Indian J. Genet., **63**(3): 265-266 (2003)

Short Communication

Inheritance of pod shattering in soybean [*Glycine max* (L.) Merrill]

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(Received : December, 2002; Revised: August 2003; Accepted : August 2003)

Pod shattering refers to the opening of mature pods along with dorsal or ventral sutures and dispersal of seed as the crop reaches maturity, as well as during harvesting. The extent of yield loss due to pod shattering in soybean [*Glycine max* (L.) Merrill] may range from negligible to 90 percent depending upon the environmental conditions during harvesting and genotype. With Indian agriculture operations depending on human labour, the untimely and delayed harvesting results in the increased pod shattering. Pod shattering is aggravated if there is rain followed by dry weather, low humidity, high temperature, rapid temperature changes, wetting and drying etc. Among the reasons mentioned above, the genotype of the variety plays an important role on the overall expression of pod shattering. Segregation of pod shattering was highly complex in F_2 generation and showed quantitative response in the cross of susceptible and resistant varieties [1-4]. Moreover, 12 putative RFLP markers were associated with pod shattering in F_4 population [5]. Success of conventional breeding program aimed at pod shattering resistance depends upon the desirable segregates, hence the present study was undertaken.

The field experiments were conducted at University of Agricultural Sciences, Dharwad, during rainy seasons of 1998, 1999 and post rainy season of 1998-99. The five soybean varieties *viz.*, Bragg, JS-335, MACS-58, JS 80-21 and Monetta were crossed in all possible combinations (excluding reciprocals) during *kharif* 1998. The parents and crosses were evaluated in post rainy season of 1998-99 (December sowing). The pod shattering was recorded on the seventh day after maturity on five plants. The ratio of number of pods shattered tot he total number pods in a plant was expressed as pod shattering percent. The F_2 generations of five selected crosses along with the parents were sown during *kharif* 1999 to study the segregation pattern of pod shattering in terms of frequency distribution. The pod shattering of individual plants was recorded using the laboratory method [6]. Pod shattering percentage of individual plants of five F_2 populations were classified using frequency distribution with a class interval of ten.

The shattering percentage of F_1 was in between those of the parents and did not show any heterobeltiosis. These were larger than mid parental values and near to susceptible parents in all the crosses studied (Table 1). The results imply that susceptibility to pod shattering is partially dominant over the resistance. Similar inheritance pattern for pod shattering in the cross of cultivated and wild soybean [1, 2] and in cultivated soybean [3, 4, 6] has been reported. Dominance reported for pod shattering resistance [7, 8] was not confirmed.

Segregation pattern of pod shattering in F_2 generation of five selected crosses is presented in

Table 1. Performance of parents and their crosses for pod shattering in F_1 generation during post rainy season of 1999

Parents/Crosses	Pod shattering percentage		
	Paremt	Mid Parent	F_1
Bragg	6.8	-	-
Monetta	94.3	-	-
JS-335	13.3	-	-
MACS-58	35.5	-	-
JS 80-21	69.6	-	-
Bragg × Monetta	-	50.5	81.1
Bragg × JS-335	-	10.1	11.0
Bragg × MACS-58	-	21.2	27.1
Bragg × JS 80-21	-	38.2	55.7
Monetta × JS -335	-	53.8	66.7
Monetta × MACS-58	-	64.9	75.1
Monetta × JS80-21	-	82.0	86.7
JS-335 × MACS-58	-	24.4	31.2
JS-335 × JS 80-21	-	41.5	59.5
MACS-58 × JS 80-21	-	52.5	62.2

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Table 2. Soybean pod shattering analysis in F_2 generation of five crosses by laboratory method during rainy season of 1999

Parents/Cross	No. of Plants	Mean ± SE	Number of plants expressing pod shattering (%) between									
			0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80- 90	90-100
Bragg	25	3.8 × 0.16	25	-	-	-	-	-	-	-	-	-
Monetta	25	83.2 ± 0.61	-	-	-	-	-	-	-	-	25	-
F_1	-	81.1										
F_2	197	60.3 ± 1.51	2	5	11	15	21	27	46	30	24	16
Bragg	25	3.8 ± 0.16	25	-	-	-	-	-	-	-	-	-
JS80-21	25	43.3 ± 0.5	-	-	-	-	25	-	-	-	-	-
F_1	-	55.7										
F_2	249	47.8 ± 1.04	1	10	20	34	57	65	41	14	7	-
Bragg	25	3.8 ± 0.16	25	-	-	-	-	-	-	-	-	-
MACS-58	25	22.5 ± 0.56	-	-	25	-	-	-	-	-	-	-
F_1	-	75.1										
F_2	242	46.7 ± 0.9	5	9	15	26	71	77	26	13	-	-
MACS-58	25	22.5 ± 0.56	-	-	25	-	-	-	-	-	-	-
JS80-21	25	43.3 ± 0.5	-	-	-	-	25	-	-	-	-	-
F_1	-	62.2										
F_2	216	54.6 ± 1.16	-	8	12	18	30	50	60	24	14	-
Bragg	25	3.8 ± 0.16	25	-	-	-	-	-	-	-	-	-
JS-335	25	8.9 ± 0.35	19	6	-	-	-	-	-	-	-	-
F_1	-	11.0										
F_2	234	21.1 ± 0.93	55	70	52	21	21	15	-	-	-	-

Table 2. Highly Resistant (HR) × Highly Susceptible (HS) (Bragg × Monetta) parents showed a continuous distribution of shattering percent over all the class intervals. The wide range of F_2 segregants in all the class intervals may be due to presence of dominant genes in the susceptible variety that masks the recessive resistant genes. The most desirable segregants (less than 10% pod shattering) were only two in number, whereas number of desirable segregants (less than 20% pod shattering) was only five. The F_2 population of cross between HR × S (Bragg and JS 80-21) parents exhibited similar pattern of distribution. The number of most desirable segregants (less than 10% pod shattering) was only one. But the total number of desirable segregants was more (11 plants). The frequency distribution of F_2 segregants in the cross of HR × MR (Bragg × MACS-58) had more number (5 plants) of most desirable segregants, than the HR, HS and HR × S crosses. This indicates the possible presence of more number of recessive genes in MR parent than S and HS parents. The cross of MR × S (MACS-58 × JS80-21) parents had no desirable F_2 segregants below 10 per cent pod shattering. Further, only 8 plants exhibited pod shattering of below 20 per cent. The few numbers of most desirable plants in the other crosses discussed above may be due to involvement of one HR parent. The frequency of most desirable plants in F_2 generation was the highest in the cross HR X R (Bragg × JS-335) parent. The fixation of recessive genes by both the parents in F_2 generation may be one of the main causes for recovering high number of desirable plants. The lower frequency of high shattering plants in HR × R cross may be probably due to the presence of few dominant genes in the resistant parents which might be responsible for low pod shattering in these genotypes. The chances of further segregation of most desirable plants were less because they had most of the recessive genes, which do not segregate in future generation.

The present study was able to find out high number of most desirable plants in the HR × R (Bragg X JS-335) cross indicating the possibility of development of highly shattering resistant genotypes in future soybean breeding programme.

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