different category. They were designed to cover a very wide field of basic and applied research in oils and fats. This will be evident from the list of problems that were taken up for investigation at the outset as detailed on p. 184. Work on some of these has been completed and fresh problems have been undertaken. As with all researches, those on oils and fats will continue and it is expected that these will make valuable contributions to our knowledge in this particular field.

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SOME OBSERVATIONS ON *GNETUM ULA* BRONGN. FOUND ON THE WESTERN GHATS

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GNETUM is the only gymnosperm found in the northern parts of the Western Ghats. This genus shows many interesting features resembling both Angiosperms and Gymnosperms. No work appears to have been done so far on any of the Indian species of *Gnetum* and it was thought worthwhile to study some of the important stages such as sporogenesis, male and female gametophytes, the process of fertilization and the development of the fertilized egg up to the embryo formation in one species, *viz.*, *G. ula*.

Following are the important observations made:

(1) The microspores are arranged in a tetrad. The young microspore liberated from the mother cell has dense cytoplasm, a large nucleus with nucleolus and prominent chromatin, and a very thin wall. The first division of the nucleus results in the formation of two cells, one of which is much smaller than the other. The larger nucleus soon divides into two nuclei approximately similar in size. One of these stains feebly and is the tube nucleus while the other—rather deeply stained—is the generative nucleus. This generative nucleus is seen surrounded by a layer of cytoplasm. It is at this stage the pollen grains are shed. They show a spiny exine, a small prothallial cell, a tube nucleus and a generative cell. The further development of the gametophyte was studied both in sections of ovules and in cultures. The pollen grains germinate on the nucellus and not in the micropyle. The exine ruptures and is thrown off. The intine gives rise to the pollen tube which penetrates the papillate cells of the nucellus (Fig. 1). The pollen tubes pass through the intercellular spaces of the nucellus and many such pollen tubes have been observed in a single ovule. The small prothallial cell remains behind in the grain while the pollen tube nucleus enters the tube (Fig. 1). The generative cell soon follows and divides to form two cells which are the male gametes (Figs. 2, 3). This division of the generative cell was seen a little away from the end of the pollen tube which was quite near the embryo-sac cell. In cultures made in 4 per cent. sugar solution, the last division was seen after about a week.

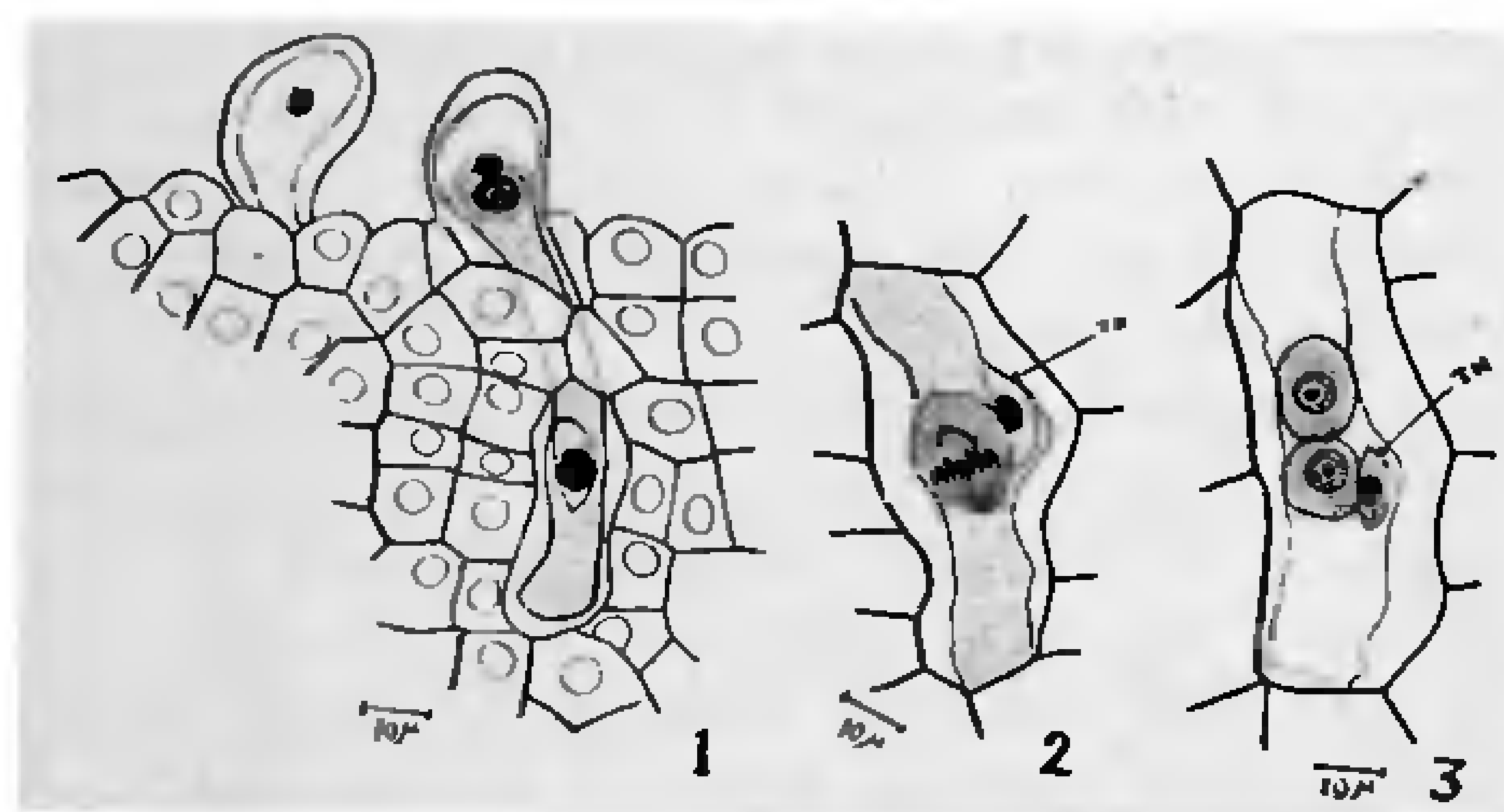


Fig. 1. L. S. of the ovule showing papillate cells of the nucellus with two pollen tubes. Figs. 2 and 3. Showing the division of the generative cell, in the pollen tube.

(2) Several radially elongated cells directly situated below the nucellar epidermis constitute the archesporium. The archesporial cells divide to form the primary parietal cells and primary sporogenous cells. The increase in the number of the parietal cells takes place by the division of the parietal cells as well as the epidermal cells. As many as twelve megaspore mother cells are seen in an ovule (Fig. 4). Out of these, generally one or two or occasionally three mother cells remain functional and undergo further development. The rest degenerate. Ultimately, only one embryo sac develops while others gradually die out. The embryo-sac from the observations made appears to be monosporic. The functional megaspore at an early stage of development shows two vacuoles on either side at the two nucleate stage—the two nuclei being in the centre (Fig. 5). These two nuclei then move towards the two poles of the young elongated embryo sac cell and large vacuole is developed in the centre (Fig. 6).

These nuclei further divide to form a large number of nuclei of the embryo sac cell. The mature embryo sac cell is an inverted flask-shaped body with a long and narrow neck. The number of nuclei in this sac is very large—exceeding a thousand. The actual number counted is 634 out of which some were in prophase and some in metaphase stage. The egg nucleus is not prominently differentiated. It may be pointed out that according to Fagerlind,[1] the embryo sac cell in *Gnetum gnemon ovalifolia* is tetrasporic. All the megaspore mother cells show at the four-nucleate stage four nuclei in the centre with vacuoles towards the periphery. At the two-nucleate stage and even before the formation of four-nucleate condition no vacuoles were seen developed. The observations made by us in *Gnetum ula* Brongn., as can be seen from the above description, appear to be quite different.

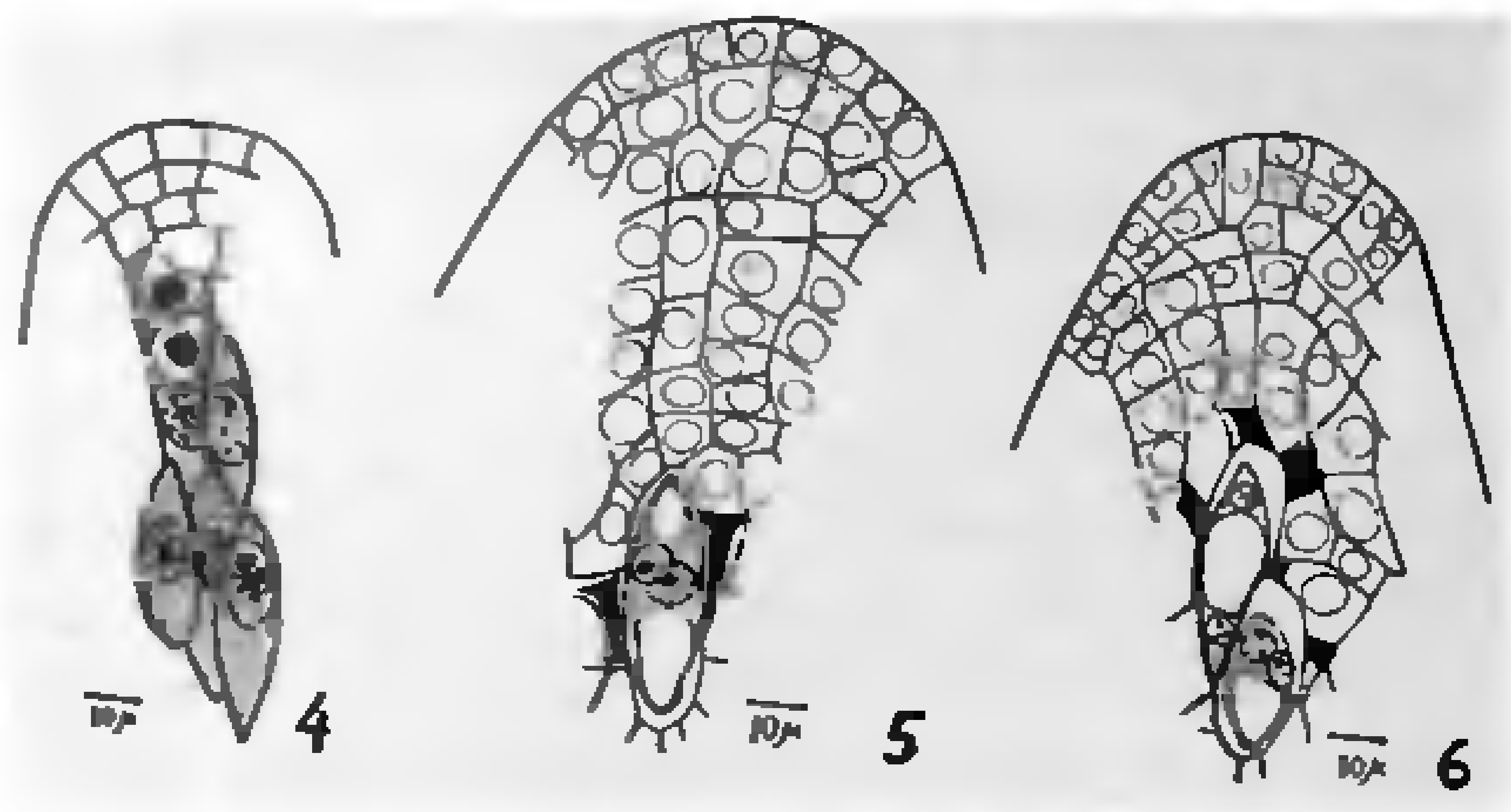
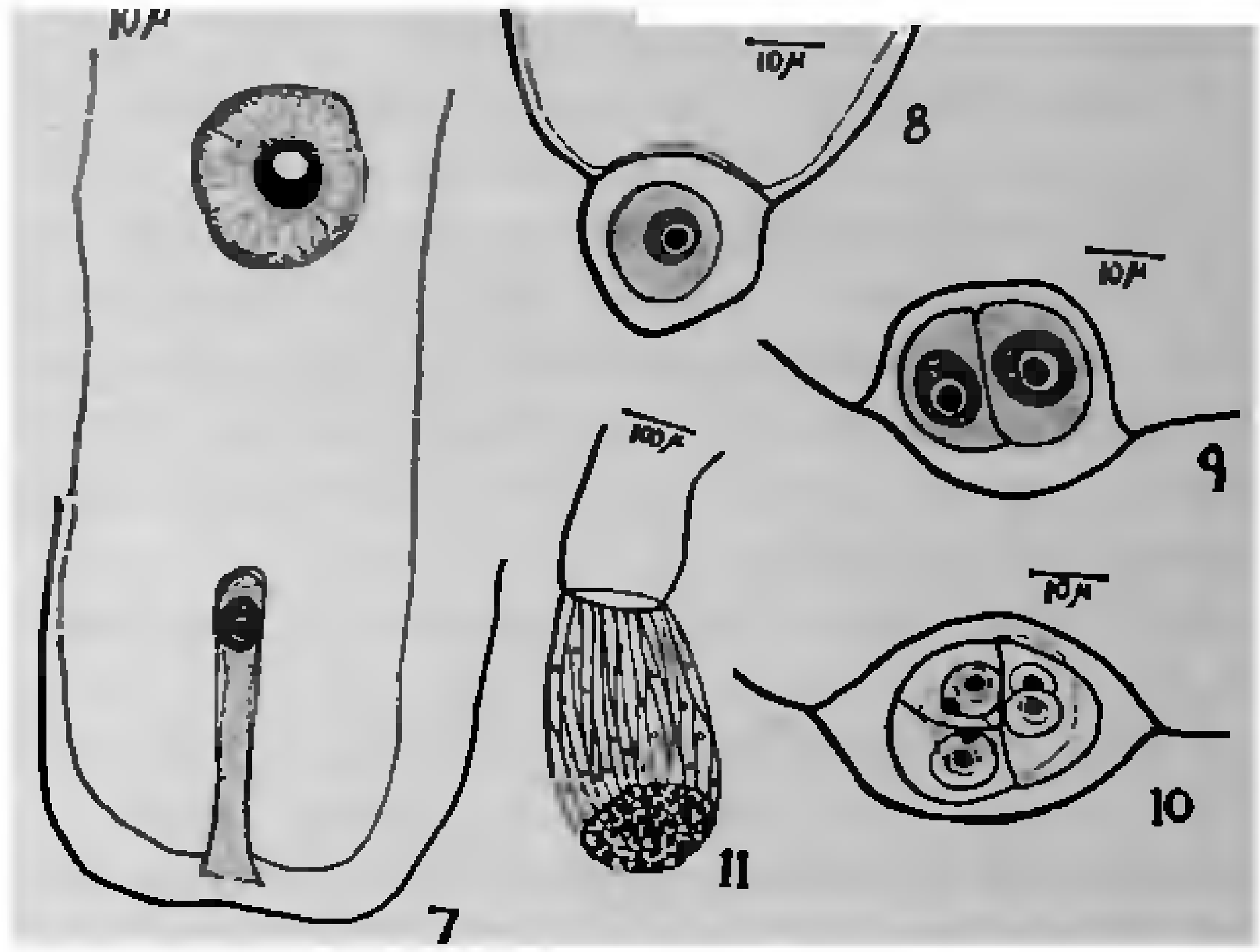


Fig. 4. L. S. of the ovule showing a few megaspore mother cells. Fig. 5. L. S. of the ovule showing embryo sac cell with two nuclei in the centre and vacuoles towards the poles. Fig. 6. L. S. of the ovule showing embryo sac cell with vacuole in the centre and the two nuclei at the two poles.

(3) Before the process of fertilization, the endosperm tissue begins to be differentiated. Cell-walls are laid down in the lower part of the embryo sac, each cell enclosing many nuclei. Walls are also laid down in the upper part—particularly towards the periphery—with the result that a large space with many free nuclei is seen in the centre. At this stage, the egg nucleus with a dense mass of cytoplasm and a male gamete nearby is observed enclosed in a wall. The nuclei fuse and a prominent fertilized egg is observed. It may be pointed out that in some ovules more than one oospore were observed. The oospore nucleus divides to form two cells. These further divide and give rise to an irregular multicellular structure from which are formed a large number of suspensor tubes which ultimately penetrate the endosperm tissue. The number of the suspensors varies from a few to more than a dozen. Each suspensor has a single nucleus and dense mass of cytoplasm towards the tip. The suspensors grow together like a long, coiled structure and often measure upto 7 cm. The nucleus of the suspensor tube divides to form two nuclei, one of which remains in the suspensor, while the second is cut off to form a small cell at the tip (Fig. 7). This cell is gradually pushed out and finally is separated from the suspensor protoplasm, but remains within the wall of the suspensor (Fig. 8). It divides vertically into two (Fig. 9), and then into four cells. These four cells divide transversely (Fig. 10). Further divisions take place rather irregularly. The cells towards the suspensor become elongated and form a multicellular secondary suspensor, while the cells towards the tip develop into the embryo proper. The secondary multicellular suspensor is seen attached to the end of the primary suspensor tube (Fig. 11). In the beginning, two cotyledons surrounding a conical projection are seen differentiated at the apex. A little later, the root initial is also differentiated internally towards the suspensor. The feeder soon develops as a lateral outgrowth from the hypocotyle region. Feeder is flat in the beginning, but soon assumes a cylindrical form. To start with, many embryos are seen developing, but ultimately, only one attains maturity.



Figs. 7 to 11. Showing early stages of development of an embryo.

1. Fagerlind, F., "Bau und Entwicklung der Gnetum Gametophyten," *Kungl Svenska Vetenskapsakademiens Handlingar*, 1941, Tredje Serien. Band 19, No. 8.