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LIV.—Sporendonema terrestre, Oudemans, an example of endogenous spore-formation among the Hyphomycetes

C.A.J.A. Oudemans

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peristoma tenue, antice parum effusum, flavescens; columella inferne subdentata.

Diam. max. 10 millim., min. $8\frac{1}{2}$, alt. 8.

Hab. Foot of Mount Astrolabe, British New Guinea.

Only a single specimen was obtained by Mr. Goldie at the above locality. It is white, varied with a few transparent spots, and an interrupted band of a reddish tint upon the upper part of the last whorl and another on the under surface. The columella forms an angle or almost a tooth at the lower part, where it unites with the basal portion of the peristome.

EXPLANATION OF PLATE XV.

Figs. 1, 1 a. *Helix (Papuina) Tayloriana*, Adams and Reeve.

Fig. 2. *Helix (Papuina) roseolabiata*.

Fig. 3. *Helix (Papuina) Rollisiana*.

Fig. 4. *Helix (Acavus) coraliolabris*.

Fig. 5. *Nanina Cairni*.

Fig. 6. *Nanina Hunsteini*.

Fig. 7. *Helix (Acavus) latiaxis*, Smith.

Figs. 8, 8 a. *Helix (Trochomorpha) Belmorei*, Cox, var.

Fig. 9. *Helix (Geotrochus) lacteolota*.

Fig. 10. *Helicina solitaria*.

Figs. 11, 11 a. *Helicina novo-guineensis*.

Fig. 12. *Helix (Papuina) albocarinata*.

Fig. 13. *Nanina exilis*, Müller, jun.

Fig. 14. *Helix (Sphaerospira) Rehsei*, Martens.

Fig. 15. *Megalomastoma Brazieræ*.

LIV.—*Sporendonema terrestre*, Oudemans, an example of *Endogenous Spore-formation among the Hyphomycetes*. By C. A. J. A. OUDEMANS*.

IT is one of the characters of the true Moulds or Hyphomycetes that their spores or conidia are not produced *in sporidia*, but by the upper parts of erect threads, that is to say free, not enclosed, or, as has been said, *exogenously*. The conidia are composed of one, two, or more cells—sometimes singly, but sometimes also placed together in more or less considerable numbers, or again united into longer or shorter chains. In the last case, the conidia which are situated furthest from their origin are the oldest, and those nearest the origin the

* From the 'Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen; Afd. Natuurkunde.' Derde Reeks, Deel ii. Amsterdam, 1886, pp. 115-122.

youngest, and the union between the conidia of the same chain is reduced to such small dimensions that one may use the word "unthreading" to indicate the readiness with which the consecutive subdivisions separate from each other. Fine examples of chains of conidia are to be found in the genera *Aspergillus*, *Sterigmatocystis*, and *Penicillium*.

It must strike every one that the conidia are essentially nothing but the upper parts of the threads which serve to support them, but, for the attainment of the purpose for which they are formed, separated from the lower parts by a diaphragm or by a process of constriction leading to complete separation. Produced for the purpose of multiplication, they needed to be separated from the threads whose limited life they cannot share, in order the better to lead an independent existence.

It may be supposed, and certainly not without reason, that in the above-mentioned tops of the threads some process goes on within the protoplasm by which the greater tenacity of life in these tops is caused and their capacity to grow into new plants is provided for; and, reasoning onwards, the supposition may be entertained that such a top, after separating or dropping from the parent thread, ought to consist of two parts, namely: 1, a spore or a conidium; and, 2, a membrane surrounding the latter. Microscopic examination, however, shows nothing of any such division into two constituent parts, and hence also it is that both the present and former mycologists have never been able to agree in the theory that the spores, in order to occur upon erect threads, should be produced as independent grains within the threads.

In saying "never" we fall, however, into an historical error. In fact, about the year 1826 Desmazières stated that he had met with a case of endogenous spore-formation, so that he felt justified in proposing for the fungus which exhibited the phenomenon a new name, and indeed that of *Sporendonema*, in place of the names *Mucor*, *Agerita*, *Oidium*, and *Sepedonium*, by which the plant had previously been indicated generically. In full this was described and distributed in dried specimens under the name of *Sporendonema Casei*, as, for example, in the 'Plantes Cryptogames du Nord de la France' (No. 161). It is found, in fact, only upon the crusty surface of cheese which has been kept for a considerable time in the cellar. It then forms light cinnabar-red soft cushions which are very convenient for microscopic examination, and have therefore, since Desmazières's statement, been more frequently subjected to examination than formerly.

Desmazières gave an account of his discovery in the fol-

lowing words:—"It is from this examination that I created the genus *Sporendonema*, and recognized that the single species that it at present contains has, as its essential character: tubes or filaments short, simple or branched, continuous, nearly transparent, erected, grouped, one hundred and twentieth of a millimetre in thickness, containing in their interior, and almost always throughout their whole extent, very large reddish rounded sporules, slightly unequal in diameter, and often very close together and pressed against each other, but placed end to end upon a single line, so that the filaments appear as if furnished with very closely approximated disseminations." The author proceeds:—"The escape of the sporules takes place at the apex of the filaments, which, after their dissemination, become quite transparent and a little narrower. Sometimes, however, the sporules are set free by the destruction of the excessively delicate membrane of which these plants are composed."

The results of Desmazières's investigations upon the cheese-mould met with no contradiction until 1838. Then, however, Corda, in the second part of his 'Icones Fungorum' (p. 8), stated that he could not agree with the French mycologist, and that the phenomenon of endogenous spore-formation was never observed by him in the numerous examples of *Sporendonema Casei* that he had examined with the greatest care. He declared that he had never seen anything but chains of spores, just such as he ascribed to the genus *Torula*.

It must be remarked, however, that the figure which is given by Corda with his text (pl. ix. fig. 36) does not at all agree with the structure of the *Sporendonema*-plant as it is to be found in Desmazières's 'Plantes du Nord de la France' (figs. 5 & 6), so that it is not too bold to infer that the two mycologists investigated different Fungi; for which reason, therefore, Corda's *Torula Casei* is not to be regarded as synonymous with Desmazières's *Sporendonema Casei*. The person who made this observation was Berkeley (Ann. & Mag. Nat. Hist. ser. 2, vol. v. p. 460), and I have had the opportunity of convincing myself of its correctness.

With the conclusion just expressed, the importance which otherwise would attach to Corda's investigation falls to the ground. On the other hand, however, the correctness of Desmazières's deduction can by no means be inferred from the negative result of Corda's investigation. Berkeley, in the same part of the above-cited Journal, showed upon good grounds that the genus *Sporendonema* had no *raison d'être*, and that *Sporendonema Casei* must be removed into the genus *Torula*. On account of the difference between the Fungi in-

vestigated and described by Desmazières on the one hand, and by Corda on the other, and seeing that the last-named author had already employed the name *Torula Casei*, another name had to be invented for the typical *Sporendonema Casei*, and that of *Torula sporendonema* was selected for it by Berkeley. This contradiction in terms can only be accepted from a describer's and not from a logical point of view.

Desmazières's error consisted in this: in his *Sporendonema*-threads he had regarded the red contents of the joints, which contrasted strongly with the colourless walls, as spores, and had overlooked the dissepiments which really existed. Further, his notion that the tops of the *Sporendonema*-threads become colourless in consequence of the evacuation of the red spores previously enclosed in them was shown to be incorrect*; and the escape of the spores at other parts of the thread might equally well be regarded as in accordance with the truth. The presence of dissepiments and the interruption of the threads at the level of these dissepiments seems to be common to *Sporendonema* and *Torula*, and in accordance with this there can no longer be any notion of perfect spores enclosed in the threads of the fungus under examination.

Among the older writers who accepted Desmazières's observation as correct, we may name, as one of the most celebrated, Elias Fries. He even goes so far as to include *Achlya prolifera*, a Saprolegniacean, which, however, at that time, had been only very briefly described, under the new genus, and to refer to it also the known *Torula epizoa*, giving it the name of *Sporendonema Sebi*. All these erroneous determinations were corrected by later mycologists furnished with better instruments; but at the same time *Sporendonema* was finally erased from the list of genera in the department of Fungi.

Under these circumstances it cannot excite any astonishment that I was exceedingly surprised when, some weeks ago, I found in a tan-bed in one of the hothouses of the Amsterdam Botanical Garden some lumps of earth covered with a network of threads, partly white, partly brownish, the constituents of which, upon careful examination, appeared to me to satisfy the chief requirements of the genus *Sporendonema* established by Desmazières, but consigned to oblivion by later writers.

The above-mentioned network consisted (fig. 1) partly of creeping and partly of erect, colourless, irregularly branching threads, of which the former, as usual, represented the vege-

* The colourlessness of these tops may merely be due to the fact that no dissepiments are as yet formed, and no coloured protoplasm has yet been produced.

tative part, or the mycelium, and the latter the generative part. Both were generally beset with extremely fine raphides of some calcareous salt (not carbonate of lime). In the creeping threads I found dissepiments, but not in the erect ones. Now, however, it appeared that the latter, charged with the spore-formation, bore these spores not at their tips, or in lateral branches, and did not produce them by separate constrictions or in chains, but really developed them in their interior. At regular distances (fig. 2) colourless denser parts

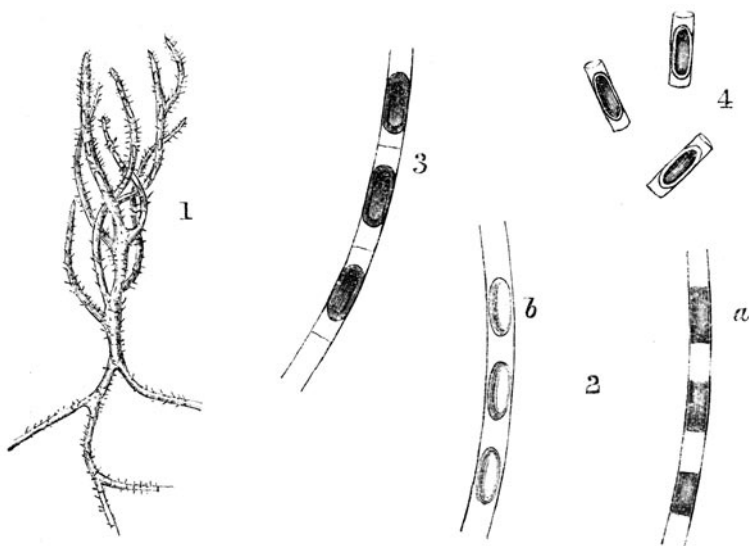


Fig. 1.—Plant of *Sporendonema terrestris*, Oud., enlarged (diagrammatic).

Fig. 2 *a*.—Part of an erect thread, with the commencement of spore-formation; ends of the colourless masses of protoplasm truncated. $\times 1000$.

Fig. 2 *b*.—Part of an erect thread with light brown spores, the ends of which are already rounded off. $\times 1000$.

Fig. 3.—Erect thread with spore-formation completed. $\times 1000$.

Fig. 4.—Separate mature spores. $\times 1000$.

(little clumps of condensed protoplasm) are formed; these gradually acquire a brown tint, and then the two flat surfaces by which they were originally bounded at their two poles (fig. 2 *a*) become rounded off (fig. 2 *b*), in consequence of which at last the somewhat elongated oval form (fig. 3) is attained. I found the wall of the mature spore to be rather thick.

It was further particularly remarkable that the spaces be-

tween the different spores not only remained empty and therefore colourless and transparent, but at last they were marked by a circular division just in the middle (fig. 3), in consequence of which the threads broke up into fragments (fig. 4), each of which showed a sporiferous part in its middle and two short tubular appendages. In our case, therefore, there can no longer be any doubt as to the endogenous formation of the spores, and we are justified in reintroducing the genus *Sporendonema* and naming the species observed *Sporendonema terrestre*.

The question whether any dissepiment is to be seen at the place of the circular division must be answered in the negative. Moreover, no trace of dissepiments is to be seen between the spores and their tubular appendages.

Before concluding, I may be allowed to remind the reader that the formation of spores within the threads of some *Hyphomycetes* has been previously observed, but that the phenomenon was always confined to the threads of the mycelium. The bodies capable of germination were regarded (none the less on account of their form differing from the ordinary appearance of the true spores) less as spores than as a sort of brood-buds, and they were never seen to be set free unless the walls of the thread in which they were produced had disappeared. This formation cannot, of course, be placed in the same line with that observed by us, and therefore does not detract from the singularity of the phenomenon that we have observed.

We may remark, further, that our fungus is one of those which stand on the boundary between the "white" and "black" moulds of the English authors, the *Mucedineæ* and *Dematiei* of the Latin-writing mycologists, or, in other words, which combine in themselves the colourless threads of the first with the darker-coloured spores of the second group. In accordance with custom, however, such forms are to be inscribed under the *Mucedineæ* or "white moulds."

That the name of "conidia," which applies exclusively to exogenous germ-granules, cannot be employed for the endogenous granules of our *Sporendonema terrestre* is a matter of course. There is no reason, we think, to refuse the name of spores to these productions. In this respect, also, our fungus therefore holds a middle place between two very different groups of *Fungi*, but now between a lower group, with which it agrees in its simple structure, and a higher one, the more complex forms of which are at once distinguished by the formation of endogenous spores.

Of the higher fungus with which our mould may stand in

genetic relation we know nothing. It is, however, the case that our knowledge of this relation, in an exceedingly large number of moulds (including the Dematiei), is still so obscure that we cannot accept the opinion of those who think that the Fungi, even now, ought not to be included in any system. This mode of treatment leads to the neglect of the generally very fine and, in any case, very important forms which belong to it, and thus to a decline of our knowledge of these plants which they do not deserve. Besides, following Fuckel, we can contrast with the series of "Fungi perfecti" a series of "Fungi imperfecti," and thus reconcile the two opinions.

The production of circular divisions on the fertile branches of our fungus is likewise one of its remarkable peculiarities. The phenomenon is of comparatively rare occurrence. Among the Algæ it is observed in the *Cedogoniaceæ*, and among the lowest of all organisms in *Bacillus subtilis* (among the Schizomycetes) and in the Mucorineæ. In the Hyphomycetes no case of the kind had hitherto been observed.

The diagnosis of our Fungus must run as follows, according to what has been stated :—

Sporendonema terrestre, Oud.

Mycelio in terra humosa repente albo, articulato, ramoso; hyphis fertilibus erectis, ramosis, continuis. Sporis endogenis, a se invicem remotis, ex hypharum fertilium protoplasmate ortis, primitus achromis, utrinque planis, postremo fuscis, utrinque rotundatis, manicatis, *i. e.* tubulo membranaceo brevi, achromo, ex hypharum interstitiis vacuis circumcissione orto ornatis. Longit. sporarum 7 μ , latitudo earum 2 $\frac{1}{3}$ μ , absque appendiculis maniciformibus.

LV.—*Descriptions of new Species of Moths (Noctuities) from the Solomon Islands.* By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

THE following new species are from the collection recently sent home by Mr. C. M. Woodford.

Ommatophoridæ.

1. *Nyctipao variegata*, sp. n.

♀. Nearest to *N. crepuscularis*, decidedly larger; the ocellus of primaries as in *N. ephesphoris* and bounded by a