plants in two such "F2" cultures was examined. In one family eight plants had about 90% normal pollen, while eleven plants had about half the pollen aborted. With the other progeny eight were about 90% and fifteen were about 45%. The progeny of a selfed SF(Hom) plant was also checked. Also as expected, all eleven checked were about 90%. (2) If these "F2" plants with about 90% normal pollen were pollinated by the inbred (A158) only fertile offspring would be expected; while, from a similar pollination of the 45% segregates, a 1:1 fertile-to-sterile ratio should ensue. A total of twelve 90% plants from the three progenies were pollinated by A158 and each gave rise to an all-fertile progeny. Thirteen plants of the 45% type from among the two "F2" cultures were crossed with the inbred in the same manner; each segregated 1:1.

This selection phenomenon is not limited to material with the A158 residual genotype. The following is a summary of all S-sterile material observed:

Source of Restorer	Background genotype	No. of progeny observed	Observation on basis of: Pollen %	Progeny Test
Ky21	A158	45	selection	selection
"	M14	20	"	"
"	P39	12	"	"
"	WF9 x Ky21	2	-----	"
A206	A158 x A206	1	selection	"
"	(M14xWF9)(A158xA206)	1	"	-----
Q703	M14 x Q703	1	"	
W22	W22 x A158	1	no selection	-----
S.P.R.*	S.P.R.	1	-----	intermediate
"	(WF9x38-11)S.P.R.	1	intermediate	

* Southern Prolific Restorer, a closed pedigree single cross produced by McCurdy.

It can be seen that this type of selection is wide-spread, though not universal in S material and therefore is not a necessary consequence of the S cytoplasm. There are indications that this inheritance pattern can be modified by both the restorer and the residual genotype; however, until the evidence is complete it will not be presented or discussed.

Preliminary observation suggests that this same type of phenomenon can occur with T cytoplasm and that it is dependent upon the residual genotype.

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7. The location and critical time of primary gene action as a mechanism of male gametophytic selection.

Since 50% of the pollen grains of the SF(Het) plants described in

article 6 (above) abort, it can be concluded that there has been no way for a sufficient amount of an essential product of the restoring gene to get into their cytoplasm. This could only come about if the critical restoring action were to have occurred after the formation of crosswalls during microsporogenesis; after the time when it became impossible for an active restorer product to travel to the other microspores. The spores not containing the restorer then degenerate due to the activity of the sterility factor.

If this is indeed the mechanism determining the male gametic selection and, as a consequence, the degree of pollen abortion and inheritance pattern in this S material, then the restorer would not be selected for if, while keeping the residual genotype constant, it were put with a type of cytoplasm other than S. The segregation (as would be disclosed by a progeny test) for the S restorer has been checked in normal and in T type cytoplasm. A number of fertile plants resulting from the cross A158T6 x A158SF5 (A158SF5 was also heterozygous for a T-restorer) were examined, and in no case was any more pollen aborted than is exhibited by the A158 inbred (about 10%). Offspring from A158 x A158SF5 likewise showed no excessive abortion. Thus, with normal, as well as with T cytoplasm, no selection manifests itself.

The time and location of the action in restored T-steriles is probably the same..

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8. On the role of the tapetum in pollen abortion.

The idea that the mechanism of abortion of pollen grains in cytoplasmic male sterile plants may be a starvation due to the withholding of food by the tapetum can be discussed in the light of the observations discussed in article 6 above. If this idea were correct, then, in those cases where there was incomplete sterility (50% of the pollen aborted), there should have been no correlation between those pollen grains aborted (or conversely, those which survived) and a gene contained by them. This, however, was not the case. There the presence of a gene in the maturing pollen grain determined which grains would be aborted by the sterility mechanism. It can therefore be concluded that in cases of the S type male sterility, the abortion is not caused by a starvation due to the withholding of the food by the tapetum.

This is probably also true in T-steriles.

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