species more closely approaches the existing *Eucalyptus ficifolia* of Western Australia than to existing species in Tasmania, or to the described fossil species *E. Kayseri*, mihi, and *E. Pluti* M'Coy. Large specimens 9 inches long when perfect, and $2\frac{5}{8}$ inches broad at greatest diameter.

Supposed locality—Tertiary Leaf Beds, Macquarie Harbour.

MOSS FLOWERS, SPLIT-MOSS, BOG-MOSS, AND EARTH-MOSS.

By R. A. Bastow,

[*Read August* 10, 1885.]

Moss Flowers.

In a paper on Mosses, read before this Society on the 12th of last May, the more easily distinguished generic characters of that natural order were described, and amongst them the peristomes or fringes of teeth surrounding the mouths of the fruit capsules, which deck their summits as with jewelled crowns. The inflorescence of these tiny plants was not referred to at that time; nevertheless, a brief description thereof is essential to the study of bryology, and it may interest the Fellows of the Royal Society.

The male inflorescence consists of *antheridia*, minute oblong bodies intermixed with a number of jointed filaments, or *paraphyses*. These are enclosed by leaves, and altogether form a small bud-like flower (*flos gemmaceus, Mitt.*), or they are sometimes surrounded by short spreading leaves, and, consequently, with the antheridia visible from above (*flos discoideus, Mitt.*). Some species of these latter flowers cannot fail to attract the attention of the most casual observer, appearing, as they do, to the unassisted vision, even at the distance of two or three yards, as glittering green or reddish stars dotted about on the darker green velvety masses of moss that cushion the moist and clayey bank.

The female inflorescence consists of *archegonia*, small bodies of an oblong form and swollen at the base. Individually, they are not unlike a flask in appearance, the upper portion or neck being in some respects analogous to the style and stigma in a phanerogamous plant. These are also mixed with jointed filaments or paraphyses, and in some species they may be found with antheridia in the same flower, they are then *synoicous*.

In order to minutely examine the antheridia and archegonia, they should be denuded of the perigonal leaves as closely as possible by means of a pair of a tweezers; they may then be laid on a glass slide with a drop of water and be finely divided with a sharp knife, they should afterwards be spread out a little with a needle point and be covered with a thin covering class. They should first be examined with a half-inch objective, and again with an eighth of an inch objective.

The archegonia never develope into fruit unless they are in the neighbourhood of antheridia, any botanist paying attention to the growth of mosses will be able to produce instances to prove that dioicous mosses (mosses that have the male and female inflorescence on separate plants), in whose neighbourhood no male plants of the same species occur, produce perfect archegonia, but never fruit. Fertilization must take place before fruit can be developed. The contents of the antheridia being probably of vital importance to the commencement of growth of the *germen* in the archegonia, they become interesting objects for investigation with the microscope. When thus examined it is observed that as the antheridia become ripe they open at the upper extremity, and from thence flows a granular substance composed of innumerable cells. If one of these cells is closely examined, an antherozoid will be observed coiled up in its centre; each of the innumerable cells contain each an antherozoid, these become free in a short time and roll about the field of vision by means of cilia, sometimes for three or four hours. Similar moving bodies may be observed in the paraphyses.

Unger, Pritchard, Griffiths, Mitten, Hofmeister, and others have borne testimony in their several works to this singular phenomenon. Hofmeister, in his work on the Higher Cryptogams, p. 156, says: "I have not succeeded in finding spermatozoa (antherozoids) in the central cell of the archegonium of mosses, near the germinal vesicle as I have in ferns. I have, however, seen in Funaria, a moving spermatozoon, which has penetrated through the third part of the length of the neck of an archegonium which was ready for impregnation."

When the archegonium has been fertilised, the interior seed-vessel rapidly advances in growth, and the young seta, or fruit stalk, may be seen to be developed at the base, its summit gradually forcing the seed-vessel upwards. As the young capsule rises, the strain on the outer coating of the archegonium is so great as to rupture it transversely, the upper part adhering to the young capsule in its ascension, and forming the beautiful object known as the veil or calyptra which adorns the ripe capsule.

In thus briefly glancing at their life history, how strange it is that this lovely though lowly order of plants should produce,

shall we say animalculæ, and that when, by insects or by the gentle breeze, these are carried to the ripe archegonia, each organism should develope into, not one, but a multitude of eggs or spores, and each egg or spore, under favourable conditions, capable of developing into a perfect plant. The note which the Poet Laureate strikes, elicits a sympathetic vibration as he pens in song :—

> " Flower in the crannied wall,
> I pluck you out of the crannies ;
> Hold you here in my hand,
> Little flower, root and all.
> And if I could understand
> What you are, roots and all, and all in all,
> I should know what God and man is."

Sub-order 1. Andreæaceæ: Split Mosses.

Genus 1. Andreæa.

The golden margined and black-brown centred tuft of Andreæa, the only genus in the sub-order Andreæaceæ, affects not " the mossy fountains sedgy sides," nor yet " the limpid bubbling rill," disdainful of such poetic corners, it aspires to great altitudes, and finding a congenial home on the face of the ancient storm-worn escarpment, there it luxuriates and attains perfection. Bridel, in his "Muscologia Universa," informs us that is found on the Alps at the line of perpetual snow, and that it is rarely found on low elevations or on plains. Mitten, in the 12th Vol. of the Journal of the Linneæn Society, defines its habitat at an elevation of from 11,000 to 14,000 feet above the sea for the continent of South America ; and Hobkirk, in his Synopsis of British Mosses, places it at Alpine and sub-Alpine heights. It has, however, been obtained within one mile of Hobart, and R. M. Johnston, Esq., has observed it near the sea level on the northern shores of Tasmania.

If we proceed along the quarry road which skirts the southern base of Knocklofty, the first great moss-covered and lime-stained crags that arrest our attention on the right, are clothed in parts with fruited tufts of this genus. These, with Bartramia and Frullania, give richly varied tints to the face of the cliff.

This singular genus is the connecting link of the two natural orders Musci and Hepaticæ, and is therefore very interesting. The capsule is small and erect, and bursts by four or more vertical slits when it is ripe. In this character it closely resembles a Jungermannia, but in other respects it is truly a moss.

There are only five species described in Flora Tasmaniæ as native of this Island, and the number has not been increased in Mitten's recent catalogue of Australian mosses ; but it is highly probable that other species will be found on the slopes

of our lofty ranges. The beautiful Andreæa Wilsoni may yet be discovered for Tasmania, and this would indeed be a reward for all the fatigue endured by the young botanist in search of new species.

Sub-order 2. Sphagnaceæ. Bog Mosses.

Genus 2. Sphagnum.

The name of this genus, the only genus in the Sub-order, was used by Pliny to designate the lemon-coloured tufts of Usnea (Lichen) that mantled the trunks and branches of trees in Italian forests, a growth by no means unfamiliar to us in Tasmania at the present day. According to Bridel, Dillenius first gave this name to the bog mosses, and Linneæus and Hedwig perpetuated it. Sphagnum may be found all the world over; in Lapland, the careful mother gathers and weaves the snowy tufts into a comfortable bed for her baby, it is so soft and spongy, so beautiful and pure, and when lined with eider down as it often is, it is a comfortable and cosy nest for the as yet unhardened inhabitant of that bitterly cold country.

The Sphagnum bogs cover extensive areas in Great Britain, and one of the greatest difficulties that George Stephenson had to encounter in making the Lancashire and Yorkshire Railway was the great bog known as Chat Moss. The Sphagnum plants in that bog reach down to an enormous depth.

When the Sphagnum bog becomes filled up and consolidated it forms peat, a substance as useful to the Skye-crofter or to the isolated inhabitants of England, Ireland, and Wales as wood or coal is to the Hobartian.

In the economy of nature the Sphagnum bog plays no unimportant part; the waterlogged depression is its home, there it luxuriates and multiplies, levying new substance from the surrounding light and air; the depression in the fulness of time becomes filled up, and in its turn is ready to yield to the husbandman produce for his toil. There are seven species of this genus described in Flora Tasmaniæ; to these may be added other two species, viz: S. Novæ Zealandiæ (Mitten), from Mitten's recent catalogue, and S. Moss-manianum (C. Muller). A specimen of this last may be seen in Mr. Archer's collection of mosses in the Royal Society's possession. Patches of this moss may be found at the top of Mount Wellington and near the Springs. Mr. Abbott, of the Royal Society's gardens obtains large quantities near Brown's River; it is so plentiful there that the carts back into the bogs almost to the depths of the wheels, and the sphagnum is forked into the cart as though it were hay, it is then sent away to fulfil some useful purpose.

The species are distinguished by the thickness of the cortical layer surrounding the stem; this is in some species constituted of five layers of cells, in others of three layers, and in yet others of one layer only. This specific character, in conjunction with the form of the leaf, is sufficient to identify the few species as yet known in Tasmania. The capsule is nearly globose and is sessile on the seta or fruit stalk, and the mouth of the capsule is destitute of peristome or teeth. It is, notwithstanding, an elegant form, and can be easily examined with a pocket lens. The leaves are remarkable for their singular cellular structure, and each cell contains a formation which Robert M. Stark in his "British Mosses" designates "a spiral fibre."

Sub-Order 3. Bryaceæ.

Section 1. *Fruit terminal.*

Tribe 1. Phascæ. Earth Mosses.—Genus 3.—Phascum. The plants of this genus are the smallest of all mosses, and probably the smallest of all flowering plants, some of the species not exceeding the size of an ordinary pin's head, roots, stem, leaves, and fruit included. All are perfect after their kind, and as varied and beautiful as flowering plants of larger growth and more easily observed.

These tiny plants must be looked for on the beds of dried up pools and on clayey or chalky banks; it will even be necessary to kneel down with pocket lens in hand and carefully examine the surface of the soil to detect the presence of some species. The capsule of Phascum bursts irregularly when ripe, and in this character it differs from all other mosses. The brightly coloured capsule, the intensely green leaves, the flowers, and the marked cellular structure combine to make this plant an interesting object for dark ground illumination with the microscope, one which may justly lead us to reflect on the mystic *Vital Force*, that of one primordial cell, developes, in its own peculiar way, and by two generations, into a minute but perfect Phascum plant; and of another to all appearance exactly similar cell, in its own peculiar but very diverse way, into a giant Pine or Eucalyptus.