Phycological studies — IV. The genus Neomeris and notes on other Siphonales

MARSHALL AVERY HOWE

(WITH PLATES 1–8)

A. THE GENUS NEOMERIS

In an attempt to determine the relationships of a peculiar *Neomeris* collected on Atwood Cay in the eastern Bahamas and later on the Caicos Islands, it was found desirable to see the material on which *Neomeris dumetosa* Lamour., the original species of the genus, attributed to the Antilles, was founded. Having been allowed to see presumably authentic specimens of *N. dumetosa* through the courtesy of Monsieur P. Hariot of the Muséum d'Histoire Naturelle of Paris, we were further enabled, through the kindly interest of other European phycologists named below, to examine plants from the Friendly Islands, Singapore, the Dutch East Indies, etc., which had been identified with *Neomeris dumetosa*. A comparative study of these specimens and of our own collected in Bermuda, Florida, and the West Indies, indicates that the genus consists, so far as is known, of six living species. We have made no attempt to study the fossil forms that have been referred to the genus and we regret not being able to add anything as to the still unknown germination phenomena of the so-called "spore." The detailed life-history, not only of *Neomeris*, but of many other marine Siphonales of the tropics, remains to be worked out by some one so situated as to have the living plants under a more continuous and leisurely observation than has as yet fallen to the lot of the writer. A brief diagnosis of the genus and more detailed descriptions of the six species follow :

NEOMERIS Lamour. Hist. Polyp. 241. 1816.

Plants subcylindrical, clavate, or subfusiform, more or less calcified, consisting of an erect normally simple and unconstricted axis affixed at the base by branching or lobed holdfasts and bearing numerous close-set whorls of 12–56 or more branches.

Branches of the lowermost whorls commonly one or more times di-trichotomous and sterile; primary branches (branches of the first order) of the remaining whorls mostly giving rise to a terminal stalked sporangium and two (in *N. stipitata* sometimes three) sterile branches, the latter springing from near the base of the sporangium. Sterile branches of the second order in adult stage either enlarged and vesicular distally, the inflations strongly coherent and forming a unistratose cortex with more or less hexagonal facets, or in (*N. Cokeri*) merely subfusiform and imperfectly coherent, scarcely forming a cortex. Each of the sterile branches of the second order terminating in a single simple or one or more times di-trichotomous, soon deciduous hair. Sporangia subglobose, obovoid, pyriform, or somewhat cylindrical, enclosed in thick calcareous capsules, these sometimes coherent; the sporangium-stalk often at length cut off from the supporting primary branch by a basal constriction and plug. Each sporangium enclosing a single spore (gametangium?), this furnished with an operculum at its basal (proximal) end.

Type species *N. dumetosa* Lamour.

Hairs monomorphous; ends of branches of the second order forming a cortex with distinct facets.
- Sporangia strongly calcified but mutually free.
  - Primary branches 500–1000 μ long, 15–35 times as long as their median diameter.
    - Primary branches coherent by intercalary lime-deposits into flat, cuneate, flabelliform, or somewhat annular transverse scales or bands of mostly 3–8 branches, easily caducous; plants mostly 15–20 times as long as thick. 1. *N. dumetosa.*
    - Primary branches strongly calcified but free, or, at most, very irregularly and loosely coherent, persistent; plants mostly 6–12 times as long as thick. 2. *N. van Bosseae.*
  - Primary branches 240–410 μ long, 4–10 times as long as their median diameter.
    - Plants 26–40 mm. long; facets of the cortex firm-walled, not calcified on the outer surface, occasionally in threes; sporangia first appearing at about 15 mm. from base of mature plant. 3. *N. stipitata.*
    - Plants 8–20 mm. long; facets of the cortex thin-walled and very mucilaginous, strongly calcified at first on the outer surface, always in pairs; sporangia first appearing at about 2–6 mm. from base of mature plant. 4. *N. mucosa.*
- Sporangia coherent laterally by their calcareous capsules, the plant thereby appearing transversely annulate in the lower fertile parts. 5. *N. annulata.*

Hairs dimorphous, the two forms in alternating zones; branches of the second order subfusiform, scarcely forming a cortex, surface of the plant after the fall of the hairs somewhat shaggy or minutely and irregularly punctate; sporangia free or coherent in short rows of 2–8. 6. *N. Cokeri.*

1. NEOMERIS DUMETOSA Lamour. Hist. Polyp. 243. *pl. 7. f. 8.* 1816; Expos. méth. Polyp. 19. *pl. 68. f. 10, 11* (*11* poor). 1821. — Cramer, Neue Denkschr. Schweiz. Naturf. Ges. **30**: —(10–14, 38). *pl. 2. f. 13–15; pl. 3. f. 3.* 1887. Not *N. dumetosa* Cramer, *op. cit.* **32**: —(19–21). *pl. 1. f. 13; pl. 2. f. 7, 8.* 1890.

Plants gregarious or scattered, subcylindrical, elongate and slender, 20–40 mm. long, 1–2 mm. thick, mostly 15–20 times as long as thick, acute or acuminate at apex: successive whorls of primary branches about 300–400 in number, 80–90 μ apart near the middle of the plant, 135 μ near apex; number of branches in a whorl usually 28–40: hairs all of one form, sparingly persistent in an inconspicuous apical tuft: * ends of branches of the second order in the mature stage forming a cortex with irregular hexagonal facets in irregular, often scarcely recognizable, transverse and oblique rows, each pair of corticating branches commonly lying in a somewhat oblique plane, cortex easily deciduous, usually persistent only in upper fourth or sixth, reticulate-alveolate on drying: branches of the first order in adult fertile stage 500–680 μ long, 14–30 μ in diameter in their median and basal parts, slender, mostly 18–35 times as long as their median diameter, soon very strongly calcified and regularly coherent by heavy intercalary deposits of lime into flat, cuneate, flabelliform, or somewhat annular densely crowded transverse scales or bands, these consisting usually of 3–8 branches with the intercalary masses of lime 2–4 times as broad as the branches, very easily caducous, the main axis often becoming extensively naked in basal and median parts: branches of the second order capitate, the terminal inflations 100–185 μ in greatest diameter, outwardly rounded-obtuse, their walls moderately gelatinous, the pedicels scarcely calcified, the terminal inflations strongly calcified proximally and laterally but not on their outer surfaces: sporangia strongly calcified but mutually free, first appearing at 2–3 mm. from base of the mature plant, soon deciduous, persisting in irregularly crowded groups or loosely scattered, 150–200 μ long (decalcified and including stalk), the calcareous capsule 16–50 μ thick; spores subglobose, 135–

* The apparently conspicuous apical tuft shown in Lamouroux's figure 3 consists quite largely, judging from specimens in the Paris Museum, of young uncalcified collapsed facets from which the hairs have already fallen.

160 μ × 130–154 μ, commonly a trifle longer than broad or occasionally *vice versa* (sometimes only 100–110 μ in diameter in the East Indian specimens). [PLATE 1, FIGURE 1; PLATE 5, FIGURE 20; PLATE 6, FIGURES 1, 2.]

TYPE LOCALITY: "Antilles." Probable type specimens in herb. Lamouroux, Institut Botanique, Caen, France, under the manuscript name "*Neomeris cespitosa*"; probable co-types in herb. Mus. Paris., under names "*Neomeris cespitosa*" and "*N. dumetosa* Lmx."

DISTRIBUTION: "Antilles," *Richard;* island of Fau (near the island of Gebee), Dutch East Indies, *A. Weber-van Bosse* (apparently associated with *N. van Bosseae*).

The only specimens found in the *Neomeris* cover in herb. Lamouroux are three plants attached to a slip of paper bearing the inscription "*Neomeris cespitosa*" in Lamouroux's hand, without indication of locality or collector. They are doubtless the three plants figured by Lamouroux in connection with the original publication of *Neomeris dumetosa*, though now occupying slightly different positions in relation to each other. In the herbarium of the Muséum d'Histoire Naturelle of Paris, in which the Richard herbarium is incorporated, is a single plant in a pocket marked "*Neomeris cespitosa*" without collector or locality, and also a group of seven individuals (six practically entire and one a basal fragment) marked "*N. dumetosa* Lmx.," also without indication of locality or collector. All of the specimens mentioned resemble each other closely and all have probably come from the one original collection. We examined all of these specimens in the summer of 1904, but then neglected to note certain characters which we have since found to be of importance in distinguishing the species of *Neomeris*. Recently, however, through the generous courtesy of M. Hariot, we have enjoyed the privilege of making a more critical study of the material in the Paris Museum. Cramer saw an authentic specimen of *Neomeris dumetosa* and gave an excellent description of it (with characteristic figures) in his first paper "Ueber die verticillirten Siphoneen besonders Neomeris und Cymopolia," but in his second paper "Ueber die verticillirten Siphoneen besonders Neomeris und Bornetella" he described under the same name some of Harvey's specimens from the Friendly Islands, which, we believe, are specifically distinct.

Later descriptions by other writers, also, have been based, in part, at least, on specimens agreeing with the true *N. dumetosa* in having mutually free sporangia but differing in various other particulars.

Just as the lateral coherence of the sporangia by their calcareous capsules forms a reliable and easily applied test for distinguishing *Neomeris annulata* from *N. dumetosa* and its near allies, so the similar coherence of the primary branches of the true *Neomeris dumetosa* by intercalated lime-deposits constitutes an apparently constant and reliable character for distinguishing the species from others which have hitherto been identified with it. This coherence was recognized by Lamouroux in his original description by the words "inferne squamosa" and "écailles presque cunéiformes" and was emphasized by Cramer in his first description, but has been generally ignored by subsequent writers. This character is well illustrated by Cramer (*pl. 2. f. 13*), his figure showing the calcareous scale perforated by the tubular branches, with the width of the connecting lime-masses commonly three or four times the diameter of the branches. Another peculiarity of the true *Neomeris dumetosa* is found in the very caducous nature of these scales. As Lamouroux well said, "le moindre frottement les arrache du tube membraneux qu'elles laissent alors à nu." In allied species which have been confused with *N. dumetosa*, the individually separate primary branches are persistent. Furthermore, the mature plants of *N. dumetosa* are more slender and more taper-pointed than those from the Friendly Islands, the Dutch East Indies, and Hawaii, which have hitherto been identified with it.

Neomeris dumetosa is said to have been brought from the Antilles by Richard and there is as yet no sufficient ground for doubting the accuracy of this statement in spite of the facts that it apparently has not since been collected in American waters and that something practically identical (except for smaller spores) has recently been brought from the East Indies by Madame Weber-van Bosse. *Neomeris Cokeri* is common enough in the Bahamas (we have it from fourteen stations and have seen it often when not collected), but the species has not yet been reported outside of this group of islands. *Neomeris mucosa*, described as new in the present paper,

is known only from the Caicos Islands and the extreme eastern Bahamas. And *Neomeris dumetosa* will possibly be found again in the West Indies when some collector of marine algae visits the right island. And, furthermore, the occurrence of this species in both the West Indies and the East Indies may occasion no surprise in view of the fact that *Neomeris annulata* and various other marine Siphonales are now generally conceded to have a similar distribution. In connection with the original description of *Neomeris dumetosa*, it is said to grow associated with *Acetabularia crenulata*, a species which appears to be exclusively American. The Paris Museum material of the probably original *N. dumetosa* is intermingled with a few broken stalks of plants apparently belonging in the genus referred to, but without caps or sporangia a determination of the species is out of the question.

2. Neomeris van Bosseae sp. nov.

Neomeris dumetosa Sonder, Alg. trop. Austral. 36. *pl. 5. f. 8–13.* 1871. — J. Ag. Till. Alg. Syst. **5**: 147–151. *pl. 2. f. 4–7.* 1887. — Cramer, Neue Denkschr. Schweiz. Naturf. Ges. **32**: — (19–21). *pl. 1. f. 13; pl. 2. f. 7. 8.* 1890. — Solms, Ann. Jard. Bot. Buitenzorg **11**: *pl. 8. f. 11.* 1893. Not *Neomeris dumetosa* Lamour. Hist. Polyp. 243. *pl. 7. f. 8.* 1816.

Plants gregarious or scattered, clavate, subcylindrical, or somewhat fusiform, 15–35 mm. long, 2–3.5 mm. thick, mostly 6–12 times as long as thick, often curved near the middle or toward the rounded-obtuse or subacute apex: successive whorls of primary branches about 290–350 in number, 50–80 μ apart in basal and median regions, 150–170 μ toward apex; number of branches in a whorl usually 32–44: hairs all of one form, persistent in a moderately conspicuous apical tuft: ends of the branches of the second order in the mature stage forming a cortex with the hexagonal facets in regular or irregular rows, each pair of corticating branches commonly lying in a transverse plane, the number of transverse rows of facets equaling, in consequence, the number of primary whorls, and the number of facets in a row being twice that of the elements in a primary whorl, or, the pairs of corticating branches lying in oblique planes and the arrangement of the facets then less manifestly regular, cortex rather brittle, yet usually persisting in upper third or half, reticulate on drying: branches of the first order 570–1000 μ long, 20–50 μ in diameter in their basal and median parts, mostly 15–30 times as long as their median diam-

eter, soon strongly calcified but remaining distinct and free from each other, or very irregularly and loosely coherent, persistent: branches of the second order capitate, the terminal inflations 110–220 μ in greatest diameter, outwardly subtruncate or lightly arcuate, their walls rather firm, the pedicels well calcified as to their bases at least or sometimes nearly free from lime, the terminal inflations strongly calcified proximally and laterally, but their outer surfaces, with rare exceptions, uncalcified and nitent: sporangia strongly calcified but mutually free, first appearing at 1–4 mm. from base of mature plant, commonly long persistent, 135–220 μ long (decalcified and including stalk), the calcareous capsules 20–55 μ thick; spores subglobose or oval, 105–176 μ × 96–170 μ, their width often about $\frac{11}{12}$, rarely $\frac{4}{5}$, their length. [PLATE 1, FIGURES 4, 7; PLATE 5, FIGURES 17–19.]

Type from Sikka, Flores, Dutch East Indies, *A. Weber-van Bosse 1196*, in the herbarium of the New York Botanical Garden and in the herbarium of Madame Weber-van Bosse, Eerbeek, Holland. Known also from Savoe [Savu], Dutch East Indies, *Weber-van Bosse*; from Vavau and Lifuka, Friendly Islands, *W. H. Harvey*, August and October, 1855; and from Koolauloa. Oahu, Hawaii, *Josephine E. Tilden*, June, 1900, Am. Algae *445*. The specimens from New Guinea, *Beccari*, cited by Solms (*loc. cit.* 71), under *N. dumetosa* we have not seen, but it is quite possible that they belong here, as this seems to be the most common species of the group in that region.

It is a pleasure to associate with the present species the name of one of its collectors, Madame A. Weber-van Bosse, who had already recognized that her material of the *Neomeris dumetosa* group included two species, and to whom the writer, like many other students of the marine algae of the present day, is indebted for numerous most helpful courtesies. J. Agardh (*loc. cit.*) seems never to have seen Richard's West Indian plant and in describing *Neomeris dumetosa* from Harvey's material from the Friendly Islands he gave evidence of some doubts as to whether the two were really the same.

Neomeris van Bosseae agrees with *N. dumetosa* in its mutually free sporangia, but the two, so far as can be judged from the material now in hand, appear to be sufficiently and constantly distinct. The most obvious distinguishing character of *N. van Bosseae* is that the branches of the first order, though strongly calcified, re-

main mutually free. If there is any irregular or accidental coherence among them, there is no approach to the beautifully regular coherence of *N. dumetosa*, and the lime-masses between the branches are narrower than the branches, while in *N. dumetosa* they are, except at their bases (or sometimes, also, at their apices), 2–4 times as broad as the branches themselves. Moreover, the primary branches of *Neomeris dumetosa* are easily deciduous or caducous, while in *N. van Bosseae* they are persistent, and the sporangia also, show a similar tendency quite apart from branches on which they are borne. *Neomeris van Bosseae* is also a stouter plant than *N. dumetosa*, being mostly 6–12 times as long as thick, as opposed to 15–20 times as long as thick, and it is usually more rounded-obtuse at the apex.

The arrangement of the facets in the cortex appears to be somewhat variable in *N. van Bosseae*. When, as is often the case, the members of each pair of corticating branches are opposed to each other laterally, that is, lie in a transverse plane, the arrangement is manifestly regular, the number of transverse rows of facets corresponds exactly to the number of primary whorls, and the number of facets in each row is consequently just twice the number of elements in the corresponding primary whorl. But when, on the other hand, the members of each pair lie in an oblique plane, there are two possible ways of interpreting what shall constitute a transverse row of facets and, according to the method adopted, there may be either twice as many rows as there are primary whorls or only the same number. A change from the regularly transverse arrangement to the oblique may sometimes be noted in the different parts of a single individual plant.

3. **Neomeris stipitata** sp. nov.

Neomeris dumetosa Church, Ann. Bot. 9: 581–608. *pl. 21–23.* 1895. Not *Neomeris dumetosa* Lamour. Hist. Polyp. 243. *pl. 7. f. 8.* 1816.

Plants cespitose or gregarious, elongate-clavate, lightly calcified, 26–40 mm. long, 2–2.5 mm. thick, mostly 13–20 times as long as thick, subacute at apex: successive whorls of primary branches about 300–500 in number, 90–120 μ apart in median regions; number of branches in a whorl in later stages usually 16–32: hairs all of one form, persistent in the apical fourth to sixth and making a rather conspicuous coma: ends of branches

of the second order in the mature stage forming a cortex with irregularly hexagonal facets in mostly very irregular transverse rows or often without recognizable order, each pair of corticating branches lying in a transverse or somewhat oblique plane, the corticating branches occasionally in threes, cortex rather pliable, commonly persistent in the upper half, plants of a younger stage often somewhat extensively corticated by inflations of the primary branches: branches of the first order in adult fertile parts 240–410 μ long, 32–42 μ in diameter in their basal and median parts, mostly 6–10 times as long as their median diameter, lightly calcified, free, persistent, the main axis commonly clothed for a space of 10–15 mm. in the lower sterile half by clavate 2-scarred long-persistent scarcely calcified primary branches 150–240 μ long: branches of the second order mostly in pairs but now and then in threes, capitate, the terminal inflations 116–215 μ in greatest diameter, outwardly mammiform, subconical, domed, or merely arcuate, their walls firm, the pedicels uncalcified, the terminal inflations lightly or moderately calcified proximally, their outer surfaces uncalcified: sporangia rather strongly calcified, mutually free, first appearing at about 15 mm. from base of the mature plant, 185–210 μ long (decalcified and including stalk), the calcareous capsules 11–28 μ thick; spores subglobose or slightly obovoid, 142–172 $\mu \times$ 132–144 μ. [PLATE 1, FIGURE 3; PLATE 5, FIGURES 15, 16.]

Neomeris stipitata was collected at Singapore by Mr. H. N. Ridley or one of his assistants and was described and figured with much thoroughness and detail by Dr. Arthur H. Church of Jesus College, Oxford, in the Annals of Botany in 1895, as quoted above. Type material of the species is preserved in the herbarium of the New York Botanical Garden and in the botanical department of the museum of Oxford University.

Neomeris stipitata differs rather strikingly in several particulars from the other members of the *N. dumetosa* group. The specimens, which have been preserved in alcoholic media (ours transferred lately to 50 per cent. glycerine), are, at the present time, at least, very much less calcified than those of any other known species of the genus. Dr. Church writes us that he believes they have lost fully 50 per cent. of their lime since he studied them in 1895, but even at that time (*loc. cit.* 582) he was impressed by their "delicately calcified" condition as compared with the "densely calcified" *N. Kelleri* Cramer. Another peculiarity of *N. stipitata* is found in its long sterile basal portion, constituting nearly half

the length of the adult plant, while in the allied species the sporangia appear within 1–4 mm. of the base of the adult plant. The branches of the first order are short, 150–410 μ long as compared with 500–1000 μ long in *N. dumetosa* and *N. van Bosseae*, and are 6–10, instead of 15–35, times as long as their median diameter. The corticating branches of the second order are quite often in threes instead of being uniformly in pairs, a character which, apparently, was not observed by Church and which has thus far not been noted in any other species of the genus. Partly as a result of the interpolation of these trimerous elements in the cortex, the arrangement of the facets is commonly very irregular, rather more so than might be inferred from Church's figures, 17, 21, and 24. The hairs, also, are less gelatinous, more rigid, more persistent, and more conspicuous than in other species of the genus.

4. **Neomeris mucosa** sp. nov.

Plants cespitose, mostly in clusters of 3–20, subcylindrical or subfusiform, 8–20 mm. long, 1.5–2.5 mm. thick, mostly 4–8 times as long as thick, bright or yellowish green in upper tenth to third, becoming chalky- or dingy-white below, apex often appearing somewhat obtuse or truncate when living, but commonly acute or acuminate on drying: successive whorls of primary branches mostly 120–300 in number, 85–150 μ apart in median regions; number of branches in a whorl in later stages usually 28–48: hairs all of one form, soft and mucilaginous, di-trichotomous above, a rather conspicuous chlorophylose tuft persisting at the apex: ends of branches of the second order in the mature stage forming a cortex with irregularly hexagonal or somewhat rhombic or triangular facets in close rather regular or at length sometimes not easily recognizable transverse rows, each pair of corticating branches lying in an obliquely radio-vertical plane, there being consequently twice as many transverse rows in the cortex as there are primary whorls, the number of facets in each row equaling the number of members in the primary whorl, the cortex usually persisting in the upper half and deeply alveolate on drying: branches of the first order of the first 10–12 whorls of the juvenile stage cylindrical, each commonly bearing three di-trichotomous assimilatory filaments; the succeeding branches of the first order in the younger stages cylindrical, clavate, or somewhat fusiform, 275–400 μ long, 95–115 μ in diameter, each bearing a pair of deciduous di-trichotomous assimilatory filaments, the primary branches mostly

persisting, soon strongly calcified and more or less coherent in well separated, often somewhat divergent or reflexed transverse rings or bands of 2–6 or more, the sheathing lime-tubes showing on drying conspicuous orifices about 80 μ in diameter, thickness of the lime-sheaths usually less than half the diameter of the branch ; mature corticated plants sometimes reverting toward the apex and bearing there whorls of filamentous non-corticating branches ; branches of the first order of the mature stage cylindrical or clavate, 275–400 μ long, 40–72 μ in diameter in their basal and median parts, mostly 4–9 times as long as their median diameter, moderately and rather diffusely calcified, scarcely coherent, persistent : branches of the second order capitate, the terminal inflations 100–220 μ in greatest diameter, outwardly mammiform, subconical. or subrostrate, their walls thin, very mucilaginous, and often not easily visible after decalcification, the pedicels scarcely calcified, the terminal inflations strongly calcified throughout their entire surface, proximally, laterally, and distally, the lime-coating of the outer surface soon flaking off, usually persisting a little longer than the hairs : sporangia strongly calcified but mutually free, commonly appearing within 2–6 mm. from base of adult plant, 178–215 μ long (decalcified and including stalk), the calcareous capsule 20–55 μ thick ; spores obovoid, 140–160 μ × 104–121 μ, their width usually $\frac{4}{5}$ to $\frac{2}{3}$ their length. [PLATE 1, FIGURE 5 ; PLATE 5, FIGURES 1–14.]

Growing on moderately exposed rocks, at and near low-water mark, usually associated with *Neomeris Cokeri* and sometimes also with *N. annulata :* Atwood (Samana) Cay, Bahamas, *Howe, 5308* (type) ; Cockburn Harbor, South Caicos, *Howe 5548 ;* Great Ragged Island, Bahamas, *Howe 5771.*

Neomeris mucosa is a well-marked species, differing from the other known species of the genus in the extremely gelatinous diaphanous character of its membranes, particularly those of the corticating utricles. After decalcification it is often difficult to trace the outlines of the various members of the plant-body, with the exception of the sporangia. From *N. dumetosa*, it differs, furthermore, in being a shorter and relatively stouter plant (8–20 mm. *vs.* 20–32 mm. long ; 4–8 times *vs.* 15–20 times as long as thick), in the shorter and stouter primary branches (275–400 μ *vs.* 500–680 μ long ; 4–7 times *vs.* 18–35 times as long as their median diameter), which are persistent and scarcely cohere in scales if we except those that belong to the earlier phases of development (and even then the coherence is of a different sort),

in the calcification of the outer surfaces of the corticating facets, and in the distinctly obovoid spores. From *N. van Bosseae*, it differs also in its usually smaller size, in the shorter and stouter primary branches (275–400 μ *vs.* 570–1000 μ; 4–7 times *vs.* 15–30 times as long as their median diameter), which commonly cohere in a peculiar fashion in the earlier stages of the plant's ontogeny, in the not unusual reversions to the branches of the primary form, in strong calcification of the outer surfaces of the corticating facets, in the more obovoid spores, etc.

The earlier stages in the development of *Neomeris mucosa* are quite different from those of *N. annulata* and *N. stipitata*, in which species alone the earlier stages have previously been described and figured. Church * has distinguished five stages in the development of the Singapore plant, which we have in the present paper named *N. stipitata*. In *N. mucosa* we have noted but two or, at most, three, recognizable stages. While the plant is bearing its first 10 or 12 whorls the primary branches are cylindrical and each bears, as a rule, three assimilatory filaments (FIGURES 1 and 2). This possibly might be called stage I, but it is poorly defined and passes very gradually into a condition that is continued for many successive whorls — one in which the primary branches become stouter, often at length somewhat elongate barrel-shaped, each bearing two deciduous assimilatory filaments (FIGURES 3–5). The transition from this condition to the corticated sporangium-bearing state is abrupt. It is possible that corticating branches of the second order sometimes spring from sterile primary branches (Church's stage IV) but we have been unable to demonstrate that such is the case in the present species. Church's stage II, in which what appears to correspond to the original branch is divided into two segments, and his stage III, in which the basal segments are irregularly dilated so as to form a sort of cortex, appear to be wholly absent in *Neomeris mucosa*. In *Neomeris annulata*, according to Cramer, † the primary branches of the earlier whorls each bear, with few exceptions, only a single deciduous assimilatory hair, and the primary branches, as shown also by Solms, ‡ are, in several

* Ann. Bot. 9 : 581–608. *pl. 21–23.* 1895.

† Neue Denkschr. Schweiz. Naturf. Ges. 32 : — (14, 15). *pl. 1. f. 1, 2, 3, 5.* 1890.

‡ Ann. Jard. Bot. Buitenzorg 11 : *pl. 8. f. 1, 13.* 1893.

or many of the later whorls, irregularly dilated so as to form a kind of cortex much as in *N. stipitata.* In *N. mucosa* we have never seen a primary branch terminating in a solitary hair and we have never seen the primary branches inflated in such a way as to simulate a corticating layer. The material of *N. annulata* figured by Cramer in connection with the characters mentioned came from Bermuda, and that figured by Solms was from Mauritius. In specimens of *N. annulata* from Bermuda we are able to confirm the observations of Cramer and of Solms, so far as concerns the stages studied and figured by them, but in a juvenile condition, showing only the first two whorls of branches, we find the branches of the second order in pairs.

Neomeris mucosa is preserved less well by adding formaldehyde to seawater than is the case with *N. annulata* and *N. Cokeri.* After a few weeks in such a solution, the plants can scarcely be handled without breaking across the main axis.

5. NEOMERIS ANNULATA Dickie, Jour. Linn. Soc. Bot. **14**: 198. 1874. — Solms, Ann. Jard. Bot. Buitenzorg **11**: 62–71. *pl. 8. f. 1, 3, 4, 7, 8, 12, 13, 17.* 1893. — Börgesen, Bot. Tidsskr. **28**: 272. *f. 1, 2.* 1908.

? Corallina vermicula Nelson & Duncan, Trans. Linn. Soc. Bot. II. **1**: 200, 201. *pl. 26. f. 14–17.* 1876.

Neomeris Kelleri Cramer, Neue Denkschr. Schweiz. Naturf. Ges. **30**: — (3–10, 39). *pl. 1; pl. 2. f. 1–12; pl. 3. f. 1, 2.* 1887; **32**: — (9–19). *pl. 1. f. 1–12; pl. 2. f. 1–6; pl. 4. f. 15–24.* 1890. — Vickers, Phyc. Barbad. **1**: *pl. 46.* 1908.

Plants scattered or more often densely gregarious, subcylindrical or somewhat fusiform-clavate, 5–25 mm. long, 1–2 mm. thick, light or yellowish green in upper half or third, becoming chalky-white below, subacute, in dried condition often appearing rather gradually tapering: successive whorls of primary branches mostly 60–175 in number, 115–250 μ apart in median regions; number of branches in a whorl 20–56: hairs all of one form, soon deciduous, persisting in a small apical tuft: ends of branches of the second order forming a cortex with hexagonal facets in transverse rows, each pair of corticating branches lying in a radio-vertical or somewhat oblique plane, there being consequently twice as many transverse rows in the cortex as there are primary whorls, the number of facets in each row equaling the number of members in the primary whorl, the cortex persisting in the upper half or three

fourths and regularly reticulate or reticulate-alveolate on drying; plants of the younger stages often more or less corticated by irregular inflations of the primary branches: branches of the first order in the adult stage 200–280 μ long, 11–20 μ in diameter in their basal and median parts, mostly 12–21 times as long as their median diameter, at length strongly calcified and often more or less coherent laterally, the width of the intervening lime-masses commonly less than the diameter of the branches, which are persistent or sometimes deciduous in basal parts: branches of the second order strongly calcified and coherent by a continuous lime layer, capitate, the terminal inflations 80–135 μ in greatest diameter, outwardly gently arcuate or rounded-obtuse, occasionally acute or subrostrate, rather firm-walled, their outer surfaces uncalcified: sporangia strongly calcified and coherent laterally by their capsules, forming nearly complete or more or less interrupted transverse rings, mostly 165–230 μ long (decalcified and including stalk), the calcareous capsules 15–60 μ thick; spores oblong-obovoid to oblong-ellipsoidal, 115–175 $\mu \times$ 46–80 μ, usually about twice as long as broad. [PLATE 1, FIGURE 2.]

TYPE LOCALITY: Mauritius; type specimen in the herbarium of the British Museum (Natural History).

DISTRIBUTION: Bermuda, southern Florida, and the West Indies; Mauritius, Madagascar, Savoe (Dutch East Indies, *Weber-van Bosse*); reported by Solms also from Cobija, Bolivia (now Chile) and from Tongatabu, Friendly Islands. The Mauritius type of *N. annulata* we have seen in the herbarium of the British Museum, but we have not made a microscopic examination of it. Judging, however, from the excellent figures given by Cramer and by Solms, and from East Indian specimens kindly communicated by Madame Weber-van Bosse, there is nothing to indicate that the plant of the Atlantic Ocean can be distinguished even varietally from that of the Indian and Pacific oceans. We have thus far collected *Neomeris annulata* at twenty-one stations in Bermuda, southern Florida, the Bahamas, Porto Rico, and Jamaica; Börgesen has reported the species from four stations in the Danish West Indies; and Miss Vickers has figured it from Barbados specimens. It grows on rocks, stones, and shells, in sheltered or moderately exposed places, usually near the low-water mark, though Dr. Börgesen records a specimen from a depth of 50 m. in the Danish West Indies.

6. NEOMERIS COKERI M. A. Howe, Bull. Torrey Club **31**: 97. *pl. 6. f. 3–12.* 1904; **32**: 580. 1905.

Plants solitary or cespitose, rarely widely gregarious, subcylindrical or clavate, 7–37 mm. long, 1.5–3 mm. thick, dark green in upper third or fifth, becoming grayish white below, apex rounded-obtuse or subtruncate, often exhibiting a delicate, translucent apiculum formed of the mantle-caps: number of successive whorls of branches mostly 60–175; number of branches in a whorl 12–56: hairs of two forms in separate alternating zones, those of one form consisting of a single, clavate, often curved or somewhat hooked cell rich in chlorophyl and having a maximum diameter about equal to that of the supporting cell, the apex acute, obtuse, or more often apiculate; those of the second form consisting of a somewhat similar though slightly narrower basal cell bearing at its apex one or two earlier caducous, more slender branches, these in turn each bearing 2–4 branches; unicellular hairs and basal cells of the multicellular persisting in the upper third or fifth of the plant, the surface after their fall appearing somewhat shaggy or minutely and irregularly punctate, a cortex being scarcely developed: branches of the first order lightly calcified, scarcely coherent; branches of the second order more strongly calcified, irregularly and imperfectly coherent, subfusiform, often somewhat curved or gibbous, broadest (100–150 μ) a little above the middle, tapering to a conico-truncate apex 22–34 μ broad at the insertion of the hair: sporangia strongly calcified, free or coherent in short rows of 2–8, 180–260 μ long (decalcified and including stalk), calcareous capsule 25–40 μ thick; spores obovoid or oblong-ellipsoidal, 140–190 $\mu \times$ 82–94 μ. [PLATE 1, FIGURE 6]

TYPE LOCALITY: Opposite Current Town, Eleuthera, Bahamas.

DISTRIBUTION: Bahamas; commonly under shelving rocks, near low-water line.

We now have this very peculiar species from fourteen stations, all within the Bahamian archipelago.

B. TWO WEST INDIAN SPECIES OF ACETABULUM* OF THE POLYPHYSA SECTION

Acetabulum pusillum sp. nov.

Plants minute, short-stalked, 1–3 mm. high, grayish green, well calcified throughout but with especially heavy deposits of

* In the Botanisk Tidsskrift **28**: 274, 275. 1908, Dr. F. Börgesen has remarked upon the present writer's employment of the generic name *Acetabulum* instead of the more usual *Acetabularia*, giving there the impression that the use of 1753 as the initial date

lime between the rays, the lime-coating often flaking off at maturity: disc solitary, nearly flat, 1–2.5 mm. in diameter; sporangia (rays) 6–17 (mostly 11–15), obovoid-clavate to clavate-subfusiform, 2–3½ times as long as greatest width (which is at two thirds or three fourths of their length), bluntly subconical, obtusely taper-pointed, or occasionally rounded obtuse, rather easily separable and often more or less free on drying, mostly free in mature specimens after decalcification; coronal processes very small, short-cylindrical, slightly enlarged at the top and appearing oval or orbicular in surface view, 22–35 μ in greatest diameter, each bearing 2 (rarely 3) hairs, hair-rudiments, or hair-scars; hypopeltal processes wanting: aplanospores 15–60 in a sporangium, globose or ellipsoid, 68–82 μ in greatest diameter: stipe occasionally corrugated and enlarged in the upper part, 0.1–0.2 mm. in maximum diameter. [PLATE 6, FIGURES 13–15; PLATE 7, FIGURES 1–4.]

On a reef, near low-water mark, with *Neomeris annulata* and *Acetabulum polyphysoides*, Montego Bay, Jamaica, *Howe 5029a* (type), January 19, 1907; Mariguana, Bahamas, *Howe 5453;* Castle Island, Bahamas, *Howe 5731b.*

Acetabulum pusillum differs from *A. polyphysoides*, with which it is sometimes associated, in its smaller size, in being strongly calcified throughout, in the character of the coronal processes, which are only 22–35 μ instead of 75–150 μ in diameter and bear only 2 (rarely 3) instead of 5–13 hairs, and in the smaller aplanospores, which are 68–82 μ instead of 88–190 μ in diameter. It is one of the most minute of the species thus far described in the genus, the average diameter of the disc being about 1.6 mm.

The nearest relatives of *Acetabulum pusillum* are apparently two East Indian species, *Acetabularia exigua* Solms * and *A.*

of botanical nomenclature would prevent the adoption of *Acetabulum*. As a matter of fact, the generic name in its original Tournefortian form was used in Boehmer's edition of Ludwig's Definitiones Generum Plantarum (p. 504) in 1760, Tournefort being there cited, as he was cited also by Linnaeus two years earlier, in establishing the binomial *Madrepora Acetabulum* (Syst. Nat. 793. 1758), so the name is technically free from whatever opprobrium there may be in prelinnaeanism. The generic name *Acetabulum* was used also by Lamarck in 1816 (Hist. Nat. Anim. sans Vertèb 2: 149), though this fact has no bearing on the priority question, as it was four years later than Lamouroux's establishment of *Acetabularia* (Nouv. Bull. Sci. Soc. Philom. 3: 185. 1812). However, *Olivia* (Bertol. Rar. Pl. Ital. Dec. 3: 117. 1810), to which no valid exception can be taken, antedates *Acetabularia* and must be preferred to it under any enforcement of priority principles, unless a comparatively modern date be taken as a starting point. Under the circumstances, we prefer the original *Acetabulum*, which has a clear post-1753 claim upon our favor.

* Trans. Linn. Soc. Bot. II. 5: 28. *pl. 2. f. 1, 4.* 1895.

*parvula** Solms, described from material collected by Mme. Weber-van Bosse at Macassar, Celebes, and vicinity; yet the West Indian plants in our opinion cannot be well identified with either one of these East Indian forms, specimens of which we have seen through the generosity of the collector. Of the character of the calcification in *Acetabularia exigua*, Solms states "I am unable to say anything more definite as to the calcification of the sporangial membrane of this species than that the few sterile specimens from Macassar were uncalcified. The others came under my observation only after lengthened treatment with acid. However, their sporangial rays are so widely separated from each other that a union of these by means of lime-incrustation is scarcely likely." In the single specimen of *A. exigua* that we have seen the rays are entirely free, spore-bearing, and are well incrusted with lime over their whole surface except for their apices and small areas here and there which have been left naked and smooth by an evident flaking-off of the lime-crust. The aplanospores in this specimen are 82–91 μ in diameter. From *Acetabularia exigua* Solms, *Acetabulum pusillum* differs in its usually smaller size, in the more coherent, less pointed, commonly more numerous rays, which are broadest at two thirds or three fourths their length instead of near their middle, and in the smaller coronal processes, which nearly always bear two instead of three hairs or hair-rudiments.

In *Acetabularia parvula* Solms, the calcification of the disc is confined to the contact faces of the rays and to a narrow sharply defined zone involving the bases of the rays and flanking the coronal processes; the projecting interradial lime-buttons, described and figured by Solms, are apparently not always present, and such, so far as we have observed, are wholly wanting in *Acetabulum pusillum*. *Acetabulum pusillum* further differs from *Acetabularia parvula* Solms in its commonly smaller size, in the often fewer, usually pointed, instead of rounded-obtuse or subtruncate-obtuse, rays, which are broadest at two thirds or three fourths their length instead of at their extreme ends, and in the smaller coronal processes (22–35 μ *vs.* 42–55 μ), which in nearly all cases bear two instead of three or four (!) hairs; the aplanospores of the East Indian plant are still undescribed.

* *Loc. cit.* 29. *pl.* 2. *f.* 3, 5.

ACETABULUM POLYPHYSOIDES (Crouan) Kuntze, Rev. Gen. Pl. **2**: 881. 1891

Acetabularia polyphysoides Crouan; Schramm & Mazé, Essai Alg. Guad. 101. 1866; Mazé & Schramm, Essai Alg. Guad. 84. 1870–77 (*nomen seminudum*); — Solms, Trans. Linn. Soc. Bot. II. **5**: 29. *pl. 4. f. 2, 6.* 1895; Vickers, Phyc. Barbad. **1**: *pl. 47.* 1908.

Plants small, short-stalked, 2–7 mm. high, light green, rays of the disc little calcified except in the contact-areas, the interradial lime-masses shorter than the rays and inconspicuous (sometimes almost wanting) or slightly projecting at the margin with flabelliform or inversely deltoid apical expansions: disc nearly flat or cup-shaped, solitary, 2–5 mm. in diameter, the margin subentire or stellate-dentate; sporangia (rays) 11–25 (mostly 11–18), varying from inflated-obvoid and about twice as long as broad to clavate-cylindrical or subfusiform and 3–5 times as long as greatest width, rather easily separable and often more or less free, rounded-obtuse at apex or obtusely taper-pointed, obtusely subrostrate or bluntly subconical; coronal processes knob-like, oval-elliptical in surface view, 75–150 μ in longest (radial) diameter, each bearing 5–13 (usually 8–10) hairs, hair-rudiments, or hair-scars arranged in an elliptical manner; hypopeltal processes wanting: aplanospores 6–50 in a sporangium, globose, ovoid, or ellipsoid, 88–190 μ in greatest diameter: stipe usually much corrugated, often enlarged in the upper part, reaching a maximum diameter of 0.35–0.70 mm. [PLATE 6, FIGURES 16–20; PLATE 7, FIGURES 5–9.]

Low littoral to at least 4–5 m. of water. Pointe-à-Pitre, Guadeloupe, *Mazé;* Atwood Cay, Bahamas, *Howe 5310, 5212;* Malcolm Road, Caicos Islands, *Howe 5652;* Castle Island, Bahamas, *Howe 5731a;* Montego Bay, Jamaica, *Howe 5029b.*

Acetabulum polyphysoides deltoideum forma nova. Sporangia (rays) mostly 7, vesicular-inflated, inversely deltoid or obovoid-deltoid when viewed from above, about as broad as long; coronal processes with 6–8 hairs or hair-rudiments. [PLATE 6, FIGURE 21; PLATE 7, FIGURE 10.]

Low littoral, with *Neomeris Cokeri* and *Acetabulum polyphysoides*, Atwood Cay, Bahamas, *Howe 5311*, December 4, 1907. Only six or seven plants of forma *deltoideum* were found; they were growing intermingled with our *5310* (see PLATE 7, FIGURE 9), which we are referring to *A. polyphysoides* without a distinctive form name, even though the rays are commonly narrower and

more pointed than in the Guadeloupe plants. No connecting forms between our *5311* and *5310* were observed and the two are rather strikingly different in habit, but the specimens of the former are infertile and as some of the Guadeloupe representatives of *A. polyphysoides* have a somewhat intermediate appearance, we cannot do otherwise, for the present, than to consider *deltoideum* a form of this species.

C. A NEW HALIMEDA

Halimeda lacrimosa sp. nov.

Dark gray-green in the younger parts when living, becoming albescent or white with age, soon decumbent, weak and straggling in habit, estipitate, 2–5 cm. in height or length, very strongly calcified, the calcification soon involving the medulla and the entire length of the peripheral utricles; branching irregularly dichotomous or trichotomous, largely but not wholly in a single plane, the nodes in decumbent forms now and then rhiziniferous, or somewhat stoloniferous: segments obovoid, pyriform, or subglobose, occasionally subterete, 1–5 mm. long, 1–5 mm. broad or thick (those near base scarcely different or often a little smaller), solid, firm, and stone-like, or the larger very often more or less hollow or cavernose in the medullary region and easily crushed on drying, the surface compact, smooth, and commonly nitent: peripheral utricles mostly rather obconical, usually somewhat flaring at surface, 40–110 μ long, 33–37 μ in average maximum diameter in surface view, truncate or very slightly rounded at apex with apical walls often incrassate, retuse on drying, lateral walls in contact for only $\frac{1}{10}$–$\frac{1}{30}$ their length but commonly coherent on decalcification: utricles of the subcortical layer in a single series, clavate-capitate, their subglobose or obovoid heads mostly 66–110 μ in maximum diameter, each bearing 6–18 peripheral utricles: filaments of the central strand fusing in twos, threes, or rarely fours at the nodes, the resulting filaments sometimes again incompletely fused in twos, threes, or fours: sporangia unknown. [PLATE 4, FIGURE 1; PLATE 6, FIGURES 3–11.]

In the Bahama Islands, from near low-water mark down to a depth, at least, of ten or twenty meters: Mariguana (near the Southeast Point), *no. 5524*, type (11 December, 1907, M. A. H.), and *nos. 5492* and *5504*; Great Ragged Island, *no. 5810*; and Ship Channel Cay, *no. 3947*.

A peculiar species, without close affinities among the species of the genus hitherto described. It is apparently more common in

the sublittoral or elittoral zone than in the littoral, which perhaps accounts for the rarity with which it has been collected. In respect to the prevailing mode of fusion of the nodal filaments of the central strand, *H. lacrimosa* has most in common with the *H. Tuna* group, although there is sometimes also a secondary incomplete fusion of the fused filaments or perhaps it would be better to say that several or many (6–8 or more) filaments sometimes fuse imperfectly or for a very short distance into one. But in general habit and form, *H. lacrimosa* is little suggestive of *H. Tuna* or of any other *Halimeda* known to us. The subcortical utricles are chlorophylose and as a rule they become readily visible from the exterior after decalcification.

D. UDOTEA CONGLUTINATA AND UDOTEA CYATHIFORMIS

Udotea conglutinata (Ell. & Soland.) Lamour. and *U. cyathiformis* Decaisne have been quite commonly combined by students of the *Codiaceae*, a circumstance that easily is explicable, inasmuch as *Udotea cyathiformis* is often scarcely more cyathiform than *U. conglutinata* and inasmuch as some of the other more obvious ordinarily distinctive characters are subject to a considerable degree of variation. The writer has shared in this misconception, as he now considers it, and has distributed at least one series of specimens of *U. cyathiformis* * to various herbaria as *Udotea conglutinata*. But with added experience with both living and dried specimens, it has become increasingly evident that the *Udotea conglutinata* group in the West Indies embraces at least two species. The Ellis & Solander "types" appear to have been lost, but in view of the only figure of "*Corallina conglutinata*" given by them there can be no reasonable doubt as to which of the two forms was before them, even though their description is not altogether conclusive. The probable type material of *Udotea cyathiformis* Decaisne is represented in the herbarium of the Muséum d'Histoire Naturelle in Paris by two specimens now on one herbarium-sheet but fastened to separate smaller sheets. Below the lower, less cyathiform of the two specimens, is a "Herb. Mus. Paris." label, on which is inscribed in Decaisne's hand, "Udotea Acetabulum D^no^. Iles des Saintes, près la Guadeloupe. M. D'Avrainville, 1842." The specific name was apparently changed to *cyathiformis* on publica-

* *No. 3976*, from the Cave Cays, Exuma Chain, Bahamas.

tion, without a corresponding change in the herbarium label. The two specimens agree essentially with the cyathiform plants from Bemini Harbor, Bahamas, shown in FIGURE 2 of our PLATE 3, which, by the way, were found growing with more numerous plants of *U. conglutinata*, one of which is photographed on PLATE 2 (the largest plant). The plants shown in the upper half of our PLATE 3 are rather strikingly different from the typical *Udotea cyathiformis;* they are, in fact, so *Penicillus*-like in habit that on finding them we were inclined for a time to look upon them as a probably new cyathiform species of *Penicillus*, but on a microscopic examination nothing could be found to distinguish them satisfactorily from the typical *U. cyathiformis.* They were growing on sand-covered rocks at the low-water line, a position that would presumably have been unfavorable to a full and normal development. Specimens from Culebra Island, Porto Rico (*no. 4338* in herb. N. Y. Bot. Garden), apparently bridge over the gap in habit between these short *Penicillus*-like plants and the normal *U. cyathiformis.* The plants from Key West, Florida, figured by W. H. Harvey (Ner. Bor.-Am. 3 : *pl. 40C*) as *Udotea conglutinata* are, with little doubt, *U. cyathiformis*, as would appear from the very distinct longitudinal striations of the flabellum in the natural-size figures and from the rather straight and rigid character of the filaments in the detailed enlargement.

Photographs of representatives of *Udotea conglutinata* and *U. cyathiformis* are given herewith and below are descriptions and a key which includes the more important diagnostic characters. The characters of the stipe-cortex, which we have illustrated by drawings (PLATE 8, FIGURES 8–13) we have found especially reliable in determining occasional forms whose relationships might otherwise seem a little doubtful.

Flabellum plane; transition from stipe to flabellum gradual; filaments of flabellum 28–60 μ in diameter, interwoven and tortuous, usually forming a superficial tomentulose nap; branches of the corticating filaments of the stipe somewhat loosely and irregularly fastigiate, the ultimate divisions mostly finger-shaped, subacute, or taper-pointed..... .... *U. conglutinata.*

Flabellum more or less cyathiform or open on one side and almost plane (then usually a little concavo-convex, at least at base); transition from stipe to flabellum abrupt; filaments of flabellum nearly straight and parallel, mostly 60–100 μ in diameter; branches of

corticating filaments of stipe compactly cymose-fastigiate, the ultimate divisions scarcely longer than broad, truncate, truncate-obtuse, or commonly with expanded truncate-capitate apices..... *U. cyathiformis.*

UDOTEA CONGLUTINATA (Ell. & Soland.) Lamour. Hist. Polyp. 312. 1816

Corallina conglutinata Ell. & Soland. Nat. Hist. Zooph. 125. *pl. 25. f. 7.* 1786.

Flabellaria conglutinata Lamarck, Ann. Mus. Hist. Nat. **20**: 301. 1813.

Plants 3–9 cm. high, from a bulbous, subfusiform, or fasciculate-funicular rhizoidal base, light-, yellowish-, or albescent-green, more or less strongly calcified; stipe simple, subterete below, commonly flattened, expanded, and cuneate above, 0.5–3.0 cm. long, mostly 1.5–7.0 mm. wide, corticated, its surface very minutely tomentulose-spongiose or somewhat compact and smooth: transition in structure from stipe to flabellum gradual, the flabellum uncorticated except at the very base, plane, semiorbicular, cuneate-obovate, subreniform, spatulate, or rarely cuneate-ligulate, 1.5–7 cm. long, 0.5–11 cm. wide, subentire, erose-sinuate, or irregularly lobate, rarely with innovating conformable lobes, for the most part distinctly zonate, the base cuneate, cuneate-truncate, or occasionally subarcuate, the surface longitudinally strigose, or commonly spongiose or subvelutinous: filaments of the flabellum interwoven in several or many layers, in most cases forming a superficial tomentulose nap by repeated dichotomies, the ultimate branches usually short, tortuous, and often somewhat divaricate, each filament, except in a very juvenile state, enclosed in a porose calcareous sheath, destitute of lateral branches or appendages, constricted just above the dichotomies and sometimes here and there in intervening parts, rarely subtorulose, 28–60 μ in diameter (decalcified; often larger under a dichotomy); pits of the calcareous sheath rounded or angular, mostly 8–20 μ in diameter; branches forming the stipe-cortex slender, rather flexuous and tortuous, somewhat loosely and irregularly fastigiate, the ultimate divisions mostly finger-shaped, subacute or taper-pointed, 8–19 μ in diameter. [PLATE 2; PLATE 8, FIGURES 11–13.]

TYPE LOCALITY: Bahama Islands.

DISTRIBUTION: Bermuda, southern Florida, and the West Indies.

UDOTEA CYATHIFORMIS Decaisne, Ann. Sci. Nat. II. **18**: 106. 1842

Udotea conglutinata Vickers, Phyc. Barbad. **1**: *pl. 32.* 1908; probably also Harvey, Ner. Bor.-Am. **3**: *pl. 40C.* 1858.

Plants 2–17 cm. high, from a bulbous, subfusiform, or fasciculate-funicular rhizoidal base, usually dark- or yellowish-green when living, becoming more or less albescent on drying, moderately calcified and often remaining flexible, or more encrusted with age; stipe simple, mostly subterete, sometimes a little expanded and flattened above, 0.2–5.0 cm. long, 1–6 mm. wide, corticated, its surface compact and smooth: transition in structure from stipe to flabellum abrupt, the flabellum uncorticated, cyathiform, now and then 1–5 cleft nearly or quite to the base, or more often early divided to base on one side and becoming almost plane, but usually remaining more or less concavo-convex at extreme base, then mostly triangular-obovate, subcuneate-obovate, semiorbicular, spatulate, or spoon-shaped, 1–11 cm. long, 1–9 cm. wide, subentire, often becoming irregularly laciniate-fimbriate, rather faintly or occasionally not at all zonate, the surface longitudinally strigose: filaments of the flabellum in several or many layers, nearly straight, parallel and rigid, somewhat flexuous and interwoven, distinct, often suggesting those of *Penicillus*, each enclosed in a porose calcareous sheath, destitute of lateral branches or appendages, constricted just above the dichotomies, 40–135 μ (mostly 60–100 μ) in diameter (decalcified; often larger under a dichotomy), pits of the calcareous sheath rounded or angular, mostly 5–18 μ in diameter; branches forming the stipe-cortex in compact cymose-fastigiate clusters, the ultimate divisions scarcely longer than broad, truncate, truncate-obtuse, or very commonly with expanded truncate-capitate apices, 8–50 μ in diameter. [PLATE 3; PLATE 8, FIGURES 8–10.]

TYPE LOCALITY: Iles des Saintes, near Guadeloupe, West Indies.

DISTRIBUTION: Southern Florida and West Indies.

E. A NEW BAHAMIAN UDOTEA

Udotea spinulosa sp. nov.

Plants 7–8 cm. high from a fusiform or fasciculate-funicular rhizoidal base, grayish green, strongly calcified; stipe simple, subterete below, flattened above, 1–2 cm. long, 3–4 mm. wide, corticated, its surface nearly smooth or minutely velutinous-tomentulose: flabellum obovate with a subcuneate base, 5–6 cm. long, 4–6 cm. wide, 0.4–0.6 mm. thick, longitudinally furrowed or striate, not at all or very faintly zonate, rather rigid and brittle when dry, lateral margins subentire, apical margin more or less laciniate and commonly fractured, the surface appearing minutely corrugated or spongiose-velutinous under a lens, becoming compact and nearly smooth toward the base: filaments of the flabellum in 3–7 layers,

nearly parallel or flexuose and interwoven, subcylindrical, sparingly dichotomous, strongly constricted just above the dichotomies, 46–84 μ in diameter, enclosed in a non-porose calcareous sheath especially in the outer parts, or irregularly incrusted, the superficial (or the interior wherever they touch the surface) thickly beset externally with short cylindrical, truncate-conical, subturbinate, or obconical processes 16–40 μ in diameter, each crowned with 2–8 acuminate prongs or spines formed by 1–3 close-set dichotomies, these lateral processes (mostly 55–160 μ long, including their spinulose crowns) forming an imperfect kind of cortex; medullary filaments of the stipe 70–110 μ in diameter, the lateral corticating branches 4–6 times dichotomous, their ultimate divisions taper-pointed, mostly 28–200 μ long and 8–24 μ in median diameter. [PLATE 4, FIGURE 2; PLATE 8, FIGURES 1–7.]

Collected on a sandy bottom near low-water mark in Bemini Harbor, Bahamas, *Howe 3272*, April 17, 1904.

Udotea spinulosa is most closely allied to *Udotea Palmetta* Decaisne,* but is sufficiently distinguished, we believe, by the

* *Udotea Palmetta* Decaisne was misinterpreted and wrongly described by J. Agardh, who apparently never saw an authentic specimen of it, and his conception of the species has been adopted by most of the later writers who have referred to it, though A. & E. S. Gepp have seen the type specimens and have recently published critical notes upon them (Trans. Linn. Soc. Bot. II. 7: 175. 1908). The type in the herbarium of the Muséum d'Histoire Naturelle in Paris is represented by two plants accompanied by a loose label, on the bottom of which is printed "Herbier Du Petit-Thouars." This label is inscribed in ink "Udotea palmetta Dne," Flabellaria and "Decaisne scripsit" has been added below in pencil. No locality is given. Decaisne's description was brief, as are also the notes recently added by A. & E. S. Gepp, and the evident types are therefore described in a little more detail below:

UDOTEA PALMETTA Decaisne, Ann. Sci. Nat. II. 18: 105. 1842.

Plants 5.5 cm. high from a subterete or fusiform rhizoidal base, albescent, much calcified throughout; stipe simple, subterete, about 1 cm. long, 1–4 mm. wide, its surface minutely velutinous (nearly smooth under low magnification); flabellum orbicular or obovate, 4.2–4.8 cm. long and of about equal width, 0.09–0.16 mm. thick, rounded or subcordate at base, rather indistinctly and closely zonate (about 16 zones in 4 cm.), plane, longitudinally striatulate, soft and flexible, margins erose or shortly lacerate, the surface appearing strigulose or very minutely pulverulent-punctate under a lens: filaments of the flabellum in 3–5 layers, flexuose and interwoven or somewhat parallel, sparingly dichotomous, sometimes slightly constricted above the dichotomies, 22–30 μ in the major diameter, the superficial more or less flattened laterally (*i. e.* in a plane perpendicular to the surface) and often only 8–16 μ in the minor diameter, all irregularly and amorphously incrusted with lime, crested superficially, wherever they touch the surface, with a single or double usually secund series of simple, geminate or once furcate spines or sharp teeth, these 11–30 μ long, sometimes irregularly curved or subuncinate; medullary filaments of the stipe 19–33 μ in diameter, the lateral corticating branches 2–4 times dichotomous, the ultimate divisions taper-pointed, mostly 27–80 μ long and 8–11 μ in median diameter.

thicker (0.4–0.6 *vs.* 0.09–0.16 mm.), more rigid, less zonate flabellum and its subcuneate base, by the larger (46–84 μ *vs.* 8–30 μ), less flattened filaments, which are regularly and strongly constricted above the dichotomies, and by the character of their lateral appendages, which are closely 1–3 times dichotomous instead of simple or once furcate and are 55–160 μ long instead of 11–30 μ, long, the spines crowning a thick stump-like base or pedestal instead of being practically sessile.

From *Udotea argentea* Zanard., judging by the original description and figures, by a description recently published by A. & E. S. Gepp,* and by American plants which we are somewhat doubtfully identifying with that species, *U. spinulosa* differs in its much thicker, more rigid, less zonate flabellum, which is 3–7- instead of 1- or 2-stratose, in the filaments being constricted above the dichotomies, in their spine-like instead of obtuse, truncate, or capitate appendages, which are secund instead of commonly protruding in all directions, and in the taper-pointed instead of truncate or obtuse ultimate divisions of the stipe-cortex.

From *Udotea conglutinata*, *U. spinulosa* differs greatly in the presence of appendages on the filaments of the flabellum and in the calcareous sheaths of the filaments being non-porose.

From *Udotea Flabellum*, with its strongly marked zonations and highly differentiated cortex, the present species is so widely different that comparison is unnecessary.

* Trans. Linn. Soc. Bot. II. 7 : 176. 1908.

Explanation of plates 1–8

PLATE 1

1. *Neomeris dumetosa.* Photograph of probably authentic specimens now preserved in the herbarium of the Muséum d'Histoire Naturelle of Paris.

2. *Neomeris annulata.* Photograph of fluid-preserved specimens from Bermuda (*Howe 320*).

3. *Neomeris stipitata.* Photograph of fluid-preserved type specimens from Singapore (*Ridley*).

4. *Neomeris van Bosseae.* Photograph of fluid-preserved type specimens from Sikka, Flores, Dutch East Indies (*A. Weber-van Bosse 1196*).

5. *Neomeris mucosa.* Photograph of fluid-preserved type specimens from Atwood (Samana) Cay, Bahamas (*Howe 5308*).

6. *Neomeris Cokeri.* Photograph of fluid-preserved specimens. The four large plants to the left (New Providence, Bahamas, *Howe 3075*) represent an unusually large condition of the species (see Bull. Torrey Club 32 : 580. 1905). The remaining specimens (Atwood Cay, Bahamas, *Howe 5309*) are of the normal form and size.

7. *Neomeris van Bosseae.* Photograph of dried specimens in the Muséum d'Histoire Naturelle of Paris, collected by W. H. Harvey in the Friendly Islands and distributed by him as *Neomeris dumetosa.*

The photographs all represent the plants in their natural size.

PLATE 2. *Udotea conglutinata*

The largest plant (fluid-preserved) is from Bemini Harbor, Bahamas (*Howe 3240a*); the smallest (dried), at the upper right-hand corner, is from Castle Island, Bahamas (*Howe 5741a*); the remaining (dried) are from Watling Island, Bahamas (*Howe 5237*); all are of the natural size.

PLATE 3. *Udotea cyathiformis*

1. The more or less *Penicillus*-like (fluid-preserved) plants photographed in the three upper rows are from Cockburn Harbor, South Caicos (*Howe 5547*). Natural size.

2. The five or six (fluid-preserved) plants of the lowest row (Bemini Harbor, Bahamas, *Howe 3240b*) represent the typical form of the species. The middle plant is almost perfectly cyathiform, with, however, a slit down one side of the cup-like flabellum; the plant at the extreme left has a merely concavo-convex or slightly spoon-shaped flabellum and approaches in form certain conditions of *U. conglutinata.* Natural size.

PLATE 4

1. *Halimeda lacrimosa.* The three larger plants at the left of the photograph, the type specimens, are from the island of Mariguana, Bahamas (*Howe 5524*), where they were dredged in 3 or 4 m. of water; the small plant at the right is from 10 to 20 m. of water on Great Ragged Island, Bahamas (*Howe 5810*). Natural size.

2. *Udotea spinulosa.* Photograph of type specimens (dried) from Bemini Harbor, Bahamas (*Howe 3272*). Natural size.

PLATE 5

1–14. *Neomeris mucosa*

1. A young stage, with the first four whorls of primary branches.

2. Two members of the fourth whorl of plant shown in Figure 1, showing trimerous branches of the second order.

3. Apical portion of a young plant before the beginning of cortication.

4. A portion of a plant in a similar young stage, showing the widely spaced divaricate or somewhat recurved primary whorls.

5. Five members of a somewhat younger whorl, showing form of the primary branches, their calcification, etc.

6. Parts of two whorls of a later stage, viewed from without, indicating the calcareous sheaths of the primary branches; the branches of the second order have fallen and the ends of the primary branches have to some extent collapsed and drawn away from the enclosing lime-tubes.

7. A portion of the cortex of adult stage in surface view. In the two upper rows the entire surface is calcified except the hair-scars; below, the superficial crust of lime has partly flaked off, leaving the surface of the plant more or less reticulate-alveolate.

8. A primary branch, with sporangium, decalcified.

9. Branches of the first and second orders of adult condition, in lateral view, decalcified, with sporangia; the sketch gives a suggestion of the oblique plane in which each pair of corticating branches lies.

10. A portion of the surface of the adult condition, decalcified, showing form and arrangement of the corticating inflations.

11. A portion of an older part of the cortex, decalcified, showing a less regular form and arrangement of the corticating elements.

12. Two calcified sporangia from the same whorl in proximal view, showing positions of the pedicels of the two corresponding pairs of corticating branches.

13. Parts of two whorls of sporangia, calcified, in distal view, showing their form, mutual relations, and the positions of the pedicels of the corresponding pairs of corticating branches.

14. A part of an adult fertile whorl, the shading indicating the distribution and extent of the calcification.

Figures 1–4, 7–12, and 14 are drawn from the type material (Atwood Cay, Bahamas, *Howe 5308*); 5, 6, and 13 are from *no. 5548* (Cockburn Harbor, South Caicos). Figures 1, 3, and 4 are enlarged 28 diameters; 2, and 5–14, 40 diameters.

15 and 16. *Neomeris stipitata*

15. A primary branch of adult fertile condition, bearing two secondary (corticating) branches, decalcified.

16. One of the not uncommon primary branches that bear three secondary (corticating) branches, decalcified.

Both figures are enlarged 40 diameters.

17–19. *Neomeris van Bosseae*

17. Portion of the decorticated surface of adult plant, showing the tips of the mutually free calcified primary branches. (The tips should be distinctly in pairs more often than the drawing indicates, for the stumps of the broken-off secondary branches often persist and show on the surface as independent tubes).

18. A single primary branch, with its lime-coating.

19. Portions of two primary branches, loosely coherent by the intercalary lime.

Figures 17 and 18 are drawn from the type material (Sikka, Flores, Dutch East Indies, *A. Weber-van Bosse 1196*); 19, from a specimen collected in the Friendly Islands by W. H. Harvey. Figure 17 is enlarged 40 diameters; 18 and 19, 55 diameters.

20. *Neomeris dumetosa*

Portion of the decorticated surface of an adult plant, showing the coalescence of the primary branches and intercalary lime-deposits into transverse scales. The figure is enlarged 40 diameters and is drawn from a fluid-preserved specimen collected on the island of Fau, Dutch East Indies, by A. Weber-van Bosse.

PLATE 6

1 and 2. *Neomeris dumetosa*

1. A scale formed by the coalescence of five primary branches and the intercalary lime-masses; from Fau, Dutch East Indies (*A. Weber-van Bosse*).

2. A similar scale from a presumably authentic specimen in the Muséum d'Histoire Naturelle of Paris (see Plate 1, Figure 1).

Figures 1 and 2 are enlarged 55 diameters.

3–12. *Halimeda lacrimosa*

3. Utricle of the subcortical layer, bearing six peripheral utricles.

4. Utricle of the subcortical layer, bearing twelve or more peripheral utricles.

5. Utricle of the subcortical layer with about twelve peripheral utricles.

6. Peripheral utricles in surface view, decalcified, the dotted lines indicating the form and position of the utricles of the subcortical layer, which are often clearly visible through the peripheral utricles.

7. Utricle of the subcortical layer of characteristic form, bearing probably twelve peripheral utricles, the latter showing incrassate outer walls.

8. Utricle of the subcortical layer, bearing fourteen peripheral utricles, the latter with only slightly thickened outer walls.

9. Filament from central strand of node, showing complete fusion of two filaments to form one.

10. Filament from central strand of node, showing complete fusion of four filaments to form one.

11. Filament from central strand of node, showing complete fusion of three filaments to form one.

12. Filaments from central strand of node, showing complete fusion of eight filaments to form four which, at their point of origin, are incompletely fused into one.

All the figures are drawn from decalcified type-material (Mariguana, Bahamas, *Howe 5524*). Figures 3–6 and 9–12 are enlarged 40 diameters; 7 and 8, 150 diameters.

13–15. *Acetabulum pusillum*

13. Bases of four sporangia from above, showing the coronal processes, each with two hairs or hair-scars.

14. Base of a single sporangium in lateral view, showing coronal process, etc.

15. Base of a sporangium from above, showing the coronal process with three hairs or hair-rudiments.

Figures 13 and 14 are drawn from the type material (Montego Bay, Jamaica, *Howe 5029a*); 15 is from *no. 5453* (Mariguana, Bahamas). All of the figures are enlarged 150 diameters.

16–20. *Acetabulum polyphysoides*

16. Base of sporangium from above, showing coronal process with twelve hairs (including rudiments and scars).

17. Bases of sporangia of common form, showing coronal processes with nine and ten hairs (including rudiments and scars).

18. A sporangium-base, similar to that shown in Figure 17, in lateral view.

19. A coronal process with seven hairs (including rudiments and scars).

20. A rare form of coronal process with only five hairs (including rudiments and scars).

Figure 16 is drawn from *no. 5310* (Atwood Cay, Bahamas); 17 and 18 from *no. 5731a* (Castle Island, Bahamas); 19 and 20 from *no. 5312* (Atwood Cay, Bahamas). All of the figures are drawn from decalcified material and are enlarged 150 diameters.

21. *Acetabulum polyphysoides deltoideum*

Coronal process, decalcified, viewed from above, and showing seven hairs (including rudiments and scars). Drawn from the type material (Atwood Cay, Bahamas, *Howe 5311*) and enlarged 150 diameters.

PLATE 7

1–4. *Acetabulum pusillum*

1. A mature plant, with lime coating.

2. A mature fertile plant, decalcified.

3. A large sterile plant, decalcified. (See Plate 6, Figures 13 and 14.)

4. A large fertile disc with unusually obtuse sporangia, decalcified. (See Plate 6, Figure 15).

Figures 1–3 are drawn from the type material (Montego Bay, Jamaica, *Howe 5029a*); 4, from *no. 5453* (Mariguana, Bahamas). All of the figures are enlarged 16 diameters.

5–9. *Acetabulum polyphysoides*

5. A disc, decalcified, from above, showing twenty-five lightly coherent, obtusely taper-pointed or subrostrate sporangia. (See Plate 6, Figures 17 and 18.)

6. Sporangia from another disc, natural, the shaded areas indicating the distribution of the lime.

7. A disc, decalcified, with seventeen free obtuse sporangia, showing also the corrugated upper portion of the stipe.

8. Sporangia, natural, the shaded areas indicating the extent and distribution of the calcification.

9. More inflated sporangia, decalcified. (See Plate 6, Figure 16.)

Figures 5–7 are drawn from *no. 5731a* (Castle Island, Bahamas); 8, from *no. 5029b* (Montego Bay, Jamaica); 9, from *no. 5310* (Atwood Cay, Bahamas). All of the figures are enlarged 16 diameters.

10. *Acetabulum polyphysoides deltoideum*

A sterile disc, with seven sporangia, decalcified, from above. (See Plate 6, Figure 21.) Drawn from the type material (Atwood Cay, Bahamas, *Howe 5311*) and enlarged 16 diameters.

PLATE 8

1–7. *Udotea spinulosa*

1. Cross-section of the flabellum, natural. The shading indicates rather too much lime for the medullary portions.

2. Cross-section of the flabellum, decalcified.

3. The tip of a filament from the apical margin of the flabellum, decalcified.

4. Portion of a superficial filament from near the middle of the flabellum, decalcified. The teeth form a part of the surface-covering of the flabellum

5. A crown of superficial spines from near the base of the flabellum, decalcified.

6. A dichotomy of a flabellum-filament, decalcified, showing the constrictions just above it. (The filaments are somewhat twisted and are viewed a little obliquely.)

7. A crown of spines from the stipe-cortex, decalcified.

All of the figures are drawn from the type material (Bemini Harbor, Bahamas, *Howe 3272*). Figures 1 and 2 are enlarged 40 diameters; 3–7, 150 diameters.

8–10. *Udotea cyathiformis*

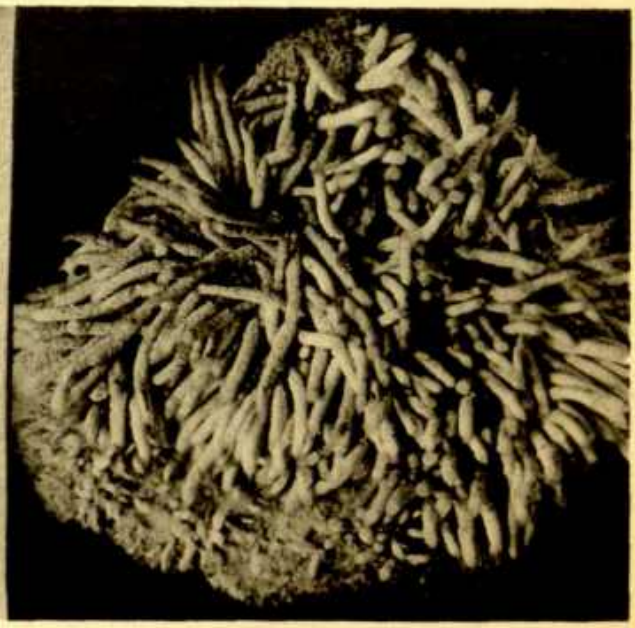
8–10. Ultimate ramifications of the corticating filaments of the stipe.

Figure 8 is drawn from *no. 5547* (Cockburn Harbor, South Caicos, —see Plate 3, Figure 1); 9, from *no. 3976* (Cave Cays, Exuma Chain, Bahamas); 10, from *no. 3240b* (Bemini Harbor, Bahamas — see Plate 3, Figure 2 — filament taken from the lower plant of the two at the left). All the figures are enlarged 150 diameters.

11–13. *Udotea conglutinata*

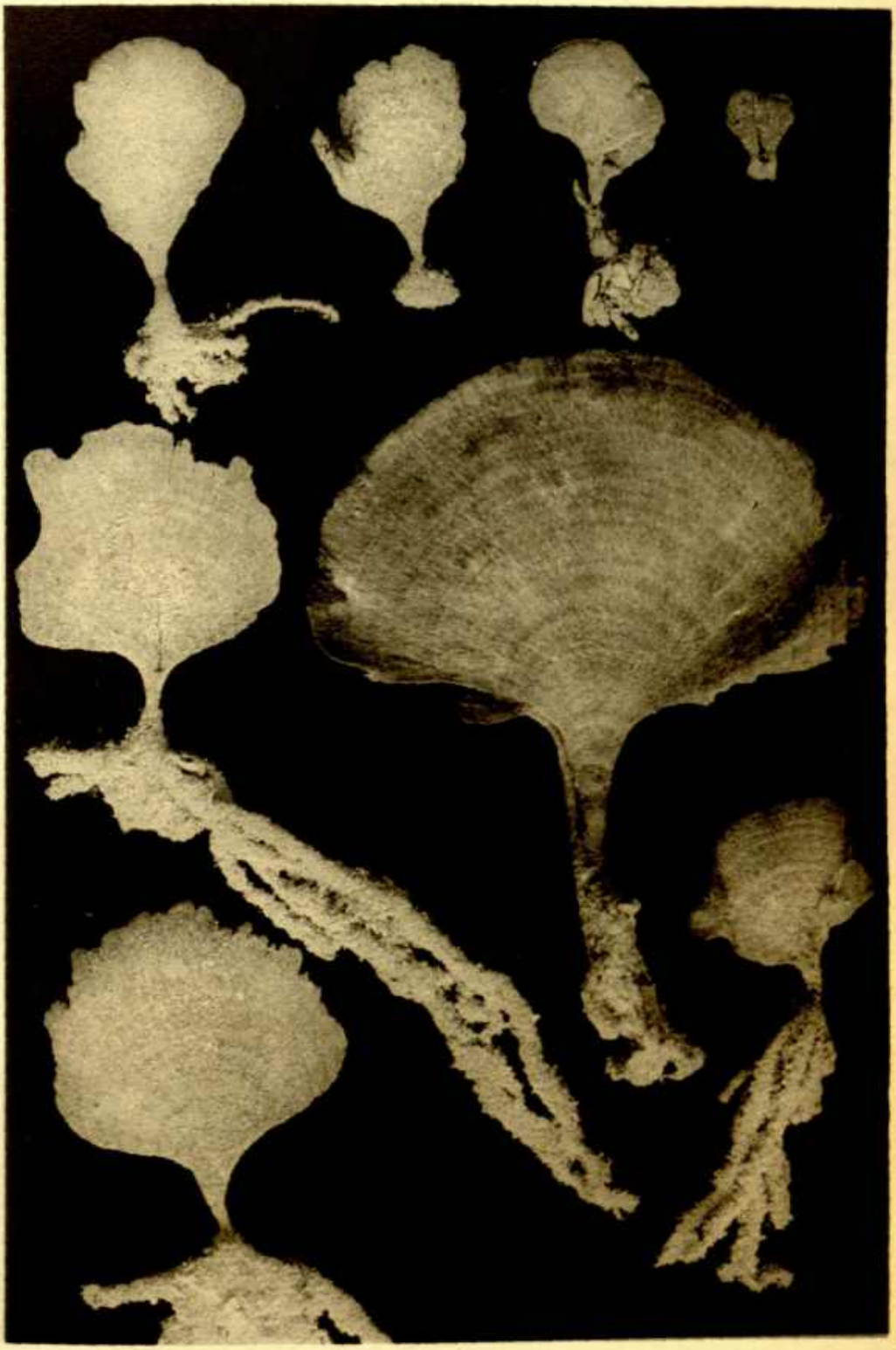
11–13. Ultimate ramifications of the corticating filaments of the stipe.

Figure 11 is drawn from *no. 3240a* (Bemini Harbor, Bahamas – see Plate 2 — filament taken from the largest plant there shown); 13, from a dried specimen of the same number; 12, from *5237* (Watling Island, Bahamas — see Plate 2 — filament from the plant with the largest rhizoids). All of the figures are enlarged 150 diameters.



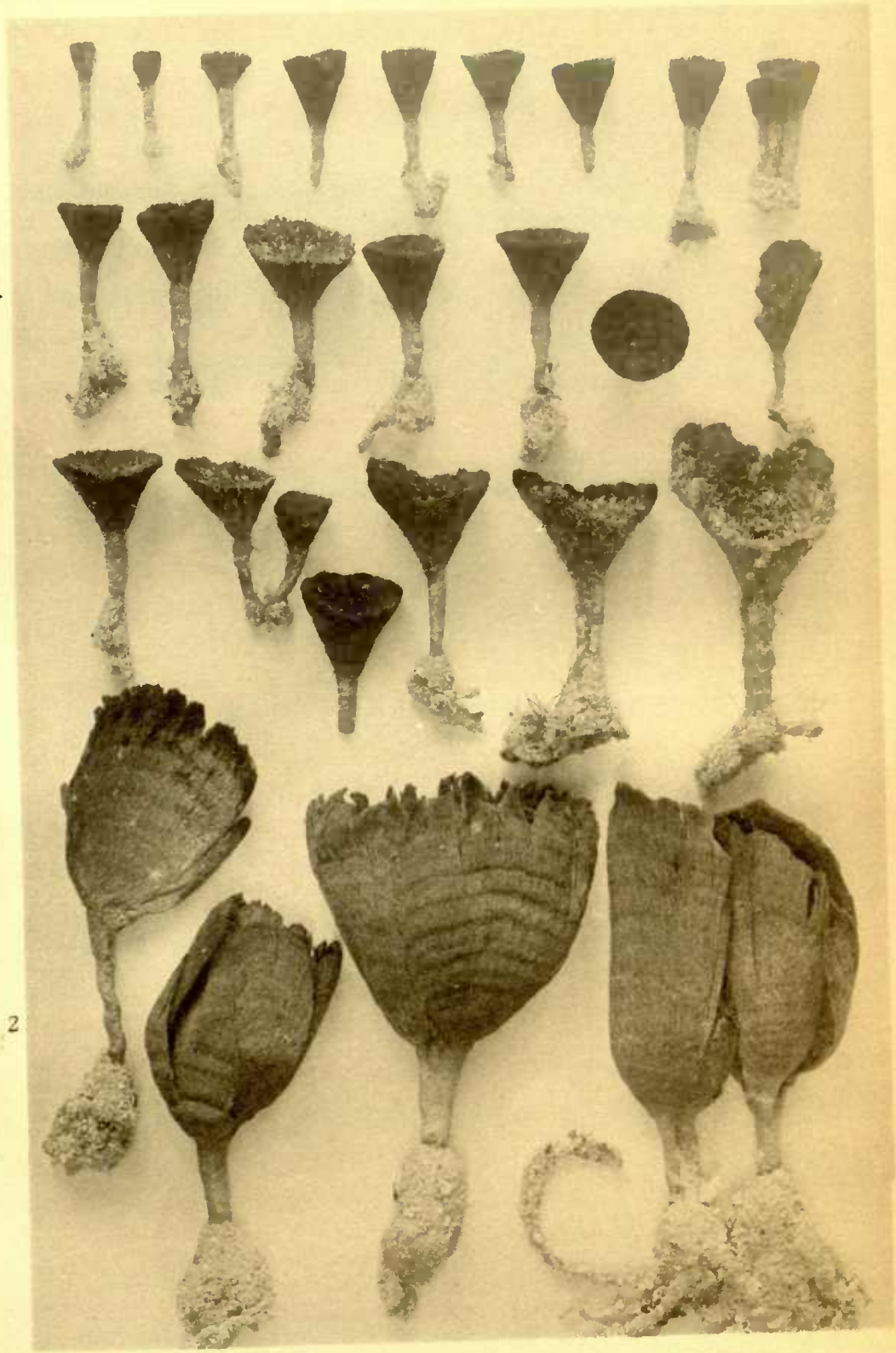
1. NEOMERIS DUMETOSA Lamour.
2. NEOMERIS ANNULATA Dickie
3. NEOMERIS STIPITATA M. A. Howe
4. 7. NEOMERIS VAN BOSSEAE M. A. Howe
5. NEOMERIS MUCOSA M. A. Howe
6. NEOMERIS COKERI M. A. Howe

COCKAYNE, BOSTON



UDOTEA CONGLUTINATA (Ell. & Soland.) Lamour.

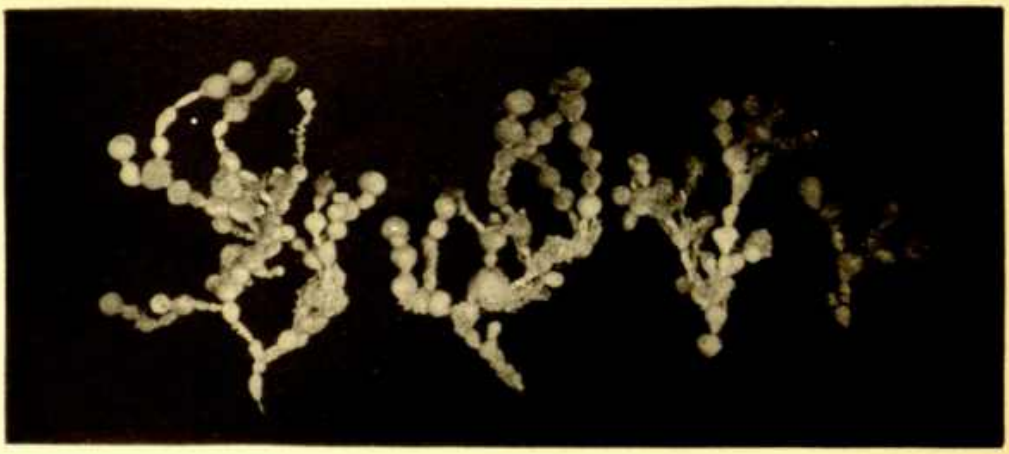
COCKAYNE, BOSTON



UDOTEA CYATHIFORMIS Decaisne

COCKAYNE, BOSTON

1



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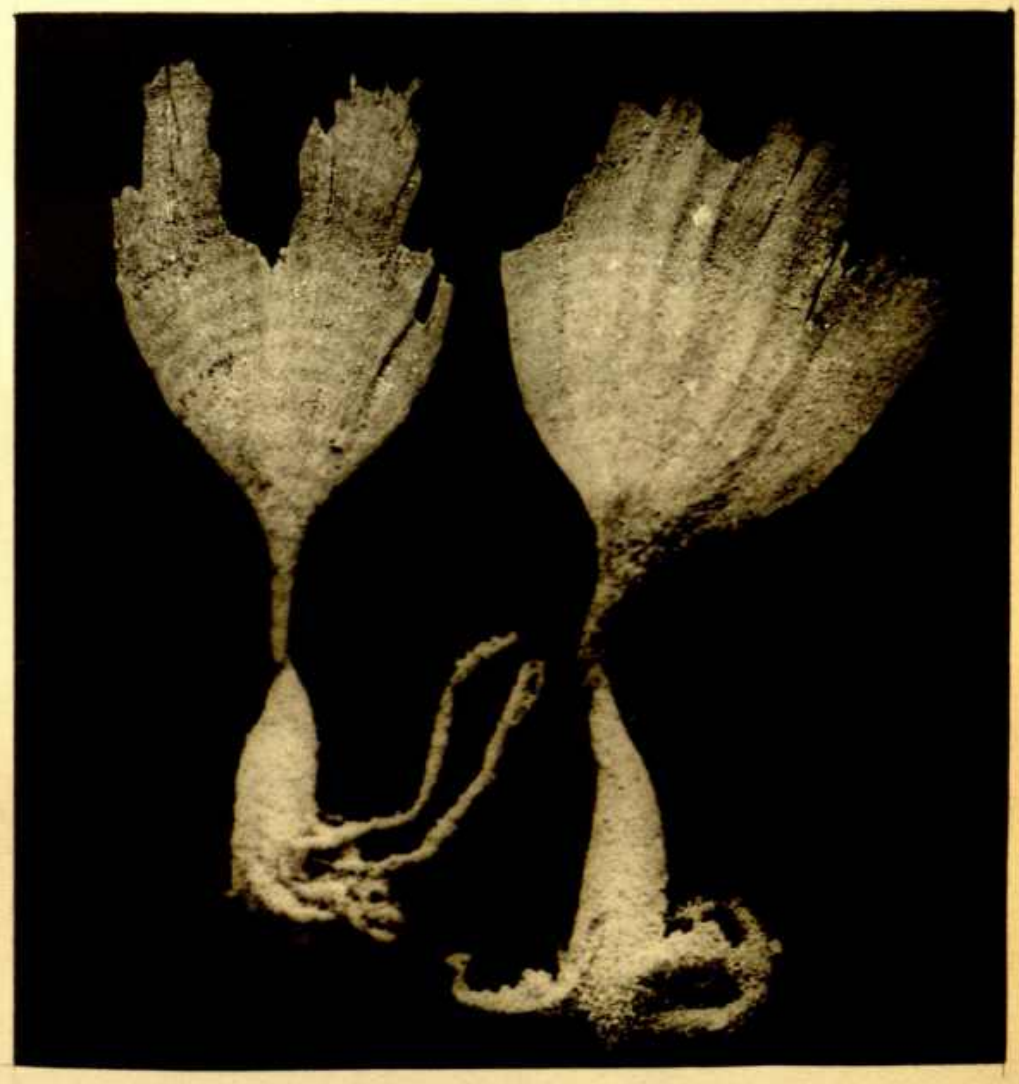
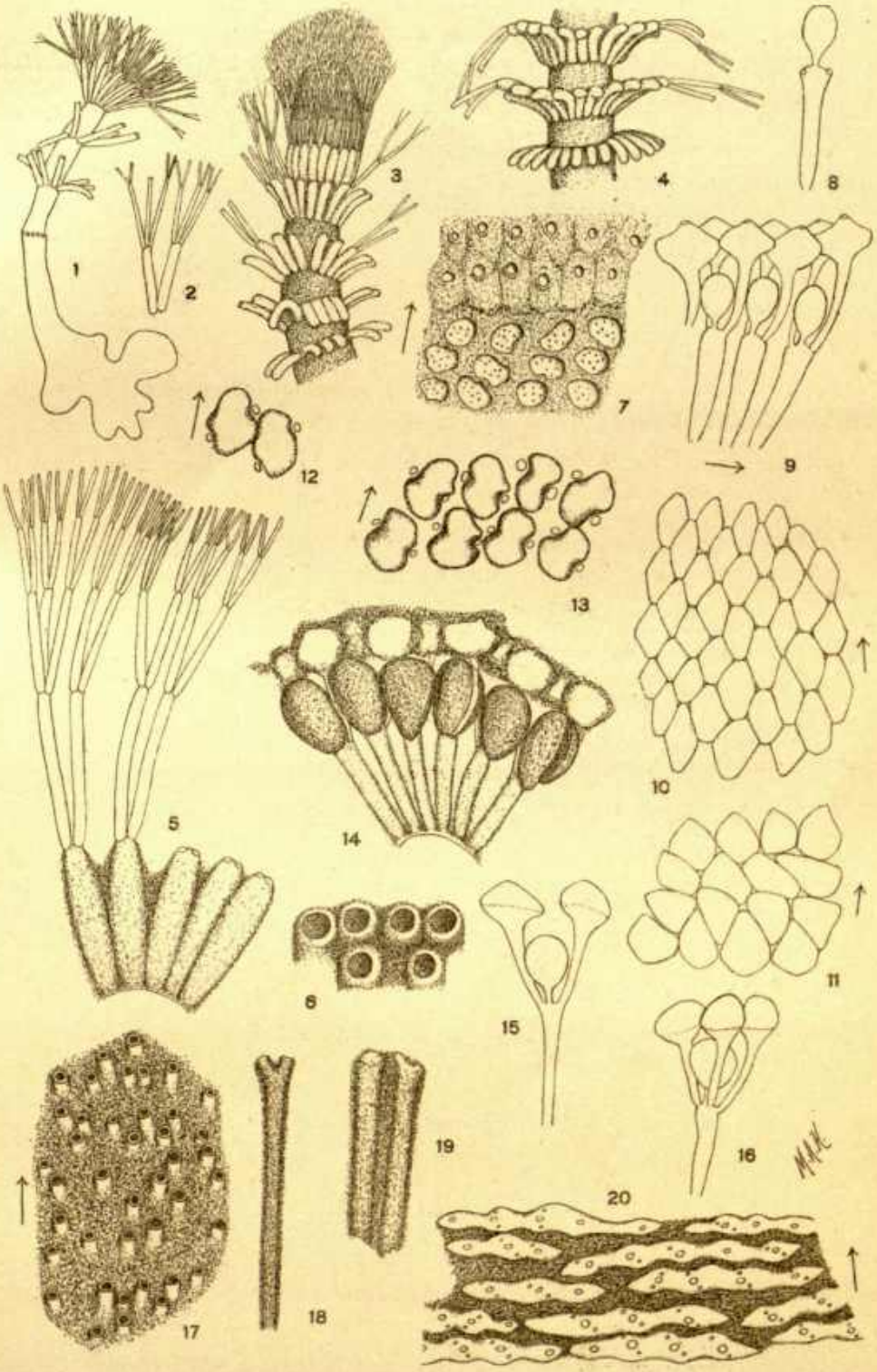


1. HALIMEDA LACRIMOSA M. A. Howe

2. UDOTEA SPINULOSA M. A. Howe

COCKAYNE, BOSTON



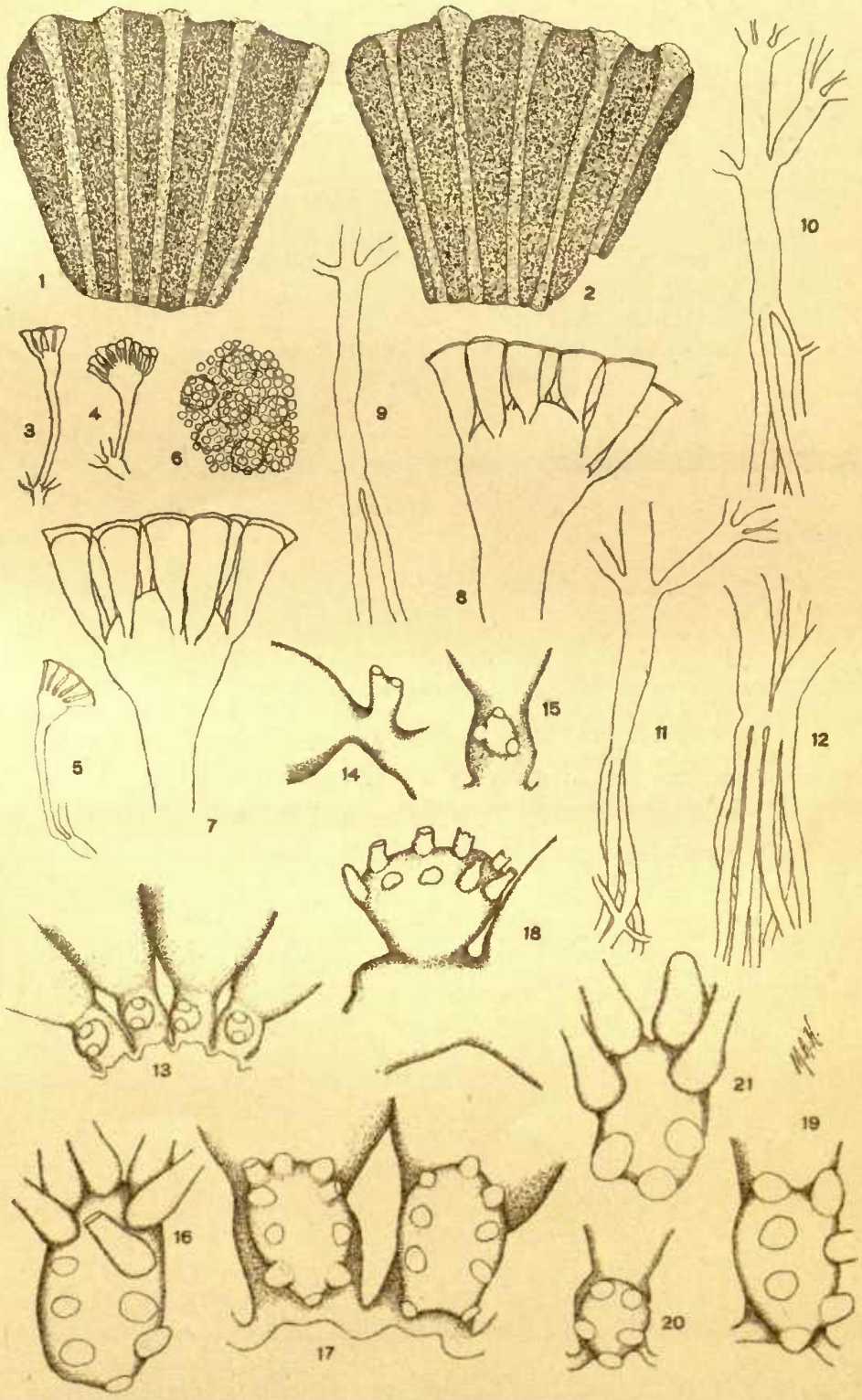
1-14. NEOMERIS MUCOSA M. A. Howe

15-16. NEOMERIS STIPITATA M. A. Howe

17-19. NEOMERIS VAN BOSSEAE M. A. Howe

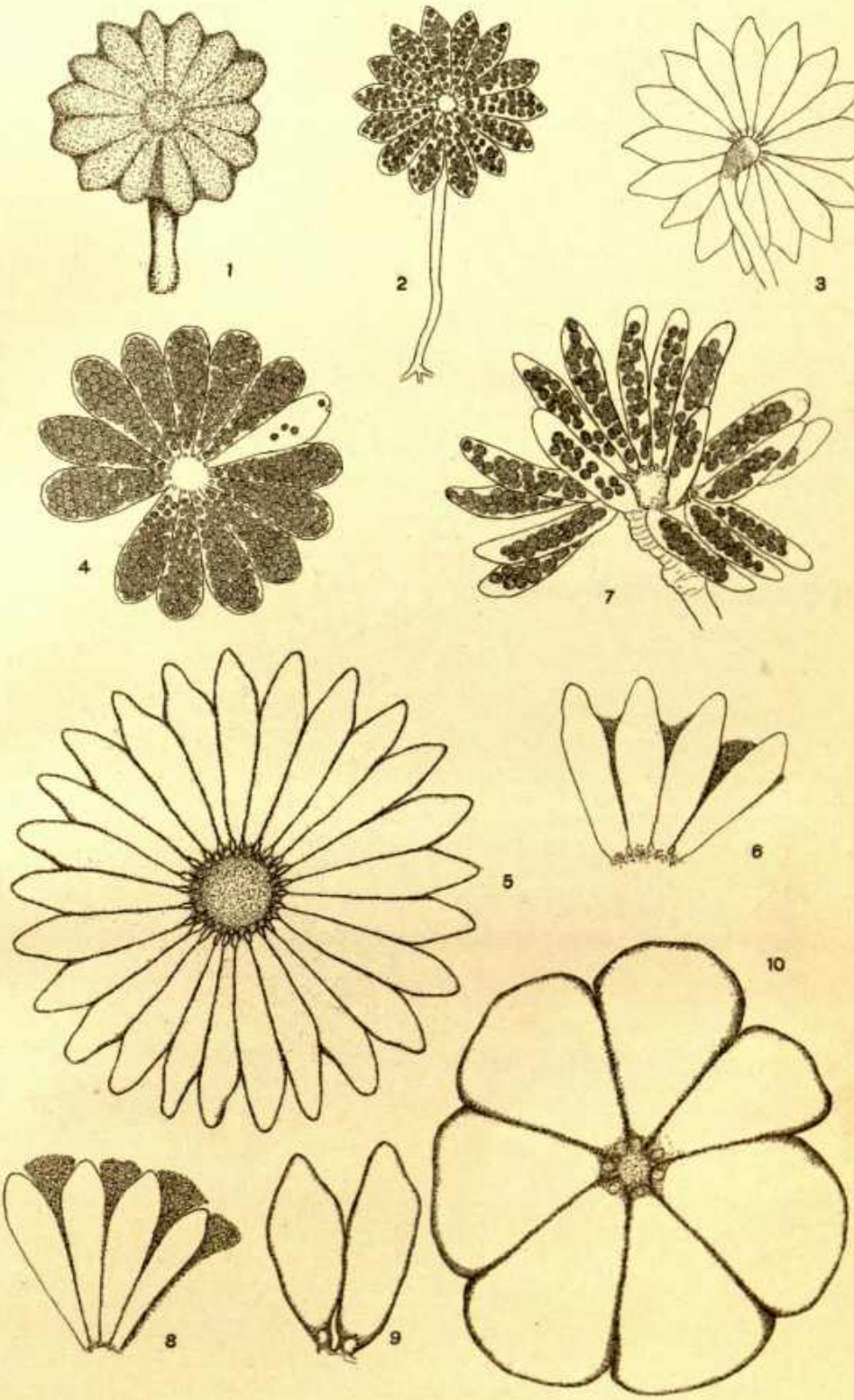
20. NEOMERIS DUMETOSA Lamour.

COCKAYNE, BOSTON.



1-2. NEOMERIS DUMETOSA Lamour.
3-12. HALIMEDA LACRIMOSA M. A. Howe
13-15. ACETABULUM PUSILLUM M. A. Howe
16-20. ACETABULUM POLYPHYSOIDES (Crouan) Kuntze
21. ACETABULUM POLYPHYSOIDES DELTOIDEUM M. A. Howe

COCKAYNE, BOSTON.

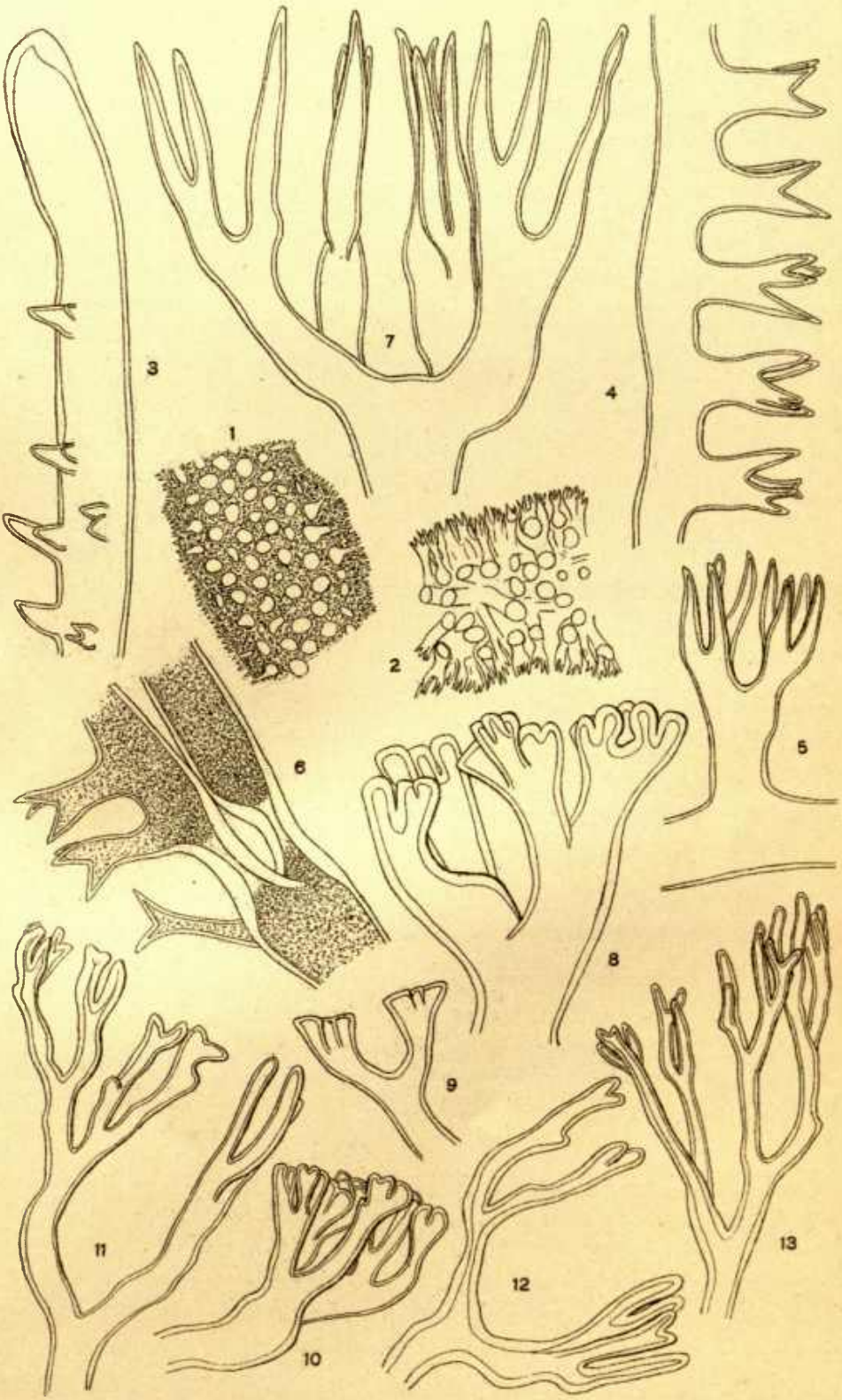


1-4. ACETABULUM PUSILLUM M. A. Howe

5-9. ACETABULUM POLYPHYSOIDES (Crouan) Kuntze

10. ACETABULUM POLYPHYSOIDES DELTOIDEUM M. A. Howe

COCKAYNE, BOSTON.



1-7. UDOTEA SPINULOSA M. A. Howe

8-10. UDOTEA CYATHIFORMIS Decaisne

11-13. UDOTEA CONGLUTINATA (Ell. & Soland.) Lamour.

COCKAYNE, BOSTON.