

## SOME ANOMALIES IN THE FEMALE GAMETOPHYTE OF PINUS.

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BY D. M. MOTTIER.

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The object of this note is to call attention to some peculiarities in the number and arrangement of archegonia and to certain other anomalies similar in character to those reported for the same and other species of *Pinus*. In her excellent and elaborate paper on the life history, etc., of *Pinus*, Miss Ferguson has directed attention to a number (9) of archegonia arranged along the top and sides of the endosperm of *Pinus montana uncinata*, together with other peculiarities regarding the number, origin and position in other species (Proc. Washington Acad. Sci., 6: 1-202, 1904).

In the work of a class of advanced students studying the gametophyte and embryogeny of *Pinus*, a number of peculiarities mentioned in the following have been found to be of rather frequent occurrence. In *Pinus austriaca* (a form of *P. laricio* frequently cultivated), several instances were observed in which a group of archegonia occurred at the chalazal end of the endosperm in addition to the group normally at the top or micropylar end. In addition to this a few cases were found in which a third group of archegonia was present at one side. Among those ovules in which a group of archegonia was present at either end, one case is especially of note in which a total of eleven archegonia was present, two near the micropylar and nine at the chalazal end of the gametophyte. The two near the micropylar end were not directly at the top but at opposite sides of that end. The nine at the chalazal end were arranged in groups of three each. One group of three was at the end, the others being more deeply seated. The second three were just beyond the first and a little to the right, while the third group was beyond the second, though somewhat to the left. In the majority of cases here under consideration the collections were made before the archegonia were mature, the ventral canal cells not having been formed. Four of the archegonia near the chalazal end had fused in pairs, a cytoplasmic union having taken place at the contiguous sides. This was made possible by the absorption of several sheath, or jacket, cells separating the archegonia. The three

groups were separated from each other by a layer of tissue from one to three cells in thickness. The central cells of two of the archegonia of the end group had fused at the outer ends only, although the sheath cells had entirely disappeared along the contiguous sides, leaving only a delicate line between the plasma membranes of the slightly shrunken cells. No nuclear fusions had taken place. Near each of these several archegonia one or more sheath cells had begun to bud out apparently to form archegonia as figured by Miss Ferguson (l.c., Fig. 265). In several preparations showing one or more of the anomalies herein mentioned, the enlargement of one or more of the sheath cells was of frequent occurrence. These enlarging cells possessed each a large nucleus and a dense cytoplasm, showing that they were being well nourished. In one ovule presenting a group of archegonia at each end of the endosperm, two large cells very poor in cytoplasm and about one-third the size of the normal archegonia lay between a normal archegonium and the end of the gametophyte at the chalazal extremity. From all appearances they had developed from sheath cells. They were not surrounded by jacket cells, hence their sparse cytoplasm.

Of this class of anomaly, namely, the presence of archegonia at opposite ends of the gametophyte, a few cases were observed in which there were *three* separate groups, one at each end and one at one side nearly midway between the extremities. In another instance the nucleus of the central cells had divided, the two daughter nuclei, which were well formed, lying in contact side by side. In this ovule all archegonia were immature; the ventral canal cells were not formed, and there was no fusion of the central cells. The two nuclei must, therefore, have been formed by the division of the nucleus of the central cell.

A second class of anomaly was observed in a single instance. It was the presence of a pollen tube containing supernumerary nuclei. This tube had grown down prematurely along one side of the endosperm and had just begun to indent the latter. The tube contained the two male nuclei surrounded by the cytoplasm of the body cell, together with about twelve other nuclei varying greatly in size. The largest of these nuclei were about the size of the male nuclei or larger. Their structural details were sharp and distinct; each contained a very distinct, but delicate, nuclear net with two or more relatively small nucleoli. In the same ovule another pollen tube had traversed about two-fifths of its way down through the nucellar tissue. In this ovule archegonia were present at each end

of the gametophyte. These organs were not mature; the adult size had not been attained nor were the ventral canal cells cut off.

A third kind of peculiarity was observed in two instances in which three archegonia formed a group at the geometrical center of the endosperm. There was no sheath layer between adjacent sides of their central cells, but on all other sides they were surrounded by the typical jacket layer. In one archegonium of this group a ventral canal cell was in process of formation; the other two were younger. No canal or opening leading to the surface of the gametophyte could be made out, neither were any necks distinguishable in connection with these nor with many other cases mentioned in preceding paragraphs.

A fourth peculiarity to be recorded is the premature arrival of the end of the pollen tube at the archegonium. In two different cases out of the material used the pollen tube had reached an archegonium in which the ventral canal cell had not been formed, nor had these organs attained their adult size. In one of these instances the tube had actually penetrated the archegonium, but had not discharged its contents.

Of the number of ovules of *Pinus austriaca* in the collection from which these anomalies were found, about one-tenth showed archegonia in either end of the endosperm. A few anomalies similar to those were observed in *Pinus virginiana*. In this paper the author has endeavored only to record the facts as observed, reserving a discussion of their probable significance until more data will have been collected.

