

stomata of cotyledons do not seem to vary much on the under surface ; but on the upper surface there is greater difference. Water-pores, when present, are usually found on the upper epidermis over the epithem, which is formed at the end of the median vein. When water-pores are present there are few or no stomata on the upper epidermis, when absent there are many stomata.

This would lead one to suppose that a group of a few water-pores at the apex of a cotyledon is equivalent to many scattered stomata which appear over the upper epidermis in the absence of water-pores ; but no weight can be attached to this until the subject has been more fully investigated.

ROBERT TURNBULL, Edinburgh.

A DISCOVERY IN CONNECTION WITH THE PRODUCTION OF HYBRID FERNS.—Occasionally in a batch of seedling ferns there will occur several plants of some strange marked variety identical in their characters, and I have long suspected that these were produced on one and the same prothallus ; indeed this seemed evident in four instances of remarkable seedling *Athyriums*, yet the development was too far advanced to enable me to be absolutely certain. However, in order to prove this a number of *Scolopendriums* were planted in the prothallus state, and on the young fronds appearing a few days ago, two separate fronds were noticed identical in character and unusual in form, which, when examined by the aid of a magnifying glass, were found to have their origin in one well-developed prothallus. With a penknife it was possible to divide the prothallus so as to secure two plants, and this was not the only instance observed. Next season's growth will prove whether these plants will retain their likeness to each other.

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FURTHER NOTE ON SPONGOCLADIA.—With reference to our paper on *Spongocladia* in *ANNALS OF BOTANY*, Vol. II, p. 169, we wish to make public a suggestion, kindly made by Dr. Hauck in a letter, that the supposed symbiotic relationship between sponge and

alga gains in probability by the observations of Dr. Marchesetti on a floridean alga (*Marchesettia spongioides*, Hauck). The alga is described and figured by Dr. Hauck in the Atti del Museo Civico di Storia Naturale di Trieste, vol. vii, p. 236, Tab. 3, and Dr. Marchesetti's paper, *Sur un nuovo caso di Simbiosi*, is at p. 239 of the same volume. The alga in this case is, as has been said, floridean (*Areschougiaceae*), is sponge-like in appearance, and is furnished with 'oscula.' Small masses of protoplasm occupy the interstices between the tissues of the alga and contain many spicules, among which there are often fibuliform bodies like those figured by Schmidt for *Reniera fibulata* (Die Spongien d. Adriat. Meeres, p. 73, t. 7, f. 9). On the surface of the alga are found spicules which form a reticulum, and completely cover it with a pellucid pellicle. Schulze, who determined the sponge, was struck by the remarkable resemblance of the alga to *Chalina* and regarded it as a case of mimicry. Dr. Askenasy has recently published some interesting observations on *Marchesettia* with an illustration (Forschungsreise der 'Gazelle,' Theil IV. Botanik; Algen, Tab. xii).

We have very little doubt that these cases (Dr. Marchesetti's and our own) are of much the same nature as those recorded by Dr. Carter (Ann. and Mag. Nat. Hist. 1878, p. 163) whatever their true explanation may be. Dr. Carter's opinion, which is of the highest value, is that in the cases he records the seaweed gradually replaces and becomes what a mineralogist would term a pseudomorph of the sponge. He observed, for example, *Thamnoclonium flabelliforme*, which had replaced *Reniera fibulata*, and an unnamed alga, which had similarly treated *Halichondria plumosa*.

It should have been said that *Marchesettia* was collected at Singapore, and that it occurs also at Nosibè, Madagascar (Hildebrandt), and in New-Caledonia, the locality of *Spongocladia neocaledonica*, Grun. It is obvious that living material illustrating one or other of these cases need not be hard to find, and it may be hoped that the observations which alone can settle the matter will be made before long.

Professor Bayley Balfour has kindly called our attention to the case of *Spongia cartilaginea*, Esp., especially mentioned by Semper in his 'Animal Life,' (Internat. Sci. Ser.), p. 343. It is obviously of the same nature as *Marchesettia*, though the alga is a different one. Esper, in describing this remarkable association of sponge and alga (Pflanzen-thiere; Fortsetzung, II. p. 23, Tab. LXIII), says that the alga agrees with '*Fucus corneus* or *cartilagineus*' = *Gelidium*

corneum, Lam., or *G. cartilagineum*, Gaill. Semper thinks that the sponge in this case 'may with some probability be included in the family of the Chalinae.'

GEORGE MURRAY, London.

L. A. BOODLE, London.

PRELIMINARY NOTE ON THE MORPHOLOGY AND DEVELOPMENT OF ISOËTES LACUSTRIS, LINN.—The

genus *Isoëtes* has always been an object of interest to botanists ever since Hofmeister's brilliant researches on the vascular cryptogams, but the accounts given by the different observers on the development and organogeny of the sporophyte are so conflicting, and moreover our knowledge of the sexual generation is so limited, that a renewed investigation of the whole subject seems desirable. In the present communication I propose to summarise, as briefly as possible, the more important of my own observations on one species, *I. lacustris*, to which my attention has been directed for some time past. I intend to deal here only with the germination of the macrospore, and to reserve details of minor significance, as well as all account of the sporophyte, for treatment in a future paper, as this part of the subject requires critical discussion.

The shape of each macrospore is, as is well known, that of a tetrahedron with somewhat rounded sides, and the protoplasmic contents are enclosed in a number of coats which in mature specimens are differentiated into six layers. Peripherally is the episporium, a colourless, glassy, and brittle layer, whose surface is beset with numerous irregular prominences. The episporium which is derived from the epiplasm of the sporangium stains with haematoxylin, though only to a slight extent. Within this outer layer is the exosporium, consisting of three brown cuticularised layers, but of which the two outer ones are frequently not easily distinguishable as separate coats. The two innermost membranes are cellulosic in character and form the endosporium.

The protoplasm which is contained in the spore includes a large quantity of reserve-material consisting of starch and oil, the latter being, however, eliminated during the process of soaking in turpentine to which the spores are subjected previously to their being embedded in paraffin. A number of sections through each spore were obtained by means of the Cambridge rocking microtome, and were arranged in series, thus permitting of an examination of the internal structure of



Murray, George and Boodle, Leonard Alfred. 1889. "Further note on Spongocladia." *Annals of botany* 3, 129–131.

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