SUBAËRIAL ALGAE FROM SOUTH AFRICA

BY

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WITH 14 PLATES

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General Remarks.

With regard to algae, South Africa — as well as all the rest of this continent — is rather incompletely known. The most momentous contributions to our present knowledge of the freshwater algae here are of comparatively recent date, viz. FRITSCH, A First Report on the Freshwater Algae, mostly from the Cape Peninsula (Annals of the South African Museum, Vol. IX, 1918). As the author here mentions the few earlier works treating of the algal vegetation of South Africa, I need in the present case only refer to this treatise.[1]) All these earlier works, however, only deal with the freshwater algae, the true subaërial algae being totally left out of consideration, and thus the subaërial algae of this continent have been absolutely unknown till now. Our knowledge of the subaërial algae of the southern hemisphere is, on the whole, extremely scanty, and excepting one family only, the *Trentepohliaceae* — which has been examined by various investigators as SCHMIDLE, KARSTEN, DE WILDEMAN, and some others — our knowledge of the subaërial algae of the southern hemisphere is very sparse and accidental.

Under these circumstances it was with particular interest I undertook the examination of quite a considerable collection of subaërial algae in the possession of the Botanical Museum of Kristiania. This collection — 403 samples in all — chiefly consisted of pieces of bark, samples of wood, and the like, collected for the Botanical Museum by ØRJAN OLSEN, lecturer on zoology at the University of Kristiania, during a sojourn in South Africa in the years 1912—1913. The collection was made party in the environs of Durban, on the east coast, in the period Oct. 24th—Nov. 17th, 1912, partly on the west coast, in the environs of Saldanha Bay, in the period March 10th—19th, 1913.

A list of the samples follows below:

No. 1—10. Close by the shore, at the South African Whaling Company's station, Bluff, Durban, in dense wood, ... Oct. 24th, 1912

[1]) While this paper was being printed, FRITSCH together with Miss E. STEPHENS published a new contribution to our knowledge of the freshwater algae of Africa: Freshwater Algae (exclusive of Diatoms), mainly from the Transkei Territories, Cape Colony. (Transactions of the Royal Society of South Africa, Vol. IX, Cape Town 1921). I mention the above work in this way for the sake of completeness.

Nr. 11—15.	In the same place, ...	Oct. 25th, 1912
» 16—23.	In the same place, ...	» 27th, »
» 24—27.	Above Bluff, at the Signal Station, at the entrance of the harbour of Durban, ...	» 28th, »
» 28—37.	On trees and pieces of wood near the ocean, south of the Whaling Station, Bluff, ...	Nov. 3rd, »
» 38—53.	On trees along Bluff Railway Line, towards Eastern Co., near the ocean,....	» 8th, »
» 54—59.	On trees in the garden of Umgeni Hotel, Umgeni River, north of Durban, ...	» 10th, »
» 60—87.	On trees at Umbilo River,..............	» 12th, »
» 88—184.	From various localities above Bluff (in dense wood), along he cross-road to the South African Whaling Co.'s station,..	» 13th, »
» 185—320.	From the forest above Bluff, between the South African Whaling Co.'s station and Isipingo Kraales, ...	» 17th, »
» 321—353.	From trees, shrubs, etc., at Ostenwald, Saldaha Bay, ...	March 10th, 1913
» 354—373.	From the «bush», on the peninsula between Donkergat and Jutten Island, Saldanha Bay, Cape Colony, ...	» 11th, 1913
» 374—403.	From the water-place, Saldanha Bay, ..	» 19th, »

It appears from this that the samples were collected within rather small and limited territories and in the course of a short period, and it was to be expected beforehand that the material would be somewhat homogeneous. At the same time the number of the samples was so large, however, that the account I intend to give in the subsequent pages of this paper, is supposed to be a fairly complete survey of the composition of the subaërial algal flora of the said places.

When compared on the basis of the material at hand, it will immediately be seen that the neighbourhood of Durban is much richer in subaërial algae than Saldanha Bay. All of the species given thus occur at Durban, while only few of them have been observed at Saldanha Bay. This, of course, is a consequence of the climatic conditions, being damp and tropical at Durban, while Saldanha Bay has a dry, desert climate. In my samples there are only two species that can be designated as really common at Saldanha Bay, viz. *Chlorococcum vitiosum* nov. spec. and *Pleurastrum lobatum* (CHODAT) PRINTZ. Besides, there occur more sparsely *Phycopeltis flabelligera* and *Ph. arundinacea,* while all the rest observed here, are very rare.

Thus, the flora of subaërial algae at Saldanha Bay is poorer both in quantity and quality. The fact that the same species are to be found both at Durban, which is a damp place, and at Saldanha Bay, with a very dry climate — two places being also very far apart — allows the conclusion that the composition of the subaërial algal vegetation is rather homogeneous over large parts of the South African continent, and mainly conformable to the following treatment.

As compared with the freshwater algae, it is only a very inconsiderable number of species and genera that occur as true aërophilous algae, — that is, algae which are reduced to cover their consumption of water by absorbtion of atmospheric moisture, and which survive the usually frequent dry periods, on which they are conditional by their mode of living, without undergoing any particular resting stages.

In my material from South Africa I have been able to discriminate 22 different species, 11 of which, or precisely one half, are new ones. 5 of them even belong to genera, hitherto unknown. This result is not surprising, considering our extremely slight knowledge of the subaërial algae of the southern hemisphere. In addition to these were further encountered three species which were not present in sufficient material for adequate determination.

If compared on the basis of the present material, the flora of subaërial algae in South Africa will be seen to have a comparatively small number of species in common with the one occurring in northern Europe, viz. *Chlorella vulgaris, Pleurastrum lobatum, Stichococcus variabilis, Hormidium flaccidum, Trentepohlia aurea, Tr. umbrina,* and *Dactylococcopsis rhaphidioides.* In the main features, however, the g r o w t h-f o r m s a r e i d e n t i c a l i n t y p e, but the bulk of the constituents belongs to other genera and species — t h e f l o r i s t i c c o m p o s i t i o n b e i n g r a t h e r d i f f e r e n t. A comparison of the freshwater algae from the said places, on the other hand — if. e. g. the species from South Africa, given by Fritsch, l. c., are compared with the species occurring in northern Europe — will evince a much closer conformity.

Among phycologists the apprehension is generally reigning, that the tropics are more deficient in freshwater algae than e. g. the temperate zones. Whether they are absolutely right, I somewhat doubt, however. It must be kept in mind that by far most of the collections of algae brought home from the tropics, have been collected by travellers, who have been mainly interested in other branches of science, and that the collections thus ought to be considered as rather accidentally brought together, and not giving any exhaustive idea of what is really to be found in the places. Further, for a successful collection of freshwater algae is needed not a small amount of experience. I therefore at present consider the accounts of the supposed sparsity of freshwater algae in the tropics as not yet quite established.

There is no doubt, on the contrary, that the tropics — where the climate is not too dry — have a far richer vegetation of subaërial algae than the temperate zones. It is particularly the *Myxophyceae* that are reported to be dominating, while the *Chlorophyceae* are playing a more modest part. On this comp. e. g. FRITSCH, A General Consideration of the Subaërial and Fresh-water Algal Flora of Ceylon. A Contribution to the Study of Tropical Algal Ecology (Proceed. Royal. Soc. Vol. 79, 1907) and WILLE, Report on an Expedition to Porto Rico for collecting Fresh-water Algae (Journ. New York Bot. Garden, 1915). It is therefore not superfluous to point out especially that the bulk of the algae that occur in the samples from South Africa, examined by me, are *Chlorophyceae,* while the *Myxophyceae* have been observed only in a few samples, and in none of them in any particular abundance. Thus, the total number of the *Myxophyceae* observed is only 5. The possibility is not precluded, however, that this, partly at least, may be due to the collecting.

As is well known, the freshwater algae evince, on the whole, a striking cosmopolitanism in their distribution, a natural consequence of the uniform character of the surroundings. On the other hand, it is to be expected that the various subaërial algae — though they are at least as easily spread by their akinetes, aplanospores, and in other ways — like the terrestrial flora on the whole, will appear to be more directly dependent on the climatic conditions, as dampness of the air, temperature, wind, size of the amplitudes, etc. As to the demands of life of the algae, their conditions in air will be exposed to greater variations than in water in the same places. It does not therefore follow that the freshwater algae are quite independent of the environments, but here, no doubt, the chemical and physical states of the water take a vital part. In an earlier paper: Kristianiatraktens Protococcoideer (Kristiania Videnskabsselskabs Skrifter, 1914), I have, by the way, pointed out the rather essential difference in the composition of the algal vegetation of the tracts west of Kristiania, abounding in lime, and the localities poor in lime and abounding in humic acid in the eastern neighbourhood of the town. Indeed, to the freshwater algae the height above the level of the sea seems to be of no considerable importance, at least not before the absolutely arctic conditions begin to assert themselves. Most species of algae, at least the most general ones, the distribution of which is known with some degree of certainty, thus are found nearly all over the world, apparently quite independent of geographic limitations as well as climatic conditions. Under extreme conditions only, e. g. in absolutely arctic countries or high up in the mountains, there apparently occur a few particular species, e. g.

of *Desmidiaceae,* as the tropics, on the other hand, also harbour some few algae that especially seem to prefer warmer climates.

Broadly speaking, there is, accordingly, this essential difference between subaërial and freshwater algae, that to the first mentioned the climatic conditions, especially atmospheric dampness and temperature are the deciding factors of their distribution, whereas the freshwater algae are more dependent on the nature of the subsoil and the involved physical and chemical conditions of the surrounding medium, while the climate is of comparatively secondary importance. Thus, among the subaërial algae one might lay down types of especially tropical and subtropical occurrence, as *Physolinum monile* (DE WILDEMAN) PRINTZ, *Phycopeltis,* and others, versus more temperate or arctic species, while the bulk of the freshwater algae, as it seems, are nearly ubiquistous. Also among the subaërial algae there naturally occur species being to some extent dependent on the substratum, especially so among lithophilous forms. Thus there is a distinct difference between subaërial algae from rocks abounding in lime, and rocks poor in lime, as there are also comparatively few species being able to fasten themselves to smooth surfaces by adhesive growth, e. g. the hard and smooth stems of the bamboo, and the like.

It is apparent that the subaërial algae in consequence of their mode of living are subject to great variations in the conditions of life, above all in the amount of humidity. The extreme and uniform conditions under which all of them are living, naturally will stamp the types morphologically, and the epharmonic convergence also here has evolved growth-forms that are in harmony with the natural surroundings. The exceedingly great variations and richness in bizarre forms which are to be found among species occurring in water — living under more favourable conditions — therefore are wanting among the subaërial algae.

In virtue of just this circumstance, therefore, the subaërial algae are rather hard to determine, as systematically quite distinct or even alien types often have a morphological likeness, and in many cases cannot be discriminated except in particular phases of their development. These primitive forms are really in many cases so slightly differentiated in point of morphology that it often, and above all in dead and conserved material, may be very hard to separate the various species, except in particular stages, especially as the individual species of subaërial algae appear to be very polymorphic and varying under different external conditions. Howewer, the subaërial algae have this advantage that in one and the same sample usually occur one single or only a few species together. Thus, there is a rule an abundance of material at hand, whereby the different phases of development are found more easily and with greater certainty, at least if they are examined at various times.

Another feature of general biological interest I will point out, viz. that the subaërial algae form natural plant-communities. The various species do not occur spread around, mixed arbitrarily, but species with the same demands on their environments unite in natural plant-communities. I have thus noticed that *Physolinum monile* primarily occurs associated with certain liver-mosses, partly also with *Trentepohlia aurea;* associated with species of *Protococcus* is usually found *Acanthococcus,* etc. However, it must be remembered that this interdependence, as far as less known and less investigated species are concerned, may indicate a genetic affinity. On plants with a smooth and hard trunk, e. g. bamboo, it is only a few species that are able to find hold, and here usually only occur plants that have an adhesive growth, e. g. *Phycopeltis arundinacea,* and some others, a flora very different from the one found on rugged bark. However, my material is too scanty and accidental and wanting the necessary information about the nature of the habitat for making further conclusions from it.

In the following account I have for each species put down the number of all the samples, wherein the alga concerned has been observed. This I consider as not being without interest, as it gives an idea of the relative frequency of the different species.

Chlorophyceae.

Protococcus consociatus nov. spec. [Pl. I, Fig. 1—17].

Cellulis minimis, vulgo 2,5—3,5 μ diametro, in colonias maximas consociatis. Cellulis solitariis vel coloniis minus quam 4—8 cellulas continentibus raris. Colonia 32 cellularum plus minusve 14 μ diametro est. Cellulae divisae diu cohaerentes, unde coloniae magnae 32—64—128 vel etiam plurium cellularum oriuntur. Cellulis cubice rotundatis, membrana tenui, glabra, colore rubello vel subaureo. Chromatophoro parietali, campanulato, totum parietem interiorem obtegente, nullas partes vacuas, achroas relinquente. Pyrenoidibus nullis.

This alga much recalls *Protococcus viridis* Ag. and *Protococcus Kützingii* G. S. West, but differs from both species mentioned in generally having smaller cells, usually forming much larger, coherent colonies. Generally colonies occur that are composed of 32 or 64 cells, or of a still greater number, up to about 300 cells. Colonies of 4—8 cells also occur, while single cells or bicellular colonies, which are rather frequent in *Pr. viridis*, are very rare here. In large colonies the individual cells by mutual compression get more or less angular, sometimes also rather irregular. The annexed illustrations (pl. I, fig. 1—17), for the rest, will give an idea of the shape and arrangement of the cells and colonies. The cell-wall is thin and smooth; sometimes it seems to be slightly crenulate.

A most distinctive feature of the species is also that the membrane has a slightly reddish or golden tint. The chromatophore is bell-shaped, parietal, covering the whole inner wall of the cell, without leaving any open or colourless part; it is without a pyrenoid. The diameter of the cells usually is 2,5—3,5 μ, only immediately before the division at times somewhat larger, up to about 4 μ. The diameter of a 32-celled colony is ± 14 μ and of a 4- (or 8-) celled colony on an average 7—8,5 μ.

This species I have found to be very common in quite a number of samples of bark collected in the woods above Bluff (Durban), along the cross-road to the South African Whaling Co.'s station, and towards Isipingo kraales, in the days November 13th to 17th, 1912.

The species occurs in the following samples: 98, 112, 121, 125, 126, 128, 179, 222, 246, 251, 252, 260, 280, 294.

Protococcus verrucosus nov. spec. [Pl. I, Fig. 18—30].

Cellulis 5—9 μ, vulgo 5,5—7 diametro, subglobosis vel angulariglobosis, plerumque 2—4—8 in colonias consociatis. Membrana crassiuscula, achroa, distincte verrucosa. Chromatophoris singulis, magnis, parietalibus et homogeneis, pyrenoide carentibus.

The characteristic feature of this species is above all its distinctly and coarsely verrucous membrane. There is no usual crenulation of the membrane, but it is more or less densely beset with rather coarse, subobtuse warts. It is frequently seen that one side of the colonies may be more or less smooth, e. g. pl. I, fig. 18, 21, 22, 25, 26. This is due to the fact that the colony on the smooth or less verrucous side has been recently detached from a larger colony. The prominences thus grow out only from the free surfaces of the cells. The cells are more or less globular, or by mutual compression somewhat angular, generally with a diameter of 5,5—7 μ, sometimes, just before the division, up to 8—9 μ. Mostly colonies of 2—4 or 8 cells occur; larger colonies are more rare, as they are easily detached. The membrane is rather thick, hyaline. The chromatophore is bell-shaped, parietal, and occupies the whole of the inner wall. There is no pyrenoid.

On account of its warty membrane, this species recalls HANSGIRG'S *Pleurococcus crenulatus* (Prodrom. I, 1886, p. 133, fig. 82), but differs from it in having a much more coarsely warty (not crenulate) membrane, and in the shape of the cells. *P. crenulatus* HANSG. is hardly any real *Protococcus* at all; according to DE WILDEMAN it is akinetes of *Hormiscia crenulata* (cfr. E. DE WILDEMAN: Note sur *l'Ulothrix crenulata* KÜTZ. in Compte-rendu de la séance du 4. décembre 1887 de la Société Royale de Botanique Belgique).

The species seems to be rare, as I have only found it in two samples (293, 294) from trunks of trees in the wood above Bluff.

Chlorococcum vitiosum nov. spec. [Pl. I, Fig. 31—51].

Cellulis globosis magnitudine multum variantibus, vulgo diametro 8—16 μ, rarius usque ad 22 μ, vel etiam usque ad pauca μ diametro decrescentibus. Membrana tenui, hyalina, glabra, tegumento mucoso nullo. Interdum cellulae et magnae et parvae membrana plus minusve distincte crenulata occurrunt. Chromatophoro viridi, parietali, fere hemigloboso et dimidium fere parietem interiorem cellulae obtegente. Pyrenoidibus nullis. Nucleo centrali singulo. Zoosporis numero valde variabilibus usque ad numerosissimas in cellulis singulis ortis, membrana materna dirupta liberis. Zoosporis ovatis, 2—3 μ longis, chromatophoro unilaterali, parietali instructis.

This species is one of the commonest aërophilous algae in the samples collected. I have met with it in several of the samples from the environs of Durban as well as from Saldanha Bay. From other species of the genus *Chlorococcum* this especially differs in its chromatophore, which is hemispherical, covering only about one half of the inner cell-wall, whereby the other half of the cell gets colourless. In the material I have had for examination, the chromatophore has often distinctly receded from the membrane, which is no doubt only to be considered as phenomena due to contraction during the gradual exsiccation. The edge of the chromatophore is even, or it may sometimes be more or less emarginate and irregularly denticulate, and at times I have seen specimens with almost reticularly latticed chromatophore. A pyrenoid is wanting. The nucleus is situated in the centre of the cell. The membrane is always very thin and colourless, without a mucous envelope, generally glabrous, but sometimes distinctly crenulate. This crenulation may be local, only limited to certain parts of the membrane, or the latter may be crenulate all over the surface. Small as well as large cells may have crenulate membranes. The size of the cells is rather varying, from diminutive to 22 μ in diameter. The average size, though, is 8—16 μ. The number of the zoospores is very varying according to the size of the mother cell. Their shape is ovoid or ellipsoid, 2—3 μ in length, and a lateral chromatophore may sometimes be pointed out, filling only about half of the inner part of the zoospore (pl. I, fig. 51). The zoospores are liberated by the rupture of the mother membrane. In samples of this species vacuous chapped membranes frequently occur (pl. I, fig. 46, 47, 49, 50, 51), which must be considered as emptied zoosporangies. Thus, the membrane does not gelatinize. Besides in free state, I have also met with this species as lichen-gonidia.

The species occurs in the following samples: 25, 28, 60, 75, 78, 85, 158, 237, 238, 245, 253, 260, 340, 359, 364, 365, 370, 373, 375, 380, 383, 390, 400, 401, 402, 403.

Chlorella vulgaris Beyerinck, Bot. Ztg. 48 (1890) p. 758. [Pl. II, Fig. 90—104].

This species occurs sporadically around Durban, but I have not found it in any of the samples from Saldanha Bay. It thus seems to be rather rare in the territory investigated, at least far more rare than e. g. in northern Europe, where the species is, indeed, one of the most frequent algae. The cells measure 7—9 μ in diameter when full-grown; only occasionally they are larger, up to 12 μ. By the growth of the autospores the membrane of the mother cell gets dilated, however, and it may then attain larger dimensions. The characteristic feature of the species is the cup-shaped or spherical, parietal chromatophore, which lines the inner cell-wall and fills it entirely, only leaving a larger or smaller, nearly circular or ovate, colourless opening; a pyrenoid is not distinct. The cell-wall is rather thick and solid, without a mucous envelope, glabrous, or sometimes finely crenulate all over the surface, or only partly so. The autospores are globose and develop in a small number (2—8) in the mother cell, and are detached by the bursting of the old membrane. Their diameter is 4—5 μ, and when still encompassed by the mother membrane, rather thick-walled and characteristic by their chromatophores.

The species occurs in the samples 83, 94, 134, 167, and 168.

Phaseolaria nov. gen.

Cellulae ovales vel fabiformiter curvatae, acervatim consociatae, liberae, non inter se coalitae. Membrana cellularum tenui, glabra vel levissime crenulata. Chromatophorum parietale, campanulatum, omnino vel fere omnino parietem interiorem obtegit. Pyrenoidibus nullis. Nucleus cellulae unicus, centralis. Propagatio zoosporis contentu cellulae maternae succedanee diviso ortis, membrana materna dirupta liberis. Species duae adhuc cognitae algae aëris.

Phaseolaria obliqua nov. spec. [Pl. I, Fig. 52—78].

Cellulis elongatis altera parte convexa altera minus convexa, recta vel concava, unde cellulae fabiformes vel reniformes, polis late rotundatis, oriuntur. Polo altero cellularum vulgo crassiore et magis rotundato quam altero angustiore et magis acuminato. Membrana tenuis et levis vel interdum leviter crenulata, incrassationibus non instructa. Cellulis vegetativis adultis 8—10 μ, raro usque ad 12 μ longis et ½—⅓ angustioribus. Cellulis aetate magis provectis zoosporas continentibus distentis et tumefactis vulgo aliquanto majoribus et inflatis usque ad 16 μ longis. Chromatophoro uno campanulato parietem interiorem totum cellulae obtegente vel raro uno latere incisura achroa instructo. Zoosporis stigmate distincto instructis.

The genus *Phaseolaria* described here, is no doubt nearly related to *Chlorococcum* Fries, as it is mainly the shape of the cells only that distinguishes these two genera, and they probably form a series of evolutions corresponding to *Chlorella-Oocystis-Nephrocytium* in the family of *Oocystaceae*. The especially distinctive feature of the genus *Phaseolaria* is that the cells are oblong, ovate-cylindric of a bean- or reniform shape. One side of the cell is usually more tumid than the other, which may be nearly straight, at times even concave, whereby the cells assume a somewhat varying shape, bean-reniform or cylindric to nearly hemispherical, with broadly rounded ends. The membrane is thin, without polar nodular thickenings, usually glabrous, sometimes — as may also be the case with most of the other subaërial algae — slightly crenulate. The chromatophore is a single parietal slab, lining almost the whole of the cell-wall. A pyrenoid is wanting. In the cells are frequently to be found some darker spots, which probably are products of metabolism, but the nature of which I have not had occassion to examine more closely. The nucleus is single, centrally situated. The asexual reproduction is done by zoospores, formed by repeated divisions of the contents of the mother cell, and which are liberated by the rupture of the old mother wall. The length of the cells of *Phaseolaria obliqua* nov. spec. usually is 8—10 μ, only as a rare exception up to 12 μ long, and ½—⅔ as broad. Further, it is very conspicuous in this species that the poles of the cells are not uniform, one end being distinctly broader and more obtusely rounded than the other.

This species is apparently very rare, as I have found it in two samples only, viz. on the bark of a tree-trunk collected near the Signal Station at Bluff, at the entrance of the harbour of Durban, Oct. 28th 1912, and on the bark of a tree near Umbilo River, Nov. 12th. On the trunks it forms a light-green incrustation, where the cells are aggregated to large congeries. Fig. 78, pl. I, shows a little of such congeries, where the cells are lying orientated in all directions possible. The contents are only drawn in one cell forming zoospores. The rest of the figures 52—77 show the cells or the membranes of the cells seen from the side, fig. 52 and 57 are cells seen from two different sides.

Under the name of *Protococcus variabilis (Chlorococcum variabile* (HANSG.) — in Physiol. u. Algol. Stud. T. 4, Prodrom. I, pag. 142, fig. 88 — is described a small alga, which in the shape of the cells much resembles *Phaseolaria obliqua.* An examination of HANSGIRG's authentic specimens from Prag in WITTROCK et NORDSTEDT, Algæ Exsiccatæ, Fasc. 23, no. 1091, however, has distinctly shown that these two are different. Thus, it may be mentioned as two distinguishing features that the species of HANSGIRG has considerably larger cells, nearly twice as long, which are quite uniform at both poles. It shows, however, in so far a close conformity to the features that are particularly characteristic of the genus *Phaseolaria,* especially in the shape of the cells, that I refer it to this genus as a second species, *Phaseolaria variabilis* (HANSG.) PRINTZ. This one is also so distinct from all other species of *Chlorococcum* FRIES — a genus for the rest so well defined and to which most of the earlier species, described as *Protococcus,* are referred — that also BRUNNTHALER in his revision of this genus in PASCHER's Algenflora, p. 64, says: «Zugehörigkeit zu *Chlorococcum* sehr zweifelhaft». Within the genus *Phaseolaria* it may, however, be given a very natural place.

Myrmecia nov. gen.

Cellulae subglobosae-ovales, subirregulares, solitarie et libere viventes. Membrana achroa, crassiuscula et latere uno in verrucam humilem, latam incrassata. Chromatophorum campanulatum, viride, parietale, totum fere parietem cellulae obtegens vel uno latere incisum. Pyrenoidibus nullis. Nucleus pro ratione magnus, centralis. Propagatio zoosporis contentu cellulae maternae diviso suc-

cedanee ortis, quae solitarie per porum membranae maternae liberantur.

Myrmecia globosa nov. spec. [Pl. II, Fig. 105—123].

Cellulis subrotunde-ovalibus libere et solitarie viventibus et adultis vulgo 16—19 μ. Membrana achroa, crassiuscula, vulgo fere 2 μ crassa et latere uno in verrucam humilem, latam incrassata. Chromatophoro campanulato, parietali, totum parietem interiorem obtegente vel interdum uno latere, vulgo membranae incrassatae opposito, inciso. Pyrenoidibus nullis. Nucleo pro ratione magno, centrali. Propagatio zoosporis contentu cellulae maternae diviso succedanee ortis, zoosporis elongate-ovatis, 3—3,5 μ longis et stigmate distincte instructis. Per porum membranae maternae solitarie liberantur. Alga aëris in cortice arborum crescens.

This alga much recalls *Kentrosphaera* in the shape of the cells. This likeness is only seeming, however, and is mainly due to the external habitus of the cells, with a thick wall and a blunt, conical or papilliform excrescence. In the inner structure *Myrmecia globosa* differs distinctly from *Kentrosphaera,* thuswise in its chromatophore, which is a parietal cup, lining nearly the whole of the cell-wall, while in *Kentrosphaera* the chromatophore is radiate, formed by numerous parietal slabs or ribbon-shaped rays. To the structure of the chromatophore there must be attached great importance in a case like this. Of other differences from *Kentrosphaera* must further be noticed the absence of a pyrenoid, the smaller number of zoospores, formed by s u c c e d a n e o u s divisions. In *Kentrosphaera* the divisions are s i m u l t a n e o u s in a far greater number of zoospores.

The inner structure of the cells shows, on the other hand, a more close conformity to *Chlorococcum,* a genus which I consider as being one of the most nearly allied ones. The most essential difference from *Chlorococcum* is the thick membrane, with a unilateral projection, and the absence of a pyrenoid, in so far as this last feature is to be considered as being of any systematical value. As the inspissation of the membrane of *Myrmecia globosa* is a unilateral excrescence only, one often has to displace, in a preparation of this kind, the cells by means of a pressure on the cover glass in order to get sight of it. It is commonly comparatively lower and broader than usual in *Kentrosphaera;* in young cells it may even be conspicuous and of comparatively considerable dimensions (e. g. fig. 114, pl. II). The membrane is colourless and rather thick, its thickness being somewhat varying, usually ± 2 μ, and without any particularly pronounced stratification. Treated with chlor-iodide of zinc, it assumes a slightly violet tint. In the cup-shaped chromatophore there is no pyrenoid; on the other hand, there may be observed one or more dark spots, which probably are products of metabolism, the real nature of which I have had no opportunity to examine, however. With regard to the chromatophore, it is further to be noticed that the colourless incision as a rule is situated in the side of the cell opposite the membrane wart.

The nucleus is comparatively large and nearly centrally located, but it is not visible except after treatment with the special tests and colouring matter. By succedaneous divisions of the contents of the cells a varying number of zoospores arise. Whether these cell-divisions are always perfectly regular, I dare not decide with absolute certainty; however, the first division in all the rather numerous specimens I have observed, seems to be orientated nearly perpendicularly on the membrane-inspissation (vide fig. 119, pl. II). The zoospores are nearly ovoid, ± 3 μ long. The material I have had at my disposal has been too badly preserved to be suitable for investigations on the cilies. The zoospores escape singly through an opening in the mother membrane.

This alga occurs sparsely in some of the samples from the environs of Durban, frequently together with *Pleurastrum constipatum* (16, 52, 85, 302).

Acanthococcus granulatus Reinsch var. **aerophilus** nov. var. [Pl. II, Fig. 79—89].

Differt membrana crassiuscula, aculeis imparibus, crassis, cuneatis, irregulariter dispositis, instructa. Cellula diametro 3—30 μ, vulgo 10—20 μ lata.

This alga I have found to be common in quite a number of samples from the environs of Durban, but I have not observed it in a single sample from Saldanha Bay. It is very varying as to the size of the cells, the thickness of the membrane, as well as in the shape and distribution of the prominences. However, the specimens observed by me hardly comprise more than a single species, but with a considerable range of variation. The decided aërophilous algae are hardly identical with the species living in freshwater, but as the specimens found by me, as to the shape of their cells, much recall *A. granulatus,* I have founded the alga in question as a variety of this one.

The cells are spherical, at times somewhat irregular, usually 10—20 μ, rarely reaching a size of about 30 μ in diameter, enclosed by a homogenous, colourless membrane, up to 4 μ thick. The projections are usually coarse, rather short and thick, with bluntish tops; specimens with more pointed projections occur, however; at times they are also shorter and more stubby, to almost hemispherical. The projections are rather distant, irregularly distributed on the surface of the cell, and rather varying on one and the same cell both as to size and shape. Sometimes the projections or warts are seen to be somewhat reduced on one side, which, no doubt, is due to the orientation of the cells to the substratum. The chromatophore is a parietal bell, which covers the whole of the inner cell-wall; it is without a pyrenoid.

I have often observed that the contents of the cells by succedaneous divisions are divided into a great number of daughter cells, escaping through a hole in the mother membrane. Thus, in this variety the old membrane does not dissolve into mucilage, which seems to be the usual way in this genus according to the information on this subject in the literature, for instance by LAGERHEIM, REINSCH, and DE TONI, and empty mother membranes (pl. II, fig. 80 and 81) are frequently to be found in preparations of this alga. As long as these daughter cells, which must probably be designated as aplanospores, are lying within the mother membrane, as also at the moment of escaping it, they are entirely smooth. Their size is about 2—2,5 μ in diameter. The smallest *Acanthococcus*-cells I have been able to recognize by the structure of the membrane, measure about 3—4 μ in diameter. In so small cells the membrane is only very slightly crenulate, however (vide fig. 89, pl. II), and the structure can be seen by a very close examination only. Whether the small cells on having escaped the mother membrane, are further divided and undergo a *Palmella*-stage, or the like, or whether they are real aplanospores directly increasing and growing out into new *Acanthococcus*-cells, I have not had sufficient material to ascertain. Personally I am of opinion that the last mentioned thing happens, as I have not observed anything that may be explained as divisions or *Palmella*-stages.

As known, the genus *Acanthococcus* is considered to be a very problematic one, and several of the species described as *Acanthococcus* are no doubt only resting cells or phases of development belonging to other algae. It is, however, beyond a doubt that some of them, at least, are entirely independent species of algae. If the small cells observed by me, escaping the mother membrane, should turn out to be real aplanospores, this genus is to be referred to the family of *Oocystaceae*, where its nearest relations must be sought among the *Chlorella* or allied genera.

This species seems to be a very common aërophilous alga in the neighbourhood of Durban. Thus, I have found it in quite a number of samples: 37, 99, 105, 109, 122, 134, 138, 171, 237, 252, 272, 279, and 313.

Hormidium flaccidum BRAUN in RABENHORST, Algen (1876) no. 2480. *Hormiscia flaccida* (KÜTZ.) LAGERHEIM in Flora 1888, no. 4; DE TONI, Syll. Alg. I, p. 161. [Pl. VI, Fig. 233—243].

Specimens of this extremely varying and yet by far not elucidated species or collective species I have found in some samples from the environs of Durban (nos. 16, 19, 26, and 238).

The specimens from these different localities evince in their broad features a close congruity. The cells are joined in rather long and usually straight filaments, consisting of up to 100 cells or more. The cells are on an average 8—9 μ broad, and nearly equally long — up to twice as long as broad, rarely shorter than broad. The filaments are equally broad, at times slightly constricted at the dissepiments. The chromatophore is entire at the edges, and the comparatively large pyrenoid rather easily discerned. I have observed some few specimens forming zoospores. These arise singly in each cell, as described and delineated by WILLE: Om Udviklingen af *Ulothrix flaccida* KÜTZ. (Svensk Bot. Tidskrift 1912), and I have nothing to add to what is already known from these investigations.

Besides this one I have found a somewhat different form: *cellulis passim tumidis* GAY, Alg. Vert. (1891) p. 97, pl. XI, fig. 106.

In pl. VI, fig. 233—243 I have drawn a series of specimens of this one. Here the filaments are composed of very few cells only, usually 2—4, rarely with up to 8—12 cells in each filament. Very frequently are also to be found single cells — akinetes — of an ovoid-globose shape. At the fracture the cells are very quickly inflated, but often there is to be found on these akinetes small inspissations in the membranes on each side, as the membrane will also be seen to be flattened. These akinetes divide by a cross-wall, and grow directly into new filaments. The breadth of the cells varies between 6—10 μ, on an average 7—8 μ, and the length is commonly equal to the breadth, but varies between one half to nearly twice the breadth.

I suppose this latter form is identical with *Stichococcus dissectus* GAY, l. c. p. 96—100 (*Hormidium dissectum* (GAY) CHODAT). Cultures show that the degree of dissociation of the cells is dependent on the natural conditions of the habitat, and this character is therefore without any systematical importance whatever.

Collected on decayed wood above Bluff, near the Signal station at the entrance of the harbour of Durban, Oct. 28th (no. 24).

Stichococcus bacillaris NÄGELI f. **minor** (NÄGELI) sec. CHODAT, Monogr. d'Algues en Culture Pure p. 155 (Matériaux pour la Flore Cryptogamique Suisse, Vol. IV. Fasc. 2, 1913); HEERING, Ulothricales, etc. in PASCHER, Süsswasser-Fl. H. VI, 1914, p. 52, Fig. 66.

Under this name I class a small alga I have found in some samples of bark and decayed wood from Bluff (Durban), and at Ostenwald, Saldanha Bay (nos. 145, 340, 343). The cells are always single, small, usually 2,3—3,2 μ broad, and 5—8 μ long. Their shape is somewhat varying, almost cylindric and straight, with obtuse ends or slightly curved and oblique, sometimes more elliptic, broadest about the middle. It also happens that one end of the cell may be more narrow and pointed than the other one, by which the cells get a nearly ovoid shape. The chromatophore is a pallid green, parietal slab, and does not line more than one half of the membrane. Because of this, the poles of the cells are commonly colourless, or the chromatophore is lateral, and fills one half of the cell only, by which the other half gets colourless. In the cells are often to be found small refractive grains. A pyrenoid is wanting.

In the course of time have been referred to *Stichococcus bacillaris* a great number of various forms, many of which are certainly quite different species. If the drawings given by the different authors are compared, great disagreements will be observed both in the shape, size, and inner structure of the cells. Further, some authors record the species to have a pyrenoid, others a pyrenoid to be wanting. In my opinion, however, the presence or absence of a pyrenoid is no particularly important systematic character, as among algae of undoubtedly near relationship, one species may have, the other one may be destitute of a pyrenoid. To make a distinction between two genera solely on such a character as the absence or presence of pyrenoids, as e. g. to establish the genus *Palmellococcus* including the species of *Chlorella*, wanting the pyrenoid, therefore may not be quite well-founded in systematical respects. Within one and the same species, however, this is a constant character. It is also dubious what systematical importance should be assigned to a character, as whether the cells of *Stichococcus* coher in rows or disintegrate immediately after the cell-divisions. This character, at any rate to a certain extent, may be dependent on the nature of the habitat, especially perhaps on the conditions of humidity, and is in some degree, at least, not without influence on the shape of the cell-ends. The specimens found by me from South Africa, agree perfectly with the description and figures of the species *St. minor*, fig. 66, given by HEERING in PASCHER'S Algenflora; especially characteristic are the oblique or somewhat curved cells, with the broadly rounded ends.

Pleurastrum constipatum nov. spec. [Pl. III, Fig. 124—155].

Thallo ex struibus cellularum parencymaticarum irregulariter formatis, 1-plures cellularum series crassis, numero variabilium usque ad amplius centum cellularum constante. Cellulis singulis et magnitudine et forma multum variis. Cellulis brevi post divisionem ad 3,5 μ parvis, adultis et majoribus ante divisionem usque ad 9 μ magnis. Cellulis polygoneis, fere isodiametricis parietibus pro ratione crasis instructis. In cellulis nucleis singulis. Chromatophoro campanulato totum parietem interiorem obtegente, nullas partes vacuas achroas relinquente. Pyrenoidibus nullis. Acinetis propagationis cellulis singulis rotundatis et dissolutis ortis. Zoosporis parvis, 1,5—1,8 μ longis in sporangiis, neque *forma neque magnitudine a cellulis vegetativis diversis ortis. Per porum membranae liberantur.*

This very characteristic and readily distinguished species occurs as a thick, greenish incrustation on the bark of trees in several of the samples collected. It occurs very frequently associated with *Myrmecia globosa,* and also often with *Trentepohlia lagenifera* var. *africana.*

One of the most conspicuous characters by which this alga differs from the already known species of the genus — as they are drawn and described by CHODAT in Mat. Hist. Prot. I (1894), and SNOW, *Pseudo-Pleurococcus* (1899) – is that the thallus in *Pleurastrum constipatum* nov. spec. is generally larger and more compact, consisting of several layers of thick parenchymatous cell-masses, with a more even and smooth outline. The shape of the thallus, furthermore, is very varying, from almost spherical complexes destitute of filaments or nearly so, through all transitions to specimens in which the thallus has produced plenty of filaments. On pl. IV is drawn a series of thalli which will give an idea of their appearance and structure. The size also varies considerably, from quite small, few-celled up to very large ones, where the thallus is formed by several hundreds of cells, polyedrical and nearly isodiametrical, lying in no real order. Some few specimens show a more regular construction, however, on account of more regular cell-divisions. The cell-walls are comparatively thick, especially so the older ones, and those on the surface bounding the thallus. The younger and newly formed cell walls are thinner, but grow with age gradually in thickness. (Vide e. g. pl. III, fig. 134). In specimens in vivacious division the cell-walls therefore are comparatively thin, in other specimens that are not in such a state of rapid division, they are comparatively thicker. The size of the cells is very varying, on an average 6—8 μ. Young cells shortly after the division may measure down to 3,5 μ, just as older cells, on the other hand, may reach a size of 9 μ in diameter, which seems to be the limits. On treatment with chlor-iodide of zinc the cell-walls get a bright, reddish-violet tint.

Like the other species of *Pleurastrum,* this one also emits irregular filaments, which here are very short and thick, with almost isodiametrical cells. The cells in the filaments are never lengthened. The chromatophore is bell-formed, parietal, and lines all the membrane without leaving irregular openings anywhere. The species, in addition, is characteristic in being without a pyrenoid. The presence or want of a pyrenoid I do not consider as being of any particularly decisive systematic value, but I regard this feature, as being a distinct criterion between species. In each cell is one central nucleus.

The reproduction is done by zoospores, formed in zoosporangies, which, as to shape and size, do not differ from the vegetative cells.

Pl. III, fig. 131 shows an emptied zoosporangium. The length of the zoospores is on an average 1,5—1,8 μ, and they are liberated by the rupture of the mother membrane. In the material examined, the formation of zoospores seems to be rare. The species propagates very frequently, on the other hand, in the narrowing and at last the dividing of a larger thallus into two or more smaller ones, which independently and directly grow further. In addition, it forms akinetes through the rounding off and liberation of the cells on account of the disintegration of the midmost membrane layer. Fig. 138—150, 152—155 show a series af akinetes. The walls of the akinetes are sculpturless, rather thick, colourless, sometimes stratified.

The genus *Pleurastrum* has been founded by CHODAT in 1894, l. c. Later on, in 1899, JULIA SNOW has, under the name of *Pseudo-Pleurococcus,* more accurately drawn and described the two species being hitherto known of this genus. As to the systematical position of these plants, great uncertainty has been reigning among the leading algologists. WILLE, HEERING (in PASCHER, Die Süss-wasser-Flora, 1914) a. o. class them among the *Chaetophoraceae,* while WEST, Algae, 1916 p. 192, designates this genus as a «Proto-derma-state» of *Protococcus (Pleurococcus),* a state, which under certain conditions, as too much dampness, may arise from *Protococcus.* CHODAT (Algues Vertes de la Suisse, 1902, p. 281) is also of the same opinion. However, as it has not been proved that the true genus *Protococcus* forms zoospores, which it does not do, at least under normal conditions, I consider the last mentioned authors' views as not yet established, and I therefore class the genus *Pleurastrum* provisionally among the *Chaetophoraceae.* It is, by the way, remarkable that a so important question, regarding some of the most common algae of the world, and in spite of this species having been brought into cultures many times, has not yet been definitely settled. This probably may be due to the fact that the material for examination in many cases has been heterogeneous, not originating from the same species. Under so homogeneous and extreme conditions of life as those of subaërial algae, various systematic types will easily adopt a uniform character. Especially the primitive and slightly differentiated forms will not be sufficiently morphologically characterized, so that it is not always possible from the external features solely to discriminate the forms, and many of them are only to be distinguished in certain stages.

It must be made an unavoidable requirement for all pure cultures of these algae that the material is derived from a single cell only. Otherwise one will too easily confound systematically heterogeneous types and get a systematicelly impure material, which during the later development will go in different directions and thus give completely deceptive results. Only in this way it will be possible to get rid of the old «*Pleurococcus*-problem».

The species occurs as a greenish coating on the bark of trees in some samples from the environs of Durban, where it seems to be of rather frequent occurrence (16, 52, 85, 302, 303), and in one single sample from Ostenwald, Saldanha Bay (356). Akinetes have been found in the samples 16 and 302.

Pleurastrum lobatum (CHODAT) PRINTZ nov. comb. [Pl. VI, Fig. 156—200].

Under the name of *Pleurococcus lobatus*, CHODAT, in his work Algues Vertes de la Suisse, 1902, p. 284, has described a species that is characteristic in having rather tumid and roundish cells, because of which they also rather rapidly disintegrate after the divisions. It is further characterized by its chromatophore and by wanting a pyrenoid. This alga I have also met with very frequently in a number of the samples from South Africa. On account of the fact that the cells are rounded off and disintegrate rather quickly after the divisions, larger and pluricellular colonies are only rarely to be met with. As a rule only solitary spherical cells or colonies consisting of 2—3 or 4 cells, such as the uppermost figures of pl. IV, are to be found. In some few samples, however, I have met with larger colonies of this species. It then appears that the cell divisions of this alga are not regular «*Pleurococcus*-divisions», that is, in all three directions, and whereby the characteristic «*Pleurococcus*-packages» are formed. The cell-divisions of this alga, on the contrary, proved to take place in two directions only, whereby cell-plates are formed. Pl. IV, nethermost, shows a number of somewhat larger colonies, where this fact is clearly observed. Fig. 196—197, and 198—199 show two colonies respectively in face and side views. J. BOYE-PETERSEN, Studier over danske aërophile alger 1915, s. 321, has already pointed out the same feature with regard to this species. Cfr. his pl. I, fig. 10. This is, besides, also noticeable on other drawings of the species in question. Thus, WILLE has found the same alga in samples from Hawaii, collected by dr. RECHINGER, and in his work, Süsswasseralgen von den Samoainseln etc., 1914, the figure (pl. III, fig. 1) of this species also distinctly shows that the cells are lying in the same plane.

In the work by BOYE-PETERSEN, quoted above, the author mentions that he seems to have observed zoospores in cultures of *Pleurococcus lobatus*. However, as he is not quite sure that this cultures were absolutely pure, he does not dare to maintain with certainty that the zoospores he has seen, really originate from *P. lobatus*, but may possibly have been produced by another species. In my material from South Africa, however, I have been able to point out with certainty zoospores in this alga, as I have found that the contents of some few cells have formed ovoid zoospores by simultaneous divisions.

This alga thus having zoospores, a way of reproduction that is not known to take place in the true genus *Protococcus* — as I consider the statements of this as very problematic — and as the alga in question further is lacking the divisions so characteristic of *Protococcus*, it differs so widely and in so essential characters, that it appears to belong to a totally different genus. I therefore provisionally class it as *Pleurastrum lobatum*, and give the following diagnosis:

Cellulis inflatis, rotundatis, vulgo 7—12 μ, raro usque ad 15 μ diametro, plerumque colonias 2—4 cellularum, vel majores in uno plano sitarum formantibus. Membrana hyalina, tenerrima et levi, raro tenuiter crenulata. Chromatophoro 1, raro 2, parietali, laminiformi, margine vulgo irregulariter lobato, latere uno partem achroam vulgo relinquente. Pyrenoidibus nullis. Nucleo pro ratione magno, centraliter sito. Propagatio cellulis in plana duo inter se perpendicularia successive divisis. Zoosporis ovatis divisionibus simultaneis contentus cellularum ortis, membrana materna tenui dirupta liberis. Zoosporis 2—5 μ longis.

It is extraordinary that such an exceedingly frequent species, apparently occurring nearly all over the world, has not earlier been more completely known. As a rule it will be met with only as 2—3- or 4-celled colonies, in which the morphological conformity to the genus *Protococcus* is absolute. That the divisions take place in two, directions only, is, accordingly, not possible to observe in such cases, as the cells after the divisions disintegrate to quickly. In some samples, however, I have not unfrequently met with this species as larger colonies, an appearance possibly owing to external conditions. At times, also solitary spherical or ovoid cells are to be found. Fig. 164, pl. IV shows a solitary cell in zoospore-formation. Fig. 165—168 represent progressive stages of cell-divisions.

The membranes in this alga are very thin, hyaline and smooth. Just as in other subaërial algae, I have also in this species at times observed cells with finely crenulate membranes, however. The size of the cells is usually 7—12 μ, sometimes up to 15 μ in diameter, and down to 5—7 μ in diameter. The divisions are rather irregular, and colonies consisting of three cells are not unfrequently to be seen. The chromatophore is cup-shaped, with partly incised edges. There is no pyrenoid. The zoospore-formation has not been common in any of the samples, and is certainly rare in free nature. It is possible, or even probable, that this only is limited to certain seasons, or is dependant on particular external conditions. It appears from the pictures that the formations of zoospores may take place in one or several cells of the same colony at the same time. The regular way of reproduction is, undoubtedly, by cell-divisions in two directions. The species also occurs as lichen-gonidia.

To judge from the samples examined, this species is one of the most frequent subaërial algae on trunks of trees in South Africa. I have found it in a great number of samples from Durban as well as from Saldanha Bay (nos. 8, 12, 20, 26, 58, 61, 65, 68, 77, 81, 82, 83, 85, 87, 99, 267, 272, 328, 333, 339, 341, 356, and 368).

Physolinum nov. gen.

Thallus ex filis irregulariter ramosis, e cellulis elliptice vel ovate inflatis, uniseriatis formatis, constat. Cellulae novae adulterioribus apice vel latere papillorum instar tumefactis oriuntur. Chromatophorum taeniaeforme, ex filo unico-pluribus parietalibus, margine incisis vel ramosis, pyrenoidibus nullis constat. Amylum deest. Propagatio aplanosporis globosis-ellipticis numero majore in aplanosporangiis subsphaericis ortis, quae e cellulis vegetativis intercalaribus vel apicalibus oriuntur, cellulis vegetativis saepius majoribus. Algae aëris.

Physolinum monile (De Wildem.) Printz nov. comb. [Pl. XIII, Fig. 306—312].

Trentepohlia Monilia De Wildeman in Bulletin de la Société de Botanique de Belgique T. XXVII; Annales du Jardin Botanique de Buitenzorg, T. IX, 1888, p. 181. *Tr. moniliformis* Karsten, Unters. Fam. *Chroolepideen,* Annales du Jardin Botanique de Buitenzorg, T. X. p. 11; De Wildeman, Notes zur quelques espèces du genre *Trentepohlia* in Annales Société belge microscop. 1894, p. 10.

Thallo valde ramoso, trunco et ramis conformibus. Cellulis ovatis, inflatis, 9,5—28 μ latis et usque ad 43 μ longis, ad parietes transversarios constrictis, 4—10 μ latis. Membrana tenuissima, levi. Chromatophoro ex filo unico-pluribus angustiusculis, ramosis constante, totum parietem interiorem non obtegente. Aplanosporangiis subsphaericis, vulgo cellulis vegetativis aliquanto majoribus, 4—16 aplanosporas globosas-ellipticas continentibus, pariete aplanosporangii dirupto liberis.

Habitat regionibus calidis in cortice arborum plerumque cum muscis et hepaticis.

This alga, which was originally described by De Wildeman, under the name of *Trentepohlia monile,* and later on by Karsten, as *Tr. moniliformis,* is rather common in some of the samples examined. Till now the reproduction of this alga has been unknown, and its systematical position, accordingly, undecided. In the reproduction by aplanospores this plant appears so widely differing from *Trentepohlia* and from the *Trentepohliaceae* on the whole, that I have found it right to separate the species in question as a new genus. Probably it even represents an entirely new family, as the vegetative thallus, and above all the cell-divisions, are also differing and very characteristic.[1])

I have never found this species in dense and macroscopically visible masses, but it has very often been found associated with a liver-wort rather frequently occurring on the bark of various trees. Associated with these two organisms were also very frequently to be found *Trentepohlia aurea f.*, and these three species seem to constitute a rather common plant-community on trunks in the environs of Durban.

As to the structure of the vegetative filaments of this plant I have nothing particularly to add to the descriptions already given by the previous authors, especially DE WILDEMAN, l. c., KARSTEN, l. c., and HARIOT, Notes on *Trentepohlia* in Journal de Botanique 1889 et 1890. It forms rather large and richly, but very irregularly ramified filaments, without any difference in main ones and branches. Intercalary cell-divisions do not occur, but new cells always originate from apical or lateral protuberances of older cells in one, or sometimes in several places. Such a protuberance is at first only a thin-walled wart or cylindric papilla, which gradually grows in size and becomes spherically inflated. As shown in the figures on pl. XIII, this protuberance, which is to form the new cell, reaches a comparatively considerable size before it is separated from the mother cell by a wall across the narrowing. Further it is a very conspicuous character in this species that the membranes are extremely thin and delicate. At least on my old material which has been dried and later on resoaked, they seem to be colourless. Usually the membrane is smooth; only as a rare exception I have observed that the membrane — just as in so many others of the subaërial algae mentioned — may be finely crenulate, either on the whole of the surface, or partially only (sample no. 154). It may also be noticed that in the samples where the specimens of *Physolinum monile* occur with crenulate membranes, the same feature is also to be noticed in the other subaërial algae associated with it, e. g. *Tr. aurea f.* This indicates that the above

[1]) In a paper: Наблюденія надъ исторіей развитія водоросли *Trentepohlia lagenifera* HILD. (Изъ „Біологическаго Журнала". Moskau, 1910) K. MEYER reports to have observed the gametes in *Trentepohlia lagenifera* sometimes not being liberated from the mother membrane, but germinating there after surrounding themselves with a wall. The author, however, is scarcely right when designating these as aplanospores as they have arisen from gametes, unisexual protoplasmic bodies. The aplanospores are, according to their origin, of an asexual nature, and must be regarded as reduced zoospores. If, however, the said reproductive organs should really turn out to be true aplanospores, this species is also to be referred to the genus *Physolinum*. It recalls, for the rest, not a little, *Physolinum monile* in the shape of the cells as well as in their inner structure and cell divisions.

feature, to be found in all species of the sample, must be attributed to a common origin, possibly being due to external conditions.

The cells are much inflated, broadly elliptic to nearly globose, 17—22 μ broad, and with a breadth of the constricted nodes of 4—7, on on average 5—6 μ. Pl. VIII will further give an idea of their shape.

The inner structure of the cells is not easy to examine exactly in a material so incomplete and insufficiently prepared. The chromatophore, however, consists of long and narrow ribbons, one or several in each cell conforming to the pictures of KARSTEN. At times, these ribbons break up in several small parietal discs. A pyrenoid is wanting.

This species seems to be an subaërial alga widely spread in the tropics, as it has been found in the tropical regions of the new as well as the old world: Chili, Costa Rica, the Dutch East Indies, Australia, and now in South Africa. Although it has been observed and examined in course of time by several investigators in nature as well as in cultures, it has always been recorded as sterile, its reproduction, accordingly, having been hitherto unknown. It is particularly interesting then, that in one of the samples examined I have found the reproductive organs of this species (in a sample from dense wood above Bluff, along the cross-road to the South African Whaling Company's station, Nov. 13th, no. 120). Its sporangies are formed from ordinary vegetative cells in their swelling to somewhat larger dimensions and assuming a nearly spherical appearance. The breadth of the sporangies I have found to be 25—31 μ. Every vegetative cell seems to be able to grow out into a sporangium; for the sporangies grow out quite arbitrarily, singly, two or several in series, intercalary or apical, and occur anywhere on the thallus. Now there appears something very interesting, viz. that the spores formed, are surrounded by a thin, but distinct membrane. Thus, they are not zoospores or gametes, as might be expected in a *Trentepohlia,* but real aplanospores. They are globose, and measure 7—11 μ in diameter, and arise in a number of 4—16 in each aplanosporangium. As is characteristic of this species on the whole, their membranes are also delicate, and on account of the mutual compression when lying within the mother membrane, they become somewhat angular, as it may also be seen that the thin mother membrane in places is bowed out owing to the pressure, which is caused by them. Pl. XIII, fig. 306. The aplanospores are liberated through an opening in the wall of the sporangium (fig. 308 and 310). In the dried material at my disposal I have not been able to examine exactly the inner structure of the aplanospores, as also their fate after leaving the mother membrane is still an unsolved problem. This ought, by the way, preferably to be examined in fresh and living material and in pure cultures. The formation of aplanospores is no doubt very rare in this alga. Though I have observed the species in several samples, in many of which it has occurred in abundance, I have found aplanospores in a single only. Neither have they ever been found by anyone else before.

With regard to the systematical position of this alga, it can, as previously mentioned, on account of its reproduction, hardly be referred to the *Trentepohliaceae,* which, by the way, as to reproductive organs, form a homogeneous and well defined family. In its aplanospores, on the contrary, it exhibits resemblance to the *Wittrockiellaceae.* In the structure of the vegetative thallus it differs from both the families mentioned. It is as yet uncertain whether this species also has motile spores, though it must be considered improbable. Akinetes, which occur both in the *Trentepohliaceae* and the *Wittrockiellaceae,* I have not been able to point out in *Physolinum,* as setae are also entirely lacking. In many ways it seems to be intermediate between the families mentioned, most likely representing an entirely new family, but this I will leave unsettled until the development and structure of this peculiar alga is better known.

The species is rather common in many of the samples from the environs of Durban, but I have not found it in any sample from Saldanha Bay (nos. 30, 57, 105, 120, 122, 134, 154, 169, 214, 238, 260, 261, and 295).

Trentepohlia aurea (L.) Martius *forma.* [Pl. VII and VIII, Fig. 244—263].

To begin with I was much in doubt whether it would be right to refer the species of *Trentepohlia,* drawn in the plates VII and VIII, fig. 244—263 to *Trentepohlia aurea* or to *Tr. abietina.* The real difference between these two species, by the way, seems to me, to be so slight that it may be dubious whether it is correct to maintain *Tr. abietina* as a species different from *Tr. aurea.* The various authors agree that they are nearly allied, but the views as to where the lines between them should be drawn, on the other hand, seem to be very vague and varying.

An attempt at drawing a line between the two species, on the basis of the existing literature, will show that much uncertainty is reigning. Let me state some instances: De Wildeman (Les *Trentepohlia* des Ind-Neerland. 1890), for instance, attaches much importance to the fact that one *(Tr. aurea)* is said to have cylindric cells, while those of *Tr. abietina* are more inflated and elliptic. The last mentioned species is said, however, to constitute a transition between these two groups, as it may sometimes be found with rectangular (cylindric) cells. Hariot (Notes sur le Genre *Trentepohlia,* 1889—90), on the other hand, refers both species to the one group of the species of *Trentepohlia,* being distinguished by *«cellulae cylindricae».* This character is, accordingly, very doubtful, and with our knowledge of other species of the genus in this regard, wnere the shape of the cells may be very varying — not only in the proportions of length and breadth, but also as to the shape of the cells on the whole — this character does not seem to be a suitable basis for the distinction of species. Thus, both cylindric and inflated cells are to be found together in the same species, not in one and the same sample only, but even in the very same filament. Other authors attach great importance to the breadth of the cells, *Tr. abietina* being recorded to have narrower cells than *Tr. aurea,* but the range of variation of both species with regard to this is very large, and as the limits of both species not only are drawn very differently by the various authors, but even over-lap (*Tr. aurea* 8—30 μ and *Tr. abietina* 4—10 μ), is does not seem possible, also with our experiences from other species in the genus — to base a distinction between the two species on this character either.

I have really been looking in vain for a good systematic character on which might be based a distinction between these two species. HARIOT, indeed, says: l. c. p. 52 on *Tr. abietina: «Tr. aureae formis gracilioribus adeo proxima ut non certe aliquando distinguatur».* Neither the shape, size nor arrangement of the sporangies seem to give safe hold with regard to a distinction between the species mentioned, as both of them, as known, are subjected to considerable variations, and the limitations also in this respect must be made very wide.

The accompanying plates VII and VIII will give an idea of the appearance of the specimens found by me. The cells are cylindric, or slightly inflated, 6—10, usually 7—9 μ broad, 1—2 times, usually 1½ times as long as broad. In some samples, however, are to be found broader filaments, to 17 μ broad (sample no. 294). They form long, straight, or slightly curved filaments, more or less branched in various ways. The branches are sometimes spreading, at nearly right angles, or more appressed. The cells of the branches do not differ perceptibly either in thickness or in length from those of the main filament. The terminal cells are never acute at the top, but generally rather obtusely rounded. The membrane is comparatively thin and colourless, glabrous, or sometimes finely crenulate. A real reticulation is not to be found on the membrane, however. The gametangies are usually spherical, rarely slightly ellipsoid, or at times ovoid, 15—25 μ in diameter. Their membrane is thin and glabrous, or crenulate. Specimens with crenulate membranes, however, may at times have glabrous gametangies. The gametangies are terminal or lateral, borne directly on the vegetative cells, and are to be found both on the main filament and on the branches, singly or in series. At times, two gametangies may arise from one vegetative cell. (Pl. VIII, fig. 250 and 252). The gametangies are opened by a hole in the membrane, through which the gametes escape. At times, however, there occur gametangies drawn out into a longer or shorter beak, with the opening at the end. (Vide pl. VII, fig. 245 and pl. VIII, fig. 253 and 260). This is rare, however, and must apparently be regarded as an abnormity. The chromatophore in this species is often seen to contract in a characteristic way, on account of the desiccation. For the chromatophore is broadest at the cross-walls of the cell, and narrows towards the middle, like an hour-glass. Pl. VIII, fig. 250 will give an idea of this.

This species is very common in quite a number of the samples examined from Durban, but I have not observed it in any of the samples from Saldanha Bay. As to its occurrence may be noticed that in practically all the samples examined, it is associated with a liver-wort and *Physolinum monile* (nos. 108, 120, 133, 179, 261, 295) or sometimes with *Acanthococcus granulatus* var. *aerophilus* (nos. 105 and 195).

Trentepohlia umbrina (Kütz.) Bornet, in Wille, Algol. Mittheil. p. 426. [Pl. IX and X, Fig. 264—289].

This species is of very common occurrence on the bark of trees in several of the samples from the environs of Durban, but is entirely lacking in the samples from Saldanha Bay (nos. 9, 37, 85, 108, 132, 133, 134, 153, 177, 179, 235, 248).

The specimens drawn on the accompanying plates IX and X are all from sample 133.

It will appear from the pictures of this widely distributed and variable species that in the South-African specimens the cells are usually more or less rounded, spherical-ellipsoid or ovoid, at times even of a rather irregular shape. When young only, the cells are nearly cylindric and about 3—4 times as long as broad, with thinner walls, while the older ones, which are apt to be rounded off and to undergoing disintegration, have a thicker membrane exhibiting a distinct stratification. The membrane is always hyaline. These older thick-walled and isolated cells really act, and must be considered as the akinetes of the species. The ramification is very irregular, and this species rarely forms distinct filaments. The cells mostly lie in irregular rows in large heaps, frequently in several layers. The size of the cells is very varying, from quite small up to 35 μ in diameter. The average size is 15—25 μ.

The thickness of the membrane is also very varying, 3—4 μ, at times up to 7 μ. The gametangies do not differ very much from the vegetative cells either in form or size. They may be terminal or intercalary. The diameter of the gametes is about 4 μ, and they escape through a hole in the wall of the mother cell.

The specimens from South Africa agree on the whole very well with the Scandinavian ones and with the material of this species in Wittrock et Nordstedt, Algae Exsiccatae nos. 42, 915, and 1423.

Trentepohlia lagenifera (Hildebrandt) Wille var. **africana** nov. var. [Pl. V, Fig. 201—220].

A forma typica differt filis curvatis et ramosissimis, massas cellularum paene pseudoparencymaticas formantibus. Omnibus partibus etiam minor, cellulis vulgo 4—7 μ latis. Gametangiis diametro 12—18 μ.

This alga forms extensive brownish-green or yellowish-brown lustreless coatings on trunks of trees. The filaments are characteristic in being curved and much ramified; long, straight filaments occurring only very rarely. The cells are rather varying both as to size and shape, usually ellipsoid or ovoid, inflated, 4—7 μ broad, and 1½—2 times as long. At times some few filaments are to be found with more cylindric cells, not inflated, or only slightly so, 3—4 times as long as broad. The chromatophore in younger cells is one or a couple of lengthened parietal ribbons or slabs, with even or slightly incised edges. A pyrenoid is wanting. In older cells the chromatophore is often divided into several smaller parietal discs. The gametangies are very varying both in shape and size. However, they are usually larger, sometimes considerably larger than the vegetative cells, roundish when young, later on commonly more lengthened, to nearly pyriform. They are formed singly or several in series, terminal or intercalary. Only towards the time of ripening the gametangies get the protruding beak so characteristic of the species, and through which the gametes escape. The length of this beak is very varying, commonly 3—4 μ. The diameter of the gametangies is usually 12—18 μ. The gametes are ovoid, and are formed in a great number in each gametangium. The species are very frequently to be found with gametangies.

This alga is one of the commonest subaërial algae from the environs of Durban, where I have found it in the following samples: 3, 15, 28, 32, 71, 73, 78, 83, 88, 89, 90, 92, 115, 117, 120, 124, 132, 148, 153, 245, and 265).

In one single sample from Saldanha Bay occurred specimens somewhat differing in the shape of the vegetative cells, being distinguished by spherical cells or nearly so, which usually formed short filaments, consisting of few cells only. (Vide pl. VI, fig. 221—228). Mostly were found only 2—3—4-celled filaments; very common were also single cells, exhibiting one or two flattened parts at the original cross-wall (fig. 228). The diameter of the cell was usually somewhat larger than common, regularly 9—11 μ. *Tr. lagenifera,* however, is rather unanimously characterized as a very polymorphous species. Comp. for instance Rabenhorst's pictures in Fl. Europ. Algar. III, p. 300, fig. 104. Figure h in the plate mentioned thus very much recalls the specimens in question found by me in South Africa. At times may also among these specimens be seen individuals forming larger and ramified filaments, which shows the exceeding variability of this species. Thus, fig. 226 shows a thallus where one end has been formed by nearly spherical cells, and how the cells, towards the other end of the filaments, gradually pass into nearly cylindrical ones. Gametangies were also frequently to be found in this sample, being of the same bottle-shape peculiar to *Tr. lagenifera* (fig. 221, 222). At times they are also to be seen with a total absence of a beak (fig. 223.) Such specimens are exceptions, however.

I addition to the species of *Trentepohlia* mentioned here, I have also found a couple of others. On account of the insignificant material, and because I have not seen particularly characteristic stages, I have not been able to determine them with sufficient certainty, but for the sake of completeness I mention here:

? Trentepohlia dialepta (NYLANDER) HARIOT, Notes sur le genre *Trentepohlia* (Journ. de Botanique, 1889—90) p. 23, Fig. 10; DE WILDEMAN, Notes sur quelq. esp. *Trentepohlia* (Annales Soc. belg. microscopie 1894) p. 23, Pl. III, Fig. 8—11.

In one sample collected south of the Whaling Station at Bluff, (no. 28) I have observed specimens of *Trentepohlia* that seem to agree very well with *T. dialepta.* The cells are ± 8 μ broad, and 2—4 times as long, with globose gametangies. The material is too sparse and incomplete for a reliable decision, however.

? Trentepohlia ellipsiocarpa SCHMIDLE, var. **africana** SCHMIDLE, Beitr. z. Algenflora Afrikas (Engl. bot Jahrb. B. 30, 1901) p. 63, Tab. II, Fig. 8—10. [Pl. VI, Fig. 229—232].

Specimens probably belonging to this one I have observed in a sample of bark collected near Bluff (no. 133), where it occurs very sparsely, though. The cells are 3,5—4 μ broad, only a little longer than broad, thin-walled and slightly inflated. The apical cell is acuminate. The gametangies are ovoid, 12—12,5 μ long and 6,8—8,5 μ broad.

Phycopeltis arundinacea (MONT.) DE TONI, Ueber *Phyllactidium* (1889); Syll. Alg. I, p. 15. [Pl. XI, Fig. 290—294].

This species is very common and occurs in nearly natural pure cultures in samples from the environs of Durban (nos. 84 and 116) as also from Saldanha Bay (nos. 381, 384, 387, and 394). It occurs here epiphytic on the stems of various woodened species of grass, probably bamboo, on the hard, smooth and silicate surface of which it forms a very characteristic coating of a dull greyish-green colour (when dried).

The individual discoidal thalli are easily seen even with the naked eye; they form nearly orbicular, sharply circumscribed discs up to 1,5 mm. in diameter, and are closely appressed to the substratum. At times they grow so densely that the discs to the naked eye melt together to a cohesive incrustation of several $cm.^2$ extent. I have often observed that where two thalli meet in this way, they do not grow into each other. Pl. XI fig. 304 shows that then they join closely at the edges, and further growth in this direction ceases. Under these circumstances older discs may, at times, get a somewhat irregular circumference, as the growth continues only in those directions where there are open spaces for a continuous growth. The covering of the stems thus gets thin and monostromatic all over, being composed of numerous single discs. From the regular series of cells in each thallus, however, the lines between the single discs may be easily discernable (vide fig. 293, pl. XI). Subjected to a microscopic examination the species is found to be very characteristic by its regular cells, arranged in radial rows. Already in young and small discs the regular arrangement of the cells in radial rows is to be seen. Towards the circumference the cell rows divide dichotomously, and in this way is formed a cohesive disc of a single layer, without holes or rents. The edge of the thallus is even and entire, always destitute of lobes, and never with a tendency to dilapidate into single threads. The individual cells are — at least in somewhat older specimens — distinctly rectangular, on an average 1½—2 times as long as broad. The size of the cells is, for the rest, somewhat varying. They are comparatively smallest on young and small thalli, and measure in full-grown specimens 7—9 μ. The disc-sporangia are somewhat larger and more roundish than the vegetative cells, from nearly globose to ovoid. They occur without order, singly or several together, and any vegetative cell seems to be able to grow out into a sporangium. Other reproductive organs do not occur in my material.

When the cell-discs crack, for instance in being torn from the substratum in order to be put under the microscope, they are mostly split up radially along the cell-series. The connection among the cells in the disc is evidently stronger between the tangential walls, that is, between the individual cells in one and the same row, than between the cell-rows mutually.

In the course of time quite a number of species of *Phycopeltis* have been described, partly under other names, as *Phyllactidium, Chromopeltis, Hansgirgia,* and others. Several of them, however, seem to have been described on primitive and, in systematical regard, dubious characters only. It is probable that with the great range of variation which the single species of this family empirically evince, several of these, described as species, in the future, when one day more closely examined and monographically treated according to modern principles, will turn out only to be modifications due to habitats, and that the number of true, systematically well defined types will be restricted to a comparatively small number, but in return, with a rather wide range of variation.

Phycopeltis flabelligera (De Toni) Hansg. Ueb. Gatt. *Crenacantha,* p. 59. *Hansgirgia flabelligera* De Toni, Syll. Alg. I, p. 363; De Wildeman, Observ. sur quelq. d'Algues Terrestres Epiphytes (Bull. Soc. Belgique 1888); A propos de l' *Hansgirgia flabelligera* (Soc. royale bot. Belgique 1889).

This species is rather frequent in some samples from the environs of Durban, above Bluff, between Eastern Whaling Company's station and Isipingo Kraales, collected Nov. 17th (nos. 194, 207) and in a single sample from the water-place at Saldanha Bay, March 13th (397), where it occurs together with some other *Chlorophyceae* as a coating on various straws and rush. Already by a slight magnification it is seen to differ from the preceding species in an irregular and indented circumference. The pictures of De Wildeman's in Obs. Alg. Ter. Epif. fig. 9, moreover, give a good idea of the appearance of this alga. On close scrutiny the species, moreover, evinces a wide range of variability. The cells are rather irregular, 3,4 or 5 angular, nor are the discs by far so regularly made up as in the preceding one. Besides, this species is more apt to dilapidating into single filaments. From a central disc, built of comparatively short and broad cells, it will be seen that the cell-rows very frequently split and grow forth rather irregularly. The cells of these free rows are, as a rule, more inflated than those of the solid disc, where they, because of the mutual compression, are apt to taking a more rectangular or polygonal shape. Also in the central disc itself are often to be found rents between the cell-series. Casually broken and isolated cell-rows are capable of continuing their growth nearly as a real *Trentepohlia.* It emits lateral branches, and I have observed intercalary cell-divisions and forming of sporangies in such specimens.

This species, which previously has been described by De Toni as a distinct genus, *Hansgirgia,* thus seemed to form a transition between the genera *Trentepohlia* and the true *Phycopeltis* (sect. *Euphycopeltis* Wille). To maintain the genus *Hansgirgia* according to the limitations given by De Toni, does not seem to be systematically well founded, now that we have got a more exact knowledge of these forms. As to the appearance of the species, the accompanying pictures on pl. XII will give an idea thereoff. The size of the cells is varying, on an average between 5—7 μ in breadth, at times up to 8—10 μ. The disc-sporangies are globose or ellipsoid, somewhat larger and more tumid than the vegetative cells.

Myxophyceae.

Microcystis amethystina (FILARSZKY) FORTI, Syll. Myx. 1907, p. 89.

var. **vinea** nov. var. [Pl. XIV, Fig. 337—341].

Differt a forma typica praecipue tegumento communi rubri vini colore simili, non lamelloso, extrorsum certe et distincte terminato. Cellulis 3,5—5,5 μ diametro latis, glaucis, vacuolis carentibus.

This small *Microcystis,* which is very characteristic by its beautiful, wine-red colour of the gelatinous investments, is frequently to be met with in some of the samples. It is further characteristic by its rather small, commonly spherical colonies, measuring up to 50 μ in diameter, the external surface of which is surrounded by a comparatively thick and solid cuticle. The gelatinous envelope itself has no stratification. The cells are 3,5—5,5 μ in diameter, globose or ellipsoid just before the divisions, bluish-green, without pseudovacuoles. This alga is no doubt closely related to *Microcystis amethystina,* growing on damp rocks, but from which it differs especially by its wine-red colour and smaller colonies.

Collected on decayed wood and on the bark of trees in the environs of Durban (28 and 85).

Nostoc spec.

In a sample of bark from a tree near Umbilo River (no. 69), I have found young *Nostoc*-colonies together with *Tolypothrix byssoidea.* The specimens were too young for an adequate determination of species, however.

Atractella nov. gen.

Fila breviuscula, simplicia, altero apice adhaerentia, erecta vel basi interdum adscendentia, anguste fusiformia, ad utrumque apicem sensim attenuata, neque vero in setam producta. Trichomata ex serie constant simplici cellularum cylindricarum conformium, heterocystis nullis, vagina achroa, crassiuscula et firma ad utrumque apicem sensim decrescente circumdata. Fila libera, non conglutinata. Multiplicatio cellula apicali angusta et longiuscula in transversum divisa. Propagatio hormogoniis.

Atractella affixa nov. spec. [Pl. XIV, Fig. 313—316].

Filis breviusculis, vulgo 100—150 μ longis, ad 9—12 μ latis, ex numero vario cellularum, vulgo 15—20, conformium, cylindricarum, 3—5 μ latarum, aeque longarum vel usque ad duplum longiorum, vacuolis nullis constantibus. Parietibus transversariis crassiusculis. Vagina crassa ad apices sensim crassitudine decrescente, achroa, haud lamellosa. Vaginis adulterioribus interdum pallide canoviolaceis. Filis erectis vel curvatis, rigidis, vulgo constipatis.

This peculiar alga I have observed on the bark of a tree taken near the ocean, south of the Whaling station, Bluff, in sample no. 28. By means of a strong magnifying glass it is to be seen as a velvety coating covering small parts. This coating is formed by the straight, short and unbranched, nearly parallel, very close-set filaments, fastened to the substratum with one end, while the free one is projecting.

The filaments are straight, or at the base sometimes slightly curved and ascending, and are easily loosened from the substratum. The trichomes themselves are short, and consist of 15—20 cylindrical cells in a simple row. The cells, all of which are uniform, are broadest in the middle of the trichome, where they may attain a breadth of nearly 5 μ, becoming gradually narrower towards the extremities, especially so towards the apex, where there is a comparatively long and narrow apical cell, propagating by vivid cross divisions. The older cells also sometimes divide, but normally the cell-division is limited to the apical cell only. With the exception of this one, which is several times as long as broad, the cells are equally long, about twice as long as broad. The trichome is enclosed within a fusiform sheath, which, in the middle, is nearly 10 μ broad and gradually narrowing towards the ends. At the base the sheath is obtusely rounded, towards the top gradually narrowing and decreasing, but never drawn out into hair-like points above the apical cell. The sheath is unstratified and colourless, at times, in older specimens, slightly greyish-violet. In the material at my disposal I have not been able to find with certainty the multiplication of the alga. In preparations of it there sometimes occur trichom-fragments, and it is probable that these serve as hormogones.

With regard to affinities, our alga must be classed among the *Oscillatoriaceae*, where it has its nearest relations among genera distinguished by a thick, solid sheath.

This genus presents an evident example of an alga which is morphologically particularly adapted to the «tufted growth» mentioned by FRITSCH, l. c. 1907, p. 210, a growth-form of the bluish-green aërial algae frequently to be met with in damp, tropical regions.

Dactylococcopsis rhaphidioides HANSG., Syn. Gen. subgen. Myx. in Not. 1888, p. 590.

Of this species I have found two different forms. One I have observed on trunks of trees, collected in the environs of Durban, at Bluff, south of the Whaling station (no. 28), and its is distinguished by nearly straight or only sligtly curved, equally broad cells, narrowed and acuminate towards the extremities. Often one end of the cells is straight, the other slightly curved, or the cells nearly S-formed, or slightly spirally twisted. The breadth of the cells is

1,5—1,8 μ, the length 18—21 μ. This form I distinguish as *forma subtortuosa.*

The other one I distinguish under the name of *forma falciformis.* It is distinguished by having always falciform cells. Besides, they are somewhat more slender than the preceding one, 1,2—1,5 μ broad, and 10—15 μ long. The cells are never so curved that the ends converge, but they are often nearly parallel.

Observed on a piece of wood, collected near the water-place at Saldanha Bay, March 19th. (No. 375).

It is possible that these two forms, mentioned above, should rather be separated as different species; but as long as the true nature of these organisms is not fully known, I have preferred to place them as done above.

Myxosarcina nov. gen.

Familiis liberis cubice rotundatis distincte definitis, densis, compactis, cellulas numerosas aequales, fere cubicas vel polyedricas continentibus. Divisionibus in tres directiones familiae cellularum regulariter dispositarum oriuntur; postea subirregulariter dividi possunt, unde familiae aetate magis provectae subirregulares videntur. Membranae leves, tenuissimae, hyalinae. Familiae tegumento mucoso tenui, achroo saepe fere inconspicuo circumdatae. Propagatio gonidiis in gonidangiis cellulis ceteris paullo majoribus ortis.

Myxosarcina concinna nov. spec. [Pl. XVI, Fig. 342—357].

Familiis regulariter cubice rotundatis ex cellulis cubicis vel polyedricis vulgo 64 regulariter formatis. Membrana cellularum tenuissima levi, hyalina, diametro 3—4 μ, raro usque ad 5 μ ante divisionem; contentu cano violaceo. Familiis adultis cellularum 64 vulgo 16—20 μ, familiis aetate provectis cellularum plurium usque ad 32 μ diametro. Propagatio gonidiis parvis numerose in gonidangiis a cellulis vegetativis et forma et magnitudine vix diversis ortis. Cellulae omnes gonidias formare posse videntur.

This genus is no doubt most closely related to *Pleurocapsa;* it differs, however, by so important characters, that it forms a genus, distinctly separate from *Pleurocapsa.*

The genus of *Myxosarcina* is very characteristic in forming free-living colonies, with a definite and distinctly limited circumference; it is never crusty, as is common in *Pleurocapsa.* Further it differs by having gonidangies of the same shape and size as the ordinary vegetative cells.

The colonies of *Myxosarcina* are commonly very regularly built. The original cell divides in all three directions, whereby arise small colonies, consisting of 8 cells. Pl. XIV, fig. 342, 343. By further divisions of each of these 8 cells in three directions, arise 64-celled colonies, which much recall the «*Sarcina*-packages. As these cell-divisions are rather regular, the colonies arisen get a very regular appearance, with nearly equally large, cubical cells, lying in regular rows. The circumference of the colonies is nearly cubically rounded. This, which seems to be the typical and full-grown state of the alga, measures 16—20 μ in diameter. The diameter of the individual cells is 3—4, rarely up to 5 μ just before the division. Sometimes the cell-divisions are somewhat irregular, however, whereby are to be found colonies with somewhat larger or smaller cells, and also less regularly built. It further occurs that some cells divide later on, whereby older families may get a rather irregular appearance. The original (oldest) cell-walls are usually rather easily recognized, however, by their regular run and by unvaryingly being somewhat thicker than the younger ones. Such old colonies may reach up to 32 μ in diameter.

The cell-walls, moreover, are comparatively thin and colourless. The cells are closely joined to each other, without intercellular spaces, whereby the cells mostly get an angular-cubic appearance. The peripheric cells, however, commonly have somewhat tumid outer walls. The contents of the cells are greyish-violet, without vacuoles. The colony is enclosed by a thin gelatinous investment.

In the material examined by me, gonidangies were very rare. Among several hundreds of colonies which I have examined, I have found only two with gonidies. This discovery is of great importance for elucidating the systematic position of the alga. The gonidies are very small, and arise in great numbers in gonidangies, which, as mentioned, neither in shape nor size differ from ordinary vegetative cells.

Empty cells, which at least partly must be considered as emptied gonidangies, I have often observed in my material.

This alga occurs scattered on bark of trees, in some samples from the environs of Durban (nos. 22, 40, and 122).

In point of external habitus our alga may, to some extent, recall the pluricellular spores of certain lichens. It is, however, even on dried material readily distinguished by the characteristic greyish-violet colour, the delicate gelatinous envelope, and, above all, the divisions of the contents of the cells into numerous protoplasmic bodies — gonidia — which are liberated by the rupture of the old membrane. The gradual development of the colonies, traceable through the various stages, also favours the supposition of the autonomy of this alga.

Tolypothrix byssoidea (HASS.) KIRCHN. in ENGL. et PRANTL, Nat. Pflanzenf. *Schizophyc.* p. 79; DE TONI, Syll. Alg. Vol. V. p. 551. *Hassallia byssoidea* HASSALL, British Freshw. Alg. I, p. 233, Tab. 67, Fig. 5.

This species is comparatively common in several of the samples examined from the environs of Durban, for instance in 9, 57, 69, 85, 179, and in a single sample from the «Bush», on the peninsula between Donkergat and Jutten Island, Saldanha Bay, March 11th (no. 368). It mostly forms a macroscopically visible bluish-green, velvety coating on the bark of trees. The sheaths are 10—15 μ broad, thin, and of a bright yellowish brown colour. The cells themselves are 8—12 μ broad, and ⅓—½ as long, slightly tumid. The filaments are fragile and dissociate easily. The specimens found, agree very well with the material in COLLINS, HOLDEN and SETCHELL, Phyc. Bor. Am. no. 258 and no. 258 a and in RABENHORST, Algen Europas, no. 352.

Explanation of Plates.

Pl. I.

Fig. 1—17. *Protococcus consociatus* nov. spec.
Cells forming larger and smaller colonies.

Fig. 18—30. *Protococcus verrucosus* nov. spec.

Fig. 31—51. *Chlorococcum vitiosum* nov. spec.
Fig. 31—43, ordinary vegetative cells, of which fig. 41 and 42 have somewhat crenulate membranes; 38 has the membrane only partly crenulate. Fig. 44, 45, and 48 show sporangies, 46, 47, 49, 50, and 51, emptied sporangies or sporangies emptying themselves.

Fig. 52—78. *Phaseolaria obliqua* nov. gen. et spec.
Fig. 52—66 show ordinary vegetative cells; fig. 52 and 57 showing cells seen from above and from the side. Fig. 67—74, cells in zoospore-formation. Fig. 71 and 73, cells with crenulate membranes. Fig. 75—77, emptied zoosporangia. Fig. 78 is a pile of cells of *Phaseolaria obliqua*. The contents are drawn in one cell only, forming zoospores.

Pl. II.

Fig. 79—89. *Acanthococcus granulatus* Reinsch var. *aerophilus* nov. var.
Fig. 84, 85, 82, 83, and 79, various advancing stages of reproduction. Fig. 81, 82 are emptied mother membranes. Fig. 87—89, very young specimens; the smallest ones measure only about 3,5 μ in diameter. Fig. 86, specimen with extraordinary low, rounded membrane-warts.

Fig. 90—104. *Chlorella vulgaris* Beyerinck.
Fig. 93, mother membrane with two aplanospores. Fig. 90 and 91, aplanospores escaping the mother membrane. Fig. 92, 94, and 95, cell-piles where the cells on account of the mutual compression are somewhat flattened on one or more sides. The membranes are sometimes partly crenulate. Fig. 96—104, solitary

cells, where the opening of the chromatophore may be seen. The membranes are smooth or partly crenulate.

Fig. 105—123. *Myrmecia globosa* nov. spec.

Fig. 112—123, ordinary vegetative cells of different size. Fig. 117, 118, and 121 show that the opening of the chromatophore is on the opposite side of the membrane-wart. Fig. 119, 110, 111, 105, and 106, advancing stages in zoospore-formation. Fig. 107, 108, and 109, zoosporangies, partly or wholly emptied.

Pl. III.

Fig. 124—155. *Pleurastrum constipatum* nov. spec.

Fig. 124—137, and 151 represent larger and smaller thalli, showing their shape and size. The contents of the cells drawn in fig. 151 only. Fig. 138—150, 152—155 showing formation of akinetes.

Pl. IV.

Fig. 156—199. *Pleurastrum lobatum* (CHODAT) PRINTZ nov. comb.

Larger and smaller colonies. Contents drawn in a few cells only. Fig. 159 and 160 are cells containing zoospores. Fig. 164 is a solitary cell in zoospore-formation. Fig. 196—197 and 198—199 are two colonies seen respectively from the face and from the side, showing that the cells are orientated in one plane only.

Pl. V.

Fig. 201—220. *Trentepohlia lagenifera* (HILDEBR.) WILLE var. *africana* nov. var.

Irregular filaments partly with gametangies. Fig. 211 shows an isolated gametangium with gametes. Fig. 212, emptied gametangium.

Pl. VI.

Fig. 221—228. *Trentepohlia lagenifera* (HILDEBR.) WILLE var. *africana* nov. var.

Vegetative cells, partly with gametangies. Fig. 228, a single isolated cell (akinete?).

Fig. 229—232. ? *Trentepohlia ellipsiocarpa* SCHMIDLE var. *africana* SCHMIDLE.

Filaments, with various stages of formation of gametangies. Fig. 231, opened gametangium. Fig. 232, filament with a short branch.

Fig. 233—243. *Hormidium flaccidum* Braun f. *cellulis passim tumidis.*

Pl. VII.

Fig. 244—252. *Trentepohlia aurea* (L.) Mart. *forma.*
Fig. 244, 245, 246, 250, and 252 show filaments with gametangies, the first mentioned one with a partly emptied gametangium. Fig. 247, 249, and 251, vegetative filaments showing ramification and apical cells.

Pl. VIII.

Fig. 253—263. *Trentepohlia aurea* (L.) Mart. *forma.*
The figures show the ramification of the filaments, apical cells, and shape and arrangement of the gametangies. In fig. 260, an emptied gametangium, the point of which is drawn out into an abnormally long beak.

Pl. IX.

Fig. 264—273. *Trentepohlia umbrina* (Kütz.) Born.
Fig. 264—272, cells of various age, partly forming akinetes. Fig. 273, gametangies.

Pl. X.

Fig. 274—289. *Trentepohlia umbrina* (Kütz.) Born.
Fig. 274, 279, and 285, emptied gametangies. Fig. 282, gametangium. For the rest, vegetative cells in akinete-formation.

Pl. XI.

Fig. 290—294. *Phycopeltis arundinacea* (Mont.) De Toni.
Fig. 290, a very young thallus, consisting of seven cells. Fig. 291—292, young thalli, the last one with a disc-sporangium. Fig. 293 shows the edge of two discs having come in contact with each other. Fig. 294 shows the regular structure of an older thallus; the cell-rows are regularly dichotomously ramified. With disc-sporangies.

Pl. XII.

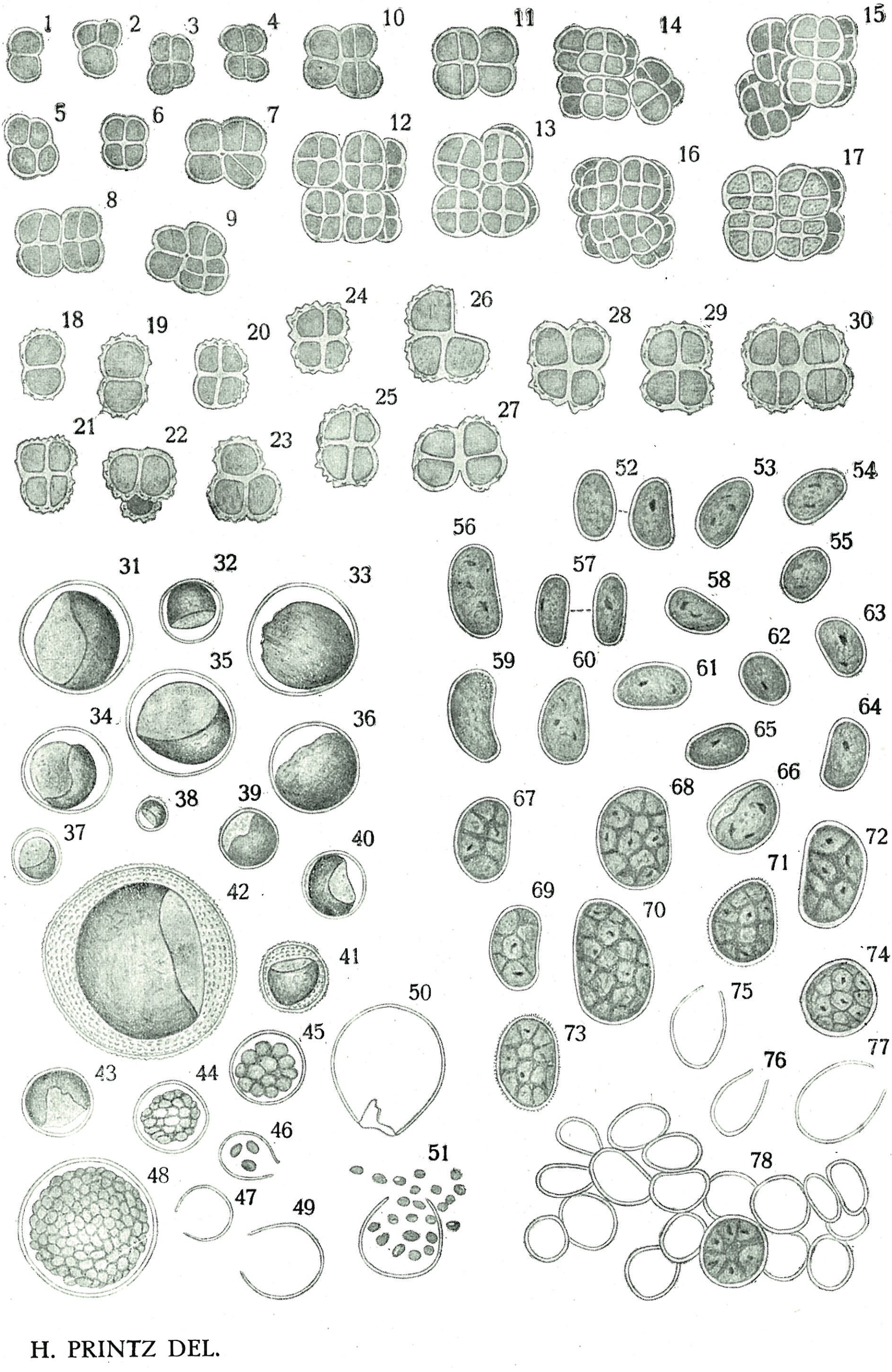
Fig. 295—305. *Phycopeltis flabelligera* (De Toni) Hansg.
Fig. 295, 297, 299, 300, and 302 are isolated filaments. The rest of the figures are parts of larger thalli, showing their irregular construction with isolated filaments and irregular circumferences.

Pl. XIII.

Fig. 306—312. *Physolinum monile* (De Wildem.) Printz nov. comb. Larger and smaller parts of thalli with aplanosporangies. In fig. 308, an open, partly emptied aplanosporangium; in fig. 310, a quite emptied sporangium. Fig. 311, with crenulate membrane.

Pl. XIV.

Fig. 313—316. *Atractella affixa* nov. gen. et spec.
Fig. 317—327. *Dactylococcopsis rhaphidioides* forma *subtortuosa* n. f.
Fig. 328—336. *Dactylococcopsis rhaphidioides* forma *falciformis* n. f.
Fig. 337—341. *Microcystis amethystina* var. *vinea* nov. var.
Fig. 342—357. *Myxosarcina concinna* nov. gen. et spec. Specimens of various size.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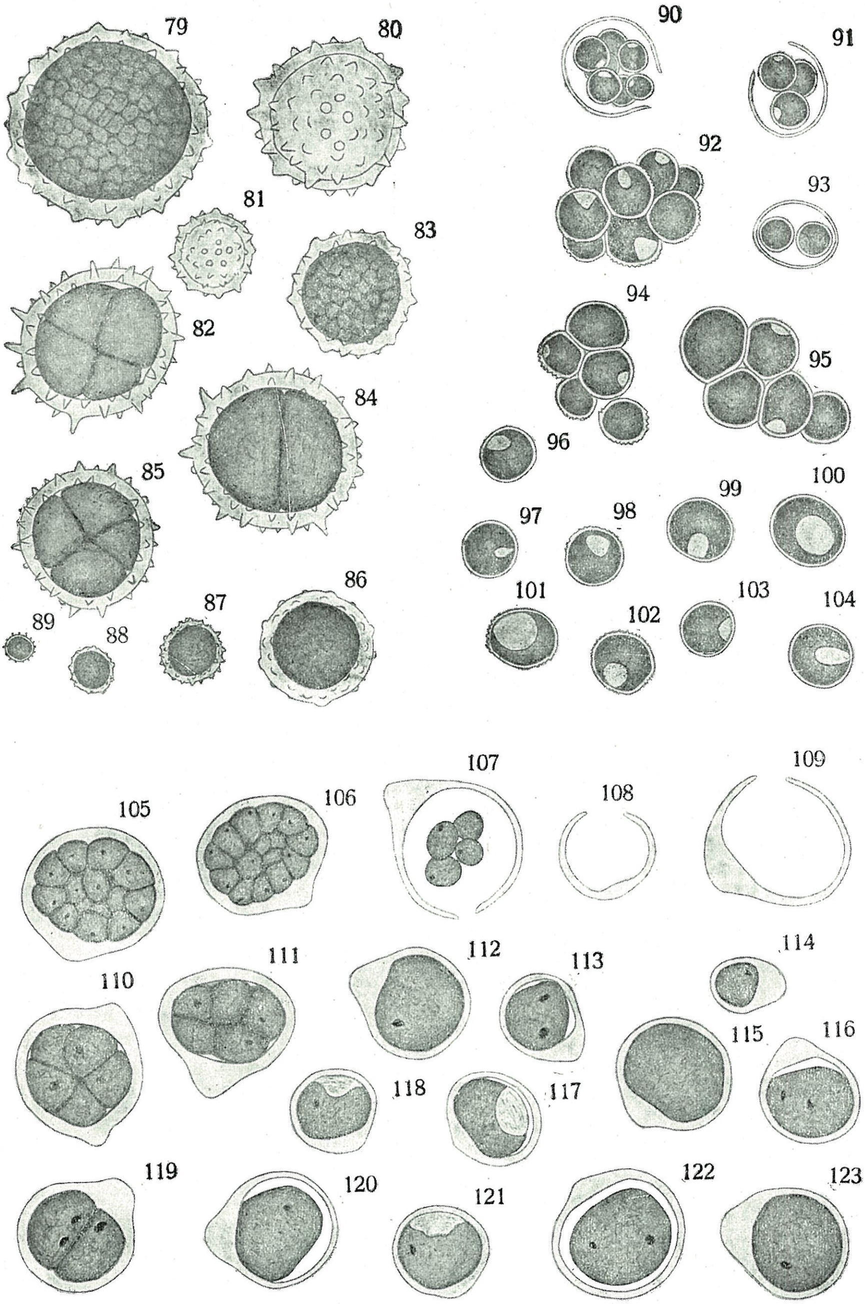
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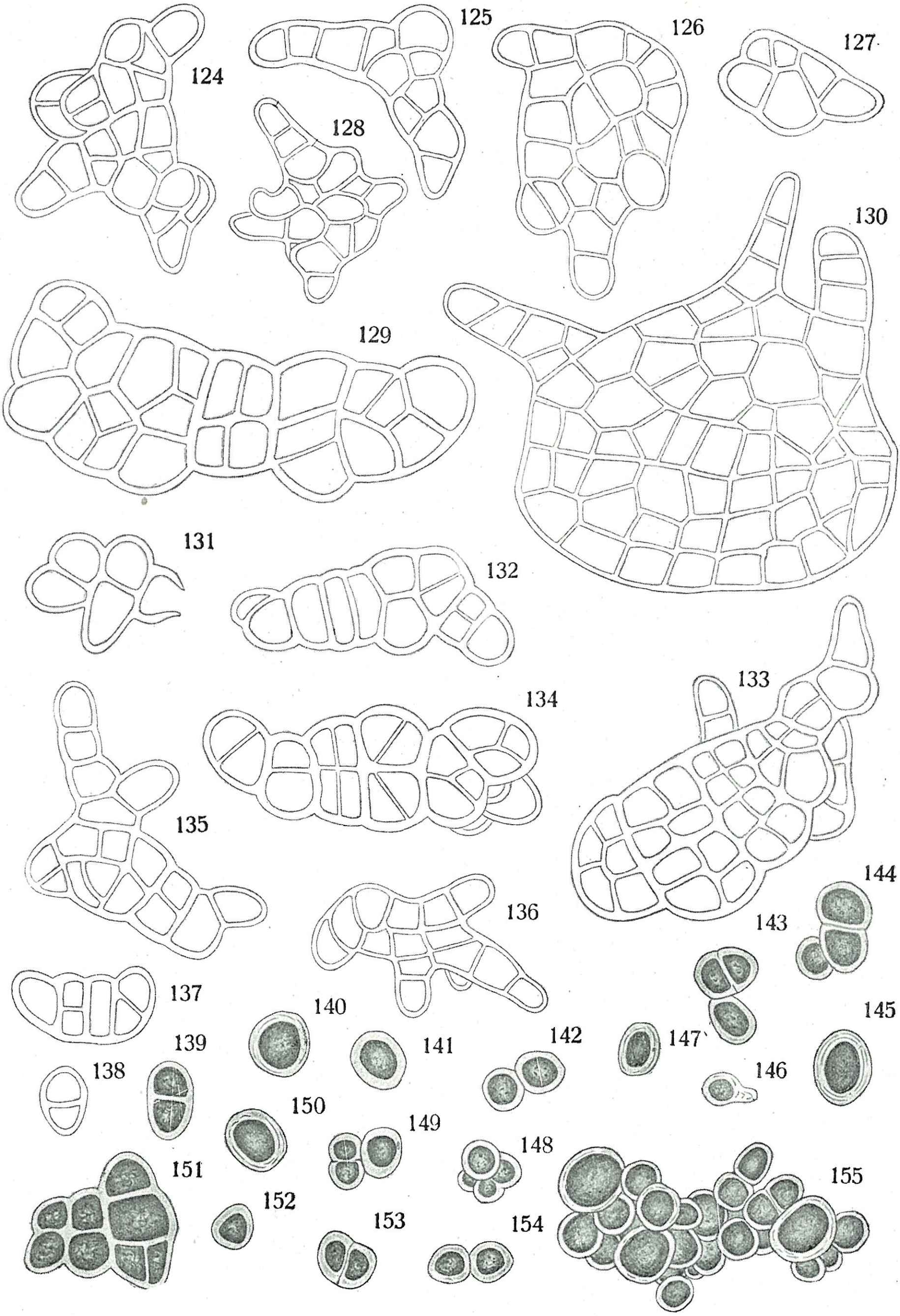

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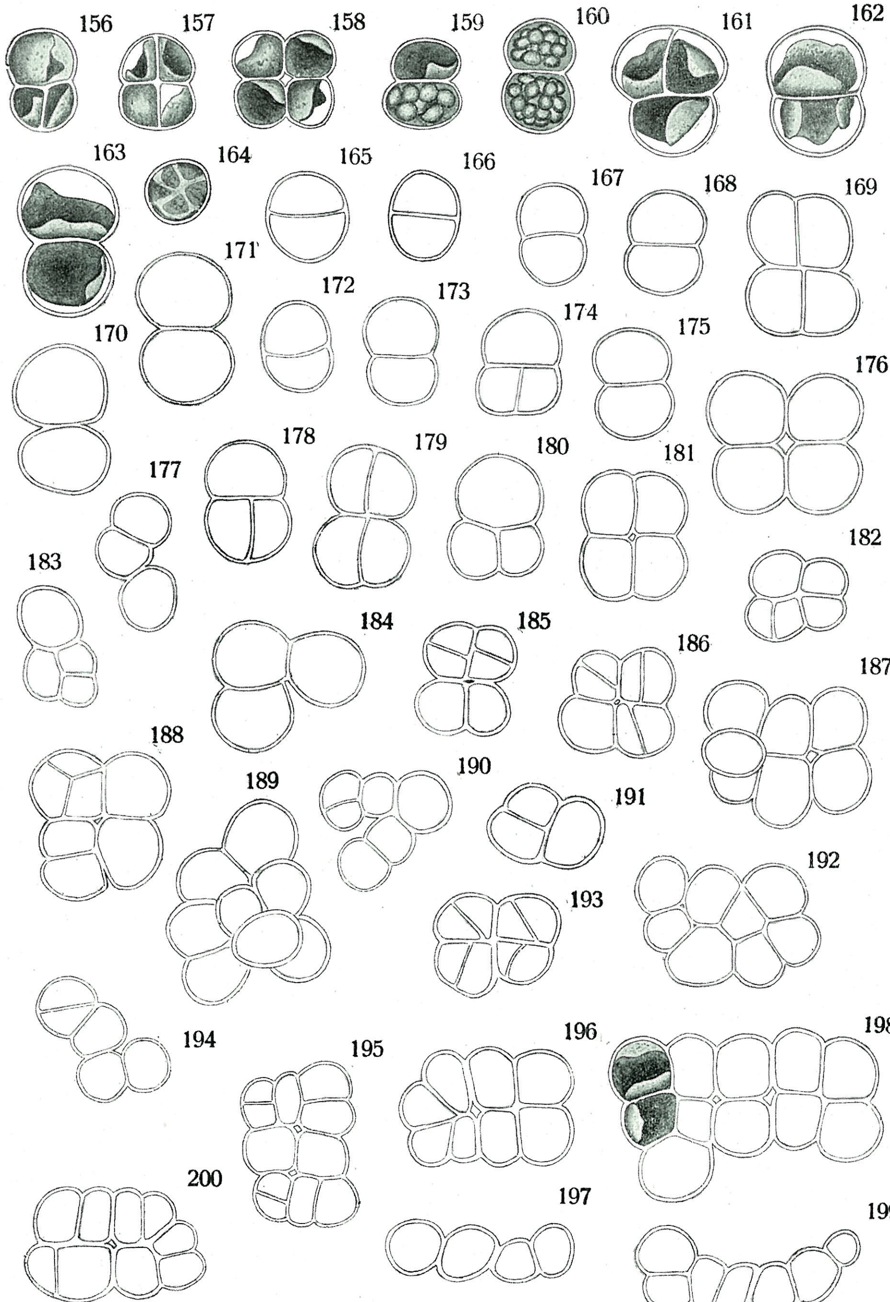

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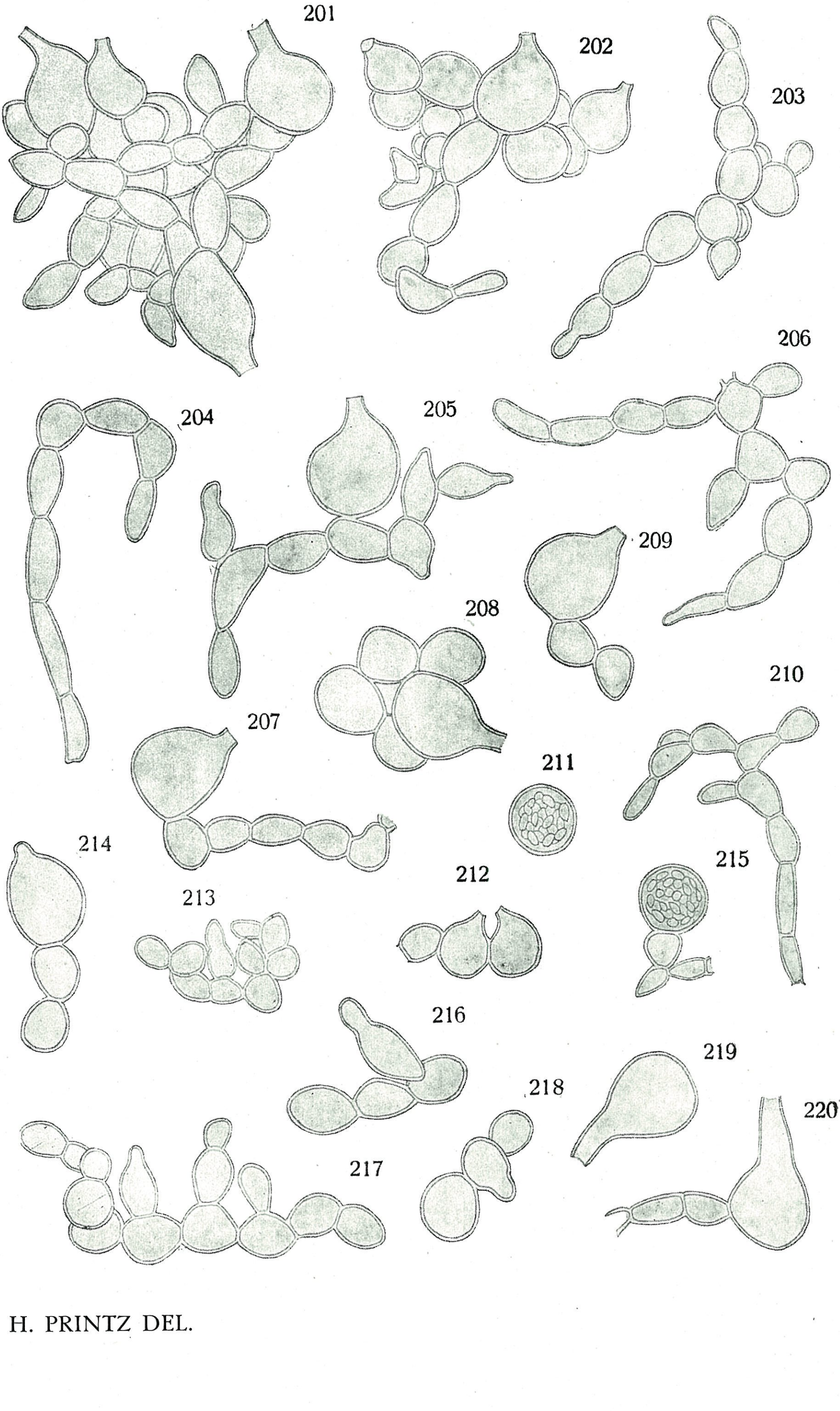
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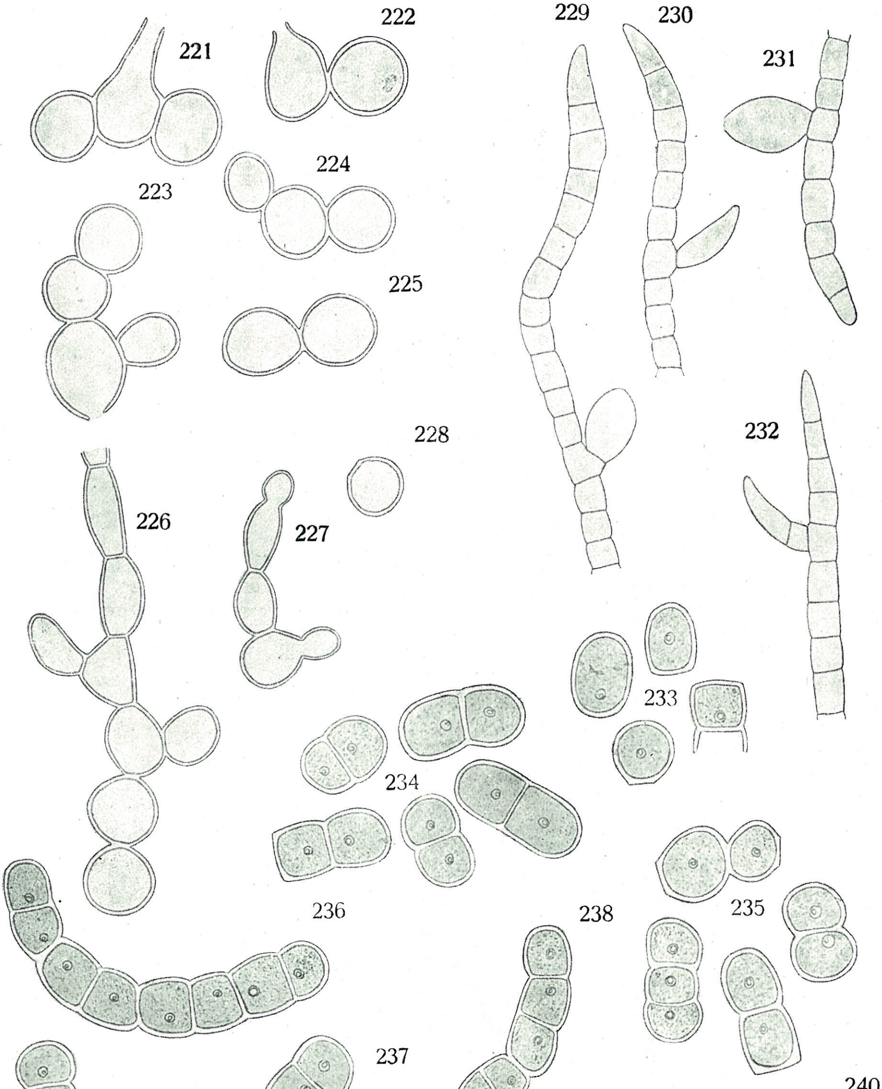
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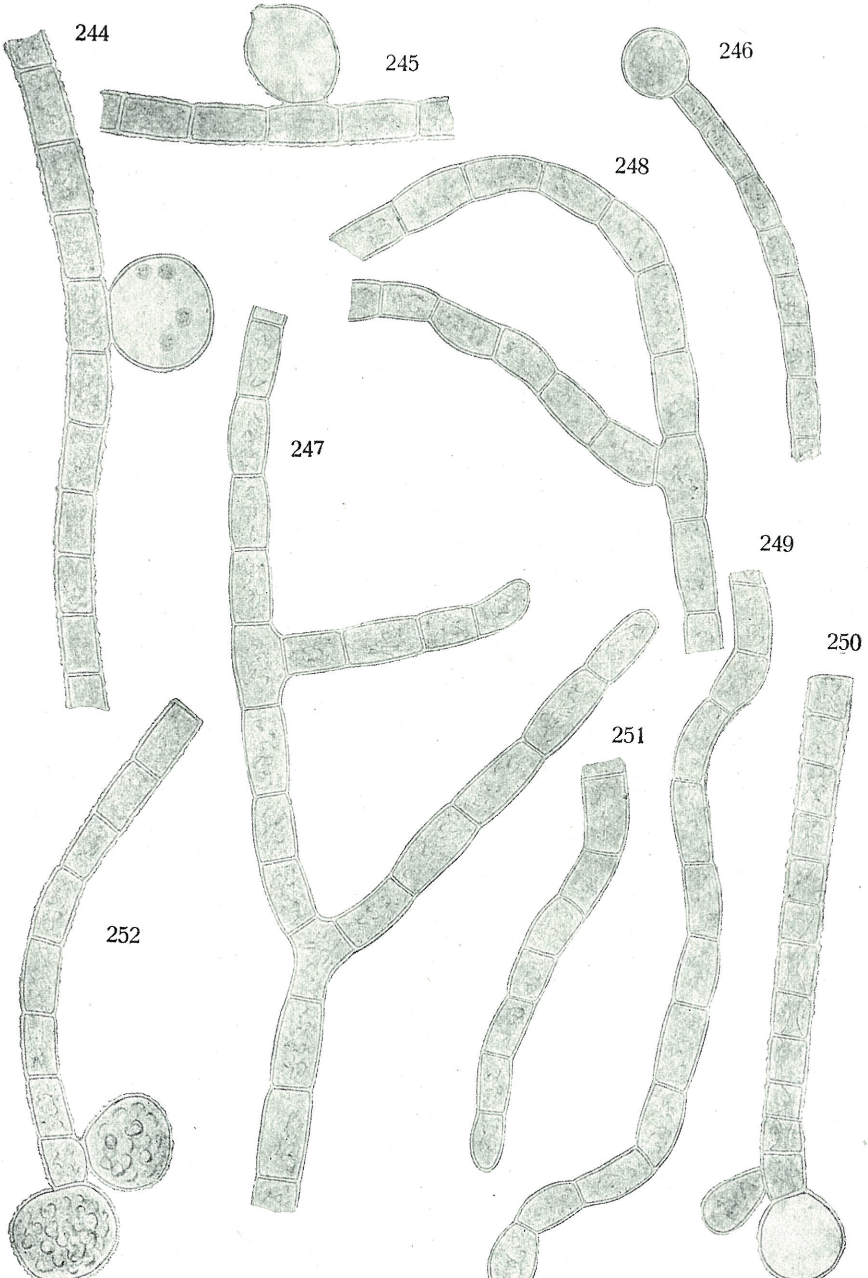

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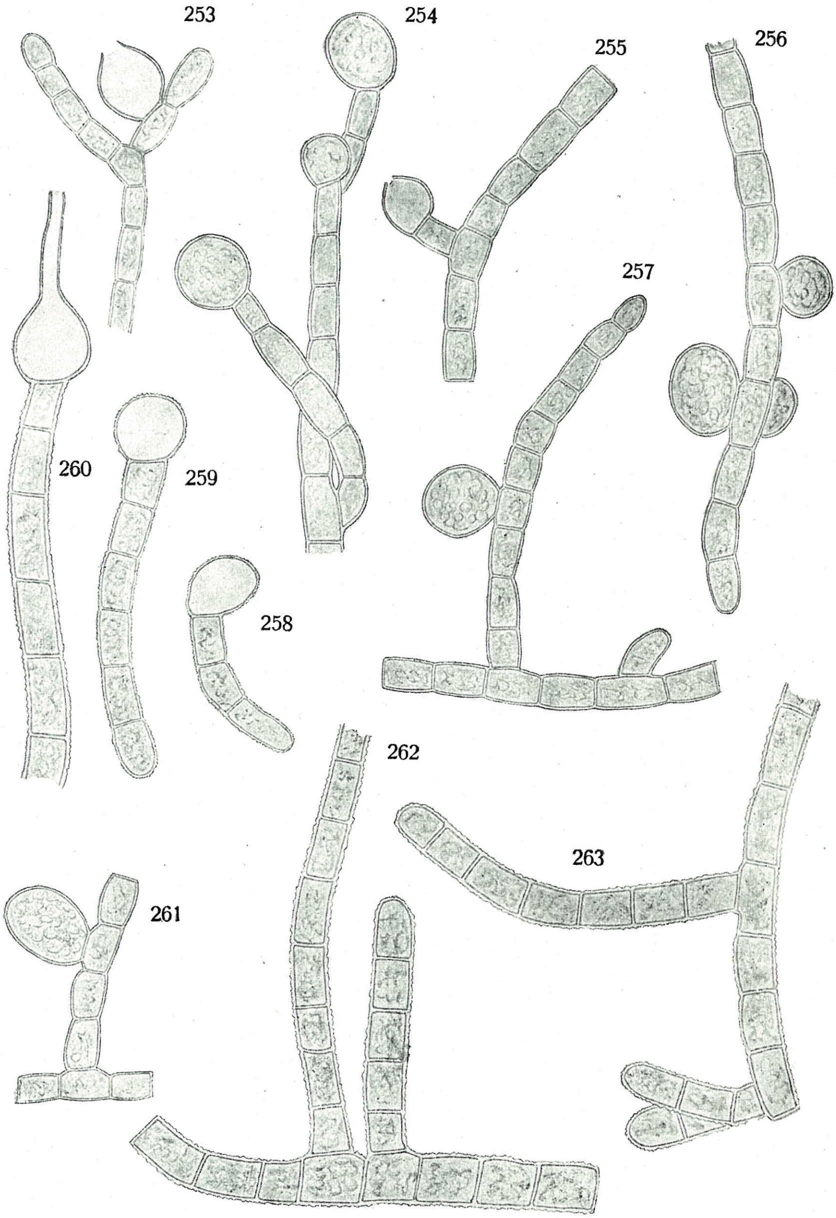

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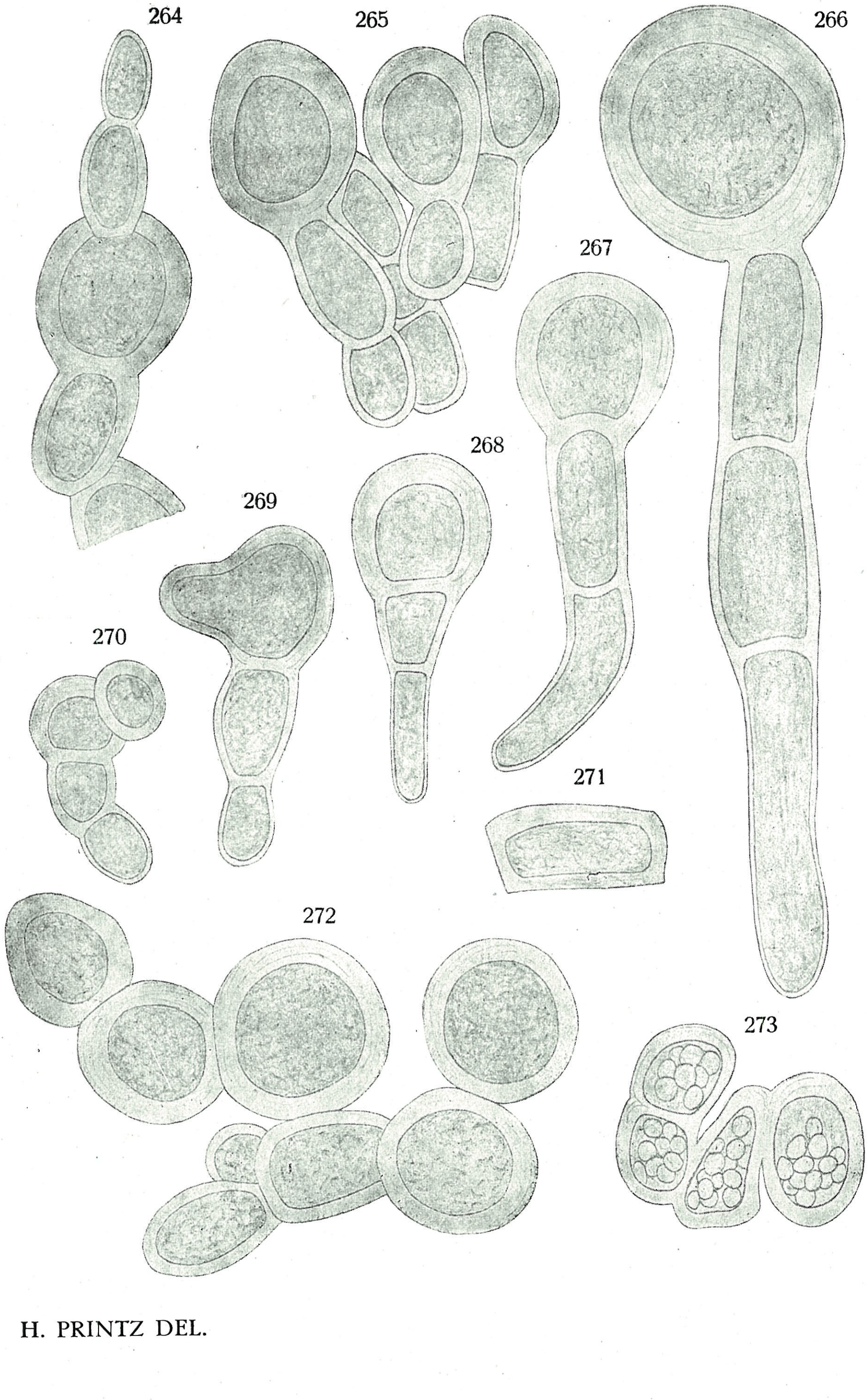

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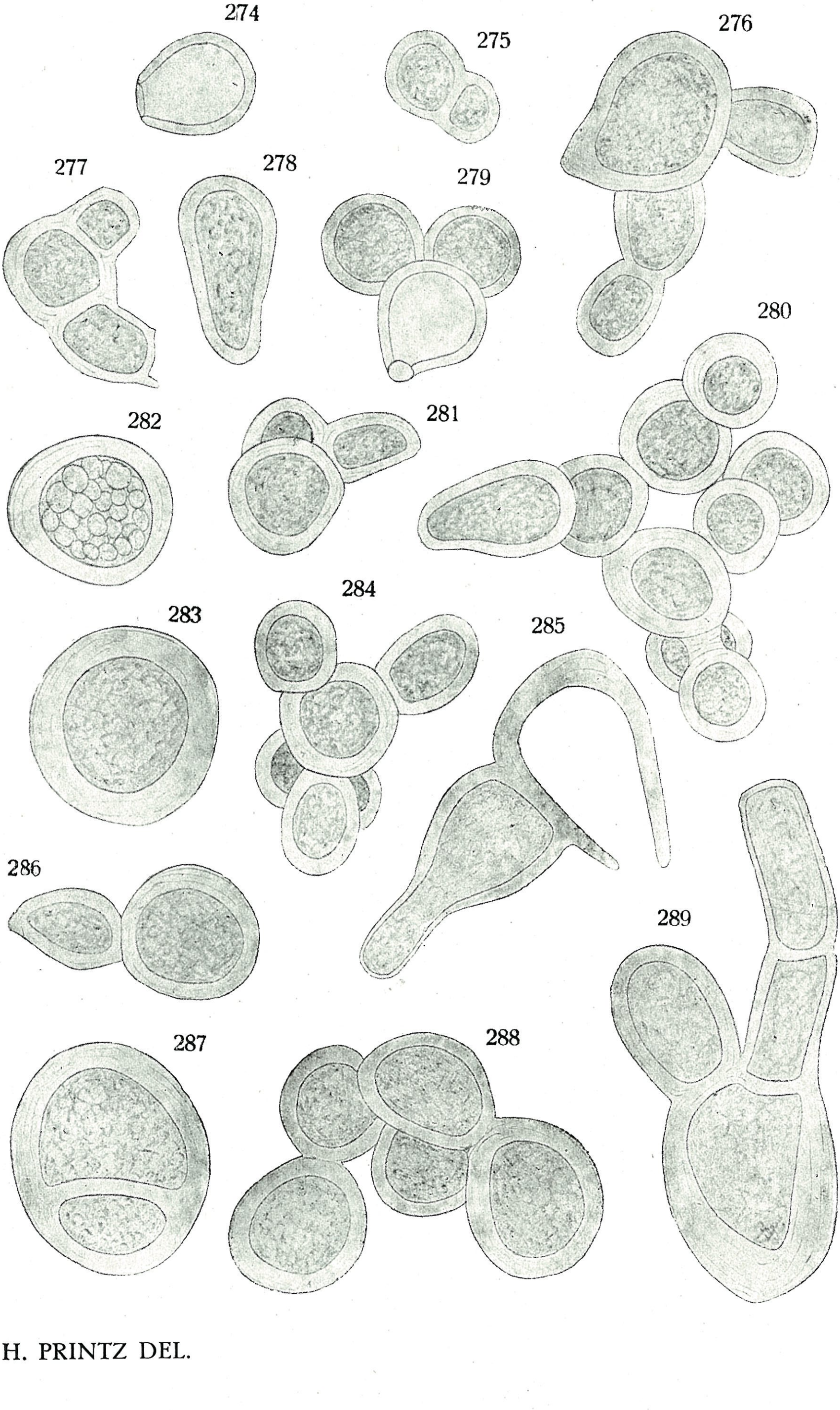

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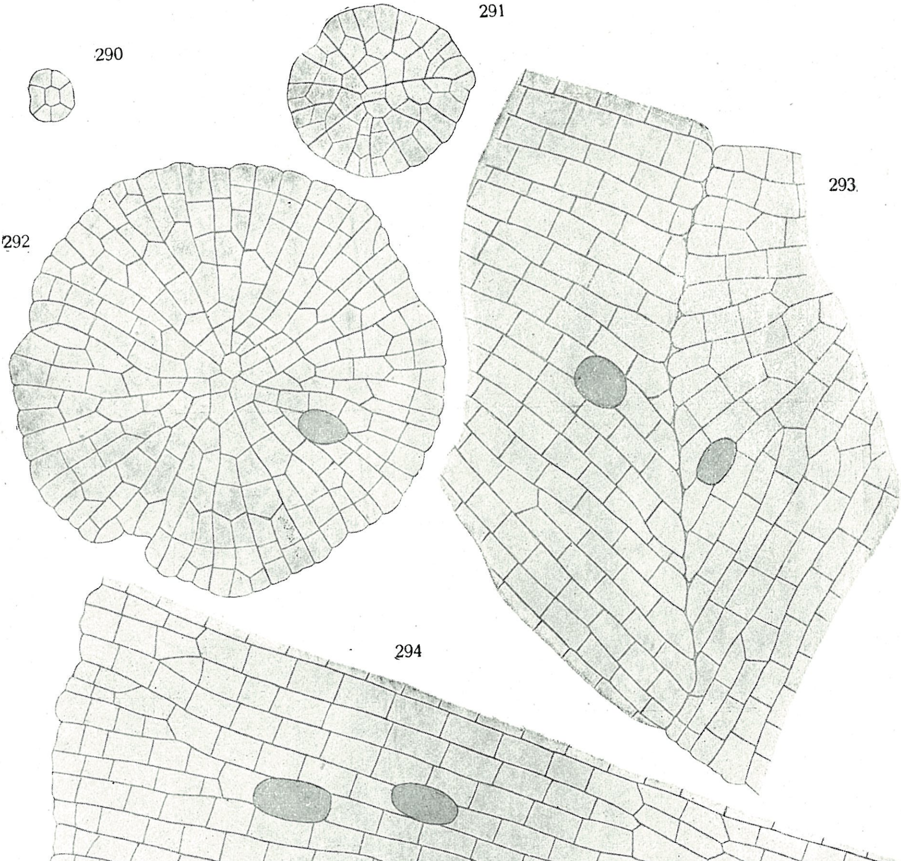

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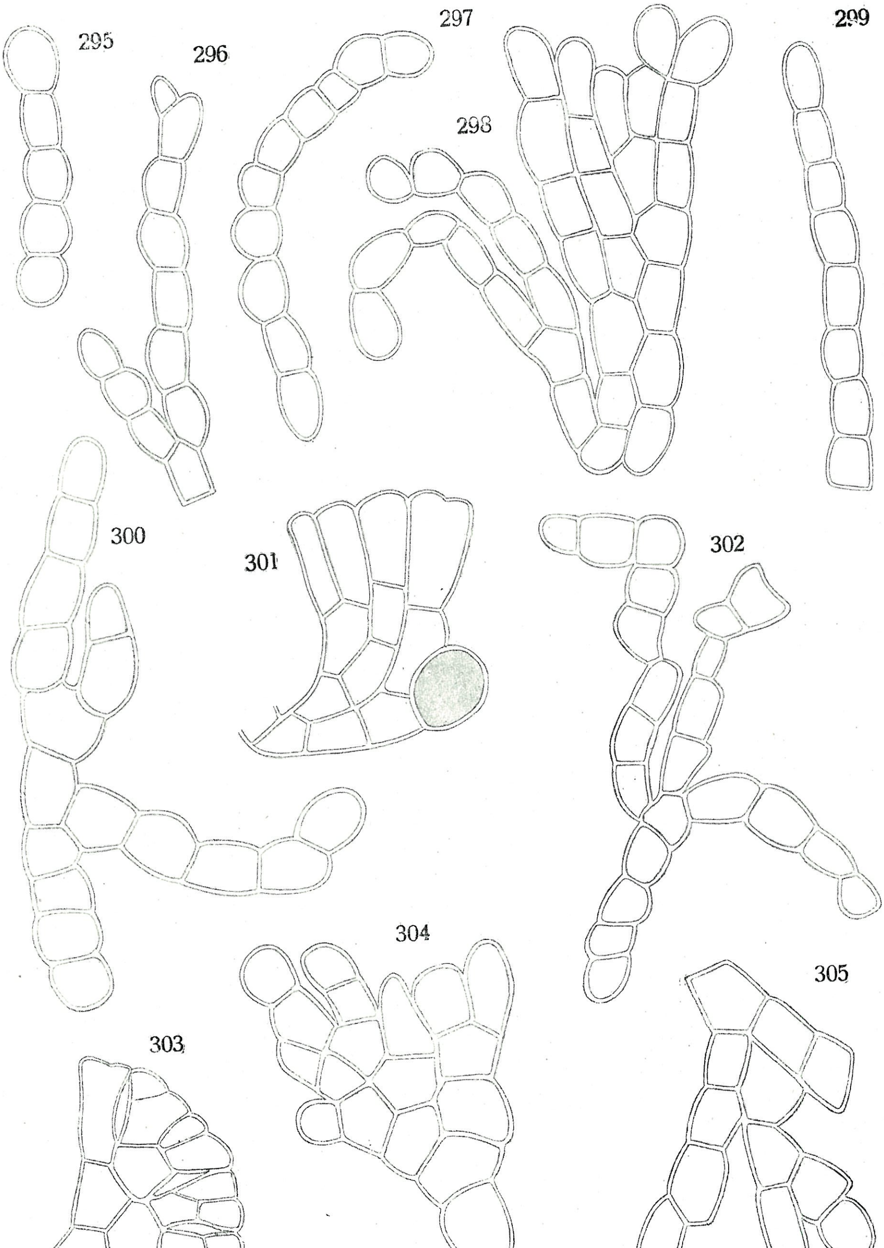

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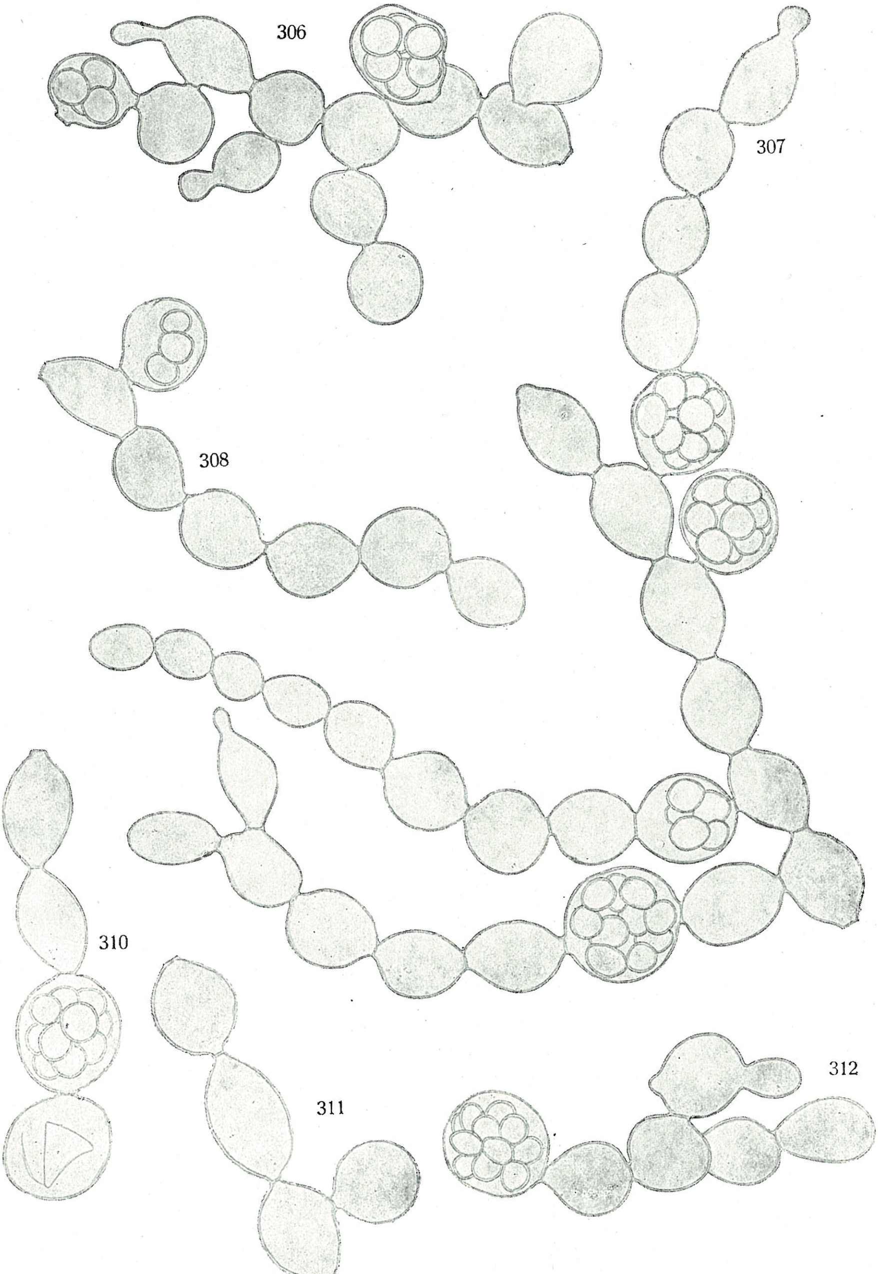

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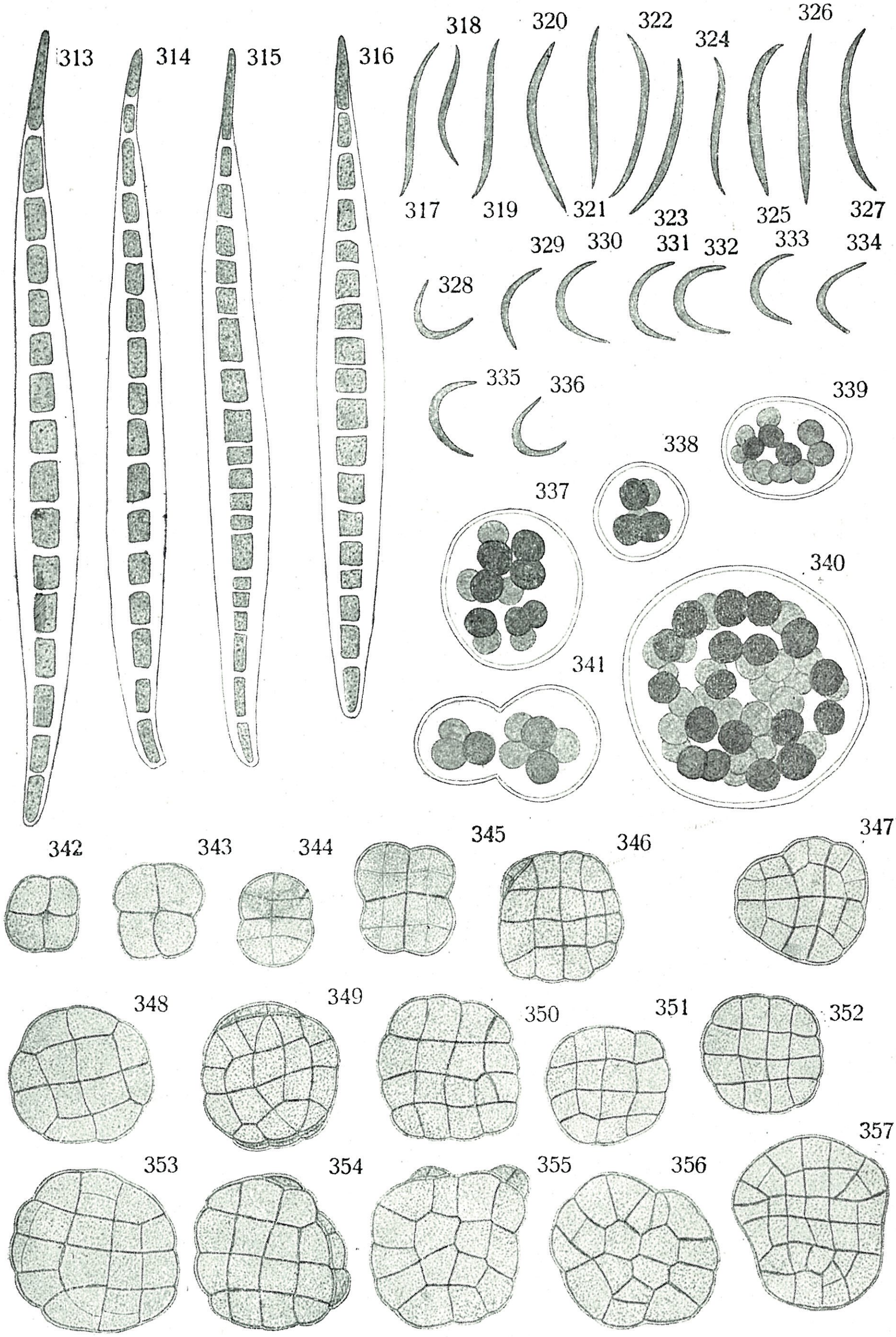
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