

1. Cytoplasmic pollen sterility studies.

A. Studies on the cytoplasmic pollen sterility phenomenon are being continued. A cytological study of the meiotic behavior of the male-sterile lines confirms Rhoades' previous finding (1931, 1933) that the meiotic process is normal. Ten bivalents are formed at metaphase of division one and the following disjunction appears normal. Quartets are formed at the end of division two. The process following quartet formation is apparently one of starvation. The contents of the newly formed microspores diminish gradually until the spores are devoid of inclusion material except for the two nuclei that stain with carmine. An examination of the pollen sacs reveals the interesting fact that the tapetal layers of the male-sterile lines appear to have grown out of proportion. Moreover, the out-sized tapetum persists longer than usual. This phenomenon seems to be associated with endomitotic divisions of the tapetal cells. A more detailed cytological examination of the tapetum development is underway.

Gabelman (1949) has postulated that the presence of one or more particulate units in the microspore results in sterility. Rhodes (1933, 1950) suggested that differences in cytoplasmic inclusions might be responsible for the sterility. Staining tests to compare the mitochondriome of the sporocytes of fertile and sterile lines were made. No obvious differences in mitochondria are observed. The sporocytes were treated via the Feulgen reaction to determine the possible presence of particulate bodies in the cytoplasm. No Feulgen-positive bodies are found. Staining with the Giemsa stain is being attempted.

The possibility that pollen sterility is a result of virus infection has not been fully explored. Attempts have been made to transmit sterility from sterile plants to fertile ones by inoculating normal seedlings with expressed juice of the sterile tassel. Later pollen counts will be made on these inoculated plants. Meanwhile, the expressed juice was mechanically inoculated into series of local-lesion test plants, none of which produced any local lesion. Transmission by means of dodder was also tried, but the parasite fails to establish on corn due chiefly to the rapid enlargement of the culm which ruptures the dodder strands wound around the stem. Heat treatment to inactivate the causal agent on the assumption of it being a virus has been undertaken. Leaves and rachis of sterile plants were examined in comparison with those of normals for vascular disorders and cellular inclusion bodies which are often associated with virus infection. The evidence obtained to date all point in the negative direction.

A study of the cytoplasmic pollen-sterile lines in comparison with genic pollen-sterile lines appears promising. Hence, parallel crossing of the two groups of sterile lines to common inbreds has been initiated to produce lines of isogenic germplasm.

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