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XIII.—*Remarks on the Structure and Morphology of Marchantia.* By GEORGE DICKIE, *Lecturer on Botany at Aberdeen.*

READ 8TH APRIL 1841.

It is proposed to include the following remarks under two heads. 1. The structure of *Marchantia*. 2. The inferences to be drawn from the facts exposed under the first head. When not otherwise mentioned, the *M. polymorpha* is the species alluded to.

STRUCTURE.

The *Frond* is composed of loose cellular tissue, inclosed between two membranes—an upper of a green colour, in which the stomata (so admirably illustrated by Mirbel) are situated; and another on the lower surface, of a dark colour, approaching to purple. On the lower surface of the fronds, Sir W. J. Hooker describes a “prominent blackish mid-rib, whence, for nearly the whole length of the plant, spring numerous pale, silky, fibrous radicles.” This so-called mid-rib is in reality a groove in the frond, from the edges of which originate purplish scales, which, by meeting, conceal the groove; in this groove are numerous transparent filaments, which will be afterwards more fully described. From the surface of the frond, at the sides of the grooves, numerous short radicles originate; they appear to be tubular, and contain a fluid, since they are transparent when viewed by the microscope under water. They arise from the frond by a dilated base; are short; and terminate in a closed and blunt extremity. (fig. 1.)

Fructification.—1st, The so-called *male receptacles* in *M. polymorpha* originate “from the base of a sinus at the ex-

tremity of the frond, just beneath the margin." (Sir W. J. Hooker.) In *M. hemisphaerica* the peduncles are short; but they originate in the same way as in the former species. Sir W. J. Hooker alludes to a variety of this species, in which the receptacles are always sessile; and in *M. conica* they are entirely sessile, "arising always from the mid-rib in various parts of its surface." (Hooker.) In *M. Polymorpha* the peduncles are described as being obtusely quadrangular. This is no doubt the general appearance presented by their transverse section; but properly speaking, the posterior surface, (that which is continuous with the lower surface of the frond) is concave. (fig. 2.) At each posterior angle of the peduncle is a groove, which passes the whole length of the peduncle, and is evidently continuous with the groove on the lower surface of the frond. From this it will be manifest, that the peduncles and their grooves, and the frond and its grooves, are continuous. (fig. 3.) In these grooves are lodged transparent filaments, which are tubular, and contain a fluid. Their walls are covered with green granules, often arranged in a spiral manner. Figs. 4, 5, 6, 7, 8, represent some of the forms assumed by these tubes. Each groove on the fronds and peduncles is occupied by a bundle of these tubes. At their lower end, which is in contact with the soil, they terminate in a blunt and closed extremity; at the upper end of the peduncle, and on the lower surface of the receptacle, the filaments diverge into as many rays as there are lobes to the receptacles. At this part they are covered with overlapping scales, similar to those of the grooves on the lower surface of the frond. The filaments, at their termination, are bent and wrinkled, and insinuate themselves among the cellular tissue of the receptacle.

The peduncles support a flattened receptacle, which is nearly horizontal, and lobed at the margin. The lobes are about eight in number; and one of the notches which divides them is large and semilunar. It is the notch next the anterior surface of the peduncle. (fig. 9.) On making a perpendicular section of a receptacle, we find it to be com-

posed of cellular tissue enclosed between two membranes, one on the upper, the other on the lower surface. In the intermediate tissue are imbedded numerous flask-shaped sacs, with long necks, terminating each by an orifice on the upper surface of the receptacle. The cuticle on this surface resembles that of the corresponding surface of the frond, and is pierced with similar stomata intermixed with the open papillary orifices of the sacs. The sacs contain the bodies called *Anthems*, which vary in form according to the stage of development at which they are examined. (figs. 11, 12, 13, 14.) Each of these bodies consists of a cellular sac filled with a granular matter.

Female Receptacles.—They originate like the former, from the extremities of the grooves on the lower surface of the fronds. They are pedunculated; and in *M. polymorpha* have grooves at their posterior angles; in *M. conica* each peduncle has only one groove. The general form of the peduncle is almost the same as that of the males. The receptacles are 9, 10—rayed; and the filaments in the grooves (or groove in *M. conica*) send off at the upper part a bundle to each ray. The rays are merely lobes bent upon themselves, from above downwards, so that the lower surface of each presents a groove in which the filaments are enclosed. Each filament terminates in the same manner as those of the lobed receptacles. Fig. 15 represents the lower surface of one of the rays, shewing the groove. The cuticle of the upper surface of the rays has stomata, almost similar to those of the fronds. Nothing can be added to Sir W. J. Hooker's excellent account of the involucre and capsules of the fertile receptacles.

MORPHOLOGY OF MARCHANTIA.

The more enthusiastic followers of Linnæus have at all times shewn a great anxiety to discover two sets of organs of fructification in the plants included under the Linnæan division Cryptogamia.

The very term itself invited inquiry; and if observers

have often, nay rather uniformly failed to detect organs really corresponding to the stamens of flowering plants, their researches have at least made known many singular facts regarding the structure of these interesting plants. It is amusing to read the opinions of some of the former disciples of the Linnæan school. How frequently do we find them doing their utmost to make nature bend to their own peculiar opinions. No better example of this can be cited, than Palisot de Beauvois's opinions regarding the reproductive organs of the mosses. He had resolved that all these plants must possess pollen as well as seeds. The contents of the capsule conveniently supplied the former; and he believed that the green fecula of the columella must be the seeds. When it was objected to this view, that Hedwig had raised mosses by sowing the contents of the capsules, he readily escaped from the dilemma by replying, that Hedwig had sown at the same time the other finer powder contained in the columella. The opinions regarding the same branch of the history of the fungi were equally remarkable. It is needless to say, that it has also been found necessary to discover anthers in marchantia; and accordingly, the lobed receptacles of that genus have been supposed to contain these organs.

When we consider the form and structure of these receptacles, and of the stalk which supports them in some species, there can be little doubt that they may be legitimately considered as metamorphosed fronds. The reasons for this opinion may be briefly mentioned; first, they are evidently (as shewn by a longitudinal section) continuations of the frond; the grooves of the peduncles are continuations of the grooves on the lower surface of the fronds, and they enclose the same spirally dotted filaments.

2. The flat receptacle is lobed like the fronds, its structure is the same, on the lower surface, filaments in grooves covered with scales, and a cuticle with stomata on the upper surface; and the fact that one of the notches is larger than any of the others, and the concavity on one side of the peduncle, appear to lead to the inference, that this recep-

taele is a small frond folded horizontally upon itself. In *M. conica* the relation of the two is more evident, the receptacle in this species being sessile, and still more so in that variety of *M. hæmispherica* where the receptacles are always sessile, and embedded, as it were, in the substance of the frond.

The next question has relation to the so-called anthers; and this cannot perhaps be better answered than by referring to the characters of the nearly allied genus *Riccia*, in which we find a "spherical capsule embedded in the frond." The only difference is, that in *Riccia* the capsules are spherical, whereas in *Marchantia*, the sacs of the so-called anthers are flask shaped, and have a long neck protruding by an orifice at the surface. The shape of the inclosed bodies is also somewhat different, but their general structure is the same, viz., a cellular membrane enclosing minute granules. From these remarks it may be inferred that the receptacles of *Marchantia*, called males, and the bodies embedded in them called anthers, have really no correspondence with these organs of phanerogamous plants, but are more probably one means by which young plants are produced. It may appear rash to arrive at any such conclusion until they are actually seen to germinate under favourable circumstances; this I have not been as yet able to ascertain; but a remark of Sir W. J. Hooker's, regarding the sessile lobed receptacles of the variety of *M. hæmispherica* already alluded to, may serve to throw some light on this subject: "The male receptacles have hitherto always been found sessile, and embedded, as it were, in the surface of the frond, situated near the extremities, whence at the period of their decay innovations of the frond are seen to issue." May it not be true that we have in these innovations young plants produced from the supposed anthers, germinating while still attached to the parent frond? in the same way as the Gemmæ in the cup-shaped processes of *M. polymorpha* and others, frequently throw out radicles before leaving their receptacles. If these opinions are correct, we have in the genus *Marchantia* a link between *Jungermannia* and *Riccia*; the rayed (fe-

male) receptacles representing the former, the lobed (male?) representing the latter genus, so that *Marchantia* might be very appropriately styled a compound genus.

EXPLANATION OF PLATE.

1. The true radicle, magnified.
2. Transverse section of a male peduncle.
3. Longitudinal section of frond and peduncle,—*g*. the groove on the lower surface,—*u*. the point of junction of the frond and peduncle on the upper surface.
- 4, 5, 6. Various appearances of the filaments in the grooves.
7. End of a filament where it terminates on the lower surface of the receptacle.
8. End of the filament in contact with the soil.
9. Receptacle, showing the anterior semilunar notch.
10. Section of a receptacle showing the anther sacs.
- 11, 12, 13, 14. The bodies contained in the sacs. The figures represent them at different stages of development.
15. Under surface of the lobe of a fertile receptacle, showing the groove.

Atriplex.

1. *A. littoralis.*

2. *A. marina.*

3. *A. angustifolia.*

4. *A. erecta.*

5. *A. prostrata.*

6. *A. patula.*

7. *A. microsperma.*

8. *A. deltoidea.*

Fig. 1.

Fig. 2.

Fig. 3.

Pothocites Grantonii.

Marchantia (1-15). *Salix* (16-21).

Jungermannia Iyoni, (Taylor).