TABLE C (Continued)

DATE 1924	TIME OF OBSERVATIONS	TIME OF SUNSET OR SUNRISE	AVERAGE BEARING °	GREATEST DIFFERENCE FROM MEAN °	REMARKS
Mar. 22	4:55–7:45 P.M.	6:22 P.M.	162.5	0.0	
Mar. 23	5:05–6:45 A.M.	6:11 A.M.	162.5	0.0	
Mar. 23	4:54–7:52 P.M.	6:23 P.M.	162.9	2.0	Broad minimum.
Mar. 24	5:10–6:45 A.M.	6:10 A.M.	162.7	1.5	
Mar. 24	4:55–7:50 P.M.	6:23 P.M.	162.5	2.0	Very broad minimum for about 1 hour.
Mar. 25	5:05–6:50 A.M.	6:08 A.M.	162.6	1.5	
Mar. 25	4:55–7:55 P.M.	6:24 P.M.	162.5	0.0	
Mar. 25	8:00–8:35 P.M.		162.5	0.5	These readings on signals from spark transmitter.
Mar. 26	5:15–6:50 A.M.	6:06 A.M.	162.3	1.5	
Mar. 26	5:00–7:45 P.M.	6:24 P.M.	161.6	3.0	Static very bad; difficult to take bearing during entire period.
Mar. 27	5:15–6:55 A.M.	6:04 A.M.	161.7	1.0	
Mar. 27	4:55–7:58 P.M.	6:26 P.M.	162.0	1.0	
Mar. 28	5:15–7:00 A.M.	6:03 A.M.	162.4	0.5	
		For 9 days	162.3		

SELECTIVE FERTILIZATION AMONG THE GAMETES FROM THE SAME INDIVIDUALS

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When certain varieties of pop corn of the *Zea mays everta* type are crossed with sweet corn a deficiency in the number of recessive segregates is commonly observed when the hybrid plants are self-fertilized. This was noted by Correns, as reported in 1901, in the first Mendelian experiments with this plant. While most varieties having corneous endosperm give the expected 3 to 1 ratio when crossed with the wrinkled translucent endosperm type known as sweet or sugary, as shown by Lock (1906) and East and Hayes (1911), a variety of pop corn having very hard and sharply pointed seeds, called Rice Pop or Squirrel Tooth, gives significantly less than 25 per cent of recessive seeds when crossed with various types of sweet corn.

Kempton (1919) reports a similar case with waxy endosperm. This character is like sweet endosperm in that it is inherited as a simple Mendelian recessive. The F_1 plants produced a small but regular and significant deficiency of recessive seeds. Pollen from the F_1 plants backcrossed on the recessive parent showed a slight deficiency of waxy seeds which was not shown in the reciprocal pollinations.

The cross of an inbred strain of pointed pop corn with a first generation hybrid of two inbred strains of sweet corn of different type gave the results shown in table I. One of the sweet strains was a small, yellow-seeded

TABLE I

		Dominant Seeds	Recessive Seeds	Ratio of Dominants to One Recessive
$(Su \times su)F_2$ 1	409	366	43	8.5
2	440	346	94	3.7
3	441	376	65	5.8
$(su \times Su)F_2$ 1	378	322	56	5.8
2	455	378	77	4.9
3	519	421	98	4.3
4	438	391	47	8.3
5	601	485	116	4.2
Total Found		3085	596	5.2
Expected		2761	920	
Deviation		324 = 18.3 x P. E.		

variety known as Golden Bantam, the other a large, white-seeded variety known as Evergreen. Since both were homozygous for the recessive endosperm factor the somewhat complicated parentage need not obscure the simple segregation taking place between the dominant and recessive factors *Su* and *su*. This material was used because it had shown a high degree of selective action in pollen mixtures where pollen from two different types of plants acting in competition fertilized more of the ovules of its own type than of the diverse type, as previously reported in 1920 and 1922.

In a total of 3681 seeds from eight self-pollinated F_1 plants of this cross, as shown in table I, there were only 16 per cent of recessives, a deviation from the normal 25 per cent of 18 times the probable error. The ratios shown by the individual plants differed widely but were all more than 3 to 1, ranging from 3.7 to 8.5 : 1. F_1 plants of a similar cross, although of somewhat different ancestry, were backcrossed both ways with the

TABLE II

	Dominant Seeds	Recessive Seeds		Dominant Seeds	Recessive Seeds
(su x Su) x su 1	191	174	su x (su x Su) 1	135	169
2	188	199	2	123	147
3	192	222	3	88	105
4	182	162	4	133	122
5	108	134	5	99	112
6	172	158	6	168	160
7	166	148	7	139	124
8	175	200	Total found	885	939
Total found	1374	1397	Expected	912	912
Expected	1385.5	1385.5	Deviation	27 = 1.88 x P. E.	
Deviation	11.5 = 0.65 x P. E.				

recessive parent. The results are given in table II. The data show a normal one to one ratio both ways the pollinations were made. The deviations are less than one and two times the probable error. In this respect the results differ from Kempton's observations with waxy corn. In all this material the segregation of smooth, corneous seeds and wrinkled, glassy seeds was very clear-cut. Occasionally a recessive seed was found that was not deeply wrinkled and at first glance might be classed as a dominant. However, the opportunity for faulty classification was just as great in the F_1 plants backcrossed with the recessive as in the F_1 plants self-pollinated. In the one case a marked deviation was found; in the other not.

The next step was to backcross the F_1 plants with the dominant parent. Since the result of fertilization by a recessive or dominant carrying gamete would be obscured, because all the seeds would have the dominant endosperm condition, it was necessary to grow the plants and determine which were segregating and which were not. This was done by planting the backcrosses, made both ways, and allowing all of the plants to interpollinate naturally. Any plants that resulted from *Su* x *Su* fertilization would show no recessive, while most of the plants of the composition *Su* x *su* would be expected to show some recessive seeds. Without selective fertilization one half of the plants would be segregating so that one fourth of the pollen in the field would be carrying the recessive factor. Segregating plants would be expected to have half of their ovules with the recessive factor so that segregating ears should have on the average one-eighth of their seeds recessive. Selective fertilization working against the recessive gametes would reduce this proportion. Only one ear was taken from each plant and most of these contained several hundred kernels. All ears which had any sweet seeds were classed as segregating. The number of sweet seeds varied on different ears as follows; the data being taken from the backcross of F_1 pollen on the dominant parent.

NUMBER OF PLANTS	NUMBER OF RECESSIVE SEEDS
6	1 to 10
15	11 to 20
18	21 to 30
15	31 to 40
17	41 to 50
7	51 to 60
8	61 to 70
1	71 to 80
1	81 to 90
88	

It will be seen from this frequency distribution that the segregating plants which had no recessive seeds and for that reason would be wrongly classified were probably less than seven per cent and were not likely to be enough to disturb the results seriously in view of the wide departure from the normal one to one ratio obtained. The backcross of pollen from the homozygous dominant parent on the heterozygous F_1 plants gave 207 segregating and 213 non-segregating individuals. These numbers differ from a one to one ratio less than the probable error. But the pollen from the heterozygous F_1 plants backcrossed on the homozygous dominant parent gave 88 segregating and 353 non-segregating individuals, a deviation from a one to one ratio of 18.7 times the probable error.

To sum up, the F_1 plants self-fertilized showed a selective action such that more of the gametes carrying the dominant factor united than would be the case in random mating. The heterozygous F_1 plants backcrossed with the recessive parent showed no selective action either way the pollinations were made. Backcrossed with the dominant parent there was no selective action when the pollen was alike but the pollen from the heterozygous F_1 plants showed a markedly greater fertilizing ability on the part of the gametes carrying the dominant factor.

This series of facts shows that the selective fertilization is not due to differences in the functioning of the pollen alone, although the differential action is exhibited only when the pollen is diverse, otherwise unequal numbers would be obtained in the backcross on the recessive parent as well as on the dominant. There is apparently an interaction between the pollen tube and the tissues in which it grows such that *pollen carrying the dominant factor is better able to accomplish fertilization than the pollen carrying its recessive allelomorph only in a sporophyte which also has the dominant factor either in the haploid or diploid state.*

There is in this case a tendency among diverse gametes from the same individuals for like to mate with like just as among individuals of different germinal constitution, as has been shown by the results of pollination with mixtures of pollen from different plants. For this reason a variation occurring in a homogeneous population tends to be separated from the parent stock more quickly than would occur in random mating. Gametes carrying the aberrant gene are handicapped when mating with gametes from individuals of the original type but not with those from the new form. In this case gametic selection favors divergent evolution.

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