PRELIMINARY NOTE ON APOSPORY AND APOGAMY IN TRICHOMANES KAULFUSSII, HK. ET GREW.—Bower¹ has already written on apospory and the production of gemmae in *Trichomanes Kaulfussii*, HK. et Grew. His investigations, however, especially with regard to the development of gemmae, are by no means complete, as he has only described the primary stages of this development. Thus he has observed that 'the filamentous growths originate from single marginal or superficial cells of the frond, and bear lateral rhizoids'. I can confirm this observation of Bower's, and may add that, as a rule, the apex of a pinna in which a midrib ends forms the origin of a prothallium, from which by continued cell-division an end-cell is cut off. On the other hand, if a marginal cell grows to a prothallium it twists away from the leaf surface and turns towards the apex.

It is interesting to note that the nucleus changes sympathetically and takes on the same curved form as the cell itself. The prothallium as it grows assumes a filamentous

form which ramifies in different directions and bears, at its extremities or laterally, sterigmata singly or in tufts. At the end of each of these branches is balanced a spindle-shaped gemma as described by Bower. The gemma is bullet-shaped or elliptical in form, and is divided by a cell-wall which runs perpendicular to the long axis of the sterigma. One or both daughter-cells of the gemma divide in the same direction, and from this a many-celled spindle-shaped growth results. The junction of the gemma and the sterigma may always be observed as a brownish scar on the mother-cell of the gemma. Very often the cell-division of the gemma takes place from one only of the two primary daughter-cells, out of which a three-celled stage develops (Fig. 1).

In this case the middle cell divides first, and cuts off a cell perpendicular to the long axis of the gemma (Fig. 2). Often, however, a gemma divides in such a way that after a four-cell stage, an end-cell of the gemma divides twice in succession and in different directions (Fig. 3). By further divisions of these end-cells in the direction indicated many-celled prothalloid growths arise which bear lateral rhizoids and thus betray the nature of a prothallium (Fig. 4). By continued cell-division of these

¹ On Apospory and production of Gemmae in *Trichomanes Kaulfussii*. *Annals of Botany*, viii, 1894.

ramifications of gemmae arise many-celled prothallia which are characterized as such by the presence of rhizoids and sexual organs. Bower did not observe these advanced stages, for he states 'after the first steps the further growth is exceedingly slow' (p. 467). I have observed very often that after the four-cell stage of the gemmae a development of the antheridia takes place by the cutting off of a neck-cell from the middle papilla whilst the antheridium develops from the other part (Fig. 5).

Furthermore I have observed that the antheridia are formed at both extremities of the spindle-shaped gemma in the same way (Fig. 6).

Lastly, I have seen cases where antheridia and prothallia with antheridia grew on the same gemma. Such cases are illustrated in Fig. 7.

At the left extremity of a four-celled gemma is seen a typical antheridium, and at the other extremity a cell which has divided twice and from which has developed a many-celled prothallium and one aborted cell destined to form a rhizoid.

This prothallium bears a typical antheridium and several rhizoids which are unmistakable signs of its gametophyte nature.

I would emphasize this fact because in the case of the genus *Trichomanes* the existence of sexual organs in the gemmae has been denied.

Bower has expressly stated this with regard to *Trichomanes Kaulfussii*, HK., saying: 'The filaments show characters similar to those of *T. alatum*, and though no sexual organs have been found upon them in *T. Kaulfussii*' (p. 467).

As far as the transition from the sporophyte to the gametophyte is concerned I can only support Farmer and Digby¹ and state 'that the transition from the sporophyte to the gametophyte in this Fern is attended by no reduction or alteration in the number of the chromosomes . . .' (p. 164).

I have done my utmost to obtain the exact number of chromosomes in sporophyte and gametophyte.

To this end I have counted the chromosomes in the cells of the leaves on the surface as well as at the point, and can fix the approximate number of chromosomes at about eighty.

The counting was carried out at different stages of mitosis, and in every case almost the same number was arrived at.

The chromosomes in prothallium cells were also counted, and the same number (about eighty) was found. During this counting the same precautions were used as before. No difference between the chromosomes of one and of the other generation could be discovered.

Moreover, the number and the appearance of the nucleoli in both generations were the same, so that this distinctive mark was also wanting. On the basis of these observations I can only confirm the statement of Farmer and Digby 'that so far as our present knowledge goes, apospory is always found to imply the absence of the meiotic phase from the life-cycle of the organism', and extend it by the result of my own research.

In accordance with this it is impossible to draw a sharp line of distinction between sporophyte and gametophyte.

BELGRADE.

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¹ Studies in Apospory and Apogamy in Ferns. *Annals of Botany*, vol. xxi, no. lxxii, 1907.

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