No. 836, 1901, Rhodora, vol. 8, p. 110, 1906.

Scinaia furcellata Harvey, Nereis Boreali-Americana, part 2, p. 136, 1853 (in part, incl. Key West plant only).

Plant pale rose red; 5–8 cm. high, 8–9 times dichotomous, axils rather broad, flattened, not constricted, 1.5–6(?)mm. in diameter (dried); axis obscure; cystocarps scattered, visible; — axial strand of 6–8 broad filaments, plain above, soon diffuse and disappearing below; epidermis of large colorless cells, or utricles, uniform and closely packed together with very scanty colored cells, except near the apices of the branches; utricles flattened at outer end, uniform and closely placed, 5–6-gonal in surface view (T), in section flattened rectangular, 34–35μ (T) by 22μ (R); colored cells of epidermis slender, very few except at tips of branches; hypodermis of a single layer, of loosely placed round or pyriform cells 8–9μ in diameter; corticating layer narrow, loose; antheridia scattered, single or two together; cystocarps broad pyriform, globular below abruptly narrowed outwards into a short neck, about 200μ (T) by 165μ (R); gonimoblasts slender, very numerous, forming a reniform mass, radiating from a few celled placenta, and abjointing successively elliptical oblong spores; periderm thin, of 2–3 layers of pseudoparenchyma, loosely placed; *punctum vegetationis* convex projecting (at least in young tips).

Scinaia complanata is based on specimens from Indian River Inlet, Florida, collected by Mrs. G. A. Hall. The description, as given here, has been drawn chiefly from No. 836 of the writer's copy of the Phycotheca Boreali-Americana (a co-type).). This is a specimen about 3 mm. in diameter (dried). Other specimens which seem to belong here are narrower and have modified some details of the description. These specimens are: (1) a specimen collected at Key West, Florida, by W. H. Harvey in February, 1850 (Herb. Univ. Calif., No. 68340)

which has a diameter of 1.5 mm. (dried); (2) a specimen collected at Gilbert's Bar, Florida by A. H. Curtiss (Herb. Univ. Calif., No. 96361), also about 1.5 mm. in diameter (dried); and (3) a specimen collected at the Bermuda Islands by Dr. W. G. Farlow in 1881. While it is difficult to be absolutely certain whether the narrower forms are flattened or not, they seem to be so and they agree in structure with No. 836 Phycotheca Boreali-Americana. Harvey states (1853, p. 137) that his Key West specimens of *Scinaia furcellata* varied in diameter about a tenth of an inch (about 2 mm.) to a *quarter* of an inch (about 6 mm.). Yet he says nothing of their being flattened. The structure of the axis and its disappearing below (flattening out) is as definitely to be seen in the narrower as in the broader specimens. In structure *Scinaia complanata* is closely related to *Scinaia latifrons,* as will be discussed further below, but the species is smaller and narrower and has the cystocarps scattered with no indication of aggregation at the margins.

From *Scinaia furcellata,* the other North Atlantic species, it is to be distinguished, not only by its being complanate but by the fact that the outer ends of the utricles are flattened and by the utricles themselves being flattened rectangular in shape as well as by minor peculiarities in each case.

In connection with *Scinaia complanata, Isymenia angusta* J. Ag. (1899, p. 66) has been mentioned (cf. F. S. Collins, 1901, No. 836, and 1906, p. 110). An examination of the material under this name in Herb. J. Agardh at Lund shows seven specimens; three were collected at Indian River Inlet, Florida, by Mrs. G. A. Hall and were evidently considered by J. G. Agardh to be young and not typical. One of them, at least, is certainly *Scinaia complanata* and the other two appear to be. Of the other four, one from Indian River, Florida, collected by Mrs. G. A. Hall, is typical *Scinaia complanata,* as is also another specimen from Florida collected by Mrs. Hall, while the remaining two are seemingly species of *Halymenia,* or a related genus, one of them, collected at Key West by Mrs. G. A. Hall, being tetrasporic, while the other collected at the same locality and from the Melville Collection, is cystocarpic. *Isymenia angusta,* then, is *Scinaia complanata* in part and in part possibly a proper species, the latter matter not to be settled at the present time.

From the North Pacific species, *Scinaia Johnstoniae* and *Scinaia japonica, Scinaia complanata* differs, not only in being complanate, but also particularly in having the colorless cells of the epidermis flattened

and it differs in the same way from all members of the constricted group, as well as in being complanate and unconstricted.

In a young growing tip examined, the *punctum vegetationis* was found to be convex and projecting above the rest of the tissue. Whether this is normal or not, it is strikingly different from the depressed *punctum vegetationis* as observed in all other species of *Scinaia* examined.

Scinaia latifrons M. A. Howe

Plate 11, fig. 23.

M. A. Howe, Bull. Torrey Botan. Club, vol. 38, p. 500, fig. 1 and pl. 28, 1911.

Plant deep rose red, 12–15 cm. high, 6–7 times dichotomous, flat, broad, 5–12 mm. in diameter (dried), branches decidedly narrowed below; axils rather broad; no axis visible (dried); cystocarps large, scattered but with strong tendency to marginal aggregation; — axial strand distinct at the apices but flattening out and diffuse below, largely of slender filaments; epidermis of uniform large colorless cells, or utricles, and sparse scattered slender colored cells, 1–4 together; utricles 5–6-gonal in surface view (T), with flattened outer ends, flattened to square to slightly radially elongated rectangular, 30–35μ (T) by 20–30μ (R); colored epidermal cells scattered, 1–4 together; hypodermis in 1–2 layers, orbicular, large, 18–20μ in diameter; corticating layer thin and loose; antheridia scanty (so far as seen); cystocarps large aggregated at or very near the margins, but some usually appearing scattered over the disk, broad pyriform, globular below, abruptly narrowed outwards into a short stout neck, 250–300μ (T) by 200–250μ (R); gonimoblasts very numerous, radiating from a few celled placenta to form a broadly reniform mass and abjointing successively globular to ellipsoidal spores; periderm thin, of about four layers of pseudoparenchyma; *punctum vegetationis* broad, slightly concave.

The type was collected at La Paz, Lower (Baja) California, Mexico, by G. J. Vives and is in the Herbarium of the New York Botanical Garden. Through the kindness of Dr. M. A. Howe I have been able to examine a fragment of one of Vives' specimens and Dr. Howe has kindly examined fragments of, and given his opinion on, certain specimens from Southern California in the Herbarium of the University of California. The latter specimens are from Santa Monica and San Pedro, floated in from deep water, and were collected by Miss Sarah P. Monks. The species seems to be of rare occurrence. Its range probably extends throughout the north subtropical province of the

Pacific Coast of North America extending from La Paz at the mouth of the Gulf of California north to San Pedro and Santa Monica, California, and may be expected as far north as Santa Barbara, California.

Scinaia latifrons is nearly related to *Scinaia complanata,* from which it is amply distinguished by the marginal position of the great majority of the cystocarps. It differs in several minor details also, as well as being a larger and broader, but slightly less branched plant. In structural peculiarities it resembles *Scinaia Johnstoniae,* which inhabits the selfsame territory with it. *Scinaia Johnstoniae,* however, is barely if at all flattened and its cystocarps are uniformly scattered with no tendency whatsoever towards marginal aggregation. From all other species, as here included, it is amply distinct.

From *Scinaia Cottonii, Scinaia latifrons* is to be separated on account of its larger, more ample frond, slight differences in the shape and dimensions of the utricles, and the greater tendency to intramarginal aggregation of the cystocarps.

Scinaia latifrons is the broadest and most conspicuous species of the genius, being, in its most ample development, nearly if not quite twice as broad as any other species. There are other broad species, however, existing, and a full study of all material now in different herbaria may at some time alter the claims of this species to superiority in this line. Any detailed study of the development was precluded by the lack of abundant material, for most of the specimens are somewhat battered, but the *punctum vegetationis* is broad and slightly concave and the axial strand is plainly evident for 1–2 mm., then broadens out and loses its identity.

Scinaia Cottonii sp. nov.

Plate 11, fig. 24.

Scinaia complanata Cotton, *in* Kew Bulletin, No. 7, p. 260, 1907 (as to Japanese plant only).

Plant rose red, 4–5 cm. high, 5–7 times dichotomous, axils moderately broad more or less acute, branches attenuated downwards, flattened, not constricted, 3–10 mm. in diameter (dried); axis not visible; cystocarps scattered, with some tendency toward intramarginal aggregation; — epidermis of a layer of utricles which are nearly cubical to rectangular oblong, 16–20μ (T) by 13–17μ (R), flat-topped; hypodermis loose; corticating layer narrow, loose; antheridia in small clusters, scattered; cystocarps not examined.

Scinaia Cottonii is represented by two specimens in Herb. E. M. Holmes (No. 9) in the University of Birmingham, collected at Enoura, Japan, by Saido. Through the kindness of Mr. A. D. Cotton of the Royal Botanical Gardens at Kew I have been able to examine a tracing of one plant and through the kindness of Professor G. S. West, of the University of Birmingham, I have been able to examine a photograph of, and a bit of the other. From these the description has been drawn up and a name given to this species. Unfortunately I have been unable to study the structure of the cystocarp.

Scinaia Cottonii is very close to *Scinaia latifrons*, from which it differs in smaller size, slightly different dimensions of the utricles, and less marked intramarginal aggregation of the cystocarps. It differs from *Scinaia complanata* in much greater breadth, shape and dimensions of the utricles, and the tendency towards intramarginal aggregation of the cystocarps.

III. Cylindrical, Normally and Fairly Regularly Constricted Species

J. G. Agardh (1876, p. 513) has referred a constricted form under *Scinaia furcellata* as var. *subcostata*, but the regularity and frequency of the constrictions are not definitely described. There are, however, five species which seem to be cylindrical and normally more or less regularly constricted. Two of these are inhabitants of the southern and central Pacific Ocean, one inhabits the northern Pacific Ocean, while the other two are found within the proper confines of the Indian Ocean. The two former have the utricles broad and only slightly elongated with a scanty development of the corticating layer, while the two latter species have more or less narrow, palisade-like utricles and a broad, dense corticating layer. The fifth species, in the North Pacific Ocean, is temporarily to be referred here. The joints of the first two species are short (or at least shorter) proportional to the diameter, while the points of the other three are long (or at least longer) proportional to their diameter. The jointed species may, so far as present knowledge is concerned, be looked upon as austral rather than boreal in distribution and possible origin, especially since no cylindrical and continuous (i.e., unconstricted) species of *Scinaia* (as here limited) occurs with certainty in the Southern hemisphere. It is possible that farther search may, however, invalidate this statement.

Scinaia moniliformis J. Ag.

Plate 12, figs. 31, 32; plate 13, fig. 38.

J. G. Agardh, Til. Algernes Systematik, IV, p. 72, 1884;
J. Bracebridge Wilson, Proc. Roy. Soc. Victoria, new ser., vol. 4, part 2, p. 173, 1892;
De Toni, Syll. Alg., vol. 4, sect. 1, p. 105, 1897.

Plant rose pink(?), 8 cm. high, 7–8 times dichotomous, stout, 3–5 mm. in diameter (dried), from a stout solid(?) stipe, regularly and frequently constricted; joints oblong to oblong-cuneate, 3–5 mm. in diameter and 7–13 mm. long, never globular or short pyriform (except perhaps at the extreme apex), thin walled; axis apparent (dried), especially below; cystocarps sparse (in specimens seen), visible; — axial strand fairly stout, of interwoven filaments at the nodes; epidermis of colorless cells, or utricles, with very few widely scattered slender colored cells; utricles broad palisade-like, flat topped, uniform, 5–6-gonal in surface view (T), 20–22μ (T) by 38μ (R) as extremes; colored epidermal cells slender, sparse and widely scattered; hypodermis of one layer of loosely placed, flattened globular to broadly pyriform cells, 8–16μ in diameter; corticating layer thin of scanty slender filaments; antheridia not seen; cystocarps (all young in specimen examined) elongated pyriform, apparently of the type of true *Scinaiae*.

Scinaia moniliformis is known to the writer from the type specimen in Herb. J. G. Agardh at Lund and specimens in Herb. British Museum of Natural History at South Kensington. All these specimens were collected by J. Bracebridge Wilson at Port Phillip Heads near Melbourne, Australia. It has been possible to examine one of the specimens in the J. Bracebridge Wilson collection at South Kensington, to supplement the description of Agardh. That specimen, as are all of them, was young, so that a detailed description of the mature cystocarp is impossible for the present account. The young cystocarp examined had the narrow pyriform shape usual in the *Scinaia* assemblage and seemed distinctly to have the gonimoblasts radiating free into the cystocarpic cavity. This, with the possession of an epidermis largely composed of utricles, distinctly stamps this species as a member of the genus *Scinaia* as limited in the present account.

From the following species, *Scinaia moniliformis* is to be distinguished by the usually longer, more regularly oblong joints and certain minor details of structure which will be discussed below. From *Scinaia carnosa* and *Scinaia Salicornioides*, it is amply distinct as to structure of cortex throughout.

Scinaia hormoides sp. nov.

Plate 12, figs. 33–35; plate 13, figs. 36, 37.

Plant deep red purple (to brownish when dried), 4–6 cm. high, 7–8 times dichotomous, with short solid stipe, branches all regularly and uniformly deeply constricted into globular to obovate, at times even oblong, joints, 3 mm. in diameter and 3–10 mm. long; axis barely visible (dried); cystocarps scattered, plainly visible; — axial strand distinct, at first of few large parallel tubes, soon re-enforced by slender corticating filaments; epidermis of large colorless cells, or utricles, and frequent regularly distributed slender colored cells, 1–4 together; utricles flat-topped, 5–7-gonal in surface view (T), nearly square in section, 24–25μ (R) by 20–22μ (T); colored epidermal cells frequent, somewhat distant, but rather regularly placed; hypodermis in one layer of distant, irregular, obpyriform cells, 8–10μ in diameter; corticating layer thin, of sparse slender filaments; antheridia in small stellate clusters; cystocarps broadly pyriform, globular and abruptly contracted outwards, 250–350μ in each diameter; gonimoblasts slender, very numerous, arising from a few-celled placenta, successively abjointing short ellipsoidal spores; periderm of 3–4 layers, pseudoparenchymatous.

The type of *Scinaia hormoides* is a specimen collected at Haleiwa on the Island of Oahu, Hawaiian Islands, by J. F. Rock (No. 56 Rock). It was collected in the same locality by Miss Minnie Reed (No. 985) and a specimen preserved in formalin solution is available for study. There is also a specimen in the herbarium of the Bernice Pauahi Bishop Museum collected by E. Bailey, at Kahalui on the Island of Maui. What appears to be the same species has been collected on the reef at Puro, Province of La Union, Island of Luzon, Philippine Islands, whence a specimen (Philippine Bureau of Science, No. 13014) has been available through the kindness of Dr. M. A. Howe.

Scinaia hormoides is very closely related to the preceding *Scinaia moniliformis,* but is of very different aspect due to the different shape of the joints which are shorter and less oblong than in the Australian species. In the most typical specimens of *Scinaia hormoides,* the joints are nearly globular or more or less pyriform. Some of the joints in a specimen may, however, be nearly as oblong as those of *Scinaia moniliformis.* The joints in the latter species, however, are always and uniformly oblong. Too few specimens, however, are available to make as full a comparison in this respect as is desirable. The utricles in *Scinaia hormoides* are nearly square or slightly flattened while those of *Scinaia moniliformis* are radially elongated. The colored cells of the epidermis are decidedly more numerous in *Scinaia hormoides* than in *Scinaia moniliformis.*

Scinaia carnosa Harv.

Plate 11, figs. 25–27.

Harvey, Algae of Ceylon (Exs.) No. 38, and *in* J. G. Agardh, Spec. Alg., vol. 3, 1, p. 513, 1876, vol. 3, 2, pp. 15, 112, 1880.

Ginnania carnosa Harvey, *in* Kuetzing, Tab. Phyc., vol. 16, p. 30, pl. 83, 1866.

Plant deep red, opaque, up to 17 cm. high, 9–10 times dichotomous, slender, 2 mm. in diameter (dried), cylindrical, deeply constricted at irregular intervals; axils narrow; no axis visible (dried); cystocarps scattered, barely visible; — axial strand of stout and slender filaments intertwined; epidermis of colorless cells; colorless cells flat-topped, closely packed, palisade-like, 20–22μ (R) by 5–8μ (T); hypodermis of 2–3 compact layers of nearly globular cells; corticating layer thick, compact; antheridia not seen; cystocarps broad pyriform, abruptly narrowed into a very distinct cylindrical neck, 280–300μ (T) by 240–260μ (R); gonimoblasts very numerous and slender, radiating from a distinct and considerable cellular placenta, abjointing successively globular(?) spores; periderm compact, of 6–8 layers, fibrous-pseudo-parenchymatous.

Scinaia carnosa Harvey is founded on a plant from Ceylon distributed by Harvey under No. 38 of his Ceylon Algae, with printed label giving the name but no description. The specimen in the writer's possession agrees exactly with the description and figure of Kuetzing (1866, pl. 70, f. *a*, *b*, under *Ginnania carnosa*) in habit and structure.

By the structure of the cortex, viz., the very much elongated palisade-like utricles of the epidermis, the compact hypodermis and the thick, compact corticating layer, this species differs from all other *Scinaiae* except *Scinaia Salicornioides* with which it may be identical. The reasons for keeping the two distinct in this account are given below under the latter species. Both *Scinaia carnosa* and *Scinaia Salicornioides* are irregularly constricted and it seems probable that the constriction is due to accident rather than to a regular process of growth. The scarcity of specimens does not allow any satisfactory settlement of this question just at present, but since the descriptions and figures show constrictions and all specimens mentioned or available show them, it seems best to refer both species to this particular group until farther observations and study are possible.

Scinaia Salicornioides (Kuetz.) J. Ag.

Plate 11, figs. 28–30.

J. G. Agardh., Spec. Alg., vol. 2, 2, p. 423, 1851; *ibid.*, vol. 3, 1, p. 513, 1876;
Barton, Journ. Botany, vol. 31, p. 144, 1893; *ibid.*, vol. 34, p. 197, 1896;
De Toni, Syll. Alg., vol. 4, sect. 1, p. 106, 1897.
Ginnania Salicornioides Kuetzing, Spec. Alg., p. 716, 1849; Tab. Phyc., vol. 16, p. 25, pl. 70, 1866.

Plant dark red, up to 26 cm., 7–11 (or more?) times dichotomous, 2–3 mm. broad (dried), frequently but irregularly constricted, dense and opaque; axis invisible (dried); cystocarps scattered; — axis stout of broader thin walled filaments and more slender thick walled filaments intermixed; epidermis palisade-like, of slender elongated utricles and no colored cells or antheridial filaments (so far as seen); utricles radially elongated, 28–35μ (R) and 6–9μ (T), flat topped and closely placed together; colored hypodermal cells in 2–3 layers, globular to pyriform; corticating layer very broad, very dense in older portions; antheridia not seen; cystocarps flattened globular, 240–250μ (T) and about 200μ (R), with a thick periderm of 6–8 fibro-pseudoparenchymatous layers.

Scinaia Salicornioides is the largest and most robust of all the species of *Scinaia*. The figures of Kuetzing (1866, pl. 70) give a very good idea both of habit and of structure. The palisade-like layer of utricles, the broad, dense corticating layer and the stout central axis distinguish it readily from all except *Scinaia carnosa*, and from the latter species it is to be distinguished by the size and proportions of the utricles as well as by the greater width and density of the corticating layer.

Scinaia Salicornioides is confined, so far as known, to the shores of South Africa. The original specimens were collected at Port Natal, by Guenzius. Through the kindness of Mme. Weber van Bosse, I have been able to make a microscopic examination of this specimen. It has also been collected at The Kowie by Dr. H. Becker and at Cape Morgan by Danvers (cf. Barton, 1893, p. 144). I have drawn the description chiefly from a Becker specimen kindly loaned by F. S. Collins. It is very desirable that living specimens be studied to determine more accurately the structure of the cystocarp and the details of the occurrence and structure of the antheridia.

Since 1851, when J. G. Agardh (p. 423) placed it as a doubtful synonym under *Scinaia Salicornioides*, the *Corallopsis dichotoma* Suhr (Flora, vol. 22, p. 70, fig. 44, 1839) has regularly appeared in the

doubtful synonym of this species. The specific name *dichotoma* antedates that of *Salicornioides* and must replace it if, as certainly seems from the description of Suhr (*loc. cit.*), the plant of Suhr should prove to be identical with that of Kuetzing. Dr. A. J. Ewart, at my request, kindly allowed me to examine a fragment of Suhr's type which is preserved in the National Herbarium of Victoria. While the habit is close, the microscopic structure is entirely different from that of *Scinaia Salicornioides* and exactly that of a *Galaxaura*. The type of *Corallopsis dichotoma* Suhr is well represented in Suhr's figure (*loc. cit.*), is faded and lacking calcification (decalcified?). In habit and structure it agrees well with the description and figures of *Galaxaura magna* Kjellman (1900, p. 82, pl. 15, figs. 1–10, pl. 20, fig. 46) and were it not for the lack of calcification might be referred to that species without hesitation. It is to be removed, however, from even the doubtful synonymy of *Scinaia Salicornioides* and is to be farther considered when the status of both name and rank of *Galaxaura magna* may be under investigation.

Scinaia articulata sp. nov.

Plate 13, figs. 39, 40.

Plant deep rose red, 10 cm. high, 7 times dichotomous, broad, 3–5 mm. in diameter (dried), cylindrical, regularly and frequently constricted, segments elongated cylindrical; branches slightly attenuated below; axis conspicuous throughout; cystocarps sparse, scattered, of medium size; — axial strand broad, stout, dense, largely of slender filaments; epidermis of large colorless cells, or utricles, and almost no colored cells; utricles flattened outwards, 5–7-gonal in surface view (T), uniform, slightly rectangular in section, 17–20μ (R) by 10–15μ (T), closely placed together; colored epidermal cells so few as to practically escape notice; hypodermal cells in 1 layer, scattered orbicular, 12–14μ in diameter; corticating layer thin, loose; antheridia not seen; cystocarps broadly pyriform, flattened globular, abruptly narrowed into a short broad carpostome, 215–235μ (T) by 165–170μ (R); gonimoblasts slender, very numerous, radiating from a scanty central, cellular placenta forming a compact spore mass, abjointing successively globose-ellipsoidal spores; periderm of 2(–3?) layers, pseudoparenchymatous.

The writer has seen but two specimens of this puzzling plant, one, No. 32172 in Herb. J. G. Agardh from Santa Barbara, California, collected by Mrs. Bingham, the other in Herb. F. S. Collins, sent from Santa Barbara by J. W. Calkins. It is possible that the two specimens

may be only portions of one and the same plant and that that plant may be an abnormality. Certain it is, that there is need of farther material before it can be satisfactorily placed. J. G. Agardh did not refer his plant to any definite species or variety but placed it apart, labelling it "*Scinaia fronde prolifera.*"

Were it not for the constrictions, the writer would unhesitatingly place it in the first subgroup and hesitate only as to whether to refer it to *Scinaia japonica* or *S. Johnstoniae.*

The question of the value of constriction as a diagnostic character is, as stated above, a puzzling one. All species of *Scinaia* probably present constricted forms, but such forms in the cylindrical continuous form are irregular and plainly the results of proliferation following injury. The plant under discussion, however, is as regularly constricted as, or even more regularly constricted than, *Scinaia Salicornioides* and cannot be such an injured plant as those just referred to. It is, perhaps, to be compared with *Scinaia furcellata* var. *subcostata* J. Ag. which the writer, however, has not examined. Agardh, however, evidently did not refer the present plant to his variety and *Scinaia furcellata* var. *subcostata* may, of course, be nothing more than a chance constricted form of *Scinaia furcellata,* as the writer sometimes suspects the present plant to bear a similar relation to *Scinaia Johnstoniae,* or perhaps more likely to *Scinaia japonica.*

There are certain differences, however. The rather stronger axial strand and certain differences in the utricles attract attention. The latter differences may or may not be important, but the utricles certainly approach those of *Scinaia japonica* in size, shape, and in certain markings (artefacts?) on the radial walls.

The utricles of the proposed new species under discussion are more elongated radially than those of *Scinaia Johnstoniae,* giving more of the palisade character of *Scinaia japonica.* Besides, in both the present species and in *Scinaia japonica* the radial cell walls, in all sections examined, have narrow, very definite transverse folds, appearing as striations in surface view. These are probably artefacts, due to incomplete swelling of the walls of the dried specimens, but they are different from the coarse and irregular wrinkles noticed under similar conditions in other species. They may be of no diagnostic value whatsoever, yet they are striking in their appearance and constant in their occurrence.

GLOIOPHLOEA J. G. Agardh

Cylindrical, unconstricted, dichotomous plants, with axial strand arising from a much depressed *punctum vegetationis* and giving off dichotomous filaments excurrent obliquely upwards, whose outer ends form at first a layer of utricles intermixed with colored cells, later, however, by the continued growth of the latter developing into a cortex of anticlinal rows of fasciculate moniliform anticlinal filaments intermixed with more or less collapsed utricles at different levels; monoecious or dioecious; antheridia forming a continuous covering over large portions of the frond; cystocarps scattered and irregularly aggregated, arising in the inner layers of the cortex, pyriform, opening outwardly through a narrow carpostome; gonimoblasts free, arising from a few celled placenta, abjointing spores in succession; periderm of few layers, pseudoparenchymatous or closely filamentous.

As defined and described by J. G. Agardh (1870, p. 29), *Gloiophloea* is a genus to be distinguished from *Scinaia* by the structure of the cortex. This is true of the adult frond where the cortex consists of more or less closely placed anticlinal filaments whose inner cells are large and rounded and whose outer cells are gradually smaller. A study of the development of the cortex, however, shows that it passes through a *Scinaia*-like stage. At first the outer cells are transformed into utricles, but the cells below the utricles give off branchlets which grow out between the utricles and ultimately form the anticlinal rows described by Agardh. The utricles first formed collapse and are to be detected only in thin sections and upon very careful examination. Younger parts and young specimens, especially on the cystocarpic plants of the dioecious species, have the appearance of being true members of the genus *Scinaia*. It is possibly a question whether it is better to retain the genus *Gloiophloea* or not, but, on the whole, I think it better to retain it for the present at least. The species of *Gloiophloea* show the cymose method of branching of the peripheral filaments in a pronounced fashion. The terminal cell becomes a utricle and does not divide farther. The later branchlets grow up around the utricle, overtop it and may, in turn, become utricles, to be overtopped in turn by their lateral branches. The utricles are gradually compressed and become inconspicuous on account of their lack of color, thus giving the appearance of a cortex of anticlinal filaments.

The cystocarps have the structure of those of *Scinaia* as Agardh has stated. The antheridia occupy more extended areas than those of any species of *Scinaia* thus far known, and in certain species which are dioecious they cover the whole plant. In structure they agree with those of *Scinaia*.

The type of the genus is *Gloiophloea Scinaioides* J. Ag. of Australia, of which I have not had the opportunity of examining the type specimen; but I have had the privilege of examining a New Zealand specimen collected by Berggren, which seems clearly to be Agardh's species. The statements made above, as to the structure and relationships of *Gloiophloea,* are justified by a study of this specimen which is in Herb. Farlow.

This species of *Gloiophloea,* like those of *Scinaia* and also those of the new genus *Pseudoscinaia,* to be proposed later in this paper, resemble one another and those of the other two genera. From my examination of the material available, I have been convinced that there are five species, possibly even six, but the technical points of distinction are not completely satisfactory. The main distinction separating the species into two groups is whether the species are monoecious (three or four species) or dioecious (two species). This separation seems to rest on a basis that is constant and readily to be determined. Within each group the thickness of the cortex presents seemingly constant differences which are associated with less tangible differences in general appearance and with geographical segregation. I have, as will be seen from the analytical keys to species given farther on, used it as a main character for separating the species. A study of larger suites of specimens and in the living condition will, I feel certain, add to the list of differences.

Gloiophloea Scinaioides J. Ag.

Plate 15, fig. 48.

J. G. Agardh., Bidr. Florid. Syst., p. 29, 1870, Spec. Alg., vol. 3, 1, p. 510, 1876, Florid. Morph., pl. 28, figs. 1–5, 1879;

J. Bracebridge Wilson, Proc. Roy. Soc. Victoria, new ser., vol. 4, p. 173, 1892;

De Toni, Syll. Alg., vol. 4, sect. 1, p. 107, 1897.

Scinaia furcellata Harvey, Phycologia Australica, vol. 5, p. xxxviii, 1863 (in part, at least as to specimen from Western Port);

J. G. Agardh., De Alg. Nov. Zel. Mar., p. 26, 1877 (in part?);

Laing, Trans. N. Z. Inst., vol. 34, p. 348, 1901 (at least in part).

Plant up to 8 cm. high, 12–15 times dichotomous, fastigiate, cylindrical, continuous, 1.5–2 mm. broad(?), soft, deep red; axis obscure; cystocarps scattered; — axis broad of loosely intertwined large thin walled filaments accompanied by numerous longitudinal and oblique slender thick walled corticating filaments more or less intertwined; adult outer cortex 85–110μ thick, the outer portion 65–85μ thick, of

moniliform anticlinal rows of colored cells with oval utricles at two or three different heights; corticating layer averaging about 100μ thick, dense in older parts, of interwoven slender thick-walled filaments, often very nearly filling the entire cavity between axis and cortex; monoecious; antheridia single on slender stalk cells, over the entire surface; cystocarps obpyriform, like those of *Scinaia*, with thick pseudoparenchymatous periderm.

The description of this species must necessarily remain imperfect since only a small fragment of a specimen presumably of this species has been available for study. This specimen is in Herb. Farlow and was collected at the Bay of Islands, New Zealand, by Berggren. It was identified as *Scinaia furcellata* by J. G. Agardh (1877, p. 26). The specimen is clearly a *Gloiophloea* and answers to Agardh's description. It is monoecious as I suspect from Agardh's figures the species is, since his figure 5 (1879) represents a very young cystocarp with what I interpret as an antheridial branchlet (fig. 5*h*) on each side of it. It is to be compared then with *Gloiophloea Okamurai* from Japan and other monoecious species, which are less branched and darker as well as more rigid. I have been able to examine an abundance of antheridia but only a few very young cystocarps in the New Zealand specimen. Consequently the description of the cystocarp must remain incomplete. Agardh's figure of the cystocarp (1879, fig. 4) is manifestly imperfect and represents the periderm as filamentous(?). The young cystocarps of the New Zealand specimens show a pseudoparenchymatous periderm. Agardh's type was one of the specimens distributed by Harvey under No. 348 of his Australian algae and comes from Western Port near Melbourne.

Gloiophloea undulata (Mont.) comb. nov.

Plate 15, fig 49.

Ginannia undulata Montagne, Ann. Sci. nat. bot., 2 ser., vol. 18, p. 247, 1842, Voyage Bonite, Bot., vol. 1, p. 59, and Atlas, pl. 145, fig. 3, 1844–1846, *in* Gay, Hist. fisc. pol. de Chile, Bot., vol. 8, p. 432, 1852, Syll. Gen. et Spec. Crypt., p. 437, 1856;
Endlicher, Gen. Plant., Suppl. III, p. 40, 1843;
Kuetzing, Spec. Alg., p. 715, 1849.

Scinaia furcellata var. *undulata* J. G. Agardh, Spec. Alg., vol. 2, 2, p. 422, 1851, *ibid.*, vol. 3, 1, p. 512, 1876;
De Toni, Syll. Alg., vol. 4, sect. 1, p. 105, 1897.

Myelomium undulatum Kuetzing, Phyc. Gen., p. 393, 1843.

Halymenia undulata J. Ag. Mss. *in* Spec. Alg., vol. 2, 2, 1851 (as synonym), *ibid.*, vol. 3, 1, p. 512, 1876 (quoted by Montagne, Harvey, J. G. Agardh, and others).

Plant up to 6 or 7 cm. high, 9–10 times dichotomous, cartilaginous, dark red, cylindrical continuous, 1.5–3 mm. broad (dried); axis invisible, cystocarps irregularly aggregated; — axis slender, adult cortex 83–90μ broad; outer cortex 50–70μ, commonly 50–60μ broad, of 2–3 layers of large rounded hypodermal cells and short anticlinal rows alternating with single larger cells, the utricles; inner cortex 20–30μ thick, of loosely interwoven corticating filaments; monoecious; antheridia in groups, borne singly on elongated supporting cells; cystocarps (young in fragments examined) of the *Scinaia* type with a periderm pseudoparenchymatous below, but filamentous above.

For some years the writer has looked upon a certain plant of the *Scinaia* assemblage, more or less frequent on the coast of California and differing in aspect from other members of the *Scinaia* group, especially in its abundant branching, darker color, and a certain robustness, as probably the same as the *Ginannia undulata* Mont., the *Scinaia furcellata* var. *undulata* (Mont.) J. Ag. A superficial examination of the specimens in Herb. Montagne at the Museum d'Histoire Naturelle at Paris seemed to confirm this impression and antheridial plants colected by C. P. Nott at Monterey, California, were distributed under J. G. Agardh's combination (Phyc. Bor.-Amer., No. 422). Recently, however, through the kindness of Dr. Paul Hariot, the writer has been able to make a more thorough examination of the Montagne specimens, with the result that the previous impression has been dissipated and the discovery made that the specimens upon which Montagne founded his species belongs to the genus *Gloiophloea* rather than to *Scinaia* and that the California specimens referred to do not agree with them. Consequently *Gloiophloea undulata* (Mont.) is proposed as a new combination to refer solely to the Chilian and Peruvian species.

From the literature, it seems that the specific name *undulata* chosen by Montagne for his *Ginannia undulata* was taken from a manuscript name given to the species by some one else (cf. Montagne, 1842, p. 257) and the original combination was probably the *Halymenia undulata* J. Ag. Mss., quoted by Montagne (*loc. cit.*), J. G. Agardh (1851, p. 422), Kuetzing (1843, p. 393), and others. The original specimen seems to be one collected by Bertero, but Montagne evidently founded his species on specimens collected by Gaudichaud on the voyage of the "Bonite." These specimens have been examined and particularly one marked, apparently in Montagne's handwriting, "*Ginannia undulata* Montag. in Gaudichaud Voy. Bonite e. icone Chile." Besides this are two other specimens from Chili. All three,

with the specimen marked "Chile—ex coll. Berteroana" seem to be the same. There is one specimen, however, in Herb. Montagne, which is different, possibly a slender sterile *Callophyllis*. This is marked "Coquimbo (Chili), lgt. Gaudichaud." This specimen agrees with the figures of Kuetzing (1866, pl. 69) which are evidently not taken from any species of *Ginannia* as conceived by Montagne. The other Chilean specimens in Herb. Montagne agree with the figures in the Voyage Bonite (pl. 145, under f. 3). The cortex there represented is not distinct, otherwise the details are characteristic of the specimen that I have taken to be the type.

The plant from La Paz, referred to *Scinaia furcellata* var. *undulata* by M. A. Howe (1911, p. 502), has been found to be a true *Scinaia* and will be found above under *Scinaia Johnstoniae*.

Gloiophloea undulata is a monoecious species with a thin cortex and is to be compared with *Gloiophloea Okamurai* of Japan, to which it comes very close. It appears to be a slightly broader, somewhat lower species than *Gl. Okamurai*, with a cortex intermediate in thickness between it and *Gl. Scinaioides*. These differences, together with the widely separated geographical distribution of the two species, make it seem best to keep them separate, for the present at least. From *Gloiophloea Scinaioides* it differs in its broader, lower, less branched frond and in its much thinner cortex, while from *Gl. Halliae* it is to be distinguished by its lower stature, greater number of dichotomies, and somewhat thicker cortex. From the other two species, viz., *Gloiophloea capensis* and *Gl. confusa*, it differs fundamentally in being monoecious.

Thus far *Gloiophloea undulata* is known only from the type material from the coasts of Chili and Peru.

Gloiophloea Okamurai sp. nov.

Plate 15, figs. 50–56; plate 16, fig. 57.

Scinaia furcellata Okamura, Alg. Jap. Exs., No. 2, 1899 (excl. synonymy), not *Scinaia furcellata* Okamura, Icones of Japanese Algae, vol. 1, no. 1, p. 10, pl. 2, fig. 19, pl. 3, fig. 16–20, 1907;
De Toni, Phyceae Japonicae Novae, p. 19, 1895 (at least in part);
Dickie, Journ. Linn. Soc., Bot., vol. 15, p. 451, 1876 (in part?).

Plant up to 9 cm. high, 10–11 times dichotomous, cartilaginous, dark red to almost black in drying, cylindrical continuous, 1–1.5 mm. broad (dried); axis invisible; cystocarps irregularly aggregated; axis slender; adult cortex 70–100μ thick, the outer portion 35–50μ thick, of

anticlinal moniliform rows of colored cells, enclosing pear-shaped or elliptical utricles at 1–2 heights, the inner 35–50μ thick, of loosely interwoven corticating filaments; monoecious; antheridia nearly or entirely covering the surface, consisting of slender branches abjointing solitary(?) oblong antherozoids; cystocarps pyriform, 105–120μ (R) (160–180μ with neck) by 120–135μ (T) with a periderm of 6–7 layers of interwoven coarse filaments, opening gradually outward by a long carpostome.

Gloiophloea Okamurai is founded on a specimen distributed by Okamura under No. 2 of his Algae Japonicae Exsiccatae and labelled as *Scinaia furcellata*. This is not the same, however, as the *Scinia furcellata* of his Icones of Japanese Algae (vol. 1, no. 1, p. 10, pl. 2, fig. 19, and pl. 3, figs. 16–20, 1907) which is a true *Scinaia* and is referred above to *Scinaia japonica*. While this statement refers to No. 2 of the copy of Okamura's Algae Japonicae Exsiccatae in my own possession so far as the type specimen is concerned, I have found that identical specimens are to be found also in three different sets of the same exsiccatae in Herb. Farlow. These specimens were all credited to Enoshima, Japan, whence also there is a specimen of *Gloiophloea Okamurai*, collected by H. M. Richards. H. M. Richards also collected the same species at Kamakura, Japan, according to a specimen in Herb. Farlow. I have been able therefore to examine some six specimens of this proposed new species and find them to agree in all essential characters.

Gloiophloea Okamurai is a monoecious species and may be distinguished from *Gloiophloea Scinaioides* by its darker red color, less fastigiate branching, less number of dichotomies, and its thinner cortex; from *G. undulata*, of the same group, it is to be distinguished chiefly by its thinner cortex; while from *G. Halliae* of Florida it is to be separated by its somewhat thicker cortex.

Gloiophloea Halliae sp. nov.

Plate 10, fig. 13.

Plant 11–13 cm. high, 5–7 times dichotomous, cylindrical, continuous, 2 mm. broad (dried), deep wine red; cystocarps scattered; — axis slender; adult outer cortex 22–40μ thick of anticlinal corymbose colored filaments with ovate utricles at two heights; corticating layer 20–45μ thick, very lax; monoecious(!); antheridia thickly covering the surface, fasciculate; cystocarps globular pyriform 100–118μ (T) by 66–88μ (R, without the broad carpostome); periderm filamentous, thick, of 5–6 layers.

A slender species, known only from two specimens in Herb. Farlow, collected at St. Lucie, Florida, by Mrs. G. A. Hall. *G. Halliae* approaches *G. Okamurai* but is thinner-walled, somewhat taller, with less number of dichotomies, and is widely separated geographically. The other species of the genus are either found in the Pacific Ocean or in the Indian Ocean and the occurrence of an undoubted species of this genus in the North Atlantic suggests the extreme possibility of there being other members of the genus *Gloiophloea* on the American or European coasts.

Gloiophloea capensis sp. nov.

Plate 16, figs. 58, 59.

Scinaia furcellata Barton, Journ. of Botany, vol. 31, p. 144, 1893(?).

Plant 7–9 cm. high, 7–11 times dichotomous, cylindrical, continuous, 1–3 mm. broad (dried), dark red, fleshy cartilaginous; axis invisible; cystocarps irregularly aggregated; — axial strand slender, loose; adult cortex 110–150μ thick, the outer cortex 60–85μ thick, of anticlinal moniliform rows of colored cells with 1–2 sets of utricles at different heights, the inner cortex 50–65μ thick, of loosely interwoven hyphae; dioecious; antheridia covering almost the entire surface of the antheridial plant, single at the tips of slender elongated cells, oblong; cystocarps broadly obpyriform, 65–130μ (R) by 115–150μ (T), with a filamentous periderm of 5–9 layers of filaments.

Gloiophloea capensis is founded on an antheridial plant collected at Port Alfred, Cape Colony, by J. Burtt Davy in 1908. Another antheridial plant collected in the Cape Colony region by Poeppig exists in Herb. Farlow and has been examined. Finally I have found a cystocarpic plant collected at "The Kowie," South Africa, by Dr. H. Becker among the specimens of *Scinaia* kindly loaned from the Herbarium of the Königliche Biologische Anstalt zu Helgoland through the kindness of Dr. Paul Kuckuck. This account then has been drawn up after a study of these three specimens.

Gloiophloea capensis is a true *Gloiophloea* in the light of what has been said here of the genus and is dioecious. From *Gloiophloea confusa,* the other dioecious species known to me, it is to be distinguished by its small number of dichotomies and its decidedly thicker outer cortex. The cortex is comparatively thin in the cystocarpic plant and noticeably thicker in the antheridial plant. It is probable that the various references to the occurence of *Scinaia furcellata* on the South African coasts refer to this species wholly or in part.

Gloiophloea confusa sp. nov.

Plate 14, figs. 44–47.

Scinaia furcellata Farlow, Rept. U. S. Fish Comm. for 1875, p. 699, 1876 (as to Pacific Coast references only);
C. L. Anderson, Zoe, vol. 2, p. 222, 1891;
McClatchie, Proc. So. Calif. Acad., vol. 1, p. 356, 1897 (not *Ulva furcellata* Turner).

Scinaia furcellata var. *undulata* Farlow, Proc. Amer. Acad., vol. 10, p. 367, 1875, Rept. U. S. Fish Comm. for 1875, p. 699, 1876;
Cleveland, Marine Algae of San Diego;
Setchell *in* Collins, Holden and Setchell, Phyc. Bor.-Am., no. 422, 1898 (Exsicc.!);
Collins, Marine Algae of Vancouver Island, p. 114, 1913 (not *Ginannia undulata* Mont.).

Plant dark red purple, 10–15 cm. high, 10–15 times dichotomous, 2 to 3 mm. in diameter (dried), branches of the same diameter throughout, cylindrical, continuous; axils moderately broad; no axis visible; dioecious(!); antheridia forming a continuous coating over the plant; cystocarps numerous, scattered, obscure; — axial strand stout, of parallel longitudinal coarse filaments, slightly agglutinated together; outer cortex 40–60μ broad, of 5–6 layers of cells, the inner large and rounded, becoming smaller toward the surface, the outermost slender and elongated in short anticlinal rows; utricles at first forming a layer later overtopped by the anticlinal filaments; corticating layer just within the cortex, 105–120μ broad, loose; excurrent, oblique filaments from strand to cortex, numerous, persistent, enclosed in a dilute jelly; dioecious; antheridia forming a close layer over the outer surface of the antheridial plant, short, oblong; cystocarps broad pyriform, tapering gradually to a carpostome, 250μ (T) by 280–300μ (R) gonimoblasts numerous, slender, radiating from a distinct, few-celled placenta, abjointing successively ellipsoidal spores; periderm of 5–6 flattened pseudoparenchymatous layers.

As stated under *Gloiophloea undulata* and also indicated by the synonymy quoted above, the plant of the western coast of North America has been confused with *Gloiophloea undulata*. It is, however, a dioecious species, as careful study of the Californian material has demonstrated, while *Gloiophloea undulata* has been shown, by a study of the type specimen, to be monoecious. From *Gloiophloea capensis*, the only other dioecious species known at present, it is to be distinguished by being more branched and by having a thinner cortex. It has been collected in California at San Pedro by the writer, about Monterey Bay by C. P. Nott and the writer, at Santa Cruz by Dr. C. L. Anderson, near Half Moon Bay by Dr. Carl Skottsberg, Dr. N.

L. Gardner, and the writer, and in British Columbia near Victoria by John Macoun. Its distribution along the western coasts of North America, then, extends from the southern boundary of the United States (or below it in all probability) to Vancouver Island.

Gloiophloea(?) articulata Weber van Bosse

Trans. Linn. Soc., 2 ser., Zool., vol. 5, no. XIV, p. 276, pl. 16, fig. 1, pl. 18, figs. 26, 27, 1914.

Just at the time of writing there has been referred doubtfully to genus *Gloiophloea* a species from the westerly portion of the Indian Ocean. Through the kindness of Mme. Weber van Bosse I have been able to examine a specimen of this plant. The habit resembles that of the constricted species of *Scinaia* but the structure is not of that group. Neither has it the structure of cortex or apical pit of *Gloiophloea,* at least as I understand it and have described it above. It seems to me that the plant is likely to prove to be found to be a member of the Chaetangiaceae, as Mme. Weber van Bosse has already suggested, but, in my own estimation, it is probable that it will also be found to belong to an, as yet, undescribed generic type close to the genus *Chaetangium.* At present it seems best to leave it under the name assigned to it, but still farther emphasizing the doubt as to its generic designation.

PSEUDOSCINAIA gen. nov.

Frond arising from a disk, cylindrical, continuous, repeatedly dichotomous, with blunt apices and branches of the same diameter throughout, devoid of calcification; — axial strand of nearly parallel thin walled broad filaments more or less firmly agglutinated together, whence slender branchlets are obliquely upwardly excurrent, whose terminal portions are combined into a continuous cortex whose inner layers are colored but whose outer layers, or "epidermis," is made up largely of inflated colorless cells, or utricles, between which slender colored cells are more or less regularly scattered, the whole being clothed externally by a distinct cuticula; slender corticating filaments may accompany the axial strand and clothe the inner surface of the cortex; the space between the axial strand and the inner surface of the cortex is filled with a dilute jelly; tetrasporangia unknown; antheridia single or few together; inserted between the utricles; cystocarps scattered, originating within the cortex and partially or nearly entirely suspended in the interior jelly, more or less globular to pyriform, with

more or less elongated carpostome; gonimoblasts projecting into and also lining the walls of the sporiferous cavity, variously grouped and abjointing successively more or less elongated spores; paraphyses absent; periderm distinct, pseudoparenchymatous; growing point slightly depressed, as in *Scinaia.*

A genus of two species, one, the type, from Southern California, the other from southeastern Australia. Both these species have all the external appearance of being genuine species of *Scinaia.* In habit, however, there is a slight difference in that the branches are not at all attenuated downwards as is the case in practically all species of *Scinaia.* In vegetative structure *Pseudoscinaia* is exactly like *Scinaia* in having the epidermis of colorless utricles. The cystocarps, however, are very much like those of *Galaxaura* and *Whidbeyella,* from both of which it differs in the structure of the epidermis. It seems best therefore to create a new genus for the reception of these two species and the name *Pseudoscinaia* is proposed for it.

Pseudoscinaia Snyderae sp. nov.

Plate 16, figs. 60, 61.

Plant dark red, 12–20 cm. high, 9–13 times dichotomous, cylindrical, continuous; axils narrow; branches not narrowed downward but nearly uniform in diameter throughout, 1–2 mm. in width (dried); axis distinct (dried); cystocarps abundant, scattered, small, readily seen (dried); — axial strand stout, of numerous broad parallel filaments strongly agglutinated together; epidermis of irregular colorless cells, or utricles, and frequent scattered slender colored cells; utricles, of the epidermis, convex at outer end and not closely appressed at the tips thus giving an irregular and only bluntly polygonal appearance in surface view (T), low palisade-like, 20–26μ (R) by 12–20μ (T); hypodermis of 1–3(?) layers (mostly one), of loosely placed globular or pyriform cells; corticating layer broad, compact; antheridia single or in small (2–4 together) clusters, scattered through the epidermis; cystocarps globular to globular pyriform below, narrowed abruptly into a slender carpostome, 165–205μ (T) by 130–170μ (R, exclusive of the carpostome), but the carpostome itself is 75–100μ long; gonimoblasts spreading out from a few-celled placenta, lining the basal half to two-thirds of the sporiferous cavity, curving up and bearing short branchlets successively abjointing elongated pyriform spores, somewhat grouped; periderm of 4–5 layers, pseudoparenchymatous.

The specimen chosen for the type of the genus *Pseudoscinaia* and of the species *Pseudoscinaia Snyderae* is No. 77886 of the Herbarium of the University of California. It was collected at "Pacific Beach"

near San Diego, California, on June 30, 1898, by Mrs. M. S. Snyder, to whom the species is dedicated in token of appreciation of her interest, industry, and generosity in collecting, studying, and distributing marine algae of Southern California. Specimens collected at La Jolla by Mrs. Snyder and by M. B. Nichols and at San Pedro by Mrs. H. D. Johnston and Dr. N. L. Gardner have also been used for study.

Pseudoscinaia Snyderae is closely allied to the next species below both in habit and structure. It is, however, a more robust plant with smaller cystocarps and more radially elongated utricles. The vegetative structure in both species is distinctly close to that of *Scinaia furcellata,* but the cystocarps are not those of *Scinaia furcellata* but rather those of *Galaxaura.* It is, in turn, entirely free from calcification and has colorless utricles in the epidermis. It is of a certain peculiar appearance due to the considerable number of dichotomies and the uniform diameter of base and apex in its branches. It is to be expected from Santa Barbara to La Paz, if arguments may be drawn from the distribution of other members of the *Scinaia* assemblage.

Pseudoscinaia australis sp. nov.

Plate 16, fig. 62.

Scinaia furcellata J. Bracebridge Wilson, Proc. Roy. Soc. Victoria, new ser., vol. 4, p. 173, 1892? (not *Ulva furcellata* Turner).

Plant pink purple, 9–10 cm. high, about 10 times dichotomous, slender, 1 mm. in diameter (dried); axils broad; axis obscure but often visible (dried); cystocarps scattered, minute, barely visible; — axial strand slender of coarser and finer filaments nearly parallel, loose; epidermis of colorless cells (utricles) with frequent scattered slender colored cells; utricles oblong to square in radial section, 20–21μ (T) by 13–21μ (R), convex at the outer end presenting an appearance of irregular, loose, blunt polygons in surface view (T); hypodermis of two layers of globular cells, 4–5μ in diameter; corticating layer thin and loose; antheridia scattered, mostly solitary; cystocarps globular or flattened globular, abruptly narrowed into a slender carpostome, 150–175μ (T) by 130–150μ (R, exclusive of carpostome); gonimoblasts spread out over the basal half to two-thirds of the cystocarpic cavity and abjointing successively pyriform spores in several groups; paraphyses wanting; periderm pseudoparenchymatous, of 5–6 layers.

Of *Pseudoscinaia australis* there is only a single specimen, the type, which is No. 74793 of the Herbarium of the University of California. It was collected by J. Bracebridge Wilson on January 17, 1893, at

Port Phillip Heads near Melbourne, Australia, and was distributed under the name of *Scinaia furcellata.*

Pseudoscinaia australis differs from *Pseudoscinaia Snyderae* in being less robust, in having slightly smaller cystocarps and having the utricles ordinarily less elongated. The cystocarp is very distinctly like that of *Galaxaura,* but lacks paraphyses.

It may be that this plant is the same as the *Scinaia furcellata* var. *australis* J. Ag. (1876, p. 512), but it has not been compared with authentic material. Consequently it is necessary to consider it for the present as distinct. It is known, at present, only from the type locality. It is probably the plant referred to by J. Bracebridge Wilson in his "Catalogue of Algae collected at or near Port Phillip Heads and Western Port" (1892, p. 173 as above) under *Scinaia furcellata* and may also be included under Harvey's reference to *Scinaia furcellata* in the "Synoptic Catalogue of Australian and Tasmanian Algae" in the fifth volume of the "Phycologia Australica" (1863, p. xxxviii). A specimen collected by Harvey at Western Point and referred to *Scinaia furcellata* is, however, the type of *Gloiophloea Scinaioides* J. Ag.

V. SYNOPSIS OF GENERA AND SPECIES

Scinaia Bivona

A. Cylindricae—

a. Utricles outwardly convex and tumid.

1. *S. furcellata* (Turner) Bivona

b. Utricles outwardly flattened.

2. *S. Johnstoniae* sp. nov.
3. *S. japonica* sp. nov.

B. Complanatae—

4. *S. complanata* (Collins) Cotton
5. *S. latifrons* M. A. Howe
6. *S. Cottonii* sp. nov.

C. Constrictae—

7. *S. moniliformis* J. Ag.
8. *S. hormoides* sp. nov.
9. *S. carnosa* Harvey
10. *S. Salicornioides* (Kuetz.) J. Ag.
11. *S. articulata* sp. nov.

Gloiophloea J. Ag.

A. Monoicae—

1. *G. Scinaioides* J. Ag.
2. *G. undulata* (Mont.) comb. nov.
3. *G. Okamurai* sp. nov.
4. *G. Halliae* sp. nov.

B. Dioicae—

5. *G. capensis* sp. nov.
6. *G. confusa* sp. nov.

C. Dubia—

7. *G.*(?) *articulata* Weber van Bosse

Pseudoscinaia gen. nov.

1. *P. Snyderae* sp. nov.
2. *P. australis* sp. nov.

VI. KEY TO GENERA AND SPECIES

A. Gonimoblasts radiating, forming a single unlobed sporogenous mass, all free
- *a.* Utricles present forming the outer layer even in the adult, colored cells fewer or even wanting ..... Scinaia.
  - 1. Fronds cylindrical continuous ..... *Cylindricae.*
    - *x.* Adult utricles strongly convex on the outer end..... 1. *S. furcellata.*
    - *xx.* Adult utricles flattened on the outer end.
      - *. 7–8 dichotomies, utricles square or slightly flattened radially, 21–25μ (T) × 20–21μ (R) ..... 2. *S. Johnstoniae.*
      - **. 9–11 dichotomies, utricles elongated radially, 8–12μ (T) × 30μ (R) ..... 3. *S. japonica.*
  - 2. Fronds cylindrical, more or less constricted ..... *Constrictae.*
    - *x.* Constrictions regular and frequent, utricles not palisade-like.
      - *. Segments long, cylindrical.
        - *z.* Utricles 20–22μ (T) × 38μ (R) ..... 7. *S. moniliformis.*
        - *zz.* Utricles 10–15μ (T) × 17–20μ (R) ..... 11. *S. articulata.*
      - **. Segments short, globular to obovate ..... 8. *S. hormoides.*
    - *xx.* Constrictions less regular and frequent, utricles palisade-like.
      - *. Utricles shorter, 5–8μ (T) × 20–22μ (R) ..... 9. *S. carnosa.*
      - **. Utricles more elongated, 6–9μ (T) × 28–35μ (R) ..... 10. *S. Salicornioides.*
  - 3. Fronds complanate to much flattened ..... *Complanatae.*
    - *x.* More slender, cystocarps scattered ..... 4. *S. complanata.*
    - *xx.* Broader, cystocarps more or less marginal.
      - *. Cystocarps mostly marginal, utricles 30–35μ (T) × 20–30μ (R)..... 5. *S. latifrons.*
      - **. Cystocarps partly marginal, utricles 16–20μ (T) × 13–17μ (R) ..... 6. *S. Cottonii.*
- *b.* Utricles present, more or less conspicuous when young, but obscured by a later growth of short moniliform anticlinal filaments of colored cells ..... Gloiophloea.

1. Fronds monoecious.
   x. Outer cortex 85–110μ thick ..... 1. *G. Scinaioides.*
   xx. Outer cortex 50–70μ thick ..... 2. *G. undulata.*
   xxx. Outer cortex 35–50μ thick ..... 3. *G. Okamurai.*
   xxxx. Outer cortex 22–40μ thick ..... 4. *G. Halliae.*
2. Fronds dioecious.
   x. Outer cortex 60–85μ thick ..... 5. *G. capensis.*
   xx. Outer cortex 40–60μ thick ..... 6. *G. confusa.*

B. Gonimoblasts radiating, variously grouped, the central free, the lateral longer and applied closely to the periderm ..... Pseudoscinaia.
1. Plant more robust, utricles 12–20μ (T) × 20–26μ (R) ..... 1. *P. Snyderae.*
2. Plant more slender, utricles 20–21μ (T) × 13–21μ (R) ..... 2. *P. australis*

VII. DIAGNOSES OF NEW GENUS AND OF NEW SPECIES

Scinaia Johnstoniae sp. nov.

S. atropurpurea, 8–12 cm. alta, 7–8-plo dichotoma, cylindrica, continua, lata, 3–5 mm. diam. (sicca); ramis inferne attenuatis; axillis angustis; axi obscuro (sicco); cystocarpiis minutis, sed visibilibus, dispersis; — filo axiali laxo latoque, filamentis paucis majoribus et gracilibus laxe intermixtis; epidermide cellulis magnis, decoloratis (aut "utriculis"), extus truncatis et cellulis coloratis paucis gracilibus dispersis et singulis aut tetraplo aggregatis intermixtis composito; utriculis extus truncatis, arcte appressis, superficie 5–7-goniis, in magnitudine prope uniformibus, quadratis aut leviter complanatis, parietibus tenuibus; cellulis epidermidis coloratis paucis, dispersis, 1–4-plo aggregatis; cellulis hypodermalibus in strato singulo laxoque positis, orbicularibus, 16–18μ diam.; strato corticato tenui, laxi, filamentis tenuibus percurrentibus composito; monoica(!); antheridiis dispersis, 1–4-plo aut leviter aggregatis; cystocarpiis late pyriformibus, in collum angustum abrupte contractis, 180–265μ (T) et 128–170μ (R); filamentis gonimoblasticis gracilibus, numerosissimus, e placenta parva, cellulari et breve pedicellata radiantibus corpus sporogenum late reniforme efficientibus, sporas ellipsoidales deinceps abscidentibus; peridermio tenui, prope 4 stratis cellularum pseudoparenchymaticarum composito; in California australi prope "San Pedro" a Domina H. D. Johnston et "La Jolla" a Domina M. S. Snyder atque in California inferna prope "La Paz" a Domino Vives detecta.

Scinaia japonica sp. nov.

S. atrorubra, 15 cm. alta, 9–11-plo dichotoma, modice lata, 1–3 mm. diam. (sicca), cartilaginea; axillis angustis; substantia, ut videtur, densa et carnoso-cartilaginea; axi invisibili (sicco); cystocarpiis obscuris (siccis); — filo axiali robusto, filamentis latis numerosis et filamentis gracilibus paucis composito; epidermide cellulis magnis

decoloratis (utriculis) et cellulis gracilibus coloratis perpaucis composito; utriculis magnis, conformibus, stricte aggregatis, extus truncatis, superficie 5–7-goniis, vallatoideis, 30μ (R) et 8–12μ (T), parietibus radialibus tenui-rugosis (siccis); hypodermide 2–4 stratoso, cellulis globosis; strato corticato tenui filamentis gracilibus composito; antheridiis nondum detectis; cystocarpiis globuloso-pyriformibus, collo brevi abrupto contractis, 400μ (T) et 300–350μ (R); filamentis gonimoblasticis numerosissimis, gracilibus, e placenta cellulari distincta radiantibus, sporas oblongas deinceps abscidentibus; peridermio 5–7-stratoso, pseudoparenchymatico; in Japonia prope Misaki a K. Yendo lecta.

Scinaia Cottonii sp. nov.

S. roseo-rubra, 4–5 cm. alta, 5–7-plo dichotoma, moderate lata apicibus plus minusve acutis, ramis inferne attenuatis, continua, 3–10 mm. diam. (sicca); axi obscuro; cystocarpiis dispersis aut parce intra marginem positis; — utriculis prope quadratis ad rectangulo-oblongis, 16–20μ (T) et 13–17μ (R), extus truncatis; hypodermide laxo; strato corticato angusto, laxo; antheridiis in fasciculis parvis; cystocarpiis adultis nondum examinatis; in Japonia prope "Enoura" a Saido lecta.

Scinaia hormoides sp. nov.

S. atropurpurea (siccitate fuscescens), 4–6 cm. alta, 7–8-plo dichotoma, stipite perbrevi solida, ramis uniformiter et regulariter constrictis, segmentis globularibus ad obovatis, deinde oblongis, 3 mm. latis et 8–10 mm. longis; axi plus minusve obscuro (sicco); cystocarpiis dispersis, visibilibus; — filo axiali distincto, primo filamentis latis paucis parallelis composito deinde filamentis gracilibus corticantibus intertextis; epidermide cellulis magnis decoloratis (utriculis) cum cellulis gracilibus coloratis frequentis et regulariter positis interspersis, 1–4 aggregatis composito; utriculis extus truncatis, superficie 5–7-goniis, in sectione prope quadratis, 24–25μ (R) et 20–22μ (T); cellulis epidermidis coloratis numerosis, distantibus, subregulariter positis; hypodermide unistratoso, cellulis irregulariter obpyriformibus distantibus, 8–10μ diam., composito; strato corticato tenui, filamentis gracilibus sparsis composito; antheridiis in fasciculis parvis stellulatis; cystocarpiis late pyriformibus, globulis et extus abrupte contractis, 250–350μ in diametro utro; filamentis gonimoblasticis numerosissimis, gracilibus, e placenta cellularum perpaucarum orientibus, sporas brevi-ellipsoideas deinceps abscidentibus; peridermio 3–4 stratoso, pseudoparenchymatico; in insulis Hawaiiensibus a J. Rock, Dom. Minnie Reed, et E. Bailey lecta, nec non in insulis Philippensibus unde specimen a Doctore M. A. Howe benevolente communicatum examinavi.

Scinaia articulata sp. nov.

S. profunde roseo-rubra, 10 cm. alta, 7-plo dichotoma, 3–5 mm. diam. (sicca), cylindrica, regulariter et frequenter constricta, segmentis elongatis oblongo-cylindricis; ramis inferne leviter attenuatis;

axi omnino conspicuo (sicco); cystocarpiis sparsis, dispersis, moderate magnis; — filo axiali lato, robusto, denso, maxime filamentis gracilibus composito; epidermide cellulis magnis decoloratis, aut utriculis, et cellulis coloratis perpaucis composito; utriculis extus truncatis, superficie 5–7-goniis, conformibus, in sectione transversali subrectangularibus, 17–20μ (R) et 10–15μ (T), congestis; cellulis epidermidis coloratis perpaucis ut observationem evadere; hypodermide 1-stratoso, cellulis dispersis, orbicularibus, 12–14μ diam.; strato corticato tenui, laxo; antheridiis nondum detectis; cystocarpiis late pyriformibus, complanato-globulosis, abrupte in carpostomium latum breveque contractis, 215–235μ (T) et 165–170μ (R); filamentis gonimoblasticis gracilibus, numerosissimis e placenta exigua cellularique radiantibus, sporas globoso-ellipsoideas deinceps abscidentibus; in California ad oras Sanctae Barbarae lecta.

Gloiophloea capensis sp. nov.

Gl. 7–9 cm. alta, 7–11-plo dichotoma, cylindrica, continua, 1–3 mm. lata (sicca) saturate rubra, carnoso-cartilaginea; axi obscuro; cystocarpiis irregulariter aggregatis; — filo axiali tenui, laxo; cortice adulto externo 85–110μ crasso, seriebus anticlinis cellularum coloratarum moniliformiumque composito inter quibus 1–2-seriebus periclinis laxis utriculorum vacuorum collabentiumque interspersis; cortice interno 50–65μ crasso, filamentis gracilibus laxe intertextis composito; dioica; antheridiis superficiem prope totam plantarum mascularum vestientibus, singulis in apicibus cellularum gracilium positis, oblongis; cystocarpiis late pyriformibus, 65–130μ (R) et 115–150μ (T), peridermio filamentoso, 5–9 stratoso; ad oras Capitis Bonae Spei.

Gloiophloea Okamurai sp. nov.

Gl. ad 9 cm. alta, 10–11-plo. dichotoma, carnoso-cartilaginea, saturate rubra aut fere atra (sicca), cylindrica, continua, 1–1.5 mm. lata (sicca); axi invisibili; cystocarpiis irregulariter aggregatis; axi gracili; cortice adulto 70–100μ crasso, externo 30–50μ crasso, seriebus anticlinis cellularum coloratarum moniliformiumque composito inter quibus 1–2 seriebus periclinis utriculorum pyriformium ellipticorumque vacuorum et collabentium laxe interspersis, interno 35–50μ crasso, filamentis gracilibus laxe intertextis composito; monoica; antheridiis superficiem plantarum mascularum fere aut totaliter vestientibus; solitariis in apicibus cellularum gracilium; antherozoidiis oblongis; cystocarpiis pyriformibus, 105–120μ (R) (160–180μ cum collo) et 120–135μ (T), peridermio 6–7 stratoso, laxe filamentoso; ostiolo longo latoque extus contracto; ad oras Japoniae a K. Okamura et H. M. Richards lecta.

Gloiophloea Halliae sp. nov.

Gl. saturate rubra, 11–13 cm. alta, 5–7-plo dichotoma, cylindrica, continua; — filo axiali gracili; cortice externo 22–40μ lato, seriebus anticlinis cellularum coloratarum moniliformiumque composito, utri-

culis ovatis in stratis duobus intermixtis; strato corticato 20–45μ lato, laxissimo; monoica (!); antheridiis superficiem totam dense vestientibus, fasciculatis; cystocarpiis globuloso-pyriformibus, 100–118μ (T) et 66–88μ (R sine collo lato); peridermio filamentoso, crasso, 5–6-stratoso; ad oras ditionis "Florida," ubi detexit Domina G. A. Hall.

Gloiophloea confusa sp. nov.

Gl. saturate rubro-purpurea, 10–15 cm. alta, 10–16-plo dichotoma, 2–3 mm. diam. (sicca), ramis prorsus diam. equalibus, cylindricis, continuis; axillis moderate latis; axi invisibili; dioica!; antheridiis stratum continuum superficiale in planta mascula tota efficientibus; cystocarpiis numerosis, dispersis, obscuris; — filo axiali robusto, filamentis latis paralellis laxe agglutinatis composito; cortice externo 40–60μ lato, 5–6 stratoso, cellulis in seriebus anticlinis curtis cellularum coloratarum moniliformiumque intus magnarum rotundarumque extus successive parviorum; utriculis primo stratum proprium efficientibus, deinde seriebus anticlinis cellularum coloratarum superantibus; cortice interno (corticato) 105–120μ lato, laxo; dioica(!); antheridiis stratum compactum superficiem plantae masculae totaliter vestientibus curtis, oblongis; cystocarpiis late pyriformibus, lente ad carpostomium contractis, 250μ (T) et 280–300μ (R); filamentis gonimoblasticis numerosis, gracilibus, e placenta distincta et pauci-cellulari radiantibus, sporas ellipsoideas deinceps abscidentibus; peridermio 5–6 stratoso, pseudoparenchymatico; ad oras Pacificas Americae borealis e Columbia Brittanica usque ad Californiam australem.

PSEUDOSCINAIA, gen. nov.

Frons e disco radicali oriens, cylindrica, repetite dichotoma, apicibus obtusa et diametro prorsus equalis; — filo axiali filamentis latis et parietibus tenuibus, plus minusve agglutinatis, composito unde ramellis gracilibus oblique sursum excurrentibus, quorum partibus externis in cortice externo agglutinatis; cortice externo utriculis decoloratis composito inter quibus cellulis gracilibus coloratisque, plus minusve regularibus insertis, cuticulo distincto; filamentis gracilibus corticantibus filum axiale circumdantibus et corticem internum vestientibus; gelina diluta spatium inter filum axiale et corticem internum implente; sporangiis ignotis; antheridiis singulis aut perpaucis, inter utriculos insertis; cystocarpiis dispersis, in cortice interno orientibus et in gelina medullari plus minusve suspensis, globosis aut pyriformibus, carpostomio plus minusve elongato; filamentis gonimoblasticis in cavum cystocarpiorum prominentibus et parietes cystocarpiorum vestientibus, varie aggregatis et sporas plus minusve elongatas deinceps abscidentibus; peridermio distincto, pseudoparenchymatico; puncto vegetationis depresso. Genus in structura vegetativa ad Scinaiam congruens, sed in structura cystocarpiorum ad Galaxauram vergens.

Pseudoscinaia Snyderae sp. nov.

P. saturate rubra, 12–20 cm. alta, 9–13-plo dichtoma, cylindrica, continua, non calce incrustata; ramis non basim contractis sed in

diametro e basi ad apicem prope aequalibus, 1–2 mm. latis (siccis); axi distincto (sicco); cystocarpiis numerosis, dispersis, parvis, facile visibilibus (siccis); — filo axiali robusto, filamentis numerosis, parallelis, latis firme conjunctis composito; epidermide cellulis irregularibus decoloratis (utriculis) et cellulis gracilibus coloratis composito; utriculis extus convexis et tumidis superficie (T) verisimiliter irregularibus, disjunctis et obtuse polygoniis, humile vallatoideis, 20–26μ (R) et 12–20μ (T) hypodermide 1–3(?) (maxime 1) stratoso, laxo, cellulis globosis pyriformibusve; strato corticato lato, compacto; antheridiis singulis aut in fasciculis (2–4 conjunctim) parvis, per epidermidem dispersis; cystocarpiis inferne globosis aut globoso-pyriformibus supra in carpostomio abrupte contractis, 165–185μ (T) et 130–135μ (R, sine tuba carpostomii), sed carpostomio 75–100μ longo; filamentis gonimoblasticis e placenta pauci cellulari radiantibus, mediis liberis, lateralibus parietes cystocarpiorum vestientibus, sporas longe pyriformes aliquantum aggregatas deinceps abscidentibus; peridermio 4–5 stratoso, pseudoparenchymatico; ad oras Californiae australis.

Pseudoscinaia australis sp. nov.

P. roseo-purpurea, 9–10 cm. alta, prope 10-plo dichotoma, gracilis, 1 mm. diam. (sicca); axillis latis; axi obscuro sed frequenter visibili; cystocarpiis dispersis, minutis, vix visibilibus; — filo axiali filamentis latis gracilibusque prope paralellis intermixtis, laxis; epidermide cellulis decoloratis (utriculis) et cellulis coloratis frequentis gracilibus et dispersis, composito; utriculis in sectione transversali oblongis aut quadratis, 20–21μ (T) et 13–21 (R), extus convexis tumidisque, superficie (T) verisimiliter irregulariter et obtuse polygoniis; hypodermide 2 stratoso, cellulis globosis, 4μ diam. composito; strato corticato tenui et laxo; antheridiis dispersis, maxime solitariis; cystocarpiis globosis aut complanato-globosis, abrupte in carpostomio gracili contractis, 150–175μ (T) et 130–150μ (R, sine collo carpostomii); filamentis gonimoblasticis et liberis et parietes cystocarpiorum vestientibus, sporas pyriformes varie aggregatas deinceps abscidentibus; paraphysibus absentibus; peridermio 5–6-stratoso, pseudoparenchymatico; ad oras Novae Hollandiae australis.

VIII. GEOGRAPHICAL DISTRIBUTION

In considering the matter of the geographical distribution of any group of plants, whether large or small, it is a matter of great consequence to determine generic, specific, and even varietal or form differences with as great exactitude as possible. This is of especial importance when the study of the distribution is to include some attempt to explain the facts of distribution from any physical, physiological, or evolutionary points of view. The older method has been to lump together plants of similar morphological characteristics, no

matter how widely separated in locality and this has been done with little question. It seems desirable, however, to examine these widely distributed genera and species, particularly among the more highly differentiated groups such as Florideae, to determine, if possible, how far the seeming uniformity of structure extends and whether it is really one species occurring so widely distributed or whether, in reality, it may not be a group of more or less nearly related species, each occupying its own limited domain. The cases thus far carefully investigated have shown that the latter is the truth. One of the most striking examples of this is *Ceramium rubrum*. Another is, as shown above, the alleged wide distribution of *Scinaia furcellata*.

Scinaia furcellata has been reported from the Mediterranean and southwest coasts of Europe, from southern New England and Florida, from the Cape of Good Hope, and from the Hawaiian Islands, from New Zealand, Tasmania and Australia, from the west coasts of South America, from the west coasts of North America, and from Japan. As limited above, typical forms of *Scinaia furcellata* are found only in Europe and Mediterranean north Africa and on the Atlantic coasts of North America. Whatever else may be said of the various distinctions drawn between the various species in the present paper, it certainly seems demonstrated that none of them is true *Scinaia furcellata* except as noted above. The distribution of this species, then, seems natural from the point of view of occurring within limited temperature variation and with other temperate species of similar distribution. Most of the regions credited with the possession of *Scinaia furcellata* shows forms having a similar habit but of differing cortical or even of differing cystocarpic structure. In the Australian region are two species, externally resembling *Scinaia furcellata* but assigned, in the present account, to different genera, viz., *Gloiophloea Scinaioides* and *Pseudoscinaia australis*. It is yet to be satisfactorily demonstrated that any plant closely related to *Scinaia furcellata* occurs in the southern hemisphere, the only species of the genus *Scinaia* absolutely known to occur below the equator being *Scinaia moniliformis* and *Scinaia Salicornioides*, regularly constricted species of decidedly different utricular structure. At the Cape of Good Hope occurs a cylindrical and unconstricted form previously referred to *Scinaia furcellata* but which careful examination shows to be a *Gloiophloea*. This has been given the name of *Gloiophloea capensis* in this account. A study of the plants of the western coasts of the Americas shows no true *Scinaia furcellata*. The South American plant is clearly a

Gloiophloea, viz., *Gloiophloea undulata*. On the California coasts the plants usually referred to *Scinaia furcellata* and resembling it in habit are not strictly of the genus *Scinaia*. One is *Gloiophloea confusa* while the other is *Pseudoscinaia Snyderae*. Three species of *Scinaia* are credited to the Californian coast in the present account: one is *Scinaia latifrons*, a broad, flattened species; another is *Scinaia articulata*, a regularly constricted species; while the third, *Scinaia Johnstoniae*, is a robust species of entirely distinctive utricular structure, so that none of these can be considered as being closely related to *Scinaia furcellata*.

The Japanese *Scinaia furcellata* has been found to consist of two species, *Scinaia japonica*, quite distinct from the European plant, while the other is *Gloiophloea Okamurai* of the present account.

The nature of the plant referred to *Scinaia furcellata* from the Hawaiian Islands must remain unsettled for the present. It is referred to by Harvey (1846, p. 69 (text) and 1863, p. xxxviii). No unconstricted, cylindrical *Scinaia*-like plant has occurred to me among the extensive collections of marine algae from the Hawaiian Islands in my possession. On the other hand, *Scinaia hormoides*, a regularly moniliformly constricted species, closely related to *Scinaia moniliformis* of Australia, does occur there. It does not seem probable, however, that this is the plant referred to by Harvey.

The result, then, is that *Scinaia furcellata*, instead of being a nearly cosmopolitan species, is found to be restricted to a fairly wide but natural area, through which it might readily spread and with temperature limits between 15° and 25° C, being mostly between about 18° C and 25° C, a not altogether unusual temperature range for a member of the Florideae.

Attention may now be called to the accompanying table (p. 131) showing the distribution of the various members of the *Scinaia* assemblage as they are limited and established in the present paper. In the table an × indicates established range and an 0 indicates a range previously reported but shown above to be erroneous.

The northern Atlantic Ocean has three species in two genera, the southern Atlantic, if we count South Africa as Atlantic, as well as perhaps also of Indian Ocean, has two species in two genera, if we count South Africa as exclusively of the Indian Ocean in its algal affinities, which is perhaps more natural, it has none. The north Pacific Ocean, on the other hand, has nine species in three genera, and the south Pacific Ocean has four species also in three genera; or the whole

Pacific Ocean can count thirteen species distributed through all the genera recognized. The Indian Ocean strictly limited has one species, but if we include, as seems natural, South Africa and the Philippine Islands, it has four species in two genera. Taken by zones, there is none of the species reported as occurring in the frigid zones or even much below 15° C of temperature of surface waters, except possibly one species (*Gloiophloea confusa*); the tropical zone has two species, the warmer temperate or subtropical zones have ten in the north and six in the south.

	Temperate Atlantic					Temperate Indian	Tropical			Temperate Pacific						
	Mediterranean	Southwestern Europe	New England	Florida	Bermuda	Cape of Good Hope	Ceylon	Philippine Islands	Hawaii	Southeastern Japan	South Vancouver Id.	Middle California	S. and Lower California	Peru and Chili	Southeastern Australia	Northern New Zealand
S. furcellata	×	×	×	0	..	0	..	..	0	0	0	0	0	0	0	0
S. Johnstoniae	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
S. japonica	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
S. complanata	..	..	..	×	×	..	..	..	..	..	..	..	..	..	..	..
S. latifrons	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
S. Cottonii	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
S. moniliformis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
S. hormoides	..	..	..	..	..	..	..	×	×	..	..	..	..	..	..	..
S. articulata	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
S. carnosa	..	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..
S. Salicornioides	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
G. Scinaioides	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	×
G. Okamurai	..	..	..	..	..	..	..	..	..	×	..	..	..	..	..	..
G. undulata	..	..	..	..	..	..	..	..	..	..	0	0	0	×	..	..
G. Halliae	..	..	..	×	..	..	..	..	..	..	..	..	..	..	..	..
G. confusa	..	..	..	..	..	..	..	..	..	..	×	×	×	..	..	..
G. capensis	..	..	..	..	..	×	..	..	..	..	..	..	..	..	..	..
P. Snyderae	..	..	..	..	..	..	..	..	..	..	..	..	×	..	..	..
P. australis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	×	..
	North Atlantic Ocean					Southwest Indian Ocean	Tropical Indian Ocean		Tropical Pacific Oceans	North Pacific Ocean				South Pacific Ocean		

× = occurence.
0 = false report.

In regard to temperature ranges of the different species, it may be well to state our present knowledge. Two species, at least, endure a low winter temperature (down to 5° C or below in the case of *Scinaia furcellata*) but are probably seasonal in their appearance (at least in *Scinaia furcellata*). It seems probable that the other species are at least more vigorous in summer than in winter, even though they do

not have to endure so much cold. Taking the distribution according to summer temperatures, the following statements as to the relation of the occurrence (so far as known) to isotheres may be of interest. Between isotheres 10°–15° C possibly two species may be found, viz.: *Scinaia furcellata* and *Gloiophloea confusa,* but probably always nearer the 15° C than the 10° C line. Six species, viz., *Scinaia furcellata, S. moniliformis, Gloiophloea Scinaiodes, G. undulata, G. confusa,* and *Pseudoscinaia australis,* are to be found between the isotheres of 15° and 20° C, while between the isotheres of 20° to 25° C are to be found eleven species, viz.: *Scinaia furcellata, S. Johnstoniae, S. japonica, S. latifrons, S. Cottonii, S. Salicornioides, S. articulata, Gloiophloea Okamurai, G. capensis, G. confusa,* and *Pseudoscinaia Snyderae.* These are subtropical species. The tropical species occurring between the isotheres of 25° and 30° are five, viz., *Scinaia Johnstoniae, S. complanata, S. hormoides, S. carnosa,* and *Gloiophloea Halliae.* The true tropical species is *S. carnosa* because it lives constantly in tropical heat; *Scinaia hormoides* is at times subject to a temperature of 23°–24° C. *Scinaia complanata* and *Gloiophloea Halliae* have about the same temperature relations as *Scinaia hormoides,* while *Scinaia Johnstoniae* endures much colder waters still (winter temperature as low as 14° C at least).

The *Scinaia* assemblage, then belongs to the warmer waters, mostly being the subtropical waters (20°–25° C) and entirely absent from the colder waters. They may be contrasted with the other members of the Chaetangiaceae. The species of *Galaxaura* are all tropical, or at least very nearly so. The single species attributed to *Actinotrichia,* while widespread, is, however, strictly tropical. The ill understood genus *Chaetangium* has ten species, only one of which is tropical. Three of these species, however, are subtropical, i.e., inhabiting waters between 20–25° C. Four species are credited with inhabiting waters between 15° and 20° C, and the other two with inhabiting waters between 5° and 10° C.

While the temperature of the water has the absorbing interest as presumably regulating and restricting the limits of the particular distribution of the species, there are certain general facts of distribution which are generally emphasized and which, also, are usually looked upon as throwing light upon the origin and spread of the various members of such a group as the *Scinaia* assemblage.

In the European-East North American region, viz., the North Atlantic, are to be found two (possibly three) species, viz., *Scinaia*

furcellata, Sc. complanata, and the Florida species, *Gloiophloea Halliae.* There is then a representative of both the cylindrical and the complanate groups of true *Scinaia* and one representative of *Gloiophloea.* In the Northwest North America-Northeast Asia region, viz., the North Pacific (i.e., above the tropic of Cancer), on the other hand, there are eight (out of nineteen) species and all three genera represented. In fact, no group or subgroup lacks representation, even that of the constricted *Scinaia* species having one representative. This general mixture of representative forms will probably be found characteristic of many other groups of algae as well. It is certainly very characteristic of the Laminariaceae (cf. Setchell, 1893, pp. 355–358). Two other areas stand out and are more or less related, viz., those of the Australian seas or South Pacific (south of the tropic of Capricorn) and the Indian Ocean (including the Cape region of South Africa). The South Pacific region possesses three species representing all three genera, but the species of *Scinaia* is of the regularly constricted type. The Indian Ocean (or South Atlantic?) temperate region is known to have two species, one a constricted *Scinaia,* the other a *Gloiophloea.* The intermediate tropical regions between these two south temperate (or subtropical) regions and the north temperate and subtropical Pacific regions, viz., the tropical Indian Ocean and tropical Pacific, show only two species, both of the constricted type of *Scinaia.*

In summary, then, it may be said that *Scinaia* seems to be essentially a northern hemisphere type, since nine of its eleven species are confined to a position north of the equator and these represent all the various types of structure within the genus, while on the other hand only two species of *Scinaia,* and those two restricted to the constricted type, are found south of the equator. Of the other genera, *Gloiophloea* has three species in the southern hemisphere and three in the northern while *Pseudoscinaia* has one species in each hemisphere. Yet, arguing from the similar distribution of Pacific and Indian Ocean Laminariaceae, the center of distribution is probably austral and the northward extension along the western coasts of the Americas to Japan a later development. In fact, the *Gloiophloea* and *Pseudoscinaia* species, in their distribution, call strongly to mind the distribution of the Lessonioid and Ecklonioid Laminariaceae in their relation to members of the other tribes of kelps. That this is also true of certain other families and genera of marine algae is also apparent and will give an added interest to the study of antarctic and australio-indio-pacific

forms as compared with those of the North Atlantic and Arctic Oceans. The occurrence of a *Gloiophloea* in the North Atlantic (Florida coast) seems, from this point of view, anomalous. It is to be suspected, however, that an increase in our knowledge may show other similar cases.

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EXPLANATION OF PLATES

PLATE 10

Scinaia furcellata (Turner) Bivona

Fig. 1. Radial section through the cortex of the specimen appearing to be Turner's type, in the Herbarium of the Royal Botanical Gardens at Kew (dried specimen). × 391 diam.

Figs. 2–5. Radial sections through the cortex of a plant collected at Helgoland, August 25, 1905, by Dr. Paul Kuckuck, showing different stages in the development (alcoholic material). × 391 diam.

Fig. 6. Radial section through the cortex of a plant collected at Helgoland by Dr. Paul Kuckuck, August 16, 1905 (dried specimen), showing mature utricles and antheridia. × 391 diam.

Fig. 7. Section through the cortex of a plant collected at Antibes, France, by Dr. W. G. Farlow (Herb. Univ. Calif., No. 96345, dried specimen), showing adult utricles and antheridia. × 391 diam.

Fig. 8. Radial section through the cortex of a plant collected at Palermo, Italy, by Angelo Mazza, May 22, 1902 (Herb. Univ. Calif., No. 90897), showing mature utricles and antheridia (dried specimen). × 391 diam.

Fig. 9. Radial section through the cortex of a specimen collected at Naples, Italy, by Miss Minnie Reed, showing small utricles and antheridia (alcoholic material). × 391 diam.

Fig. 10. Sketch from another part of same plant as shown in figure 9, showing larger utricles. × 391 diam.

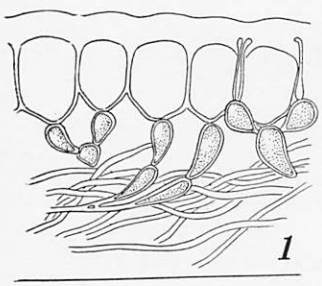
Fig. 11. Radial section through the cortex of a plant collected at Gay Head, Massachusetts, by C. P. Nott, August 10, 1895 (Herb. Univ. Calif., No. 96350, dried specimen). × 391 diam.

Fig. 12. Tangential view (of surface) of same plant as shown in figure 11, showing disassociated tips of utricles and colored cells. × 391 diameters.

Gloiophloea Halliae sp. nov.

Fig. 13. Radial section through the cortex of a plant in Herb. Farlow, collected at St. Lucie, Florida, by Mrs. G. A. Hall, April 1, 1899 (dried specimen). × 391 diam.

All the figures drawn by Miss Helen M. Gilkey under the direction of W. A. Setchell.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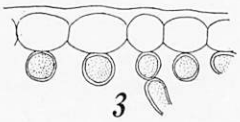
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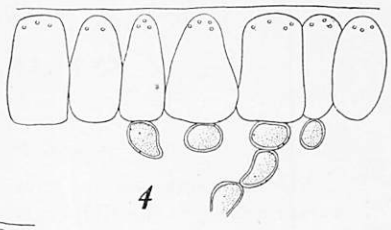
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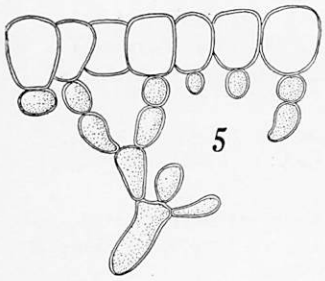
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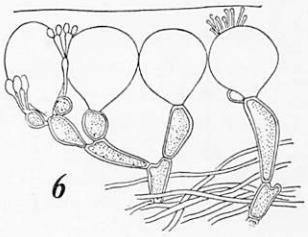
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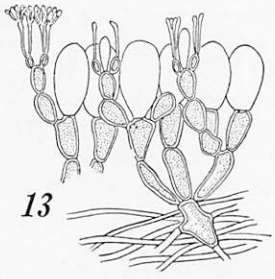
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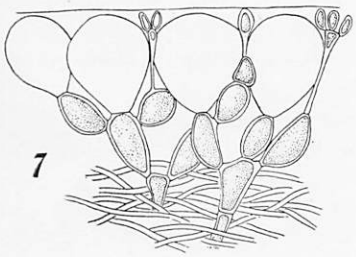
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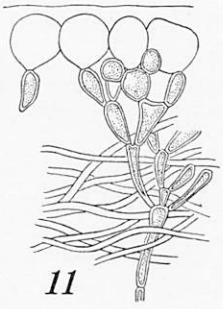
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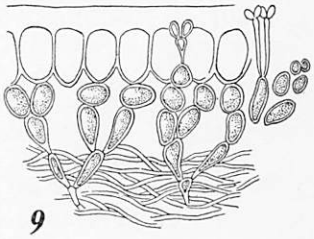
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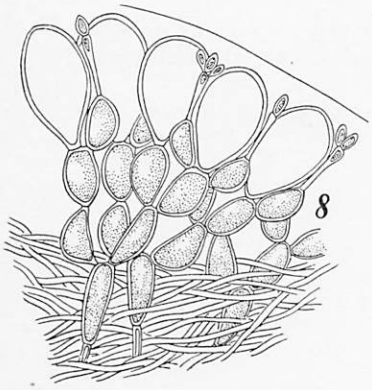
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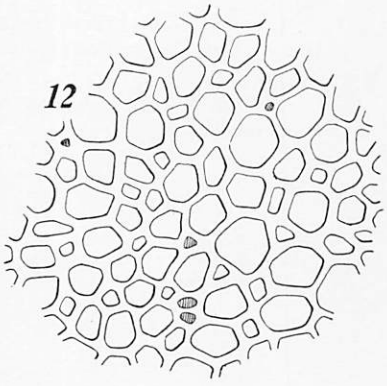
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PLATE 11

Scinaia Johnstoniae, sp. nov.

Fig. 14. Radial section through the cortex of a plant collected at San Pedro, California, by Mrs. H. D. Johnston, June 28, 1900 (Herb. Univ. Calif., No. 96356, dried specimen). The utricles in this drawing are less flattened than in the next, but flattened utricles also occur.

Fig. 15. Radial section through the cortex of a plant collected at La Jolla, California, by Mrs. M. S. Snyder (Herb. Univ. Calif., No. 90727, dried specimen), showing extreme of flattening of utricles and also antheridia.

Scinaia japonica, sp. nov.

Fig. 16–18. Radial sections through the cortex of a plant collected at Misaki, Japan, by Professor K. Yendo, April, 1900 (Herb. Univ. Calif., No. 90835, dried specimen). Figure 17 shows the peculiar striae in the walls of the utricles due to wrinkling. The sections shown in figures 17 and 18 have not recovered their shape as well as the sections shown in figure 16.

Scinaia complanata (Collins) Cotton

Fig. 19. Radial section through the cortex of the plant distributed under No. 836 Phycotheca Boreali-Americana, collected at Indian River Inlet, Florida, by Mrs. G. A. Hall, April, 1899 (dried specimen in writer's copy). × 391 diam.

Fig. 20. Radial section through the cortex of a plant in Herb. Farlow, collected at Gilberts Bar, Florida, by A. H. Curtiss, March, 1897 (dried specimen). × 391 diam.

Fig. 21. Radial section through the cortex of another plant collected at the same time by the same collector (Herb. Univ. Calif., No. 96361, dried specimen). × 391 diam.

Fig. 22. Radial section through the cortex of a plant in Herb. Farlow, collected at Coopers Island, Bermuda, by W. G. Farlow in 1881 (dried specimen). × 391 diam.

Scinaia latifrons M. A. Howe

Fig. 23. Radial section through the frond of a plant collected at San Pedro, California, by Miss Sarah P. Monks (Herb. Univ. Calif., No. 132817, dried specimen). × 391 diam. The section did not fully recover its original proportions.

Scinaia Cottonii sp. nov.

Fig. 24. Radial section through a specimen in Herb. Holmes (number 9) at the University of Birmingham, collected at Enoura, Japan, by Saido (dried specimen). × 391 diam. The utricles and antheridia are very well shown.

Scinaia carnosa Harvey

Fig. 25. Radial section through the cortex of a plant distributed by Harvey under No. 38 of his Algae of Ceylon (Herb. Univ. Calif., No. 77093, dried specimen). × 391 diam. This represents a younger state of the utricles than that represented in the next.

Fig. 26. Radial section through the cortex of another plant distributed by Harvey under the same number (38, Alg. Ceylon) and preserved in Herb. Farlow (dried specimen). × 391 diam.

Fig. 27. Radial section through a plant dredged near Observation Island (No. 5165), Philippine Islands, by the U.S. Fish Comm. Str. "Albatross," February 24, 1908, and submitted for determination by F. S. Collins (dried specimen). × 391 diam. This plant is referred to *Scinaia carnosa* with considerable doubt.

Scinaia Salicornioides (Kuetz.) J. Ag.

Fig. 28. Radial section through the cortex of a plant collected on the coast of Natal by Dr. H. Becker and preserved in Herb. Weber-van Bosse (dried specimen). × 391 diam.

Fig. 29. Sketch of another radial section from the same plant as represented in figure 28, to show variation in utricles. × 391 diam.

Fig. 30. Radial section through the cortex of a plant collected at "The Kowie," South Africa, by Dr. H. Becker and preserved in Herb F. S. Collins (dried specimen). × 391 diam.

All the figures were drawn by Miss Helen M. Gilkey under the direction of W. A. Setchell.

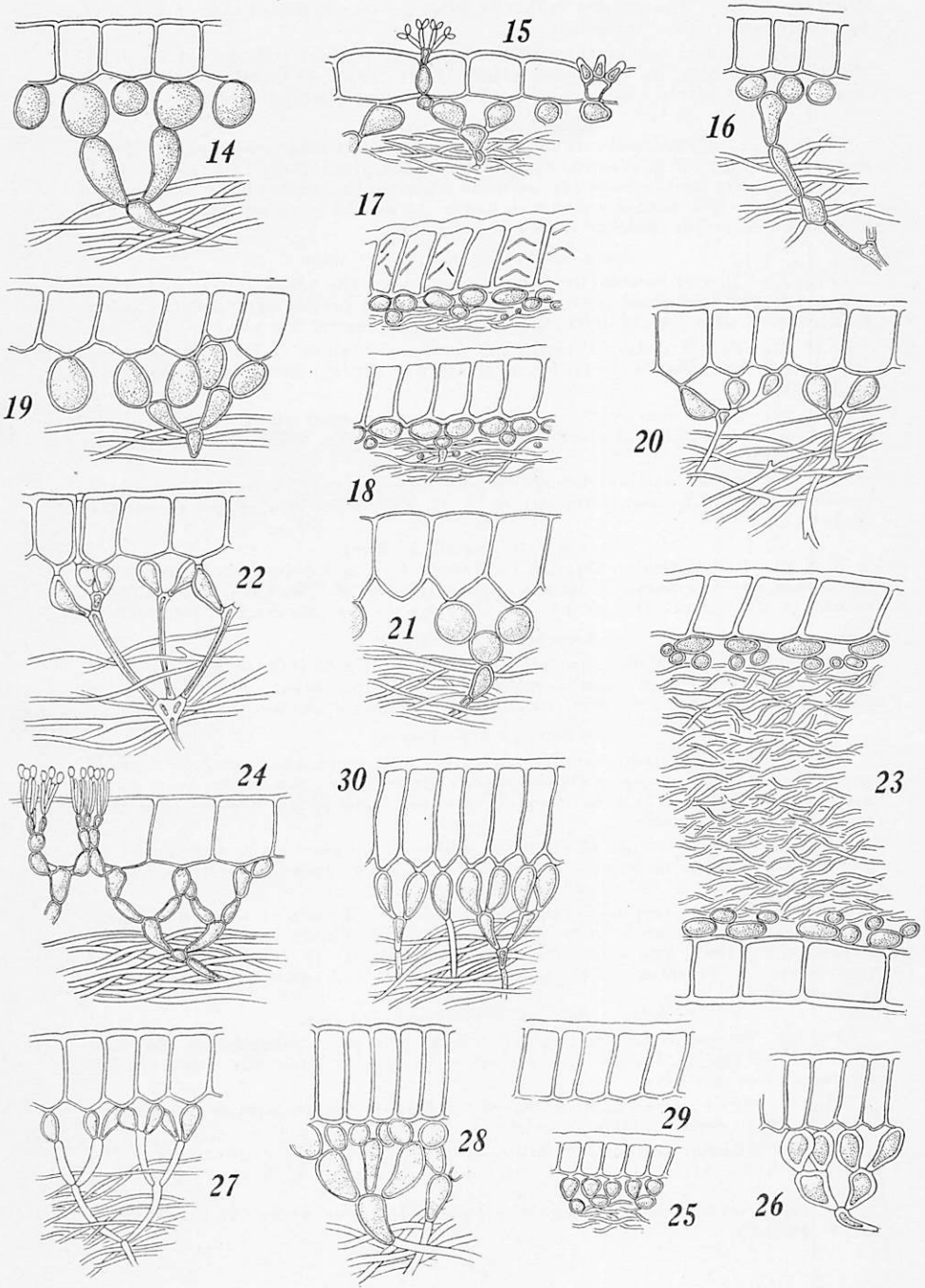
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PLATE 12

Scinaia moniliformis J. Ag.

Fig. 31. Habit sketch from a "rubbing" made by the writer of a cotype specimen in Herb. British Museum of Natural History and collected at Port Phillip Heads by J. Bracebridge Wilson (dried specimen). Natural size.

Fig. 32. Radial section through the cortex of same specimen. × 391 diam.

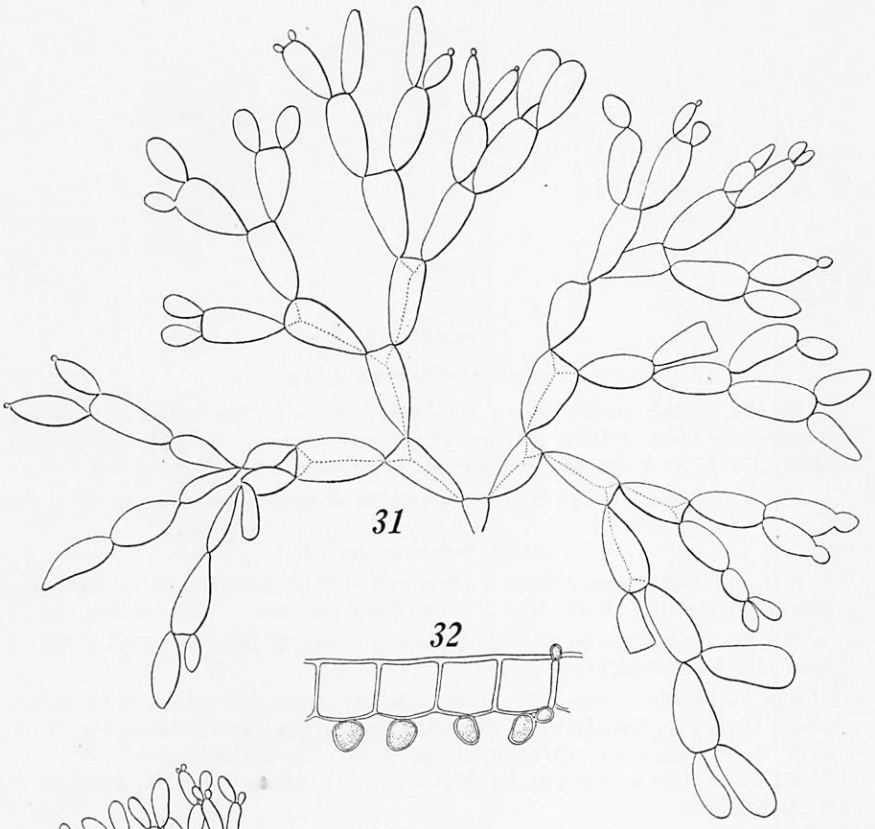
Scinaia hormoides sp. nov.

Fig. 33. Habit sketch from a plant collected at Haleiwa, Oahu, Hawaiian Islands, by Mr. J. T. Rock, May 2, 1908 (dried specimen). Natural size.

Fig. 34. Radial section through a plant collected at Haleiwa by Miss Minnie Reed (No. 985, formalin specimen). × 391 diam.

Fig. 35. Radial section of a plant collected at Puro, Province of La Union, Luzon, Philippine Islands, by E. Finix (Philippine Bureau of Science, No. 13014, Herb. Univ. Calif., No. 163388, dried specimen). × 391 diam.

All the figures were drawn by Miss Helen M. Gilkey under the direction of W. A. Setchell.



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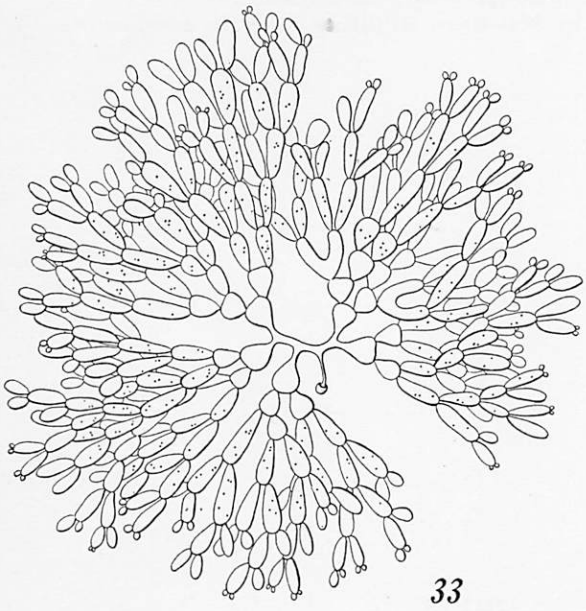

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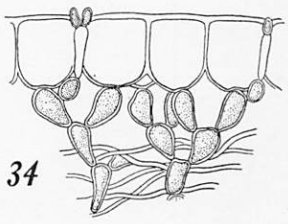

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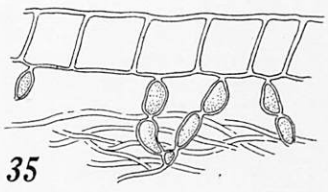

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PLATE 13

Scinaia hormoides sp. nov.

Fig. 36. Habit sketch of a plant collected at Haleiwa, Island of Oahu, Hawaiian Islands, by J. T. Rock (No. 43, dried specimen). Natural size.

Fig. 37. Surface view of a portion of a plant collected at Haleiwa, Island of Oahu, Hawaiian Islands, by Miss Minnie Reed (No. 985, formalin material). × 391 diam.

Scinaia moniliformis J. Ag.

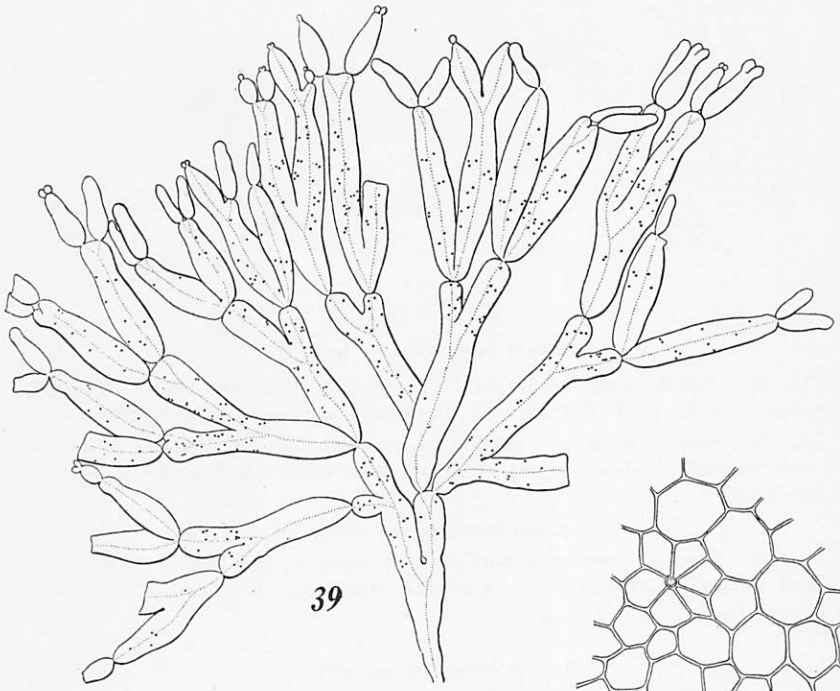
Fig. 38. Surface view of a portion of a plant in the British Museum of Natural History, collected at Port Phillip Heads by J. Bracebridge Wilson (dried specimen). × 391 diam.

Scinaia articulata sp. nov.

Fig. 39. Habit sketch of a plant in Herb. F. S. Collins, sent from Santa Barbara, California, by Mr. J. W. Calkins (dried specimen). Natural size.

Fig. 40. Radial section through a portion of the plant represented in figure 39 (dried specimen). × 391 diam.

All the figures were drawn by Miss Helen M. Gilkey under the direction of W. A. Setchell.



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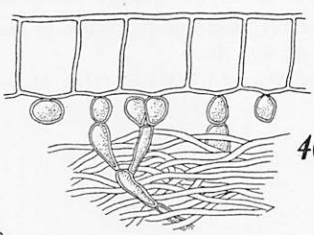

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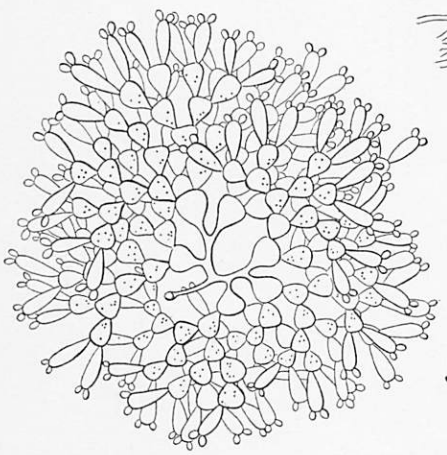

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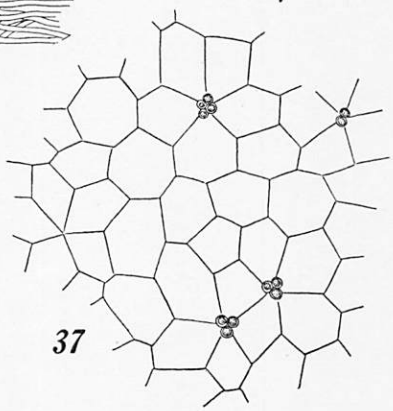

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PLATE 14

Scinaia furcellata (Turner) J. Ag.

Fig. 41. Radial section through the cortex and mature cystocarp of a plant collected at Helgoland by Dr. Paul Kuckuck, August 25, 1905 (alcohol specimen). × 391 diam.

Fig. 42. Young cystocarp (isolated) of a plant collected at Antibes, France, by W. G. Farlow (dried specimen, Herb. Univ. Calif., No. 96345). × 391 diam.

Fig. 43. Somewhat older cystocarp from same plant as shown in figure 42, isolated and slightly crushed. × 391 diam.

Gloiophloea confusa sp. nov.

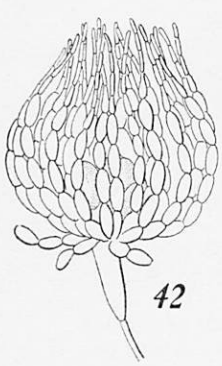
Fig. 44. Radial section through the cortex of an antheridial plant collected at Monterey, California, by W. A. Setchell, June 11, 1901 (specimen killed in corrosive sublimate and preserved in 2 per cent formalin solution). × 391 diam.

Fig. 45. Radial section through the cortex of a cystocarpic plant collected at Moss Beach, San Mateo County, California, by Dr. Carl Skottsberg (alcoholic specimen). × 391 diam.

Fig. 46. Radial section through the cortex of an antheridial plant collected at San Pedro, California, by W. A. Setchell, December, 1895 (dried specimen, Herb. Univ. Calif., No. 96351). × 391 diam.

Fig. 47. Radial section through the cortex of a cystocarpic plant, collected at Moss Beach, San Mateo County, California, by Dr. N. L. Gardner, December, 1908 (dried specimen, No. 2104). × 391 diam.

All the drawings were made by Miss Helen M. Gilkey under the direction of W. A. Setchell.



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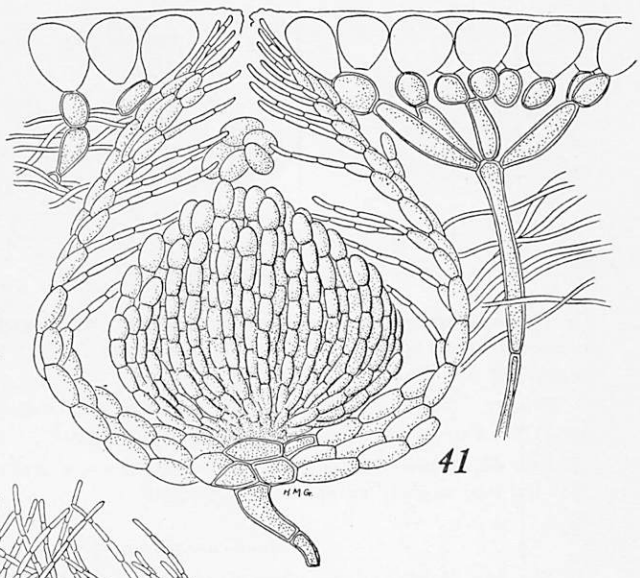

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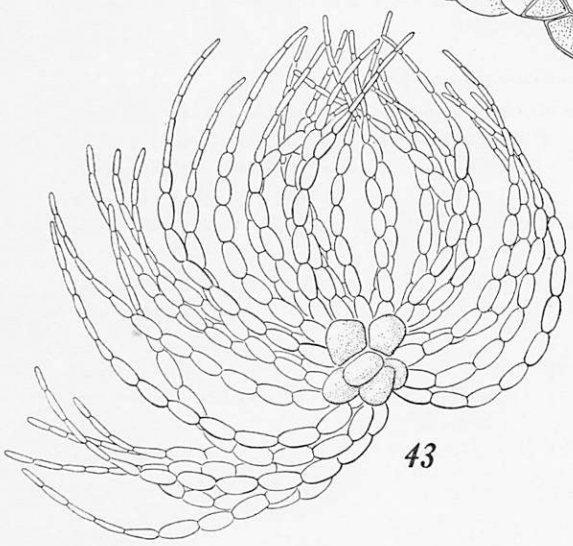

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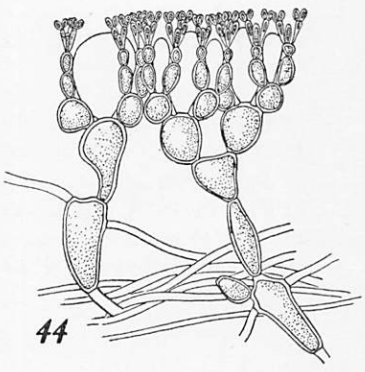

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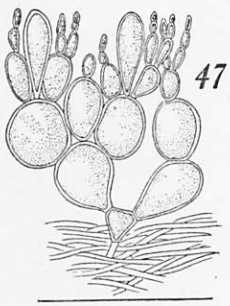

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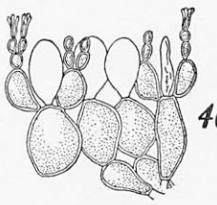

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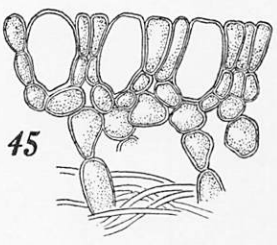

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PLATE 15

Gloiophloea Scinaioides J. Ag.

Fig. 48. Fragment of a radial section through the cortex of a plant in Herb. Farlow, collected at the Bay of Islands, North Island of New Zealand, by Dr. Sven Berggren, and distributed by J. G. Agardh under the name of *Scinaia furcellata* (dried specimen). × 391 diam.

Gloiophloea undulata (Mont.) comb. nov.

Fig. 49. Radial section through the cortex of a plant in Herb. Montagne in the Mus. d'hist. nat. at Paris, collected by Gaudichaud on the voyage of the "Bonite" and consequently assumed to be the type, or at least a cotype (dried specimen). × 391 diam. The drawing shows the structure of the cortex, antheridia, and a portion of a cystocarp.

Gloiophloea Okamurai sp. nov.

Figs. 50–53. Radial section through the cortex of three different plants distributed as *Scinaia furcellata* by K. Okamura under No. 2 of his Algae Japonicae Exsiccatae and collected at Enoshima (Sagami), Japan, March, 1898. Figures 50 and 51 are from the specimen in the writer's copy and represent younger cortices, while figures 52 and 53 are each from a different specimen in Herb. Farlow and represent adult conditions (dried specimens). × 391 diam.

Figs. 54, 55. Radial sections from a specimen in Herb. Farlow, collected at Kamakura, Japan, by Dr. H. M. Richards, June 12, 1900 (dried specimen). × 391 diam.

Fig. 56. Radial section through the cortex of a specimen in Herb. Farlow, collected at Enoshima, Japan, by H. M. Richards, June 14, 1900 (dried specimen). × 391 diam.

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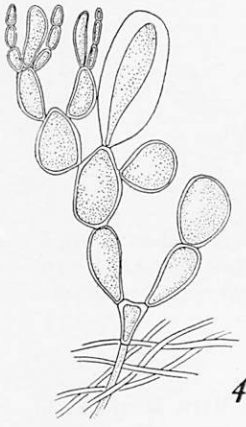

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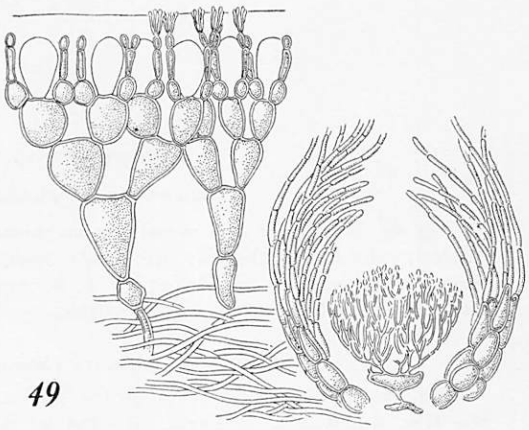

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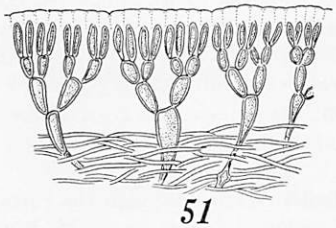

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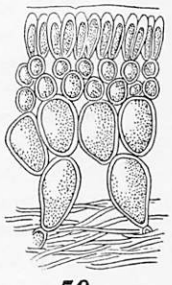

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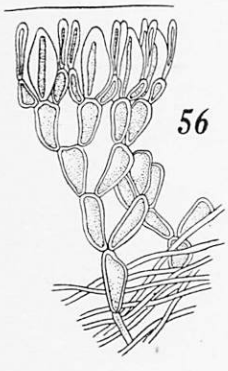

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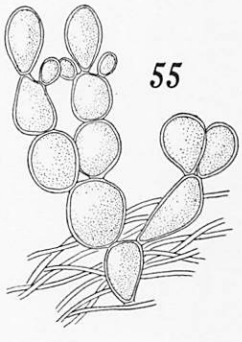

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PLATE 16

Gloiophloea Okamurai sp. nov.

Fig. 57. Radial section through the cortex of a plant in Herb. Farlow, distributed under No. 2 by K. Okamura in his Algae Japonicae Exsiccatae as *Scinaia furcellata,* and collected at Enoshima (Sagami), Japan, March, 1898 (dried specimen). × 391 diam. The drawing shows adult cortex and a nearly median longitudinal section of a cystocarp.

Gloiophloea capensis sp. nov.

Fig. 58. Radial section through the cortex of a plant collected on the coast of Cape Colony by Mr. J. Burtt Davy (dried specimen). × 391 diam. The collapsed utricles are not shown.

Fig. 59. Radial section of a plant in Herb. Farlow collected at the "Cape of Good Hope" by Poeppig (dried specimen). × 391 diam. The adult utricles of two series and the young antheridial filaments are shown.

Pseudscinaia Snyderae gen. et sp. nov.

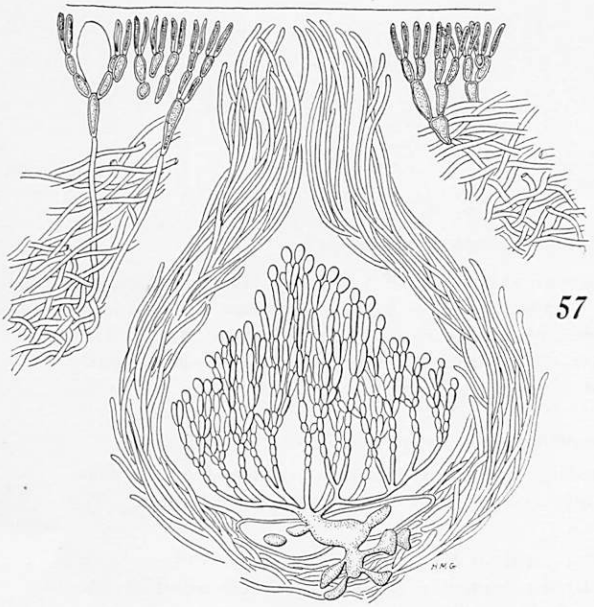
Fig. 60. Radial section through the cortex of a plant collected at San Pedro, California, by Dr. N. L. Gardner, September, 1908 (dried specimen). × 391 diam.

Fig. 61. Radial section of the same plant as shown in figure 60, showing a cystocarp in nearly median longitudinal section (dried specimen). × 391 diam.

Pseudoscinaia australis gen. et sp. nov.

Fig. 62. Radial section through the cortex of a plant in Herb. University of California (No. 74793), collected at Port Phillip Heads, Australia, by J. Bracebridge Wilson, January 17, 1893 (dried specimen). × 391 diam.

All the drawings were made by Miss Helen M. Gilkey under the direction of W. A. Setchell.



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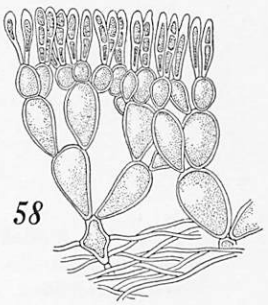

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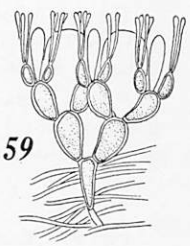

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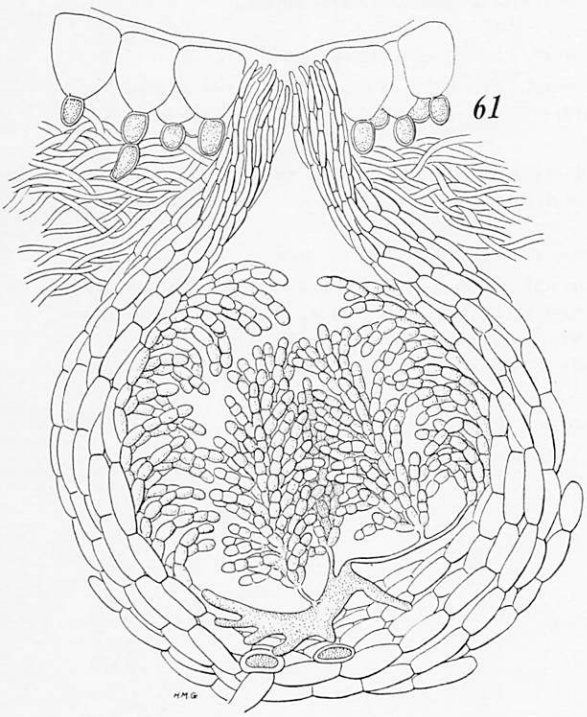

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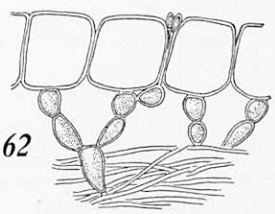

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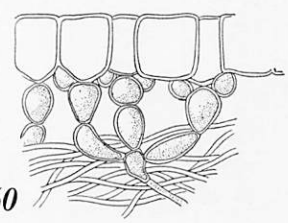

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