6. Some Observations on Pollen Tubes with Respect to Differential Fertilization

Inbred lines of Hulless (Ga_1^s/Ga_1^s), White Rice (Ga_1/Ga_1), and U. S. 13 (ga_1/ga_1) were crossed and self pollinated in order to determine the rate, the extent, and the variabilities of the pollen tube growth with respect to differential fertilization.

A squash method was developed for examining the pollen tubes within the styles (Adams and Mackay, Stain Tech. 28:295-298).

Pollen tubes were measured from material removed from the plants at the following time intervals after pollination: 20, 30, and 40 minutes, 8, and 24 hours. The average pollen tube lengths at 20, 30, and 40 minutes after pollination are given in table 1. An analysis of variance indicated a significant difference at the 30 and 40 minute periods after pollination when all crosses except Ga_1^s/Ga_1^s x ga_1/ga_1 were involved in the analysis. No analysis was determined for the 20 minute period. If all crosses except Ga_1^s/Ga_1^s x ga_1/ga_1 were involved in the analysis, there was a significant difference only at the 20 minute period. There was not significant difference at the 40 minute period when the following crosses were analysed: Ga_1/Ga_1 x Ga_1^s/Ga_1^s, Ga_1/Ga_1, and Ga_1/Ga_1 x ga_1/ga_1. No analysis was determined for the 20 and 30 minute periods.

Table 1. Average Pollen Tube Lengths at 20, 30, and 40 minutes After Pollination and Estimated Time of Germination of the Pollen.

	Est. time pollen germ. (minutes)	Minutes after Pollination 20	30	40
		(length of pollen tubes in μ)		
Ga_1^s/Ga_1^s x Ga_1^s/Ga_1^s	5	233.5	285.2	454.3
Ga_1^s/Ga_1^s x Ga_1/Ga_1	11	118.5	253.8	360.4
Ga_1^s/Ga_1^s x ga_1/ga_1	27	0	38.4	159.6
Ga_1/Ga_1 x Ga_1^s/Ga_1^s	7	165.4	288.1	380.8
Ga_1/Ga_1 x Ga_1/Ga_1	6	141.1	244.4	391.8
Ga_1/Ga_1 x ga_1/ga_1	5	145.8	288.9	329.3

At 8 and 24 hours after pollination the pollpn tubes were well established in all crosses. The average distance from the base of the average silk is given in table 2.

Table 2. Average Distance of Pollen Tubes from the Base of the Average Silk

	Hours after Pollination 8	24
	(distance from base of silk in mm.)	
Ga_1^s/Ga_1^s x Ga_1^s/Ga_1^s	----	3.4
Ga_1^s/Ga_1^s x Ga_1/Ga_1	1.5	----
Ga_1^s/Ga_1^s x ga_1/ga_1	25.2	11.8
Ga_1/Ga_1 x Ga_1^s/Ga_1^s	----	0.8

Ga_1/Ga_1 x Ga_1/Ga_1	----	0.0
Ga_1/Ga_1 x ga_1/ga_1	----	19.0

Ga_1^s and Ga_1 pollen rarely produced tubes which had swollen tips or swollen areas along the pollen tube regardless of the genotype of the silk. However such swellings were produced abundantly when ga_1 pollen was used on Ga_1^s/Ga_1^s and Ga_1/Ga_1 and silks.

From these data the rate of pollen tube growth apparently has no effect on differential fertilization. However, if Ga_1^s and Ga_1 pollen were used to pollinate Ga_1^s/Ga_1^s styles, the Ga_1^s pollen will effect fertilization. This could be true if the first few well established pollen tubes inhibited the growth of slow growing or late establishing tubes. The data in table 1 indicates that ga_1 pollen is slow in germinating, and at 40 minutes after pollination the tubes have progressed less than half the distance of the Ga_1^s tubes. The swelling of the ga_1 pollen tubes occurred one hour after pollination. This swelling was interpreted as reducing the rate of, but not terminating, growth of the pollen tube. Thus, the early advantages of the Ga_1^s pollen tubes over ga_1 pollen tubes in Ga_1^s/Ga_1^s silks may be a contributing factor to differential fertilization.

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