

Branched Haustorial Pollen Tubes of *Podocarpus gracilior* Pilger

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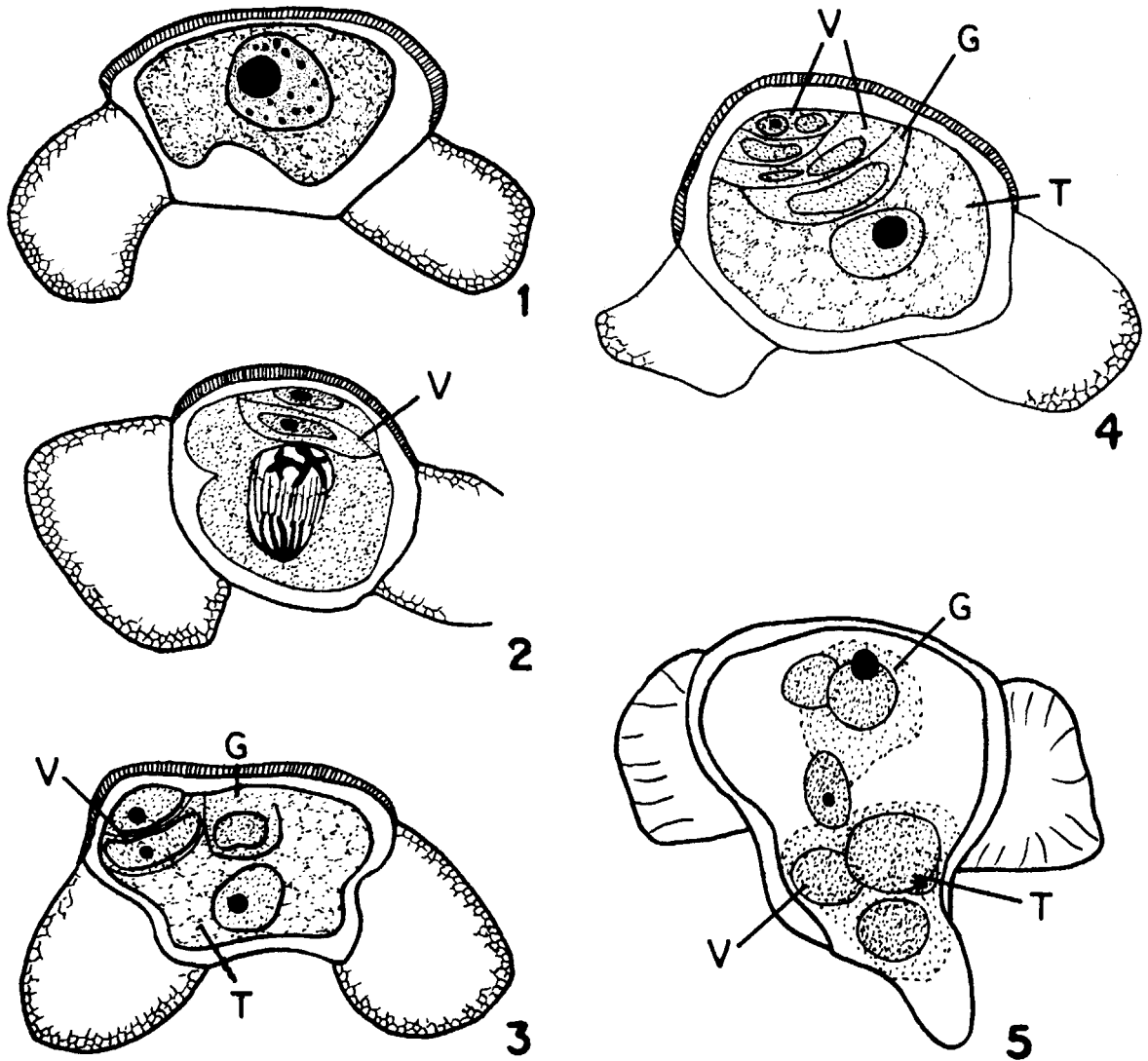
In an investigation on the embryology of *Podocarpus gracilior** belonging to the Stachycarpus section of the genus profusely branched haustorial pollen tubes have been noticed, the like of which do not seem to have been described previously in any member of the Podocarpaceae. The pollen tubes were extracted whole by microdissection of the fertilised ovules previously treated with a macerating fluid composed of saturated solution of picric acid to which a few drops of sulphuric acid had been added.

The mature pollen is two winged and possesses two primary vegetative cells (figures 1, 2) which become secondarily divided into 3 or 4 cells, a generative cell, and a tube cell (figures 3, 4). At the shedding stage the vegetative cells become disorganised liberating the nuclei into the general body of the grain (figure 5). Further germination occurs at the tip of a highly elongated nucellar break which does not organise a definite pollen chamber. The pollen tube in its early stages of growth is narrow, unbranched, and grows more or less straight through the nucellar beak but immediately on reaching the inner end of the nucellar cap it expands into a more or less cylindrical vesicle** which attains its maximum inflation in the space between the nucellar cap and the female gametophyte. From this vesicle branches are given off on all sides in the form of

elongated narrow tubes which may themselves branch (figure 6). These ramify on the inner surface of the nucellar dome and the outer surface of the female gametophyte in all directions. The branching pattern is exceedingly variable as seen in numerous preparations. In certain cases all the branches may arise on one side only (figure 7). Upto 14 branches have been observed from a single pollen tube. These branches are enucleate but their apices possess dense cytoplasm such as characterise the haustorial processes. The nuclear contents of the pollen tube all lie within the inflated vesicle and consist of varying number of vegetative nuclei, the tube nucleus which is indistinguishable from the former, and in the early stages a body cell at the periphery of which lies the stalk nucleus partially embedded in its dense cytoplasm. The division of the generative cell to form the stalk nucleus and the body cell does not occur within the grain as described for *P. nivalis* by Boyle and Doyle (1953) but in the pollen tube itself. By now the cellular female gametophyte has become organised. This is pyriform in shape and possesses a definite elliptical or ovoid archegonial chamber placed obliquely on one side of its micropylar end. Below this lie the archegonia. Just before fertilization the body cell nucleus divides to form two unequal male nuclei. The one destined to be functional is larger with clear chromatic threads and a large prominent vesicular nucleolus or two smaller nucleoli. The other one is distinctly smaller and possesses a small nucleolus (figure 8). Occasional cases have been observed where both

* The material was collected from the Botanical Garden of the Forest Research Institute, Dehradun.

** This occurs by the end of March



Figures 1-5, Stages in the development of pollen grain.

(Explanation in the text) ($\times 1750$)

G, generative cell; V, vegetative cell; T, tube cell

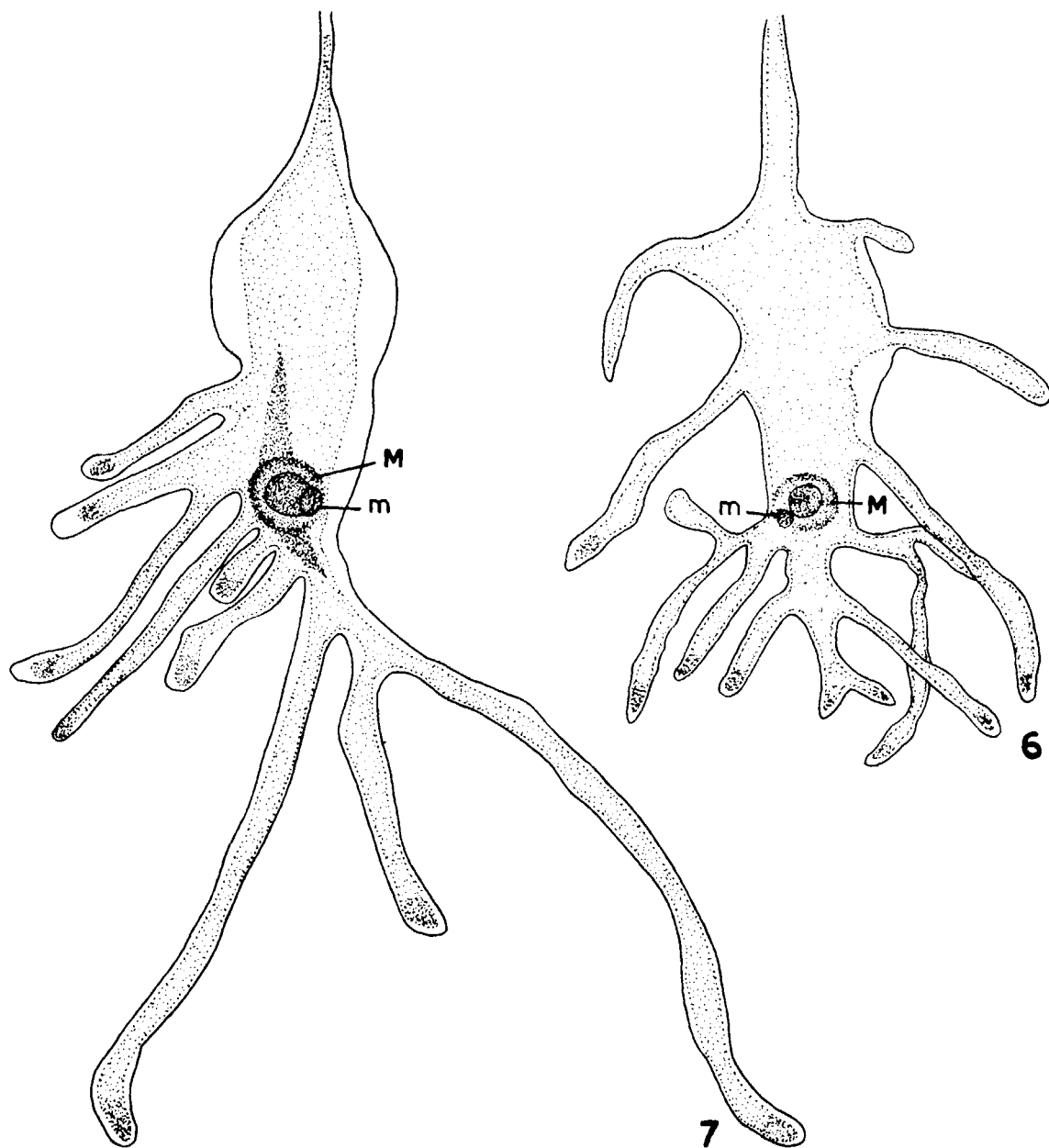


Figure 6, 7 Profuse development of haustorial tubes from the inflated vesicle ($\times 90$)
m, non-functional male nucleus; *M*, functional male cell

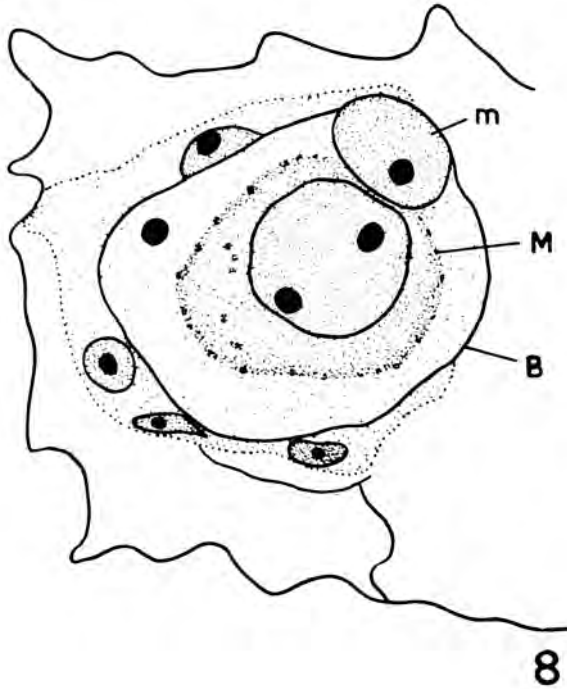


Figure 8, The stage before fertilization. (Note the free vegetative nuclei at the periphery of the body cell ($\times 725$))

B, body cell; m, non-functional male nucleus; M, functional male cells

the nuclei are more or less equal in size. The small nucleus is ultimately pushed towards one end and the larger nucleus organises into a single functional male cell.

Inflation of the pollen tube to form a vesicle just above the female gametophyte is known in *Podocarpus nivalis* (Boyle & Doyle 1953) and in other members of the Podocarpaceae but the



Figure 9 Photograph of a mature pollen tube with profuse development of haustorial processes from the inflated vesicle. Magnified

profuse development of the haustorial tubes is not so far reported probably because the investigators had to deal with the material in sections. It is anticipated that microdissection technique may reveal this position to be widespread in the Podocarps.

In Ginkgo and Cycads, which are considered to be primitive in the hierarchy of Gymnosperms, the pollen tube is branched and haustorial, thereby suggesting the primitive position of *Podocarpus* in this respect. This may possibly be so in all the Podocarps.

References

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