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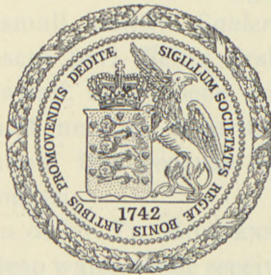
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# SOME MARINE ALGAE FROM MAURITIUS

ADDITIONS TO THE PARTS PREVIOUSLY  
PUBLISHED

BY

F. BØRGESEN



KØBENHAVN

I KOMMISSION HOS EJNAR MUNKSGAARD

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As till now I have rather frequently received collections of algae from Director, Dr. R. E. VAUGHAN and as these collections have contained also some *Chlorophyceae* and *Phaeophyceae* not formerly found in Mauritius, the present part also contains some species of these groups and furthermore some species of *Rhodophyceae* belonging to the *Nemalionales*.

In a later part I hope to be able to publish what may be found of interest in the remaining not yet worked-out material of the latter group.

Besides species not formerly found in Mauritius several already known from the island are mentioned again here, because better and more copious material has made it possible to add supplementary information to more incompletely known species.

In a former part is mentioned the interesting occurrence of several characteristic West Indian algae in Mauritius. This applies also to the small dainty *Caulerpa Vickersiae* Børgs. mentioned in the present part. Being first known from Japan and later also from Hawaii, it has been found in several places in the West Indies and now in Mauritius, a rather peculiar discontinuous distribution. But because of its small size it is of course easily overlooked.

While the collection of Dr. TH. MORTENSEN contained several sublittoral algae from deep water, those received from Dr. VAUGHAN have been gathered in the littoral and in the uppermost parts of the sublittoral regions; but among a batch received quite recently some specimens taken at greater depth upon submarine banks were included; some species hitherto unknown

from Mauritius were taken there. To improve upon this drawback as to the want of sublittoral algae from deeper water I have sent a small dredge to Dr. VAUGHAN.

As it was of importance for me to be able to see the specimens of the genera *Liagora* and *Galaxaura*, preserved at the Kew Herbarium which formerly have been determined by Professor G. DICKIE, his determinations being published in his paper On the Algae of Mauritius, I am much indebted to Professor, Dr. E. J. SALISBURY, Director of the Royal Botanic Gardens, Kew, who upon my application allowed me to get the specimens of these genera on loan here in Copenhagen.

During a visit to Lund in the early spring of 1948 I have by the courtesy of Docent, Dr. H. WEIMARCK been able to compare some specimens of algae from Mauritius with specimens preserved in J. AGARDH's Herbarium.

To Director, Dr. R. E. VAUGHAN I want to express my warmest thanks for his continual interest in sending me collections of algae from the island.

To the TRUSTEES OF THE CARLSBERG FOUNDATION I am much indebted for a continued grant for algological investigations.

# CHLOROPHYCEAE

## Siphonocladales.

### Fam. *Anadyomenaceae*.

#### *Valoniopsis* Børgs.

##### 1. *Valoniopsis pachynema* (Martens) Børgs.

BØRGESEN, F., Some Marine Algae from the Northern Part of the Arabian Sea, 1934, p. 10, figs. 1, 2. — *Valonia confervoides* Harv., Alg. Ceylon exsicc. no. 73 (nomen nudum). *Bryopsis pachynema* Martens. Die Preussische Exped. nach Ostasien. Bot. Theil. Die Tange von G. v. MARTENS, p. 24, tab. IV, fig. 2. Berlin 1876.

In some collections lately received from Mauritius some small not quite well developed specimens of this plant are found. The specimens, even small, seem to be in good conformity with my description. The thallus is about 700—800  $\mu$  thick.

Mauritius: Ilot Barkly, "Rocks exposed at low tide", May 5, 1948. G. MORIN no. 863.

## Dasycladales.

### Fam. *Dasycladaceae*.

#### *Neomeris* Lamouroux.

##### *Neomeris annulata* Dickie.

Alg. Mauritius, I, 1940, p. 43.

Of this species, of which Mauritius is the type locality, as DICKIE described the species upon specimens from the island,

I have formerly seen only some very few specimens preserved in the Kew Herbarium.

It was therefore of great interest to me in a collection sent recently from Dr. VAUGHAN to receive a really large and beautiful collection (no. 775) of this small, so nicely built *Dasycladaceae*. The specimens are from 8 mm to about  $1\frac{1}{2}$  cm high of light-green colour, darkest near the apical ends, where the assimilating filaments protrude. In the fructiferous part of the thallus the characteristic annular calcification round the gametangia was very prominent; compare YAMADA's figure 16 in his paper "The Marine Chlorophyceae from Ryukyu", Sapporo 1934. The gametangia are oblong to cylindrical, many of them a little broader upwards; for instance a gametangium with a length of  $171\ \mu$  was  $80\ \mu$  broad near the base and  $87\ \mu$  above.

To judge from the material the plant has in most cases grown gregariously; it occurred "on coral in one foot of water at low tide".

Mauritius: Pointe aux Sables, March 24. 1948, G. MORIN no. 775.

## SIPHONALES

### Fam. *Caulerpaceae*.

#### *Caulerpa* Lamouroux.

##### 1. *Caulerpa Vickersiae* Børgs.

BØRGESEN F., Some Chlorophyceae from the Danish West Indies, 1911, p. 129, fig. 2. — *Caulerpa ambigua* Okamura, On the Algae from Ogasawara-jima (Bonin Islands), 1897, p. 4.

In some material quite recently received from Dr. VAUGHAN (Nos. 843 and 861) I was agreeably surprised to find this dainty little *Caulerpa*, which I, through all the intervening years, have had no opportunity to re-examine, since I first found it in the former Danish West Indies and gave it the name *Caulerpa Vickersiae*, because Mlle VICKERS had found it on Barbados shortly before.

Mlle VICKERS referred her specimens to *C. ambigua* Okamura

described by OKAMURA a few years previously, but as I, as stated in detail below, found it impossible from OKAMURA's description and figures to believe that the Japanese and the West Indian plants could be identical, I described the latter as an independent species.

I therefore take this opportunity of replying to the few objections which, through the years, have been directed against the soundness of my species, first and foremost on the part of OKAMURA, whose mild defence of his species did not justify an earlier reply. On the other hand, Miss LOIS EUBANK's recent attack distinctly calls for an answer.

When I did not at the time find it possible to classify the West Indian material as belonging to OKAMURA's species, it was because a close comparison with OKAMURA's description and illustrations led me to conclude that the Japanese and the West Indian plant could not possibly be reconciled, as they differed radically in nearly every respect. I refer to my comparative analysis in my paper from 1911 and should like to stress the main point: that OKAMURA's description of his species seemed to show that the material upon which he based his description was a mixture of two different species, one which resembled the West Indian form to a certain extent, and another which is described as follows in OKAMURA's paper: "has contracted as if articulated rachis" and that this "is more especially so in frond bearing ramenta constricted at base", characters which cannot possibly be applied to the West Indian species. And even if it has later transpired that OKAMURA's "dubious" plant did in fact represent a deviating, poorly developed form of this species, and that its different appearance is almost certainly due to extreme external conditions, very different from the plant's ordinary habitat, this cannot, in my opinion, justify recognition of a description so misleading, that it caused Mme WEBER in her monograph, after correspondence with OKAMURA (see his paper 1897, pp. 6—7 under *Caulerpa Okamurai*), to place *C. ambigua* in the group *Opuntioides*, just after *Caulerpa sedoides*.

In order to remedy this, OKAMURA has later (see "Icones of Jap. Algae", vol. III, 1915, p. 168, pl. 139), on the plate mentioned, reproduced the illustrations from his earlier paper and added three new ones. These show a plant which unmistakably belongs

to this species, even if it is not completely true to type; but this cannot of course alter the consequences of his earlier and very unfortunate description and figures. Curiously enough OKAMURA here quotes VICKERS, "Phycologia Barbadosensis", where the species, as stated above, is called *C. ambigua*, but no reference to my species is given.

Not till 1931 does OKAMURA (see his paper "On the Marine Algae from Kotosho (Botel Tobago)", p. 101) produce an answer to my arguments. He refers to the added illustrations on his plate and claims that these, compared with the former ones, will show that his species does not comprise two species. But this is at any rate too late and cannot in any way alter the fact that I was the first to give a proper description of the species.

W. RANDOLPH TAYLOR, who in his valuable paper "The Marine Algae of Florida", 1928, p. 104, pl. 12, fig. 20, pl. 13, fig. 12 uses my name for the species, has been the first to find *C. Vickersiae* at the coast of Florida and describes a variety, var. *luxurians* Tayl., from there, a form which, however, hardly differs appreciably from the typical form. And in a later paper "Notes on Algae from the Tropical Atlantic Ocean", II, 1933, p. 396, pl. 36, TAYLOR describes the beautiful *C. Vickersiae* var. *furcifolia* Tayl. from the coast of Costa Rica.

In 1934 YAMADA mentions (see his paper "The Marine Chlorophyceae from Ryukyu", p. 64) that he has found the plant at the south coast of Japan. He calls it *C. ambigua* without comment. The plant he found (fig. 33), as YAMADA stresses, shows close relationship with the typical West Indian plant, with distichously arranged ramuli and marked periodical growth; in one specimen ramuli were scattered or nearly verticillately placed.

Last in the line comes Miss LOIS EUBANK, who discusses the matter in her paper "Hawaiian Representatives of the Genus *Caulerpa*", 1946, p. 410, and, as already mentioned, it is mainly her paper, together with the discovery of *C. Vickersiae* in Mauritius, which has caused my reply.

After reviewing the various authors who have dealt with the subject, Miss EUBANK states that she has examined some of OKAMURA's material as well as her own, and then sums up as follows: "I conclude that but one species is involved, the proper



designation of which is *C. ambigua*, and that *C. Vickersiae* should be considered a synonym of it. Such polymorphism within a species is not unusual for this genus. OKAMURA probably overstressed the importance of what appeared to be "spurious articulations" in a specimen to which he later referred (1931) as showing an extreme rather than a typical development." I should like to point out that there was no need at all for this drastic verdict, as nobody acquainted with the matter as it now stands will deny that OKAMURA's material did in fact comprise only one species. OKAMURA was unfortunate in getting hold of a poorly developed, practically deformed type from an unsuitable habitat. When OKAMURA's misleading description is viewed objectively, my conclusion at the time, that the West Indian plant belonged to another species than the Japanese one, was fully justified.

Next: Miss EUBANK tries to explain away the constrictions and articulations of ramuli and rachis, mentioned by OKAMURA, by stating that in her material from Hawaii "slight constrictions at the bases of the ramuli" were observed. But the real facts are that the ramuli may now and then taper evenly and slightly from the apex towards their base. In the same paragraph it is quite obvious that Miss EUBANK completely misunderstands TAYLOR's expression in his description of *C. Vickersiae* var. *furcifolia* (1933, p. 397) where he says about the ramuli: "very slightly contracted towards ramular bases", the idea being that they taper slightly towards their base, not that constrictions are found at the base. Therefore, I whole-heartedly agree with Miss EUBANK when she writes: "No significance is assigned to them, however, as they are not a typical feature of the plant, and are very obscure at best, showing no regularity of occurrence." How true! They do not even exist. But this hardly helps OKAMURA's description.

Furthermore, Miss EUBANK mentions the question of the rhizome. As is well-known, OKAMURA described his plant as lacking a prostrate rhizome ("with no repenting surculus"), and later on in his description he refers to this lack as "the doubtful question of surculus". Later investigations have shown that the alleged lack of a rhizome was a complete misunderstanding. When Miss EUBANK therefore writes: "Before the absence of a

prostrate rhizome can be relied upon as a distinguishable feature of *C. ambigua*, it must be remembered," etc., it suffices to state that hardly anybody nowadays will doubt that the plant is in fact furnished with a prostrate rhizome. By the way: if the words quoted above are addressed to me, I should like to refer to my conclusion (1911, p. 131) where, after an examination of OKAMURA'S specimen of *C. ambigua* in "Algae Japonicae Exsiccatae", no. 95, I point out that "this seems to me very clearly to show a rhizome." Compare Fig. 1.

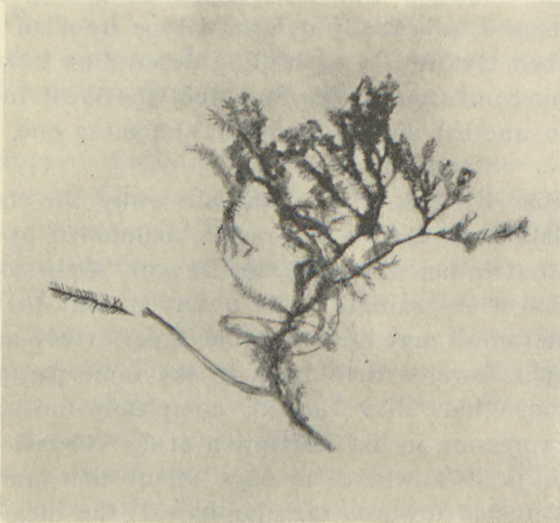


Fig. 1. *Caulerpa Vickersiae* Børgs. Habit of a specimen. ( $\times 3$ ).

Finally, I take the opportunity to say a few words about the varieties which Miss EUBANK has proposed. First, var. *Vickersiae*: As I maintain that my name for the species ought to be retained, it follows that the type which was the basis of my description of the species should be considered the typical form and be named var. *typica*. In my opinion this variety also comprises var. *simplex* Eubank, which is described as follows: "Fronde beset with distichously arranged unbranched ramuli, dichotomous ramuli rare to completely lacking." Such a distinction, in my opinion, is not only artificial, but actually impossible, as plants from the same collection may vary from specimens with completely unbranched ramuli to others with several pairs of dichotomously divided ramuli. In

this connection it may be mentioned that my renewed investigations of this small, insignificant plant, based as they are on a comparatively rich material from Mauritius, lead me to conclude that it is, to a very great extent, the external conditions which determine whether the ramuli become dichotomously divided or not. The specimens from Mauritius were growing more or less

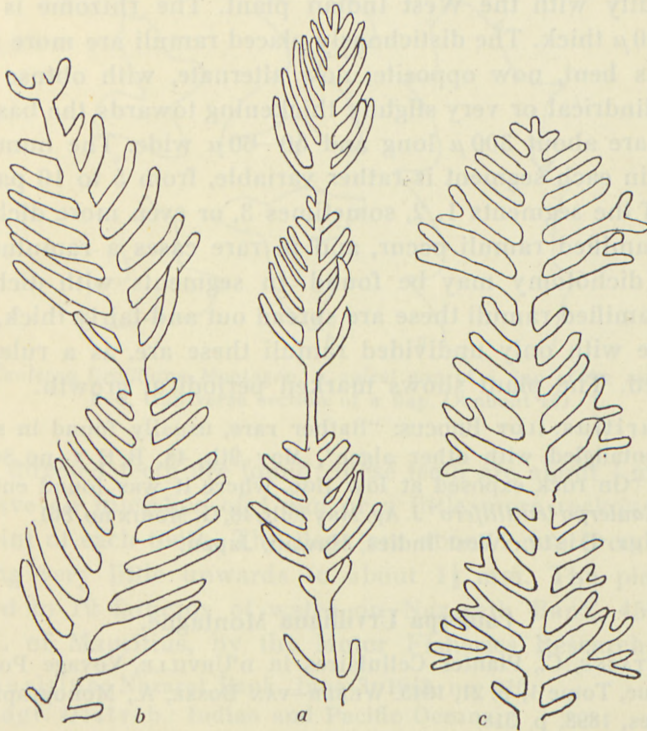


Fig. 2. *Caulerpa Vickersiae* Børgs. Forma typica. a, b, fragments of the thallus without dichotomously divided ramuli; c, fragment with dichotomously divided ramuli ( $\times$  about 20).

walled in by tussocks of *Caulerpa lentillifera*, J. Ag., which, although quite small, is a giant compared to *C. Vickersiae*. Consequently the minute *C. Vickersiae* has to stretch to its utmost extent in order to keep up, as far as possible, with the growth of its big neighbour, and it must therefore dispense with the luxury of dichotomously branched ramuli. The figure (Fig. 2a) shows such a segment: the upturned, slender ramuli and the elongated, bare portions of the rachis are plainly visible, showing how the

plant is forced to lengthen itself. Referring to the above, it is likewise my opinion that var. *dichotoma* EUBANK cannot be maintained either. Miss EUBANK's plant (l. c. pl. 22, figs. b and c) has almost certainly grown in favourable surroundings, where no serious interference from other algae was encountered.

As for the specimens (Fig. 2) from Mauritius, they are in good conformity with the West Indian plant. The rhizome is about 200—220  $\mu$  thick. The distichously placed ramuli are more or less upwards bent, now opposite, now alternate, with obtuse apical tips, cylindrical or very slightly thickening towards the base. The ramuli are about 300  $\mu$  long and 50—60  $\mu$  wide. The number of ramuli in each segment is rather variable, from 5 to 10 pairs. In some of the segments 1, 2, sometimes 3, or even more dichotomously ramified ramuli occur, and in rare cases a ramulus with double dichotomy may be found. In segments with dichotomously ramified ramuli these are spread out and fairly thick, while in those with only undivided ramuli these are, as a rule, more upturned. The plant shows marked periodical growth.

Mauritius: ILOT BROCUS: "Rather rare, usually found in shallow water, entangled with other algae", May 9th, 48, R. E. V. no. 843. Ilot Barkly: "On rock exposed at low tide, where it was found entangled among *Caulerpa lentillifera*" J. Ag. May 10th, 48, G. MORIN no. 861.

Geogr. Distr.: West Indies, Hawaii, Japan.

### *Caulerpa Urvilliana* Montagne.

MONTAGNE, C., *Plantes Cellulaires in d'URVILLE, Voyage Pole Sud, Botanique, Tome 1, p. 21, 1945.* WEBER—VAN BOSSE, A., *Monographie des Caulerpes, 1898, p. 318.*

A specimen (no. 816) of this rather variable plant has recently been received from Mauritius. It seems to me to agree quite well with Mme WEBER's fig. 8 a, pl. 26 in her monograph. This figure originates from specimens collected during the Forschungsreise S. M. S. Gazelle and according to Mme WEBER is identical with the typical specimen.

However, having no authentic material for comparison I give here a short description of the specimen.

It is a vigorous plant with a terete stem fixed with strong rhizoids in the sandy bottom. The erect assimilator is about 15 cm high and several times rather regularly furcate. While the rhizome

and the basal part of the assimilator is terete, the flaps are deeply furrowed, but in rather an irregular way, as is seen from some transverse section of an assimilator having been preserved in formalin and seawater and thus having kept its natural shape (Fig. 3 b-e). Along the margins of the flaps a continuous row of sharp up-

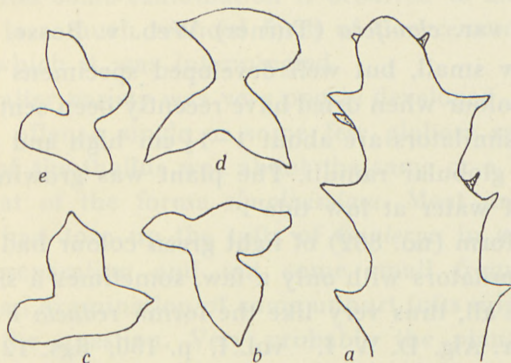


Fig. 3. *Caulerpa Urvilliana* Montagne. a, apical end of a flap of the assimilator; b-e, transverse section of a flap. ( $\times$  about 10).

wards directed teeth are found; these teeth are about  $\frac{1}{2}$  mm long and have an interstice of 1 mm or a little more reckoned from the point of each tooth. The flaps are about 2 mm broad below, tapering very little upwards to about  $1\frac{1}{2}$  mm. The plant was dredged in 19 fathoms of water on Nazareth Bank, 450 miles N.N.E. of Mauritius, by the Motor Fisheries Research Vessel.

Mauritius: Nazaret Bank, June 3, 1948, no. 816.

Geogr. Distrib.: Indian and Pacific Oceans.

*Caulerpa serrulata* (Forssk.) J. Ag. emend. Børgs.

Alg. Mauritius, I, p. 50 and Addit. List 1946, p. 38.

Of this species, of which I formerly from Mauritius have seen only very little material, some well prepared specimens (nos. 811, 865) collected in situ are contained in previously received collections from the island.

The specimens come near to var. *typica* Weber, forma *lata* Weber (1898, p. 313). TSENG in "*Chlorophyceae* from Hainan", 1936, p. 178-9 gives a good figure of this form.

Mauritius: Ilot Barkly, "in two feet of water at low tide" April 24 1948, G. MORIN no. 811. And same locality, "on Coral exposed at low tide", June 8 1948, G. MORIN no. 865.

*Caulerpa racemosa* (Forssk.) Web. van Bosse.

Alg. Mauritius, I, 1940, p. 51; Add. List., 1946, p. 39 and do., 1948, p. 32.

var. *clavifera* (Turner) Web. v. Bosse.

Some few small, but well developed specimens (no. 812) of dark green colour when dried have recently been sent from Mauritius. The assimilators are about 1—1½ cm high and densely clad with nearly globular ramuli. The plant was growing "on rocks in 1½ feet of water at low tide".

Another form (no. 862) of light green colour had small much reduced assimilators with only a few, sometimes a single or even no ramuli at all, thus very like the forma *reducta* I have described in "Mar. Alg. D. W. I." vol. I, p. 150, figs. 121—122. This form was growing "on rocks exposed at low tide".

forma *simplicissima* nov. form.

Forma assimilatoribus nudis, sine ramulis globosis, 8—15 mm altis, subcylindricis-subclavatis, apicibus late rotundatis instructa. (Fig. 4).

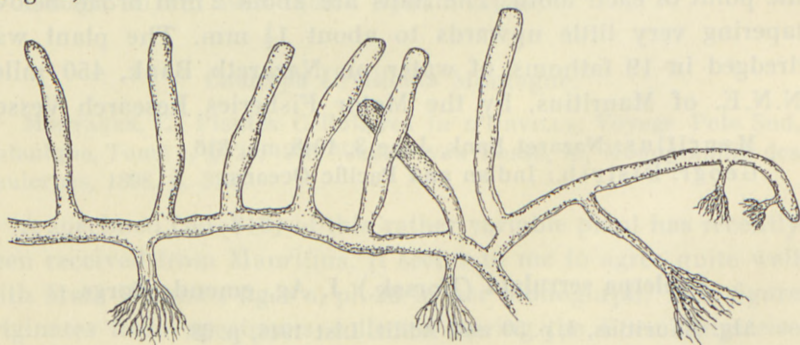


Fig. 4. *Caulerpa racemosa* (Forssk.) Web. v. Bosse. forma *simplicissima* nov. form. ( $\times 3$ ).

In some material of *Caulerpa* (nos. 812, 828, 863) which formed small tufts upon rocks in exposed localities a little peculiar form occurred of which fig. 4 gives an illustration. From the terete rhizome, about 1 mm in diameter, rhizoids are given out below, while from the upward-turned side erect subcylindrical to sub-

clavate assimilating shoots issue. As a rule these are a little narrowed towards their base and have broadly rounded apical ends; their length varies from about 8 mm up to  $1\frac{1}{2}$  cm. The largest specimen found in the collection was about 5–6 cm long.

At first, when finding this small plant, I thought it was a new species, but after some examination it occurred to me very probably that it is a much reduced form of *C. racemosa* var. *clavifera*, among which it was intermingled.

Also this latter variety was very poorly developed, the assimilators having often a single or some few globose ramuli only, and the size of the thallus was about the same or a little bigger only than that of the forma *simplicissima*. Most unfortunately the collector had torn up the tufts of *Caulerpa* in small pieces during the preparation and put some small fragments only in the bottle, an examination of some unhurt tufts might perhaps have solved the question. Very probably the plant has been growing under similar conditions as the small forma *reducta* referred to above.

The above-described form may also show likeness to *Caulerpa ramosa* var. *Lamourouxii* forma *Requinii* (Mont.) Weber, 1898, p. 369, pl. 32, fig. 7, but in this form the assimilators are ribbon-like and more or less ramified; comp. REINKE, "Ueber *Caulerpa*", p. 39, fig. 58. And it may also remind of *Caulerpa Freycinetii* var. *integerrima* Zanardini, "Plant. Mar. Rubr". 1858, p. 75; compare REINKE's fig. 39, p. 27 of this form in his above quoted paper; but this form has likewise ramified and flattened assimilators.

Mauritius: Ilot Barkly, "on rocks exposed at low tide", May 10, 1948, G. MORIN no. 862 and 863 a. Ilot Barkly, "Creeping upon old corals and rocks", May 24, 1948, R. E. V. no. 828. Ilot Barkly, April 24, 1948, G. MORIN no. 812.

#### *Caulerpa lentillifera* J. Ag.

AGARDH, J., Alg. Ruppell, 1837, p. 173. Till Algerne Systematik, Nya bidrag I. *Caulerpa*, p. 42. WEBER v. BOSSE, Monographie, 1898, pl. 34, figs. 1–2. REINBOLD in JOHS. SCHMIDT, Flora of Koh Chang, Part IV, Marine Algae, Copenhagen 1901, p. 105.

To this species I think a small *Caulerpa* (no. 813) (Fig. 5) recently received from Mauritius is to be referred. When some doubt about the referring of the plant to this species and not to *Caulerpa racemosa* var. *clavifera* forma *microphysa* is left, it

is because the characteristic feature of this species, and upon the whole of the group *Pedicellatae*, namely a marked constriction of the pedicel just below the ball-shaped ramuli, is not always present, the pedicel instead of this tapering evenly upwards or being nearly cylindrical. Fig. 6 shows some ramuli with pedicels and Fig. 7 an assimilator densely clad with the globose ramuli.



Fig. 5. *Caulerpa lentillifera* J. Ag. A dried specimen. Natural size.

Regarding the more or less marked constrictions of the pedicels variations have previously been mentioned, thus for instance by GILBERT, in his paper "Notes on Caulerpa from Java and the Philippines", 1942, p. 23, who has found that in specimens from Java the constrictions were less marked than in those from the Philippines, and in the same paper, regarding the above-mentioned var. *microphysa*, he points out that in the short pedicels of this small form he has sometimes found "a suggestion of a constriction between the globular head and the pedicel of the ramulus, which may indicate some relationship between var. *microphysa* and the *Pedicellatae*" characterized by constrictions of the pedicels.

The plant from Mauritius is quite a tiny, delicate plant (Fig. 5); the rhizome is about  $\frac{3}{4}$  mm thick only, and the longest assimilators have a length of about 1 cm; but most of them are scarcely half this length or even smaller. In some cases the assimilators are densely covered by the ball-shaped ramuli, but



in others some few or even a single ramulus is present only. The diameter of the ball-shaped ramulus is up to about 1 mm long; the length of the pedicels is rather variable, mostly about  $300 \mu$ .

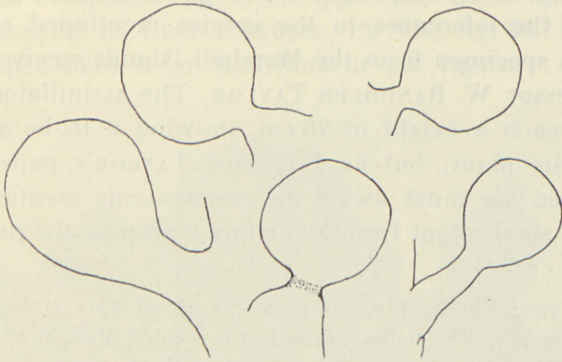


Fig. 6. *Caulerpa lentillifera* J. Ag. Globose ramuli with more or less constricted pedicels. ( $\times 20$ ).

When compared with the figures found in Mme WEBER'S monograph, the Mauritian plant differs very much, thus also when it is compared with the figures of SVEDELIUS, "Ecological and

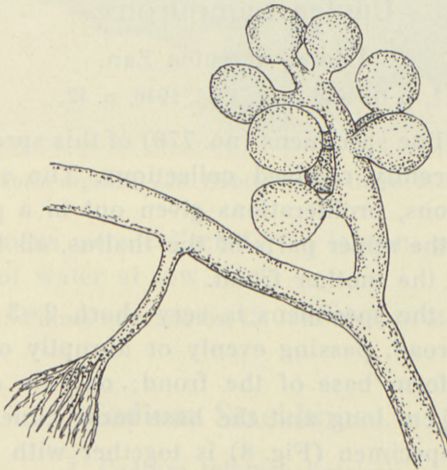


Fig. 7. *Caulerpa lentillifera* J. Ag. Fragment of the thallus. ( $\times 15$ ).

Systematic Studies of the Ceylon Species of *Caulerpa*", 1907, p. 137, fig. 45, here named *Caulerpa longistipitata* (Weber—van Bosse). On the other hand it agrees rather well with a small

form figured by Miss EUBANK in her paper "Hawaiian Representatives of the Genus *Caulerpa*", 1946, p. 418 figs. 2k,l.

Besides, *Caulerpa lentillifera*, like most *Caulerpa* species, seems to be a very variable species as to shape and size to judge not only from the references to the species mentioned above, but also from a specimen from the Marshall Islands received recently from Professor W. RANDOLPH TAYLOR. The assimilators in this specimen reach a height of 20 cm, showing it to be a very tall and vigorous plant; but as Professor TAYLOR's paper has not yet appeared we must await the observations mentioned here.

For the small plant from Mauritius I propose the name forma *parvula*.

Mauritius: Ilot Barkly, "On rocks", April 24, 1948, G. MORIN no. 813, and, same locality, "On rocks exposed at low tide", May 10, 1948, G. MORIN no. 861; in the latter locality associated with the quite tiny *Caulerpa Vickersiae*.

Geogr. Distrib.: Red Sea, Madagascar, Java, Philippine Islands, Hawaii, etc.

### Fam. *Codiaceae*.

#### *Udotea* Lamouroux.

##### *Udotea argentea* Zan.

Alg. Mauritius, I, p. 60 and Add. List, 1946, p. 42.

A number of fine specimens (no. 770) of this species are included in some recently received collections. The specimens are all very proliferous, proliferations given out in a great number especially from the upper parts of the thallus, all being replicae in small size of the mother frond.

The stipe in the specimens is very short, 2–3 mm only, terete, 2–3 mm broad, passing evenly or abruptly over in to the broadly subreniform base of the frond; only in one specimen the stipe was  $1\frac{1}{4}$  cm long and the base more cuneate.

The largest specimen (Fig. 8) is together with the proliferations 9 cm broad and without the short stipe 6 cm high. The colour is greyish-green. All the fronds show soft fan-like foldings starting from near the stipe (in the proliferations from their base) towards the margin. The surface has a mealy, spumose appearance.

While the shape of the frond, when compared with GEPP's figures in their monograph of var. *typica* and var. *spumosa*, agrees best with the latter (Pl. II, fig. 15), the filaments of which the frond is composed (fig. 9) are quite like those found in var. *typica* according to GEPP's figures, Pl. VII, fig. 58. I therefore refer the specimens from Mauritius to var. *typica*.



Fig. 8. *Udotea argentea* Zan. Habit of a specimen. Natural size.

The specimens were collected: "in lagoon, growing on coral in eight feet of water at low tide".

Mauritius: Pointe aux Sables, 13. Jan. 1948, G. MORIN no. 770.

## Codium Stackhouse.

### I. *Codium taitense* Setchell.

SETCHELL, W. A., Tahitian Algae, 1926, p. 83, pl. 12, figs. 3, 4.

In Alg. Mauritius, Add. List, 1946, pp. 49—52 I have referred several specimens of *Codium* of rather different shape and structure to *C. Geppii*. In doing so I relied upon a correspondence

about a group of *Codium* related to *C. Geppii* I had had some years ago with SETCHELL, who, as is well known, for a number of years had made the study of this genus a speciality.

But since I have later found a rather typical form of *C. Geppii* (comp. Addit. List, 1948, p. 38) and furthermore in recently received collections have found specimens which seem to agree

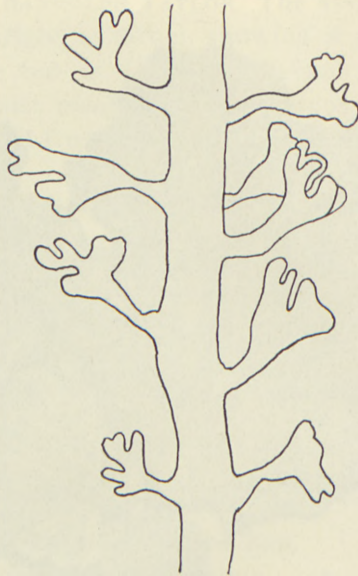


Fig. 9. *Udotea argentea* Zan. Filaments from the flabellum. ( $\times 150$ ).

quite well with SETCHELL's description of *C. taitense* Setchell, I now refer them to this species. This primarily applies to some specimens (no. 760) recently received from Mauritius.

Fig. 10 shows one of the specimens. The decumbent thallus is said to be creeping upon old corals near the shore in a lagoon. It is fixed to the substratum by means of groups of rhizoids emerging here and there from the thallus. The vesicles (Fig. 11) are subcylindrical to subclavate and show much likeness to those figured in figs. 20—22 l.c. Their length varies from 450 to 700  $\mu$  and their breadth from 165 to 350  $\mu$ ; the apical wall is mostly vaulted and the wall thickened.

Also some fragments of a specimen (no. 416) seem referable to this species. The thallus in this specimen is broader than that in the above-mentioned one.

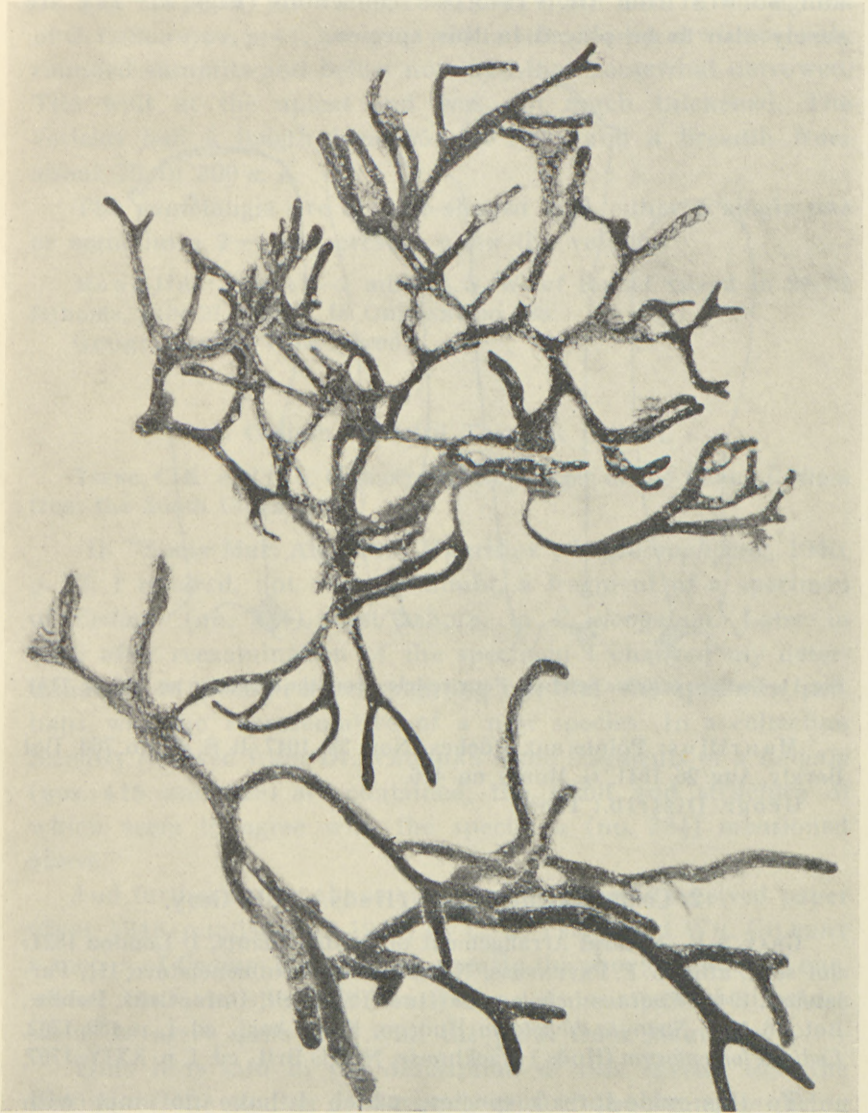


Fig. 10. *Codium taiense* Setchell. Habit of a specimen. Natural size.

And moreover some of the specimens mentioned in my paper of 1946, for instance JADIN's specimens no. 478 b (Fig. 20) and no. 413 from Dr. VAUGHAN's collections (Figs. 21—22), are surely also to be placed in this species.

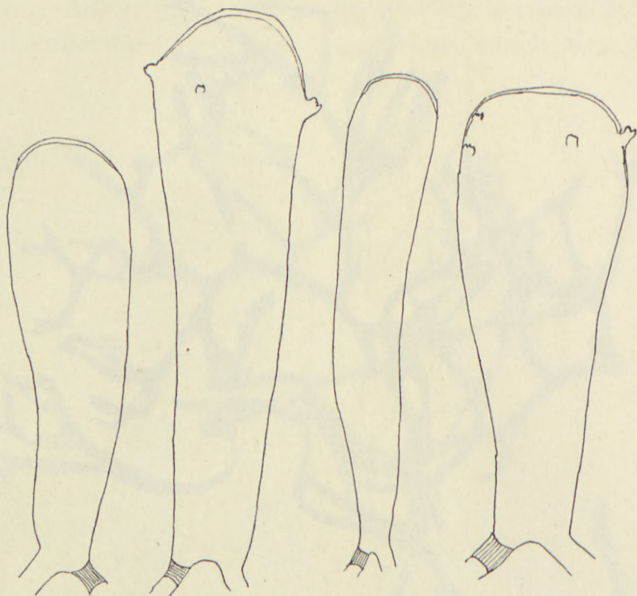


Fig. 11. *Codium tailense* Setchell. Four vesicles from the specimen no. 760. ( $\times 115$ ).

Mauritius: Pointe aux Roches, Nov. 28, 1947, R. E. V., no. 760. Ilot Barkly, Aug. 26, 1941, G. MORIN no. 416.

Geogr. Distrib.: Tahiti.

## 2. *Codium dichotomum* (Huds.) S. F. Gray.

GRAY, S. F., Natural Arrangement of British Plants, I. London 1821; not seen, after G. F. PAPENFUSS, Notes on Algal Nomenclature, III, Farlowia I, 1944.—*Codium dichotomum* (Huds.) Setchell, Univ. Calif. Public., Bot., 16, 1937. *Spongia dichotoma* Hudson, Flora Angl., ed. I, p. 489, 1762. *Codium tomentosum* (Huds.) Stackhouse, Nereis Brit., ed. I, p. XXIV, 1797.

To this wide-spread species, which I have not met with earlier in the collections from Mauritius, I think a specimen is referable which was gathered at a depth of 20—22 fathoms. The specimen is not complete without the basal disc; the fragment, 10 cm high, has a completely cylindrical thallus below, about

5 mm thick, tapering slowly a little upwards, and is more or less regularly furcated.

The shape of the vesicles answers quite well to the figures of O. C. SCHMIDT, p. 41, being clavate to subcylindrical with broadly rounded summits and below now and then somewhat narrowed. The wall at the apical end was not much thickened. The vesicles had a length from 550 to 700  $\mu$  and a breadth from about 70 to 300  $\mu$ .

The gametangia are spindle-shaped and either a single one or sometimes 2—4 are present upon the vesicles.

Mauritius: About 1—2 miles S. S. W. of Round Island in 20—22 fathoms, June 27, 1948, F. D. OMMANEY no. 838.

Geogr. Distr.: Wide-spread.

### 3. *Codium bartlettii* Tseng & Gilbert.

TSENG, C. K. and WM. GILBERT, On New Algae of the Genus *Codium* from the South China Sea.

In "Some Mar. Alg. from Mauritius", I. *Chlorophyceæ*, 1940, p. 72, I referred, not without doubt, a fragment of a specimen of *Codium* (no. 334), cast ashore, to *C. elongatum*. Later in 1946 after reexamination of the specimen I changed my determination to *Codium* spec., pointing out that the specimen perhaps was the representative of a new species. In a collection recently received from Dr. VAUGHAN some fragments of a *Codium* (nos. 415 and 529) are contained, the habit and structure of which seem to agree with the specimen (no. 334) mentioned above.

And further in the above quoted quite recently received paper (Sept. 1948, published in 1942) by C. K. TSENG and WM. GILBERT a species of *Codium* is described, namely the above-mentioned one, whose characteristic habit as well as its anatomical structure seems to agree quite well with the plant from Mauritius.

Thus it is said in the description of this species that the forking of the thallus is unequal, one of the branches being less developed, while the other becomes vigorous, continuing with the axis below, and this characteristic feature is also present in the Mauritian plant, giving it a conspicuous unilateral appearance. And the branching of the thallus is divaricate. While in the spe-

cimen cast ashore (compare fig. 25, 1946) the flattened dilatations below the furcations are much developed, these are less developed in the two larger fragments (no. 529), and in a smaller one of another specimen (no. 415), being most probably referable, too, to this species, these dilatations are much developed. In the

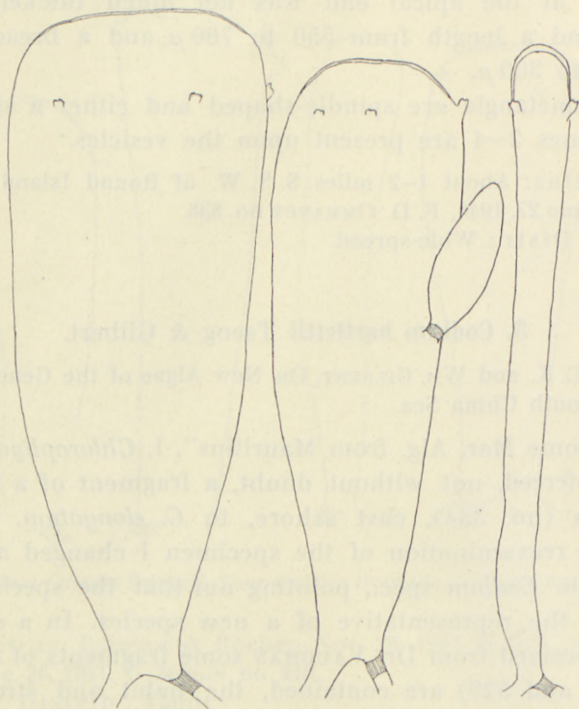


Fig. 12. *Codium bartlettii* Tseng & Gilbert. Some vesicles from the specimen no. 529. ( $\times 75$ ).

latter specimen the thallus has surely also before drying been complanate, as is the case with *Codium bartlettii*, while in the two larger fragments (529) I have been unable to state this, having had only dried material.

Regarding the structure of the specimens the vesicles (Fig. 12) in the small specimen (no. 415) are  $700-1000\mu$  and their breadth from about  $150-350\mu$ , while in the larger specimens (no. 529) their length is from  $900-1200\mu$ , sometimes up to  $1300\mu$  and their breadth from about  $80$  to  $400\mu$ , rarely more, their size thus being a little larger than the measures given in the description of



the species. The vesicles are clavate to subcylindrical, tapering below. The apical ends of the vesicles are broadly rounded, rarely a little depressed in the middle, and the walls are up to about  $8 \mu$  thick and stratified.

The gametangia are spindle-shaped, about  $275 \mu$  long and  $80-100 \mu$  broad; I have seen only a single one upon each vesicle.

All things considered, it seems to me that the Mauritian specimens show a very great likeness to *Codium bartlettii* so that their belonging to this species seems to me very probable.

Mauritius: Ilot Barkly, Oct. 22, 1945, G. MORIN no. 529. Ilot Barkly, July 27, 1945, G. MORIN no. 415.

Geogr. Distr.: Hainan Island and the Philippines.

## PHAEOPHYCEAE

### Dictyotales.

#### Fam. *Dictyotaceæ*.

#### *Dictyopteris* Lamour.

##### *Dictyopteris serrata* (Aresch.) Børgs.

BØRGESEN, F., Alg. Mauritius, 1948, p. 47.

Of this species of which I formerly from Mauritius have seen only a specimen cast ashore collected by DARUTY and without locality, some well preserved material in formol has been received from Dr. VAUGHAN in a recent collection. The species must be presumed to be a deep-sea plant, being found at a depth of 15 fathoms, from where it was brought up on fishing line. This is quite in conformity with JADIN'S observation about its occurrence in Réunion.

Mauritius: One mile S. S. W. of Morne at 15 fathoms, brought up on fishing line. June 18th, 1948, F. D. OMMANNEY no. 837.

# RHODOPHYCEAE

## Nemalionales.

### Fam. *Helminthocladiaceae*.

#### *Liagora* Lamouroux.

##### 1. *Liagora valida* Harv.

HARVEY, W. H., Nereis Bor.-Am., Part II, 1853, p. 138, tab. 31 A. AGARDH, J., Epicrisis, p. 517. Analecta Algol., Contin. III, p. 107. KÜTZING, Tab. Phyc., vol. VIII, tab. 92, I. BØRGESSEN, F., Mar. Alg. D. W. I., vol. II, 1915, p. 70, figs. 71-75, HOWE, M. A., Algae in Britton and Millspaugh, The Bahama Flora, New York, 1920, p. 555.

In some collections of algae recently received from Dr. VAUGHAN some specimens of *Liagora* are contained which are referable to *L. valida*.

Two of the specimens (no. 756) are well prepared and in fine condition, being most probably fragments of the same plant; when examined they turned out to be male plants. As their habit is rather different from the other specimens, these being female ones, I give a short description of them here.

The specimens being without base are about 5 cm high. They are much incrustated with chalk and have a whitish colour with a red tinge with the exception of the upper young tips which are dark-red. The thicker filaments are about  $1\frac{1}{2}$  mm broad, tapering slowly but very little upwards; the tips are subacute. The thallus is repeatedly irregularly furcated; the angles between the branches are about a right one and the length of the internodes varies from 2 to 8 mm. The thallus is terete, subglabrous, becoming very clearly annulated towards the summits; it is very little shrivelled.

The anatomical structure is in good conformity with my description and figures quoted above.

As said above, the specimens are male plants. The large whitish semiglobose, antheridial bodies are terminally placed upon the assimilating filaments formed by the repeatedly forked, upwards tapering filaments, the apical cells being the antheridia (Fig. 13).

The shape and structure of the antheridial bodies are quite in conformity with those pictured by KÜTZING in Tab. Phycol., vol. 8, pl. 92.

Of female specimens being referable to *Liagora valida* I have had several for examination, but most of them are small, surely fragments of larger plants only. Nos. 447 and 450 are both rather alike, having a dark-red colour, only here and there more

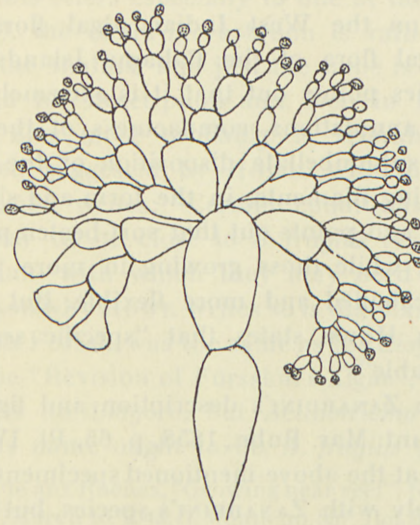


Fig. 13. *Liagora valida* Harv. An antheridial body. ( $\times 660$ ).

whitish. The thallus is in both specimens about  $\frac{3}{4}$ —1 mm thick, no. 447 having a denser ramification with shorter articulations, about 4 mm long, no. 450 being more loosely ramified with longer joints, about 5 mm long. The thallus is much shrivelled in both specimens.

Two small specimens (no. 810), most probably fragments of a larger tuft, have a whitish-red, rather shrivelled thallus.

And finally two fragments of an old plant (no. 857) have a greyish red thallus, much shrivelled and with a gritty surface.

A fine large specimen of *Liagora valida* is found in the Kew Herbarium; it is without locality except Mauritius and was collected by E. B. BLACKBURN, who according to kind information from Miss C. J. DICKINSON, the Kew Herbarium, was Chief Justice in Mauritius between 1824 and 1835.

None of the female plants had any indication of annulation of the thallus. In some of the specimens the carpogonial branch was observed; it was rather curved, much more than those found in West Indian specimens, compare my figures, 1915, figs. 72 and 75 b.

As appears from the above, the specimens I think are referable to this species have rather a variable appearance, so different that one may have a doubt as to their relationship. In this connection I want to make reference to an utterance by the well-known expert on the West Indian algal flora M. A. HOWE, who in his algal flora of the Bahama Islands (1920, p. 555) about this species points out that it is extremely variable as to size and habit, annulations, compactness of the cortex, in the subparallel or subumbellate disposition of the distal branches of the assimilating filaments, in the form and size of peripheral cells and so on, and points out that surf-beaten plants form rigid brittle cushions, while those growing in more protected places are laxer, less calcified and more flexible. But in spite of all these variations HOWE states that "specific segregations seem to be impracticable".

According to ZANARDINI's description and figures of *Liagora rugosa* Zan. (Plant. Mar. Rubr., 1858, p. 65, Pl. IV, fig. 2), it cannot be denied that the above-mentioned specimens from Mauritius agree very closely with ZANARDINI's species, but I have not been able to examine any authentic specimen of ZANARDINI's plant. Dr. JOSEPH DE TONI has most kindly according to my wish made a search for a typical specimen but in vain. But if the small fragments, upon which I in Part III, 1, 1942, p. 30, fig. 14, based the determination, are rightly referred to ZANARDINI's species, then the antheridial bodies, as is seen from my figure, are quite different from those in the present plant. Until a comparative examination of female specimens of both species may bring forward some distinctive characters in their structure, the problem must wait for its solution. To base the determination upon the shape of the cells in the assimilating filaments is not an easy task as the shape of the cells varies much in the different specimens and in the younger and older parts of the thallus.

In Part III, 1, 1942, p. 37, I have referred a few small specimens to *Liagora fragilis* Zan., l. c., 1858, p. 64, Pl. V,

fig. 2. Having now found *Liagora valida* in Mauritius, and after reexamination of the above-mentioned specimens referred to *L. fragilis*, I am convinced that these specimens should be referred to *Liagora valida* and that upon the whole this most probably also applies to the species of ZANARDINI, but to make sure an examination of ZANARDINI's specimens is of course necessary. As said in the description of the specimens from Mauritius, and this refers especially to one of these (no. 818, leg. TH. MORTENSEN), the chalk-incrustation is rather weak in the upper parts of the thallus, and just the same is also pointed out by ZANARDINI in his description and seen in his figure. That *Liagora fragilis* Zan. most probably is referable to *L. valida* has already been suggested by HOWE, who in "The Bahama Flora", Algae, p. 555 writes: "Certain conditions of the species (*L. valida*) appear to be close to *L. fragilis* (Forssk.?) Zanard. and *L. rugosa* Zan. with which they may need further comparisons." The reason why HOWE writes so is that ZANARDINI believed that *Fucus fragilis* Forssk. was the same as his *Liagora fragilis*. As I have stated in the "Revision of Forsskål's Algae", 1932, p. 6, *Fucus fragilis* Forssk. is no *Liagora*, but *Actinotrichia rigida* (Lamx.) Decsne or, as its name ought to be, *A. fragilis* (Forssk.) Børgs.

Mauritius: Pte aux Roches, "Growing near reef", Nov. 17, 1947 R. E. V. no. 756. Ilot Barkly, March 10, 1948, G. MORIN no. 857. Ilot Barkly, "In two feet of water", April 24, 1948, G. MORIN no. 810. nos. 447 and 450 without localities and dates presented by Father C. NEGROLES.

Geogr. Distr.: West Indies, Madagascar, Hawaii.

## 2. *Liagora Jadinii* Børgs.

BØRGESSEN, F., Alg. Mauritius, III, 1, 1942, p. 29, fig. 13. — *Liagora galaxauroides* Dickie, Algae of Mauritius, 1875, p. 195, according to a specimen in the Kew Herbarium.

A specimen determined as above-named by DICKIE is found in the Herbarium of Kew (Fig. 13). An examination of the structure of this specimen has shown that it is the same species as that which I in 1942 described as a new species, giving it the above-mentioned name after the late Dr. JADIN, who not only has examined the flora of Mauritius personally but also published a paper on the algal flora of Mauritius and Réunion.

The reason why it seems to me justifiable to reject DICKIE's name, is that his very short description of this species, and this also applies to the other "new" species of *Liagora* mentioned in his paper, is so insignificant, none of the characteristic features of the species being named in his quite short diagnosis, that in reality any species of *Liagora* may be referred to it. And in my opi-

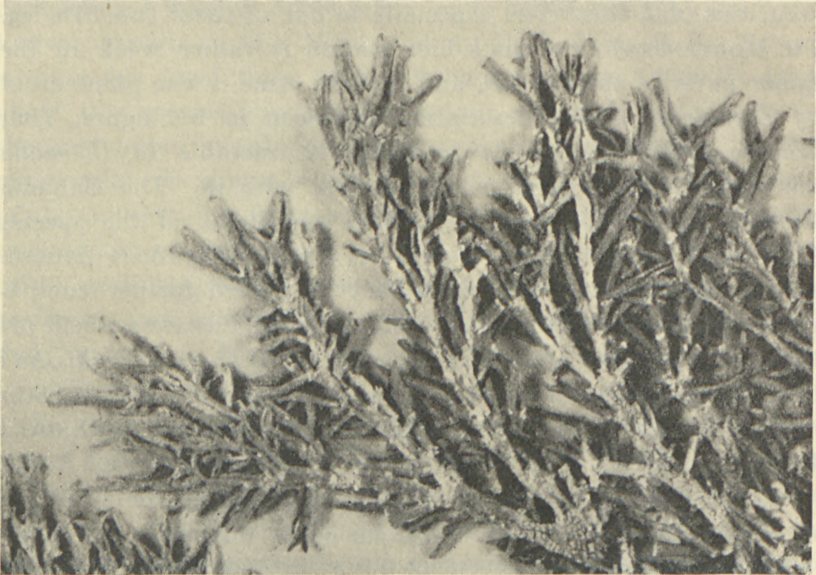


Fig. 14. *Liagora Jadinii* Borgs. Fragment of the thallus. ( $\times 3$ ).

nion a search to account for the specific name of "*galaxauroides*" is likewise fruitless.

In continuation of my former description derived from a single rather fragmentary specimen most probably cast ashore, I shall give some additional remarks on this characteristic and beautiful plant.

The specimen forms a much ramified, ca. 7 cm high tuft. From the basal disc several vigorous main branches issue which near the base are about  $1\frac{1}{2}$  mm broad in a dried condition and somewhat shrivelled. The main branches are recognizable through the whole thallus and give out side branches with branchlets on all sides which are upwards directed, issuing at acute angles. Because of this ramification the thallus when dried gets a feather-like appearance.

The colour of the thallus is red because the long clavate apical cells of the assimilating filaments protrude above the chalk incrustation (Fig. 15 c); farther down in the older parts of the thallus; these die away, and the whitish chalk incrustation is seen.

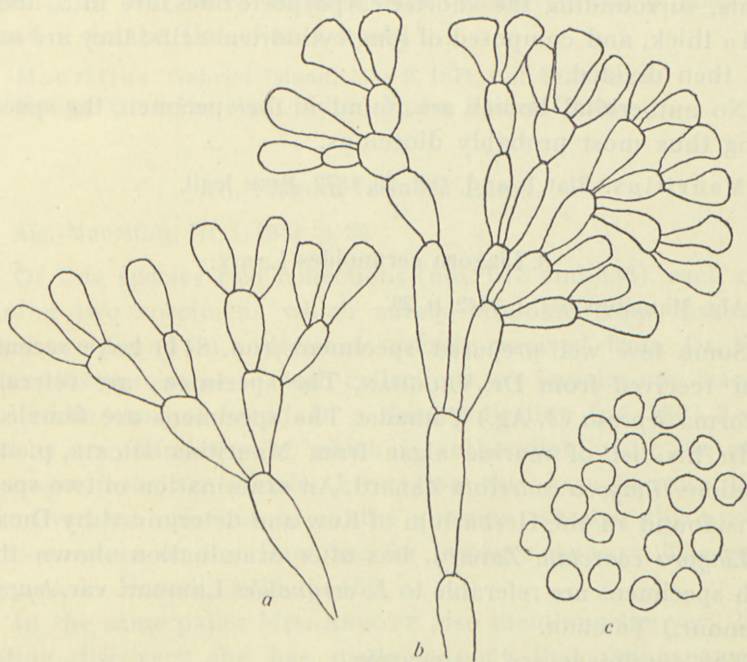


Fig. 15. *Liagora Jadinii* Børgs. a, b, assimilating filaments. c, apical cells of assimilating filaments seen from above. ( $\times 1000$ ).

The surface of the thallus is a little gritty and here and there annulated.

As to the structure of the plant the medullary tissue is composed of ramified filaments of varying thickness from about  $15-40\mu$ . From these filaments the assimilating filaments issue; these (Figs. 15 a, b) are about  $170\mu$  long with long cells below, shorter above, and repeatedly dichotomously divided. The apical cells are elongated clavate when young, becoming more or less broadened out when older. Fig. 15c shows the apical tips above the chalk incrustation, occasionally they become polygonal by mutual pressure. The apical cells may reach a length of up to  $25\mu$  and a breadth of  $12\mu$ .

The specimen is female. I have been unable to find any carpogonial branch in the specimen, but this is pictured in my former paper, p. 30, fig. 13. The gonimoblasts are semiglobose, up to about  $270\mu$  broad. The long sterile assimilating filaments, surrounding the shorter carposporic ones, are thin, about  $3-4\mu$  thick, and composed of long cylindrical cells; they are now and then divided.

No antheridial bodies are found in the specimen, the species being thus most probably dioecious.

Mauritius: Flat Island, Oct. 20, 1872. PIKE legit.

### 3. *Liagora ceranoides* Lamx.

Alg. Mauritius, III, 1, 1942, p. 28.

Some few well-prepared specimens (no. 844) have recently been received from Dr. VAUGHAN. The specimens are referable to forma *leprosa* (J. Ag.) Yamada. The specimens are female.

In his list of marine algae from Mauritius DICKIE, p. 195, mentions *Liagora coarctata* Zanard. An examination of two specimens found in the Herbarium of Kew and determined by DICKIE as *Liagora coarctata* Zanard. has after examination shown that both specimens are referable to *L. ceranoides* Lamour. var. *leprosa* (Lamour.) Yamada.

The specimens are cystocarpic.

Mauritius: Ilot Barkly, March 25, 1948. G. MORIN no. 844. Barkly Island, Jan. 17, 1870. PIKE legit.

### 4. *Liagora pinnata* Harv.

HARVEY, W. H., Nereis Bor.-Americ., II, 1853, p. 138. AGARDH, J., Epicrisis, 1876, p. 517. BØRGESSEN, F., Mar. Alg. D. W. I., 1915, p. 74, figs. 76—81. YAMADA, Y., The Species of *Liagora* from Japan, 1938, p. 27, figs. 17—18, Pl. XI. — *Liagora obtusa* DICKIE, On the Algae of Mauritius, 1875, p. 195.

Two specimens are found in the Herbarium of Kew named by DICKIE *Liagora obtusa* nov. spec. Both specimens are surely referable to *L. pinnata* Harv., even if the structure is much shrivelled; but the characteristic shape of the assimilating filaments was observable. The specimens are cystocarpic; I have been unable to find any of the carpogonial branches.



The habit of the specimens agrees quite well with West Indian ones.

This species, being originally known only from the West Indies, has some few years ago been found in Japan by Yamada 1928, p. 29 and more recently Mrs. ABBOTT (1945, p. 168) has found it in the Hawaiian Islands.

Mauritius: Gabriel Island, May 2, 1871, Col. PIKE legit.  
Geogr. Distrib.: West Indies, Japan, Hawaii, China.

### 5. *Liagora farinosa* Lamx.

Alg. Mauritius, III, 1, 1942, p. 36.

Of this species two collections (nos. 673 and 856), each containing two specimens which surely originate from the same plant are found in collections recently received from Dr. VAUGHAN; the specimens in both collections are female; any trace of antheridia was not found. In a third collection (no. 780) 3 specimens are found one of which is antheridial, while the other two specimens are female. I mention this here because there are divergent opinions as to the question whether this species is monoecious or dioecious; see for instance ABBOTT, The genus *Liagora* in Hawaii, 1945, p. 166.

In the same paper Mrs. ABBOTT also mentions the very interesting discovery she has made, namely that monosporangia develop in the apical cells of the assimilating filaments; compare her figures 14 c and d. This observation I have been able to check in material preserved in formol and seawater quite recently received from Mauritius.

The occurrence of monosporangia in this species is also of distinct interest because *Liagora farinosa* is one of the species in which occur the small peculiar endophytic bodies, as I presume they are, (compare Mar. Alg. D. W. I., 1920, pp. 455—8, fig. 421, and Alg. Mauritius, III, 1, 1942, p. 34, fig. 17), while M. A. HOWE was of opinion that they belonged to *Liagora* itself being "monosporangial discs" of this genus (see HOWE, M. A., Observations on Monosporangial Discs in the Genus *Liagora* in Bullet. Torrey Bot. Club, 47, 1920. The fact that monosporangia develop in the above-mentioned manner in this genus, in conformity with what takes place in *Scinaia* according

to SVEDELIUS, seems to me to go to show that these small peculiar bodies, as was my opinion, have no organic connection with the host plant, but are facultative endophytes.

I have not found the apical hairs issuing from the tips of the assimilating filaments in West Indian (BØRGESSEN, 1915, p. 68, fig. 68a) as well as in Canarian specimens (BØRGESSEN, 1927, p. 61, fig. 33a) in the specimens from Mauritius.

In his list (1875, p. 195) DICKIE mentions *Liagora pulverulenta* Ag. Two specimens in the Herbarium of Kew determined by DICKIE as *L. pulverulenta* Ag.? have after examination turned out to be *Liagora farinosa* Lamour. One of the specimens is female, the other seems to be sterile.

Then *Liagora lurida* Dickie (l. c.), of which a specimen is found in the Kew Herbarium, is likewise *Liagora farinosa*. This has previously been stated by HOWE (1920, p. 555) and later by YAMADA (1938, p. 24).<sup>1</sup> Of this plant, being rather deviating from the typical form, YAMADA in his paper Notes on *Liagora* (1938, in Japanese, not received from the author until Dec. 1948) gives an illustration from a specimen preserved in the British Museum, London. It shows a plant with 3—4 or even longer terminal, not ramified branches, about 1½ mm thick, spreading out in all directions and tapering upwards to acute apices. A specimen in the Kew Herbarium determined by DICKIE as *L. lurida*? is somewhat more similar to the ordinary form. Because of its rather deviating appearance and also because the assimilating filaments are somewhat broader than those in the typical one, this form perhaps ought to be kept as a special forma *lurida* Dickie. In the material I have received from Mauritius I have not yet met with it.

And finally DICKIE in his list has described as a new species *Liagora crassa*, of which a specimen likewise is found in the Kew Herbarium; as already mentioned by HOWE (l. c.) and YA-

<sup>1</sup> Being unable during the War to see the specimens of *Liagora* determined by DICKIE and preserved in the Kew Herbarium I, because of the specific name of DICKIE's species and the very short and in part quite misleading diagnosis in which for instance is said: "crusta calcarea fere nulla", came to the supposition that a specimen received from Mauritius and collected by PIKE was this species; see Alg. Mauritius, III, 1, 1942, p. 40, Pl. I. Having now been able to see the specimens in the Kew Herbarium, I find that the one I received from Mauritius, is clearly another plant; because of its poor condition it has not yet been determined.

MADA (l. c.), this species is likewise referable to *L. farinosa*. The specimen is rather fragmentary, bleached and flabby, and has most probably been cast ashore. The filaments are about  $\frac{3}{4}$  mm thick, the internodes are short and the upper ramula curved. An examination of the structure shows that the assimilating filaments are short with short and very thick cells about  $28\mu$ . But as to the possibility of considering it as a special form, more and better material is necessary.

Mauritius: Ilot Barkley, May 10th, 1948, G. MORIN no. 856. Pointe aux Sables, April 2, 1947, G. MORIN no. 673. Port Louis, "In Lagoon near Fort George", March 2, 1948, G. MORIN no. 780.

The above-mentioned specimens referred by DICKIE to *Liagora pulverulenta* and *L. lurida*, respectively, are from Cannonier's Point, May 6, 1871, and collected by PIKE, and *Liagora crassa* Dickie is from Flat Island, May 12, 1871, PIKE legit.

## Galaxaura Lamouroux.

### Sectio 1. *Subverticillatae* Chou.

(*Rhodura* Kjellm.)

#### 1. *Galaxaura mauritiana* nov. spec.

Thallus ad substratum disco adfixus, ca. 5—6 cm altus, fruticosus, teres, villosus, filis assimilatoribus sparsis aut plus minus indistincte in verticillas dispositis praeditus, ramosus et articulatus.

Rami ca.  $1\frac{1}{2}$  mm lati, irregulariter di—trichotome divisi, internodiis 4—8 mm longis.

Medulla e filis, ca. 8— $12\mu$  latis, irregulariter intertextis, sine aut versus exteriorem partem sparse incrustatione calcis intermixtis formata.

Tela peripherica e calce uberiore incrustata, e filis assimilatoriis duplicis generis, elongatis et curtis, composita; cellulis sustentibus filorum plus minus bene evolutis, interdum destitutis.

Fila elongata ca. 1 mm longa, simplicia aut raro ramosa, e cellulis basalibus late oblongis, ca. 50— $90\mu$  longis et 30— $50\mu$  latis, dein e cellulis cylindricis ca.  $20\mu$  latis et  $38\mu$  longis composita.

Fila curta e cellulis binis, ternis vel quaternis formata, cellulis basalibus majoribus, oblongis ca. 40—70  $\mu$  longis et 35—45  $\mu$  latis, versus apicem cellulis sequentibus attenuatis et minoribus cellulis apicalibus subglobosis aut elongatis ca. 25  $\mu$  latis formata.

Mauritius: Cassis, Febr. 2, 1946, leg. G. MORIN no. 528. Trou d'Eau Douce, March 22, 1947, R. E. V. no. 668. Pointe d'Esny, Aug. 17, 1907, R. E. V. no. 718. The specimens in the Kew Herbarium are from Flat Island, May 12, 1861. PIKE legit.

Some specimens of *Galaxaura* recently received from Mauritius are referable to the section *Rhodura* Kjellm. or the *Subverticillatae*, the name Mrs. CHOU (1945, p. 57) has proposed for this section. Three different gatherings are present, each containing 1—3 specimens. As to their habit they are all rather alike, having a dark reddish-brown colour. They are all irregularly furcated and the whole thallus is densely covered with assimilating filaments. Collection no. 718 contains 3 specimens; these differ somewhat from the other two by being a little slender with somewhat denser ramification and of a little darker colour than these of the two remaining collections, of which no. 528 contains a single specimen only and no. 668 two specimens. The number of specimens is of course small, for a decision of the question of their pertaining together or not, but since their anatomical structure has been found to be very alike, I think they are referable to the same species.

The thallus in the specimens is 5—7 cm high, attached to the substratum by a disc; it is evenly villous, irregularly subdichotomously divided with internodes of varying length from  $\frac{1}{2}$ —1 mm. The long assimilating filaments are evenly distributed over the surface of the thallus, in places with a tendency to become subverticillate. They have a length of about 1 mm or a little more and a breadth of 18—20  $\mu$  with cells about 38  $\mu$  long. The filaments in most cases are undivided; in no. 528 a good number were divided.

The supporting cells,<sup>1</sup> in the long as well as in the short assimilating filaments are of very variable shape (Fig. 16), sometimes irregularly polygonal, sometimes roundish, sometimes nearly wanting; the tumid basal cell is about 57—76  $\mu$  long and 46—53  $\mu$  broad. The cell above the tumid basal cell in the long assimilating filaments is a little inflated and a little shorter than the following cylindrical ones.

<sup>1</sup> As to the terminology compare Mrs. CHOU, 1945, p. 38, fig. 1.

The short assimilating filaments (Fig. 16 b, c, e, f, g, h) are dispersed among the long ones, but in a smaller number. They are composed of 2—4 cells; those with 3 cells being the commonest, but those with 4 cells are not rare, those with 2 cells rarest. In the 4-celled filaments the apical cell is subglobose about  $20\mu$  long and broad, the subapical cell is a little broader and especially longer, the following cell yet more lengthened, the length of the whole

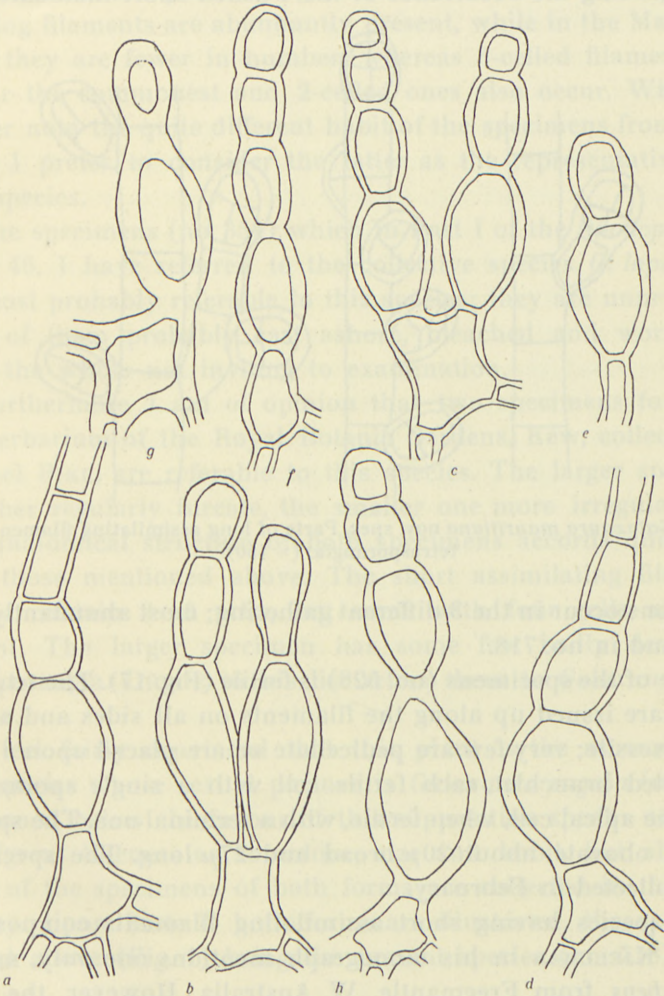


Fig. 16. *Galaxaura mauritiana* nov. spec. a, d, basal parts of long assimilating filaments; the remaining figures of short assimilating filaments composed of 2—4 cells; a—c from no. 718; d—f from no. 668; g, h from no. 354. ( $\times 330$ ).

filament reaching up to about  $150\mu$ . In the 3-celled short filaments the cells are in most cases much elongated, the whole filament reaching about the same length as that of the 4-celled ones. And in the case of the filaments with 2 cells only the cells become yet more lengthened, the filament reaching a length of up to  $140\mu$ . Compare for instance Fig. 16b in which the basal cell is  $90\mu$  long and the apical one  $49\mu$ .

Regarding the occurrence of the 4-celled short filaments some

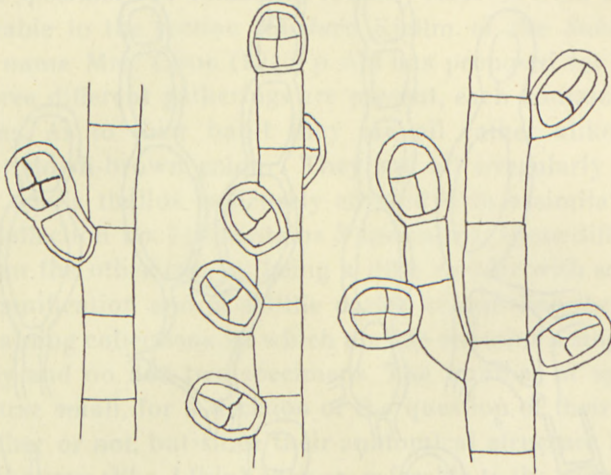


Fig. 17. *Galaxaura mauritiana* nov. spec. Parts of long assimilating filaments with tetrasporangia. ( $\times 450$ ).

variations occur in the 3 different gathering; most abundantly they are found in no. 718.

One of the specimens (no. 528) is fertile (Fig. 17). The tetrasporangia are issued up along the filaments on all sides and almost all are sessile; very few are pedicellate or are placed upon a short two-celled branchlet, each fertile cell with a single sporangium only; the apical cell, when fertile, with a terminal one. The sporangia are obovate, about  $20\mu$  broad and  $27\mu$  long. The specimens were collected in February.

Of species having short assimilating filaments composed of 4 cells KJELLMAN in his monograph mentions one only, namely *G. collabens* from Fremantle, W. Australia. However, the habit figure (Pl. 20, fig. 15) of the specimen upon which KJELLMAN based his description shows a plant very different from the

specimens from Mauritius. We have here in the Botanical Museum a specimen of HARVEY'S Alg. Austral. no. 350 from Fremantle, W. Austral., from which locality KJELLMAN'S species originates. This specimen as to habit is quite like KJELLMAN'S figure, showing a plant with extended branches with long internodes and more or less distant ramification, thus differing very much from the plant from Mauritius. Furthermore an examination of the Australian plant brings out that the 4-celled short assimilating filaments are abundantly present, while in the Mauritian plant they are fewer in number, whereas 3-celled filaments are by far the commonest and 2-celled ones also occur. When we further note the quite different habit of the specimens from Mauritius I prefer to consider the latter as the representative of a new species.

The specimens (no. 354) which in Part I of the *Rhodophyceae*, 1942, 46, I have referred to the collective species *G. lapidescens* are most probably referable to this species; they are unprepared, most of them probably cast ashore, bleached and worn, and upon the whole not inviting to examination.

Furthermore I am of opinion that two specimens found in the herbarium of the Royal Botanic Gardens, Kew, collected by Colonel PIKE, are referable to this species. The larger specimen is rather regularly furcate, the smaller one more irregularly so. The anatomical structure of both specimens accords quite well with those mentioned above. The short assimilating filaments mostly contain 2—3 cells, but some with four cells are also present. The larger specimen has some few badly developed tetrasporangia. DICKIE in his list refers them to *Galaxaura lapidescens*.

I feel fairly convinced that this plant is the asexual form of a species whose sexual partner is *Galaxaura rugosa* (no. 720) mentioned below. In favour of this supposition speaks not only their great likeness as to colour, size and habit, but also that some of the specimens of both forms are collected in the same locality. Upon Plate II both forms are illustrated, the specimen figured above (Fig. 1) being the present species (no. 718).

## Sectio 2. *Squalidae* Chou

(*Microthoë* Kjellm.).

### 2. *Galaxaura rugosa* (Solander) Lamour.

Alg. Mauritius, III, 1, 1942, p. 48.

Some more material referable to this polymorphic species has recently been received from Dr. VAUGHAN.

Some of the specimens (no. 702) form dense bushes about 5–6 cm high; their colour is dark reddish-brown. They are repeatedly but irregularly furcate, above more or less umbellate. The upper parts of the thallus is glabrous and very clearly annulate, in a dried condition being much collapsed. Further down in the thallus, where the lime incrustation is more vigorous, the branches do not collapse; here more or less annularly arranged assimilating filaments cover the thallus rather densely. The thallus is about  $1\frac{1}{4}$  mm thick.

As compared with West Indian specimens of *Galaxaura rugosa* the thallus in the plant from Mauritius is a little thicker and the annulation of the thallus perhaps somewhat more vigorous; but most different is the colour, which in West Indian specimens in most cases is a dirty greyish-green.

And when compared with a fragment of a specimen from the Philippines which Mrs. CHOU (1947, p. 13, pl. IV, figs. 11–13 and pl. X, fig. 2) refers to *Galaxaura rugosa* and of which Professor W. RANDOLPH TAYLOR most kindly has sent a fragment to me, its likeness to the Mauritian specimens, having likewise a vigorously annulated thallus, is very striking. As to the species of the group *Microthoë* (or *Squalidae* as Mrs. RUTH CHOU proposes this group of KJELLMAN to be named) enumerated by TANAKA in his paper on The Japanese Galaxaura, the plant from Mauritius seem to come nearest to *G. cuculligera* Kjellm.,<sup>1</sup> but this is densely villous below, which the plant from Mauritius is not.

<sup>1</sup> Mrs. CHOU (1947, p. 10) having examined a great number of specimens of related forms does not adopt this species, as according to her the cucullate condition is due to external conditions; she refers her specimens to *G. squalida*.



The specimens are female. These specimens according to my view are to be considered the sexual form of *Galaxaura mauritiana* mentioned above. As stated there, I base my opinion not only upon their habit, size, and colour, which are all much the same as in *G. mauritiana*, but some of the specimens were also gathered in the same locality. The plant was "growing on sand flats exposed at low tide".

A specimen of this form (no. 702) is illustrated in Plate II, fig. 2, together with its supposed asexual partner, fig. 1.

Another specimen (no. 541) is also referable to this polymorphous species. Two fragments are found, both originating from the same plant. The thallus of this specimen is bigger and the branches broader, at least  $1\frac{1}{2}$  mm, reaching a little more than 2 mm in a pressed condition. Its colour is greyish with a reddish tinge. It is clearly annulate in the younger parts of the thallus, less or not at all in the older ones. The thallus is glabrous in the young parts and in the parts below, while the middle is covered by short assimilating filaments. It is thus rather different from the above-mentioned form and most probably the sexual partner of another form or species, the asexual representative being as yet unknown.

Mauritius: Pointe aux Cannoniers, Febr. 16, 1946, R. E. V. no. 541.  
Pointe d'Esny, Aug. 18, 1947. R. E. V. no. 702.

### Sectio 3. *Oblongatae* Chou.

(*Eugalaxaura* Kjellm.).

#### 3. *Galaxaura oblongata* (Ellis et Sol.) Lamx.

Alg. Mauritius, III, 1, 1942, p. 49.

In some collections recently received from Dr. VAUGHAN a few well-prepared specimens (nos. 579, 689, 827) of this species are contained. These specimens as to their habit, size, and ramification are all in good conformity with the specimens of this species I have collected at the Canary Islands and with specimens from the West Indies which the late Dr. HOWE has pre-

sented to me. But they are also as to habit in good agreement with some few specimens of *Galaxaura fastigiata* Decsne which Dr. TANAKA has presented to me; this species, if it is to be kept separate from *C. oblongata* at all, was originally described upon specimens from the Philippines and is common for instance in the warmer parts of Japan according to TANAKA, The Genus *Galaxaura* from Japan, 1937, p. 157.

Professor SVEDELIUS some years ago when working at his material of *Galaxaura* from Ceylon, sent a specimen of his collection to me asking for my opinion about it, and after a comparison with specimens of *G. oblongata* in my herbarium I came to the result that it was referable to this species. Meanwhile SVEDELIUS in his important paper Critical Notes on some species of *Galaxaura* from Ceylon, 1945, p. 39 maintains *G. fastigiata* as a species, referring the above-mentioned specimen to this species.

SVEDELIUS bases his construction essentially upon anatomical characters, viz. the different way in which the lime incrustation is carried out, having examined not only his own material from Ceylon, but also the material found in the herbaria of Uppsala, Stockholm, and Lund. As to the species in question and related forms he distinguishes a "*Galaxaura fastigiata*-type" with strong calcification in the assimilating tissue only, and a "*G. oblongata*-type" with less calcification in the assimilating tissue and close to this a calcified zone of varying strength in the medulla.

An examination of the three specimens recently received from Mauritius has brought out that in two of these, nos. 519 and 827, some chalk incrustation was present also inside the peripheral layer, while in no. 689 no lime incrustation was found in the medulla, this latter specimen thus in this respect being in agreement with the *fastigiata*-type. Most regrettably any more exact statement about the external surroundings in which the specimens from Mauritius were found is not given, and as these, according to my experience, highly influence the development of the lime incrustation, it would have been of much interest to know if no. 689 was found in a locality in which the external conditions were different from those in which the other two specimens occurred. It admits of no doubt whatever that the lime incrustation is greater in specimens growing in exposed and

sunny localities and less in sheltered and shaded places.<sup>1</sup> As, further, the extent of chalk incrustation is different in younger and older parts of the thallus, the use of the lime incrustation as a specific character may be difficult to rely on.

As said above, SVEDELIUS based his examinations upon his own collections and upon specimens found in the herbaria. SVEDELIUS collected the specimens which he referred to *G. fastigiata* only in one locality in Ceylon and describes this in the following way (l. c., p. 28): The specimens "formed hemispherical balls" . . . . . "They were either lying loose or slightly attached to the rather soft bottom of sand and coral-mud." Such a locality for *Galaxaura oblongata* (or related forms), which is a plant growing on rocks in exposed places, must surely highly influence the habit and structure of the specimens, these most probably being detached specimens afterwards cast ashore and gathered in a sheltered place. How short or long they have stayed there, we do not know, but it cannot be doubted that the structure of the specimens and in connection with this the chalk-incrustation is gradually changed.

According to my view it is no wonder that the chalk incrustation is less here and has not entered the medulla. Otherwise SVEDELIUS bases his observations upon specimens preserved in herbaria, where in most cases no observations about the localities are found.

While TANAKA in his valuable paper (1936, p. 157) on the Japanese species of *Galaxaura* does not enter upon a comparison between *G. fastigiata* and *G. oblongata*, referring without discussion the Japanese specimens of this group to the first-mentioned species, Mrs. RUTH CHOU in her elaborate paper of 1947, p. 7, refers her large collection of specimens of this species to *G. oblongata*. Mrs. CHOU bases her thorough examination upon a very large collection originating from the Philippines and a great many localities in the Pacific and arrives at the result that the specimens in her collection are referable to *G. oblongata* in spite of the fact that the Philippine Islands are the type region of *G. fastigiata*.

But she adds that *G. oblongata* as interpreted by her "may in future turn out to be a species complex, embracing the sexual phases of more than one species or perhaps the species of a

<sup>1</sup> Compare what is said (p. 28 in this paper) about *Liagora valida* regarding the chalk incrustation in this species.

distinct genus or subgenus with several haplobiontic species", and she adds "that at present it is not possible to segregate them".

It is a great pity that Mrs. CHOU's and Professor SVEDELIUS's papers appeared at about the same time, so Mrs. CHOU has been unable to benefit by the observations of SVEDELIUS, when working out her large collections of *Galaxaura*.

Mauritius: Gris-Gris near Souillac, 20. June 1946, R.E.V. no. 579. Pointe aux Roches, 3 May 1947, "upon reef", R.E.V. no. 689. Ilot Barkly, 24 March, 1948, "in shallow water" R.E.V. no. 827.

### *Galaxaura pilifera* Kjellm.

Alg. Mauritius, III, 1, 1942, p. 51, fig. 23.

From Dr. VAUGHAN I have received a single but well-prepared specimen of this species of which I formerly have seen only a bleached specimen, most probably cast ashore. It forms a rather loose, roundish tuft reaching a height of about 10 cm. The ramification is repeatedly subdichotome, giving the branch-systems a marked umbellate appearance. Fig. 23 l. c. does not show this quite well. The thallus is rather soft and fragile because of the less chalk-incrustation, most of the joints being longitudinally shrivelled with the exception of the basal ones. The colour is a greyish yellow-green. The joints not shrivelled are about  $1\frac{1}{4}$ — $1\frac{1}{2}$  mm broad. The upper joints are rather clearly annulately constricted.

Neither in this specimen I have been able to find any assimilating filaments, which KJELLMAN alludes to not only in the specific name, but also mentions in his description and pictures. SVEDELIUS (1945, p. 46), having examined the type specimen of KJELLMAN collected by PIKE at Barkley Island, Mauritius, did not find any assimilating filaments in the specimen either. The statement of their presence in this species must therefore be presumed to be due to a mistake.

According to SVEDELIUS this species completely resembles *G. constipata* Kjellm. from Vera Cruz. I have not seen any specimens of this species. KJELLMAN himself compares it with *G. cylindrica* (Sol.) Kjellm. to which species *G. pilifera* also shows much likeness, having nearly the same ramification and colour, but the thallus of *G. cylindrica* is slender, the ramification denser and the filaments do not shrivel so much as is the case in *G. pilifera*.

SVEDELIUS refers this species to *G. fastigiata* Decsne because of the lime incrustation being restricted to the assimilating tissue. I prefer to leave it as a separate species; when it is compared with specimens of *C. fastigiata* from Japan received from Dr. TANAKA, these are in all respects smaller, the joints about 1—1¼ mm broad, and the thallus, being strongly calcified, does not shrivel so much.

The specimen is a female one.

Mauritius: Ilet Barkley, Oct. 10, 1945, G. MORIN no. 663.

#### *Sectio 4. Vepreculae* Kjellman.

##### *Galaxaura veprecula* Kjellm.

KJELLMAN, F. R., *Floridé-Slægtet Galaxaura*, p. 80. CHOU, R., *Pacific species of Galaxaura*, II, *Sexual Types*, 1945, p. 16, pl. 6, figs. 1—8; pl. 12, fig. 1.

In Part III, *Rhodophyceae* 1, 1942 of this publication, p. 51—58, when making suggestions of the supposed mutual connection of the asexual and sexual forms of the species found in Mauritius, I inquired (l. c., p. 58) after the sexual component to the tetrasporic *Galaxaura tenera* Kjellm. already found in Mauritius (l. c., p. 52). This has now been found as a single specimen in the Herbarium of Kew, being referable to *Galaxaura veprecula* Kjellm. must be supposed to be the sexual form of *G. tenera*.

The specimen was by DICKIE (1875, p. 195) determined as *G. canaliculata* Kütz.

As to the anatomical structure of the specimen, it agrees quite well with the description of KJELLMAN, the West Indian plant I called *G. occidentalis* (1916, p. 109), and with Mrs. CHOU's description.

As far as I have seen the specimen is sterile.

Mauritius: Without locality, Aug. 1878, PIKE legit (Herb. Kew).  
Geogr. Distr.: Madagascar, Philippine Islands.

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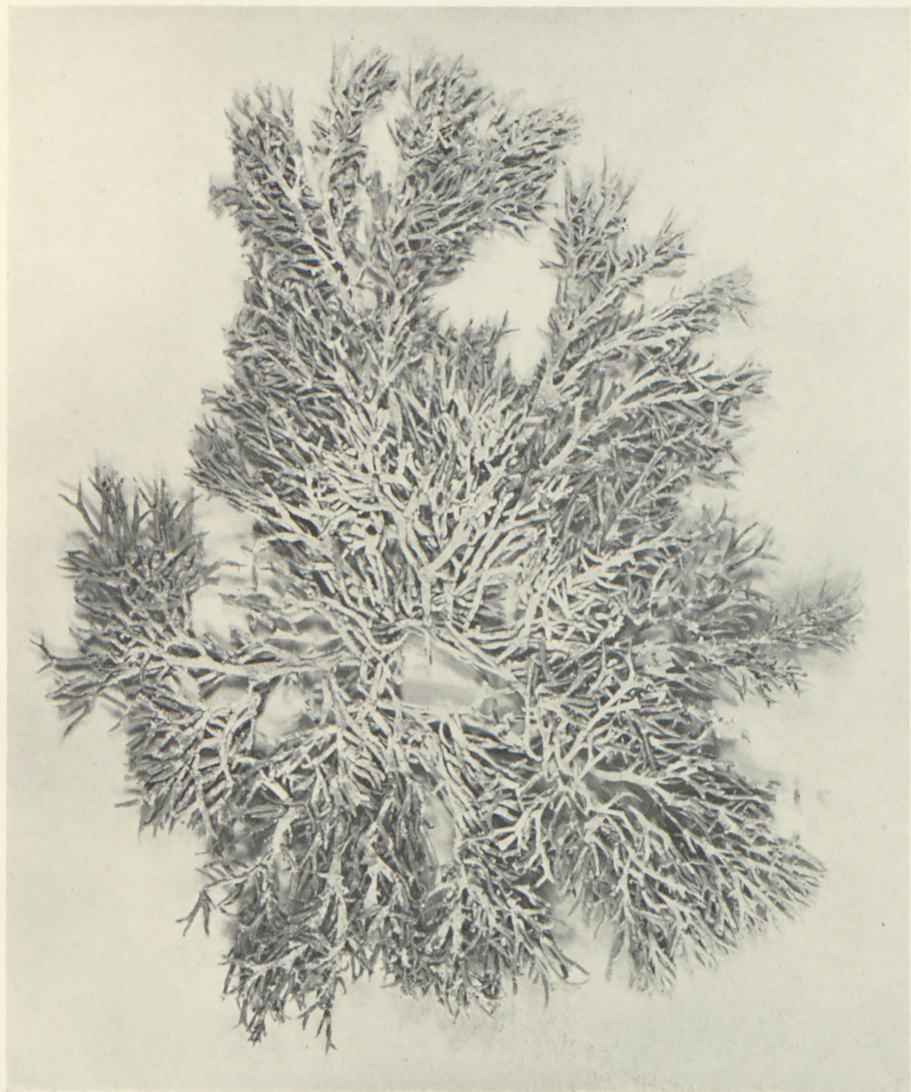
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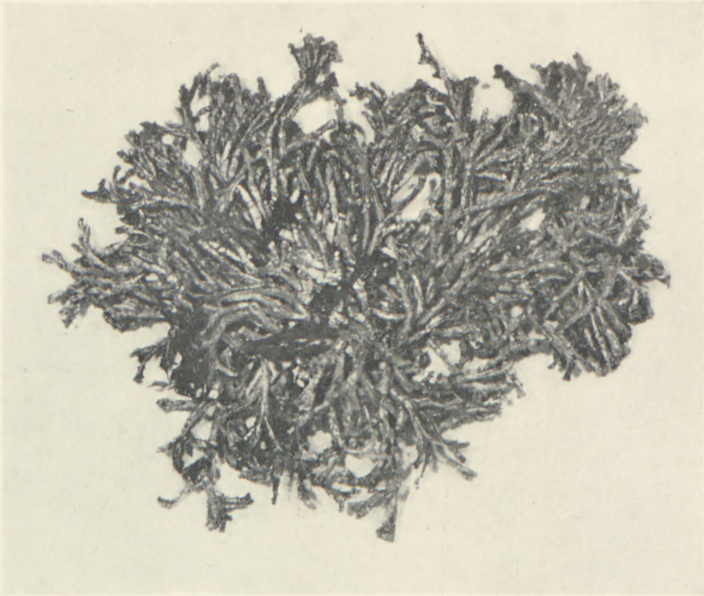
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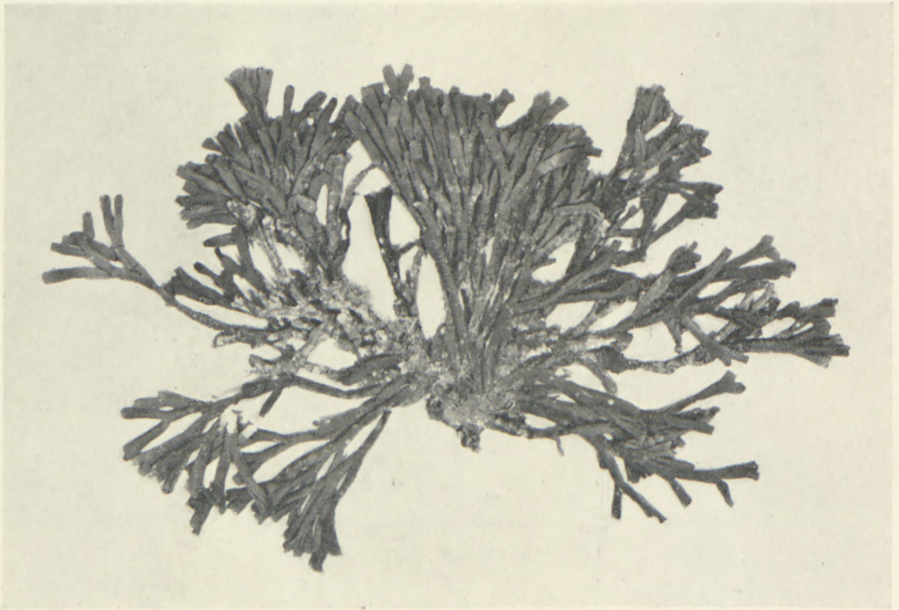




*Liagora Jadinii* Börgs. ( $\times 1$ ).



1. *Galaxaura mauritiana* nov. spec. ( $\times \frac{2}{3}$ ).



2. *Galaxaura rugosa* (Lol.) Lamour. The supposed sexual form of *Galaxaura mauritiana*. ( $\times \frac{2}{3}$ ).