

3. The source of pollen degeneration in a cytoplasmic male sterile.

A stock of unknown origin of cytoplasmic male sterility was furnished by Dr. D. F. Jones to Dr. H. Terao about fifteen years ago. This sterility has been maintained by crosses with the American sweet corn "Country Gentleman" in our breeding field. In the summer of 1956, Prof. G. F. Sprague and Dr. M. T. Jenkins visited our fields, and they said that the sterility may be of the T type. The pollen restoration in its F_1 hybrids was remarkably different in races of the two different origins, Japanese old flint and U. S. Corn-belt dent. The majority of flint races native to Japan were found to restore pollen production with a high frequency, whereas most of the races from the U. S. Corn-belt gave completely sterile F_1 's though a few of them restored fertility with a low frequency.

The source of pollen degeneration in microsporogenesis of the male sterile plant was examined by anatomical pictures of the cross or longitudinal sections of young anthers cut at 15μ and stained with Heidenhain's iron-alum haematoxylin method. Meiosis was normal, liberating the young microspores from the tetrads. Soon after this stage, an abnormal growth of the tapetal cells occurred. Owing to such an abnormality of the tapetum, the supply of nutrients to the microspores apparently became impossible. The microspores progressively underwent chromatolysis, resulting in a degeneration of pollen grains. In extreme cases of abnormal development of the tapetum, plasmodial masses were sometimes met within the anther cavity. These varied in shape as well as in size. Usually, it is said that the cytoplasm in the tapetal cells strongly indicates a metabolic reaction, and that the nutrients produced in the cytoplasm are then utilized by the developing microspores. The tapetal cells in the male sterile plants became abnormally enlarged, probably due to an accumulation of nutrients which are not supplied to the microspores. The plasmodial masses were apparently formed by evolving such an excessive protoplasm from the enlarged tapetum. In appearance, these plasmodial masses seemed to digest the microspores through covering them with a lengthened pseudopodial cytoplasm. At last, no pollen grains were found to exist in such an anther cavity. The flowers with such anthers never exerted their anthers. The plant was completely male sterile. It may therefore be concluded that the male sterility is conditioned by the abnormal behavior of the tapetum.

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