NOTES.

FERTILIZATION IN SPHAEROTHECA.—In connexion with a course of lectures on the Ascomycetes given by one of us, material of the Hop-Mildew (*Sphaerotheca Humuli*, Burr.) was collected in the summer of 1904 for the purpose of following the development of the perithecium. As the results obtained, incomplete as they are, confirm the work of Harper [1] on the same object, it seemed worth while to put them on record, since the accuracy of his observations has been so directly called in question by Dangeard [2], and also doubted by other workers (Lindau Holtermann, Kuyper).

Fig. 17, 1 shows the oogonium and the antheridial hypha side by side; the actual antheridial cell has not yet been cut off. In Fig. 17, 2 (in which the plane of section is at right angles to that of Fig. 17, 1, and the antheridium is behind) there is actual cytoplasmic continuity between oogonium and antheridial cell, and the male nucleus has obviously just passed in; the contents of both nuclei are somewhat contracted away from the nuclear wall. Four cases were observed in which the oogonium and antheridium were in open communication. In Fig. 17, 3 the two nuclei probably represent the sexual nuclei, as, judged by the branch which has only just begun to grow up from the basal cell, the stage is still quite young; it is, of course, possible that the two nuclei have been produced by division (as in Fig. 17, 6), for the development of the sheath, as some of the figures show, does not always run *pari passu* with the internal development of the oogonium. In Fig. 17, 4 the two nuclei which are in contact must clearly be the sexual nuclei just before fusion; the nuclei here, also, are badly fixed, so that they stain in a homogeneous manner. Neither in this nor in Fig. 17, 3 is the communication between antheridium and oogonium now visible. In Fig. 17, 5 the large single nucleus in the oogonium (oospore) represents, no doubt, the fusion nucleus. The non-nucleate antheridial cell is clearly visible here as well as in Fig. 17, 3, and in both these figures the separate origin of the hyphae which bear the oogonium and antheridium, respectively, is well seen. Fig. 17, 6 shows what are doubtless the first two nuclei formed by division in the fertilized oogonium; the antheridial hypha, with the cell above containing only cytoplasm, is clearly visible on the left, having been pushed aside by the upgrowths from the basal cell which form the sheath. In Fig. 17, 7, a section from an older perithecium, is seen a row of four cells developed from the fertilized oogonium; the penultimate cell is binucleate and is the young ascus.

We observed no cases in which the antheridial cell was without a nucleus while the oogonium was still unfertilized, nor any in which the antheridial cell still contained a nucleus when the oogonium showed two nuclei; neither did

[1] Ber. d. Deutschen Botan. Ges., xiii. 1895, p. [67].

[2] Le Botaniste, 5e série, 1896, p. 245.

we observe any instances of degeneration of the nucleus in the antheridial cell. It is on cases such as these, and on the absence of observed cell-fusion, that Dangeard relies for his refutation of Harper's statements. Furthermore, the row of cells produced from the egg (Fig. 17, 7) was generally found to consist of at least four cells; the three or two cells of Dangeard were very rarely, if at all certainly, observed. Unless Dangeard's material showed a course of development very

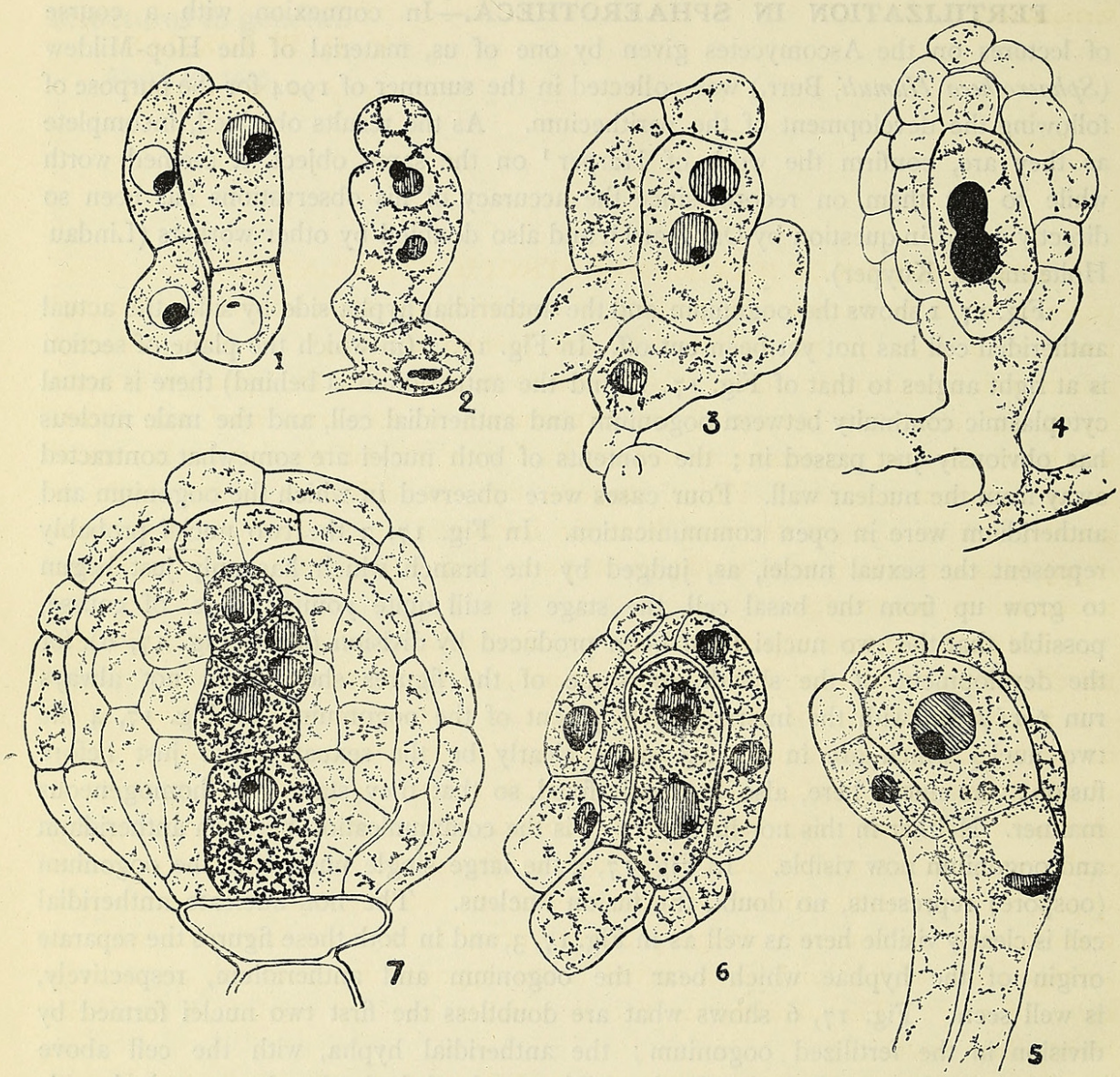

Fig. 17. × 1700.

different from that observed by Harper and ourselves, we can only conclude, with Harper[1], that the methods used by that worker were hardly adequate for the elucidation of the question at issue.

The material used was fixed in Flemming's weak fluid diluted with an equal volume of water, and cut 4–6 μ in thickness. The fixation was rather erratic, a certain number of the young stages and all the older perithecia being badly fixed—probably owing to the weakness of the fluid.

[1] Annals of Botany, xiv, 1900, p. 330.

It may be suggested here that the most satisfactory homology of the parts of the perithecium in *Sphaerotheca* is to regard the oogonium as a uninucleate ascogonium, which, after fertilization, develops directly by division into a row of cells, i. e. into a *single ascogenous hypha*, of which the usual penultimate cell becomes the ascus. This row of cells cannot satisfactorily be compared with the whole 'scolecite' of *Ascobolus*, for that is certainly not, itself, a product of fertilization.

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THE POSITION OF MAXIMUM GEOTROPIC STIMULATION.—In a recent paper in which he discusses the position of maximum geotropic stimulation, Fitting[1] refers to a note by me published in this Journal in 1899[2]. I then obtained results with apogeotropic organs which seemed to prove that the optimum position lay at 45° below the horizontal, but experiments of the same kind and others which are still more conclusive, carried out by Fitting, all indicate that the horizontal is the optimum position. Fitting suggests that the difference in my results is possibly due to a slight deviation from the horizontal in the position of the axis of my klinostat, which error would, as he proves experimentally, be quite sufficient to account for my results.

Although Fitting's experiments are so convincing as to leave little doubt that the error must lie with me, it yet seemed desirable to repeat my experiments.

I again made use of grass-haulms (those of *Lolium perenne*) and fixed them on an intermittent klinostat at an angle of 45° to the horizontal axis (the position of which was most carefully adjusted) so that they were for periods of 25 minutes alternately 45° above and below the horizontal. The results, unlike those of my earlier experiments, quite agreed with those of Fitting, for there was no indication of any difference in the amount of stimulation in the two positions. Of twenty-eight grass-haulms ten remained straight; eleven curved towards the horizontal with an average curve of 6·1°, and seven curved in the opposite direction with an average curve of 11·7°. The experiments, five in number, were all carried on for about twenty-three hours.

In order to obtain more positive results I then employed a method suggested and carried out by Fitting. Inclining the axis of the klinostat 22·5° from the horizontal, I so arranged the haulms that they were alternately horizontal and 45° below the horizontal. Almost without exception they curved decidedly away from the side which was stimulated whilst horizontal, showing that the stimulus in that position is greater than it is when inclined 45° below the horizontal. Of

[1] Untersuchungen über den geotropischen Reizvorgang, Teil I. Jahrb. für wiss. Bot. xli. 2. 1905. See also F. C. Newcombe, Geotropic responses at various angles of inclination. Ann. of Botany, 1905, p. 319.

[2] On the gravitation stimulus in relation to position. Ann. of Botany, 1899, p. 620.