

5. Importance of "rootlessness" in maize.

Last summer (1970), several maize varieties were tested for their germination in laboratory and greenhouse conditions. Normal seedlings with similar color, shape, and size (root and shoot length) were selected and transplanted to the field for study of their pollen grain size under various environmental conditions. The maize varieties which originated either from the arid localities of Central America (e.g. Chapalote popcorn, Papago flour corn) or from areas with a short growing season (e.g., Gaspé flint from the northeastern part of Canada) were found to exhibit a maximum percentage of rootless seedlings. Rootless seedlings in maize were previously reported by Nickerson (MGCNL 1962, 1965, and 1966) and by Lorenzoni and Salamini (MGCNL 1970). Nickerson considered that perhaps this unusual rootless character is in some way related to growth hormones which may inhibit root formation. He noticed that when "really rootless" plants survive, they flower a few days earlier than the "regular rootless" plants. He concluded that "the gene rootless forms no roots because of an excess production of IAA (indole acetic acid) rather than because of a dearth of this substance in the nodal meristems of the lower stalk of the plant as was thought heretofore." In a recent report, Dakshini and Tondon (Ann. Bot. 34:423-25, 1970) have reported a delay in radicle formation in an unusual type of germination in Oropetium thomaeum, a member of the family Gramineae, characteristic of rocky, gravelly, and semi-arid habitat in certain tropical regions of the world. Our observations also suggest that "rootlessness" in maize is possibly an adaptive device to facilitate drought resistance in seedlings growing under adverse conditions of water supply or in a short growing season. In the literature we have also found that an agronomic practice in dry regions called "presowing drought hardening" is often used. Presowing hardening is done by soaking seeds in water and then air drying. The dehydration after soaking confers a high drought resistance without interfering with germination, growth and yield, all of which are decreased when untreated seeds are subjected to soil drought during the growing period. We consider presowing hardening is the result of extensive physiological reorganization induced by the dehydration process. In our "rootless" maize seedlings, we found that "rootless" plants are metabolically quite active

and flower a few days earlier than the normal plants (with normal rooting system) of the same race. "Rootlessness" is also recorded in some teosinte races as discussed above.

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6. Identification of pollen grains of maize: importance of size.

Recently we have studied (Banerjee and Barghoorn, MGCNL 44, 1970) the differences existing among pollen grains of maize and its relatives, using scanning and transmission electron microscopy. The use of better resolution and high magnification electron micrographs further helps in precise identification using micro-morphological characters of pollen grains. However, earlier reports from this laboratory clearly suggest that pollen grain size (outer diameter at pore axis) alone could be used safely to distinguish maize pollen from that of its relatives. Maize has the largest pollen grain size so far recorded among grasses (up to 150 μ in some cultivated varieties of maize). At this stage we suggest that any pollen grains of grasses larger than 100 μ present in the sediments can be safely interpreted as maize, if the pollen shows an evenly distributed granular exine pattern with the light microscope (LM). Moreover, accurate measurements of pollen grain size are only possible with the LM. So the use of the LM still has great potential in maize palynology. If LM phase-optics or a high quality oil-immersion objective is used one can distinctly recognise the granular nature of exine (spinulate ectexine pattern) of maize and teosinte pollen from the negatively reticuloid exine pattern of Tripsacum species pollen. Problems arise when the predominantly smaller pollen grains of some cultivated maize varieties (especially of popcorn races) fall within the size range of teosinte pollen. In these cases the use of electron microscopy is essential. Recently, we have found that the pollen grains of some popcorns and teosinte among some wild populations exhibit an ectexine spinule dimorphism at the ultrastructural level which makes it very difficult to separate the two genera. The cause of such an ectexine spinule dimorphism and variation in pollen grain size, due to various environmental factors in both maize and teosinte, is under investigation.

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