TWO MORE ABNORMAL FEMALE RECEPTACLES OF *ASTERELLA BLUMEANA* NEES.[1]

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ABNORMAL sexual shoots have now and again been described in several genera of the Marchantiales, *e.g.*, Goebel (1880), Taylor (1836), Lindberg (1875), Klien (1881), Townsend (1889), Müller (1906–11), Earnst (1907, 1908), Coker (1909), Cutting (1910), Campbell (1918), Peissel (1925), Haupt (1926), Bergdolt (1926), O'Hanlon (1927), Kashyap (1929), Heberlein (1929), Srinivasan (1939), Burgeff (1943) Pandé, and Srivastava and Khan (1953). Recently Pandé, Srivastava and Khan (1953 *a*) described some abnormal female receptacles of *Asterella blumeana*, a member of the Marchantiales assigned to the Rebouliaceæ (Evans, 1939). In the present article two more abnormal female receptacles of this species collected from the W. Himalayas, different from those described earlier, are dealt with.

Specimen 1.—This specimen (Figs. 2 *a* and 2 *b*) is comparatively more robust than an ordinary plant (Fig. 1). The stalk of its carpocephalum is forked above and, as compared to normal cases, is shorter and stouter. Both the branches of the stalk subtend normal receptacles lying very close to each other and each receptacle carries three involucres two of which are fertile and subtend normal perianths, while the third is abortive. The sporophytes have not fully matured but are otherwise normal. Just behind the base of the stalk there is a small male receptacle (Fig. 2 *a*, *m.r.*). The arms of the stalk are comparatively thicker than the stalk of a normal receptacle (Fig. 1) and, as in normal cases (Fig. 4), each includes a single rhizoidal furrow (Fig. 5 *a*). Below the point of bifurcation the stalk is greatly flattened (Fig. 5 *b*) and has two rhizoidal furrows. This condition persists even through the fused portion of the stalk (Figs. 5 *c* to 5 *e*) and can be followed literally to its very base. The fused portion of the stalk is thus comparable to the stalk of some more complex members of the Marchantiales that possess two rhizoidal furrows.

Specimen 2.—This specimen (Figs. 3 *a* and 3 *b*), at a superficial glance, does not show much difference from a normal specimen except that the carpocephalum is more robust and the stalk is comparatively thicker and somewhat flattened at its distal end. Behind the stalk of the female receptacle there is a small male receptacle (Fig. 3 *a*, *m.r.*). The female receptacle bears three involucres, one of which subtends a

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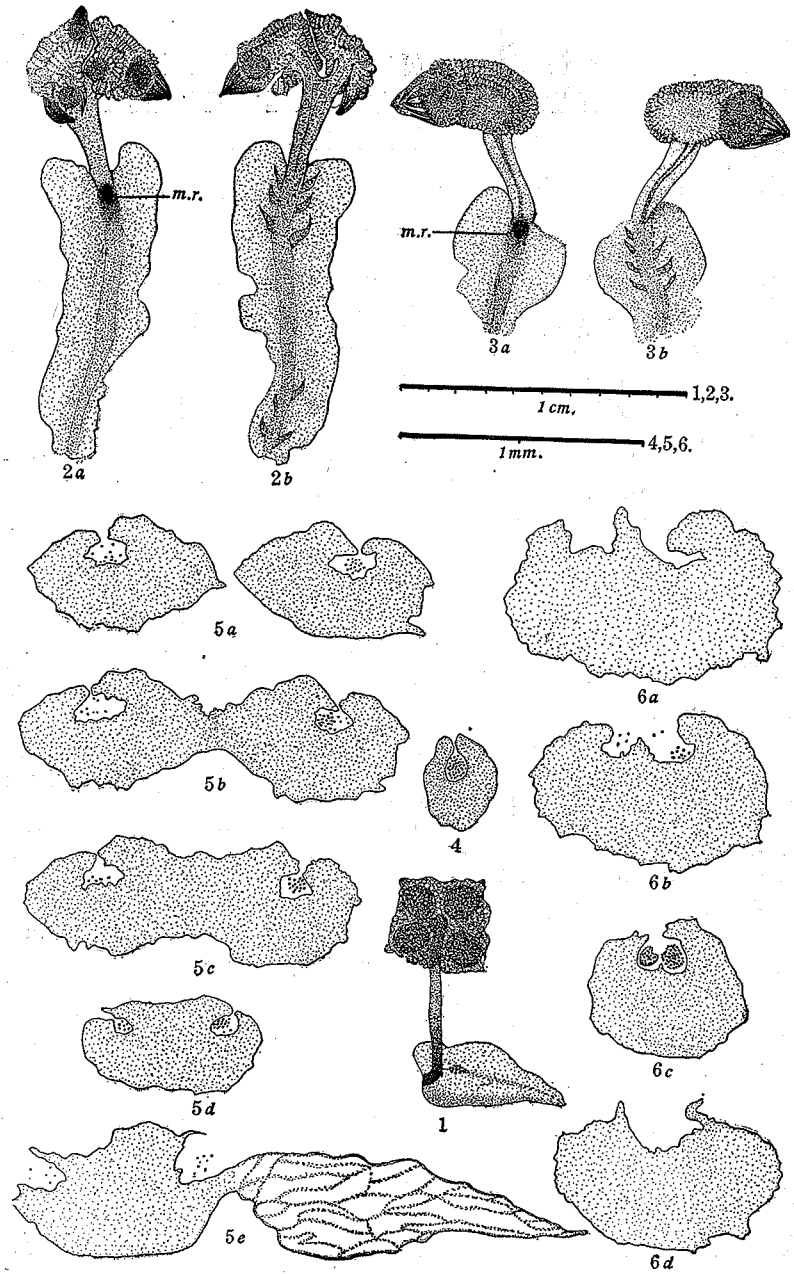

FIGS. 1–6. *Asterella blumeana*.—Fig. 1. Normal plant. Fig. 2. Abnormal specimen 1. Note the bifurcated stalk. *a*, dorsal, *b*, ventral, *m.r.*, male receptacle. Fig. 3. Abnormal specimen 2. *a*, dorsal, *b*, ventral, *m.r.*, male receptacle. Fig. 4. Transverse section of stalk of normal receptacle. Fig. 5. Transverse

sections of stalk of specimen 1. *a*, above point of bifurcation; *b*, below point of bifurcation, *c*, near about the middle; *d* and *e*, near the base. Fig. 6. Transverse sections of stalk of abnormal specimen 2. *a*, near the apex. Note the distinct septum between the two rhizoidal furrows; *b*, above the middle; *c*, a little above the base; and *d*, near the base. Note that in *d*, the septum has totally disappeared.

mature sporophyte while the other two are abortive. The mature sporophyte has the usual type of spores and elaters. An examination of the serial sections of the stalk of this specimen near the apex (Fig. 6 *a*) reveals that, though externally the stalk is single and without any evidence of branching, it has two rhizoidal furrows separated by a definite partition (Fig. 6 *a*). As the sections of the stalk are followed downwards towards the base (Figs. 6 *b*, 6 *c* and 6 *d*) the septum, separating the two rhizoidal furrows, becomes gradually less and less pronounced and is ultimately eliminated with the result that the two rhizoidal furrows become confluent and the septum between them disappears. The stalk in this part shows only one rhizoidal furrow as in normal specimens. Its groove is comparatively shallower and broader.

Discussion

It is a well-known fact that an individual in its life-history may sometimes show abnormalities that are best interpreted as reversion to ancestral characters. Viewed from this angle the abnormal carpocephala with two rhizoidal furrows in the stalk, described here, would indicate that forms like *Asterella* have probably arisen from some higher type, such as *Marchantia* or one of its allies, in which the stalk of the carpocephalum had two rhizoidal furrows. This view is further strengthened by the structure of the stalk of the female receptacle of specimen 2, which shows a gradual elimination of the septum separating the two rhizoidal furrows of the stalk till ultimately only one rhizoidal furrow is left. It thus shows a transitional stage between the ancestral type with two rhizoidal furrows in the stalk, and the existing condition in *Asterella* with a single rhizoidal furrow.

Another important conclusion resulting from these observations is that the carpocephalum of *Asterella blumeana* is a branch system, a conclusion arrived earlier by Cavers (1911) and Campbell (1928).

The carpocephalum of the Marchantiales represents a modified shoot. Leitgeb (1881) distinguishes three types of carpocephala in the Marchantiaceæ:—

1. With furrow-less stalk and one archegonium in each involucre, *e.g.*, *Plagiochasma* and *Clevea.*
2. With a single groove in the stalk and a single archegonium in each involucre, *e.g.*, Astroporæ, Operculatæ and *Conocephalum.*
3. The composite type with two furrows in the stalk and several archegonia in each involucre, *e.g.*, *Marchantia.*

According to Leitgeb (*l.c.*) the first type of carpocephalum represents the simplest type and is purely an outgrowth of the thallus. The

second type he regards as a single branch in which the growing point produces the carpocephalum without undergoing dichotomy. His third type is, however, the most advanced one and represents a branch system, the growing point dividing repeatedly during the formation of the carpocephalum. Later investigations by Cavers (1911) and Campbell (1928) have shown that there is no distinction between the second and third type of the carpocephalum of Leitgeb (*l.c.*) and, as Cavers (*l.c.*, p. 54) remarks—"We are probably justified in regarding the carpocephalum which terminates the apical growth of the thallus as being in all cases formed by repeated dichotomy of the apex, resulting in from two to sixteen growing points, each of which may produce either a single archegonium or a series of archegonia." Campbell (1928) has shown that the carpocephalum in *Asterella californica* is a branch system. The abnormal branched receptacles of *A. blumeana*, described by us, furnish further evidence in support of this view.

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* Original publication was not seen.