

1. Further study of the a_1^{m-1} - Spm system.

A general outline of the system of control of gene action at a_1^{m-1} was given last year in this News Letter, and transpositions of the controlling element, Spm, were mentioned. To determine Spm constitutions in the cells of different parts of a plant, several ears of a single plant were utilized in test crosses. From 101 plants, tests of two ears per plant were obtained. In 95 plants, the number of Spm elements was the same in the cells that produced each ear (63 with 1 Spm; 26 with 2 Spm; 6 with 3 Spm). In 6 plants, the Spm constitution was not the same in the cells that gave rise to each ear (1 case of 1 Spm in one ear and no Spm in the other; 3 cases of 1 Spm in one ear and 2 Spm in the second; 2 cases of 1 Spm in one ear, the second ear having a sector with no Spm). From 12 other plants, tests of three ears per plant were obtained and correspondence in number of Spm elements was evident in each of the 3 ears of 11 of them (6 with 1 Spm; 4 with 2 Spm; 1 with 3 Spm). In one plant, the cells that gave rise to two ears contained 1 Spm element but 2 Spm elements were present in the cells that gave rise to the third ear.

Tests were made of Spm constitutions in the progeny of plants in which 1, 2, or 3 Spm elements were known to be present. One test of 238 individuals derived from plants having 1 Spm element will illustrate the nature of the results obtained. The parent plants carrying Spm had been crossed by plants homozygous for a_1^{m-1} but having no Spm. Kernels on the resulting ears that showed the presence of Spm in the endosperm were selected and the plants grown from them were again crossed by plants homozygous for a_1^{m-1} but carrying no Spm. On the ear produced by 7 of these plants, no kernels having Spm appeared. One Spm element was present in 205 plants, 2 Spm elements were present in 20 plants and in 6 plants, 3 Spm elements were present. Also, tests were conducted to determine the position of Spm in the progeny of plants in which the location of Spm was known. In the majority of such tests, the Spm element occupied the same position in the chromosome complement as it had in the parent plant, with some exceptions, however, that were to be expected. In one such test, 103 individuals in the progeny of plants carrying Spm in chromosome 6 and showing approximately 35% recombination with Y, were examined. In 92 of these plants, 1 Spm was present and it showed the same linkage with Y as it had shown in the parent plants. Two plants had 2 Spm elements, one of which was linked with Y. Five plants had 1 Spm but it showed no linkage with Y, and 1 plant had 3 Spm elements whose linkage relationships could not be detected because of the high number of Spm elements that were present. In another test of 22 individuals in the progeny of a plant carrying Spm in chromosome 6 but showing, in this case, closer linkage with Y, 19 plants proved to have 1 Spm element and its location was similar to that in the parent plant. In two plants, 2 Spm elements were present and one of them was linked with Y. In the remaining plant of this culture, 1 Spm was present but it showed no linkage with Y. The table below will illustrate the nature of the tests conducted and the results obtained from them for this progeny of 22 plants.

$$\begin{array}{l} a_1^{m-1}/a_1^{m-1} \\ ; \\ \text{or} \quad Y/y_m \times a_1^{m-1}/a_1^{m-1}; y/y; \text{No Spm}_h \\ a_1^{m-1}/a_1; \end{array}$$

Plant No.	Pale aleurone (No Spm)		Colorless aleurone with spots of A ₁ (Spm present)		Totals	Germinal Mutations
	Y	y	Y	y		
A. One Spm, linked with Y						
1	38	132	114	44	328	1
2	27	161	144	27	359	
3	31	172	154	17	374	3
4	28	186	150	18	382	
5	48	125	130	32	335	
6	40	234	222	54	550	
7	30	196	151	34	411	
8	51	238	230	46	565	
9	37	174	174	53	438	
10	32	157	149	25	363	
11	43	113	125	40	321	
12	41	153	155	32	381	
13	34	164	199	51	448	
14	45	161	155	38	399	
15	20	156	139	24	339	
16	23	136	154	34	347	
17	35	192	164	44	435	
18	28	142	153	31	354	
19	52	172	171	40	435	1
Totals for A	683	3164	3033	684	7564	5
B. Two Spm elements, one linked with Y						
20	9	17	63	29	118	
21	30	101	252	152	535	
Totals for B	39	118	315	181	653	
C. One Spm, not linked with Y						
22	117	112	101	100	430	2

Similar results were obtained from tests of progeny of plants carrying Spm in chromosome 5 and showing linkage with Pr. However, in one other test of a small progeny of only 5 plants, quite aberrant results were obtained. In the parent plant, 1 Spm element was present and from the ratio of kernel types on the ear it produced, there was no evidence of linkage of Spm with alleles of Y, Pr, or Wx which were also segregating. In one of the 5 plants in this progeny, 2 Spm elements were present and one of them was loosely linked with Y. In each of the remaining 4 plants, 1 Spm element was present. It was very closely linked with Y in one plant. In another, it showed 35%

recombination with Pr. In the third plant, it gave 33% recombination with Wx, and in the fourth plant, no linkage of Spm with any of these markers was noted. It is suspected that many transpositions of Spm occurred in the parent plant and at a time that was late in the development of its sporogenous cells.

On test ears, such as those described above, an occasional kernel may appear showing a markedly altered pattern of mutation. Some of them arise from a change in state of the a_1^{m-1} locus. Others, however, arise from modifications of another type. Several examples of the latter type of modification have received some study. One type appears relatively frequently and the evidence suggests that it may arise from a change in the Spm element itself. In the presence of the modified element and in the absence of Spm, plant tissues show pigmentation but the aleurone layer is almost totally colorless, only a few specks or dots of color appearing in it. When both the modified element and Spm are present in the same plant, the action of Spm is dominant to that of the modified element and clear-cut segregations of these two different controlling elements are observed. Like Spm, the modified element may occupy different positions within the chromosome complement. Other types of modifiers have also arisen and in the same general manner. Their presence results in altered distributions of pigmentation in the plant tissues and in the aleurone layer of the kernels and also in an altered time and frequency of occurrence of mutations at the locus of a_1^{m-1} in these tissues.