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Genetics of Locule in *Sesamum indicum* L.

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Abstract: Sesame (*Sesamum indicum* L.) Varieties Vm, X-79-1, Ec359007, EC351887, EZ351881 their 10F1s, 10F2s were evaluated for genetics of locule .Since the multiloculed nature is of economic advantage in boosting the productivity an attempt is made to follow up the genetics of the locules from the segregation noted in ten crosses, to isolate lines pure for 6, 8, 10L. The 10 crosses of the present study therefore involved the combinations 4×8, 8×8 and 4×8 locules. Progenies of these crosses were evaluated for assessing the genetic nature of the locule character in *Sesamum.* Plants with 4, 6, 8 and 10L screened from progenies were selfed and seed collected individually was soon sown in separate lines to follow up the segregation. F1 from all types of segregation was 4L. The F2 segregation fitted to the 3:1 ratio of 4L versus multiloculed plants with a non significant χ^2 suggesting monogenic dominant nature of 4L over the multiloculed nature,with the penetrance and expressivity of the recessive multilocule allele effected by modifying factors.

Key words: χ^2, monogenic control, penetrance and expressivity, *Sesamum indicum* L.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the oldest oil seed crop and has been cultivated in Asia from ancient times.It is cultivated by small or margin farmers of which 99.99% is mainly produced in developing countries Ashri (1994). India is a major sesame producer accounting for 40% of sesame area and 27% of world production Sharma (1994). Phenotypic genetic markers of plants are classified into seed,seedling and adult plant markers (Krishna Rao *et al*., 1990).These characters are useful in plant breeding and genetics. In early literature Nohara (1933), John (1934), Kumar and Rao (1945), John and Nair (1981, 1984) reported multiloculed condition is recessive to the four loculed condition. Sasikala and Kamala (1985) suggested the influence of modifying factors on number of locules.

Multilocules in pods of sesamum are of added economic advantage over the normal four locules found in most of the cultivated and wild species. Multilocules although, occurred more frequently in the progenies of the ten cross. The present situation of the parental combination with four and eight locules, along with the differential pattern of segregations with respect to the number of locules in the progenies, was availed to follow up the inheritance and explain the genetics of locules. In view of these observations, the present investigation was undertaken to study the inheritance of this trait.

MATERIALS AND METHODS

An experiment was undertaken at Andhra University agriculture farm Visakhapatnam during kharif to know the inheritance of locule in five parents and their F1, F2, F3. The five parents included in the present study are Vm, X-79-1, EC 359007, EC351887 and EZ351881. The parent vinayak mutant (Vm) and EC351887 are characterized by eight loculed (8L) pods and the rest of the three parents had four loculed (4L) capsules. F1 seed collected from the ten crosses along with the five parents were organized in rabi. The F1 of all ten croses showed 4L Pods. The flowers of ten F1s were strictly self pollinated by applying pollen of the same flower to the stigmas and enclosing them in straw tubes for 2-3 days, till appearance of the pod. Seeds of the ten crosses collected from the pods of strictly self pollinated flowers of F1 was sown along with that of the five parents in the immediate next kharif. Plants of the F2 progenies of the ten crosses revealed wide variation in the number of locules on their capsules.Some of the plants had either 6L, 8L and 10L alone .Some more plants contained all capsules with different number of locules ranging from 6, 8,10L through 12,16 upto 24L (Fig. 5, 6).

For follow up genetics of locules, seeds from capsules with different number of locules was collected separately on individual plant basis , seeds of the ten different crosses , thus collected was sown in separate plots of 80×80 feet size ,in individual lines with 15×30 spacing with not less than 50 plants per line .Data relating to the segregation with respect to the number of locules were noted.Chi square test was applied to test the goodness of fit for different genetic ratios (Gomez and Gomez,1984).

RESULTS AND DISCUSSION

As the multilocule nature is of economic advantage in boosting the productivity, attempt is made to follow up

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Table 1: Inheritance of locules in ten crosses of *Sesamum indicum L.*

S. No.	Cross			4loculed	Multi loculed 6L	8L	10L	Total progeny	Genetic ratio	χ^2 calculated	χ^2 Table value at 0.05P
1	V_m x EC351887		F_1, 4 Loculed								
	8L	8L	• F_1 selfed - F_2	167	0	57	1	225	3:1	0.67	3.84
			• 10-L selfing	112	0	21	9	142			
			• 8-L selfing	75	68	5	0	148			
2	V_m x EZ351881		F_1 4Loculed								
	8L	4L	F_1 selfed - F_2	186	0	65	0	251	3:1	0.10	3.84
3	V_m x EC351887		F_1 4 Loculed								
	8L	4L	• F_1 selfed - F_2	195	0	62	1	257	3:1	0.10	3.84
			• 10-L selfing	0	0	247	3	250			
4	V_m x EC351887		F_1 , 4Loculed								
	8L	4L	F_1 selfed - F_2	199	0	59	0	258	3:1	0.624	3.84
5	X-79-1 x EC351887		F_1, 4 Loculed								
	4L	8L	• Selfed - F_2	135	1	1	0	137			
			• 6-L selfing	75	70	5	0	150			
6	X-79-1xEC359007		F1,4 oculed								
	4L	4L	• F_1 selfed-F_2	252	0	0	0	252			
7	X-79-1xEZ351881		F_1 4Loculed								
	4L	4L	F_1 selfed – F_2	156	0	0	0	156			
8	EC359007xEC351887		F1,4Loculed								
	4L	8L	• F_1 selfed - F_2	184	0	54	0	238	3:1	0.66	3.84
9	EC359007xEZ351881		F_1 , 4Loculed								
	4L	4L	F_1 selfed – F_2	255	0	0	0	255			
10	EC351887xEZ351881		F_1, 4 Loculed								
	8L	4L	• F1 selfed – F_2	154	0	0	0	154			

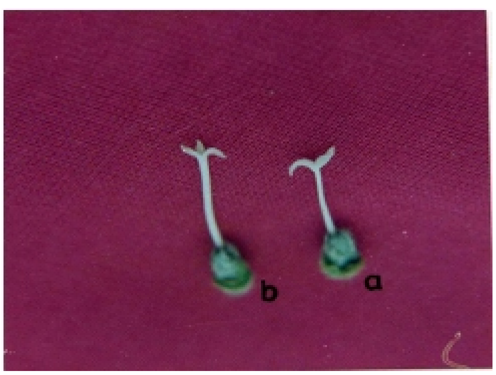

Fig. 1: a) Bifid Stigma and 4-L ovary, b) Trifid Stigma and 6-L ovary

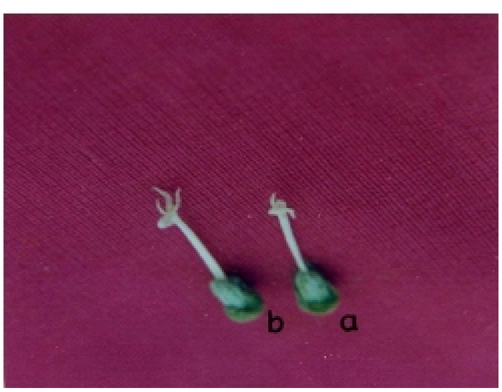

Fig. 2: a) Stigma with 4 lobes and 8 loculed ovary, b) Stigma with with 5 lobes and 10 loculed ovary

the genetics of the locule, from the segregation noted in ten crosses. The ten crosses with combination of locules of 4 and 8 and segregations in F1 and F2 are shown in Table 1.

The segregations in table indicated that irrespective of the number of locules in the male or female parents all the F1 showed four loculed capsules (crosses 1-5 and 8). F2 progenies of the selfed F1's showed segregation with respect to number of locules (table, crosses 1.1, 2, 3.1, 4, 5.1 and 8). Progenies of the crosses where both parents are 4 L had exclusively 4L capsules in F1 and F2 also (table,crosses 6,7 and 9). Vocationally in the F2 progenies obtained after selfing the 4L F1 plants,a spectrum of variation was seen with respect to the multiloculed condition (table crosses 1.2, 1.3, 3.2 and 5.2). The F2 progenies containing entire plants with exclusively either 6, 8 and 10L alone could be located in addition to those with normal 4L ones, along with parents having a combination of all these varied multiloculed pods. The proportion of plants with different multilocules didn't however confirm to any specific ratio to explain the genetic basis of the multiloculed nature.

Stigma in the flowers of the normal 4L plants is bifid (Fig. 1a). The number of stigma lobes were observed to increase with the number of locules in the ovaries (Fig. 1b, 2a, b), Thus serving as a marker character for selecting the multilocule types as parents. As such the flowers with different stigma lobes 2, 3, 4 and 5 were selectively self pollinated and seed collected from the pods was sown in separate lines to follow up their segregation.

The progenies contained entire plants with either 4, 6, 8 or 10 L pods and also single plants having

Fig. 3: Transverse section of pods with range in number of locules from 4 to 16 in sequence from Left end

Fig. 4: Pods with 8 and 10 locules along with their transverse sections

Fig. 5: Single plants with pods having 4, 6 and 8 locules

combination of pods with different number of locules (Fig. 3, 4, 5, 6) and addition to normal 4L pods (Table 1-crosses 1.2 and 1.3, 3.1 and 3.2 ,5.1 and 5.2 and 8.1).

The pattern of segregations of multiloculed Vs 4L pods in the crosses Vm X EC351887,Vm X X-79-1,Vm X EC359007,EC359007 X EC351887 fitted better to the 3:1 ratio with a non significant χ^2 (Table 1). The results therefore suggest the monogenic dominant nature of the 4 L condition over the recessive multiloculed.

Fig. 6: Close up of a branch showing pods with 4 locules through 6, 8, 10, 12 upto 24 locules

F1 from all types of crosses were all 4L.irrespective of the female parent whether 4 L or multiloculed excluding, thereby any maternal influence on the expression of the locule nature (table-crosses1-5 and 8). The F2 segregations fitted mostly to the 3:1 ratio of 4 L. versus multiloculed plants with a non significant χ^2 (table-crosses 1.1, 2.1, 3.1, 4 and 8) suggesting the monogenic nature of 4 L over the recessive multiloculed nature. These findings are mostly confirming the earlier records regarding the monogenic dominant nature of the 4L condition over the multiloculed nature (Nohara, 1933; John, 1934; Kumar and Rao, 1945; Tyagi, 1972; Manivel *et al.*, 2001) but differ from the digenic control reported by (John and Nair, 1981, 1984, Singh *et al.*, 2002).

Examination of the flowers of the progeny having different number of locules, revealed the number of stigma lobes to correspond with the number of locules in the ovary .Although entire plants in a substantial proportion of the progenies had exclusively 6 L and 10L pods,with associated enhancement in productivity, progenies of seed collected from strictly self pollinated flowers , however showed a spectrum of segregation from 4-10 L(table-crosses 1.2,1.3,3.2 and 5.2). The 6 and 10 L condition even though emerged very frequently therefore appear unstable.These results thereby suggest that the expression and penetrance of the multiloculed recessive allele is giving modified by some nuclear factors. The present findings confirms the conclusions made earlier from our laboratory in *Sesamum* (Sasikala and Kamala, 1985) and in oil seed crop *Brassica* (Kamala and Rao, 1984; Kamala,1998).

Based on segregations of the different number of multilocules simulating recessive epistasis , a minimum of atleast two genes is necessary for control of locules, thus confirming the reports of John and Nair (1981). John and Nair (1981) indicated that two recessive independent genes l1 and l2 results in multilocules in their homozygous condition, but didn't spell out the specific number of multilocules either 6, 8 or 10 L. Moreover species with 6 or 10 L are not recorded in nature; as with 4 or 8 L.

CONCLUSION

The findings from present study reveals that the monogenic nature of the number of locules, rather than the digenic control, with the penetrance and expressivity of the recessive multilocule allele effected by modifying factors.

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