against 12 to 15 in both the parents. This behaved as a recessive trait. The tassel emergence took place after 65 to 70 days, compared to 45 to 50 days in controls. These mutant traits were associated with increased numbers of ears (4 to 6) at each base, but had very few seeds. Tassel seeds also were present occasionally.

When the mutant was crossed with both parents, the F_1 had uniformly 16 to 18 leaves and flowered more or less at the same time as the parents, showing intermediate dominance expression for number of leaves. F_1 plants were crossed as female parent with normal and mutant pollen. F_2 segregation and backcross ratios (Table 1) indicate that mutant expression is governed by a single recessive gene. F_1 plants crossed with mutant pollen had F_1 types and mutant types in equal numbers, while F_1 plants crossed with normal pollen had F_1 types and normal ones in the same proportion. The segregation for plant height and ear number did not follow any specific pattern.

Table 1. Segregation of leafy mutant.

Cross	No. of progenies	Number of plants		
		Normal	F_1 type	Mutant
Mutant x ACR	5	-	96	-
" ⊗	27	122	209	144
ACR x Mutant	6	-	82	-
" ⊗	32	154	329	170
" x Mutant	8		335	379
Mutant x <u>c</u> <u>sh</u> <u>wx</u>	6	-	38	-
" ⊗	36	234	436	193
<u>c</u> <u>sh</u> <u>wx</u> x Mutant	9	-	34	-
" ⊗	32	306	539	289
" x <u>c</u> <u>sh</u> <u>wx</u>	8	179	204	

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EMS-induced jointed seed syndrome

An induced heritable character, "jointed seed syndrome" (MNL 48:14) continued to be expressed in the succeeding generations. In F_3 generation the following observations were noted; a brief summary of the previous generation is also included.

- F_1: EMS treated seed. Silks crossed with normal pollen (2.5% Jointed seeds).
- F_2: 51 plants expressed jointed seeds (0.3 to 5.4%). 21 plants normal.
- F_3: 23 (Possible homozygotes); Jointed seeds in each plant (0.3 to 12.50%); 28 (Possible heterozygotes) segregated for mutant trait. From the 21 normals of the F_2, 10 plants (Possible heterozygotes) segregated for mutant trait, 11 plants (Homozygotes) gave normal.

The F_3 segregation ratio and the occurrence of the segregation of mutant type plants from normal plants suggests that the mutant expression is controlled by a single dominant factor and is possible maternally inherited.

Some of the plants which were considered to be homozygous were further selfed for two more generations. Individual plants in these progenies expressed the mutant trait ranging between 0.35 and about 12.50 percent. The frequency of jointed seeds obtained in some of the selfed plants in F_5 generation was quite high compared to the F_1 plant (Table 1).

From plants which had more than one ear, one was selfed and another was utilized for reciprocal crosses with normal plants; this revealed that the mutant expression was only in the female plant (Table 2).

Table 1. Frequency of jointed seeds in homozygous plants.

Progeny No.	Normal seeds	Jointed seed (%)
74-55b-44	135	17 (11.18)
" -56a-48	98	11 (10.09)
" -55b-12	130	14 (9.27)
" -53f-9	280	26 (8.49)
" -55b-8	190	16 (7.76)
" -55c-9	194	16 (7.61)
" -53f-1	176	14 (7.36)
" -54c-4	136	10 (6.84)
" -54C-4	280	19 (6.35)
" -53f-4	133	9 (6.33)
Total	1752	152 (8.68)

Table 2. Jointed seed mutant expression through female parent.

Pedigree No.	Number of seeds					
	Ear I Selfed		Ear II x Normal		Normal x Mutant	
	Normal seeds	Jointed seeds	Normal seeds	Jointed seeds	Normal seeds	Jointed seeds
74-56a-12	78	5	251	6	250	Nil
" -56b-1	85	4	165	9	257	"
" -53f-4	253	15	295	17	250	"
" -55c-2	266	10	178	4	300	"
" -55c-11	203	10	146	6	200	"
" -55E-5	153	2	96	4	250	"
" -55b-12	240	26	88	1	200	"
" -54E-10	183	6	62	3	200	"
" -56a-57	92	3	156	4	300	"
" -55b-9	91	5	182	5	300	"

The F_1 plants were crossed with mutant and normal pollen. Again, depending upon the female parent, in some progenies all plants were mutant type and in others there were normal plants. These plants, when crossed with both the parents, showed segregations (Table 3).

Table 3. Segregation of jointed seed mutant in the crosses.

Cross	No. of progenies	Number of plants	
		Normal	Mutant
(F_1 Mutant-type x N) x N	10	136	152
(F_1 Mutant-type x M) x M	10	121	146
(F_1 Normal x N) x N	10	143	162
(F_1 Normal x M) x M	10	96	114

The jointed seeds of both homozygous and heterozygous lines gave rise to twin plants. However, mutant expression was observed in either one, both, or none of them, depending upon the genotype of the plant (Table 4).

All these data clearly indicate the induction of a dominant gene which is maternally inherited and which governs the formation of twin seeds. This gene in homozygous condition is expressed in the range of 0.5 to 12.5 percent.

Table 4. Behaviour of twin seedlings originating from jointed seeds.

Pedigree No. Jointed seed	Number of seeds			
	Plant One		Plant two	
	Normal	Jointed	Normal	Jointed
74-53E-10	289	5	183	6
54d-9	273	4	135	3
54d-4	71	2	146	9
55b-9	91	5	125	5
55b-12	240	26	108	1
55b-4	114	2	94	1
55b-1	85	4	121	2
53b-2	173	-	92	-
53b-8	226	-	136	-
53E-4	192	-	241	-

Examination of mature seeds as well as seeds at early stages of development had revealed that the occurrence was due to the development of another carpel along with the fertile carpel of the normal flowers. Although the seeds were separated internally, the same pericarp layer surrounded both the seeds. Also, the twin seeds had only a single silk scar which indicated the development of twin seeds from a single ovary. All the three styles of the ovary of both the mutant and the normal plants were fused from the base upwards and in many cases only two styles were distinct. In the mutant, compared to normal, one of the styles was shorter and this was connected to the fertile carpel. One style, being short and therefore not fully exposed, gave a low percent of jointed seeds.

Experimentally cutting the ear at different levels and delaying pollination resulted in the increased frequency of jointed seeds (Table 5).

Table 5. Effect of cutting the ear and delaying pollination on the production of jointed seeds.

Operation	No. of plants	Number of kernels		Percent
		Normal	Jointed	
Routine cut				
Pollination 2nd day	24	5291	73	1.37
" 3rd day	28	3252	48	1.47
" 4th day	30	3645	66	1.51
Cut up to pith				
Pollination 2nd day	22	4610	86	1.87
" 3rd day	24	5898	130	2.21
" 4th day	32	6962	248	3.44

If it is possible to obtain a mutant of multi-carpellary type in maize then induction of all the three carpels to fertility may be visualized. This may help in explaining the nature and origin in evolution of this mutant condition from the wild ancestor where tricarpellary condition is a rule in monocots.

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