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Impact of selection and self-pollination on morphological characters of rape seed (*Brassica juncea*)

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Abstract

Selection was made for earliness and high yield in open-pollinated population for three successive generations. Plant height, branch number, leaf number, fruit number, fruit weight and seed weight showed high inbreeding depression. High level of self-pollination under restricted pollinator availability was suspected for the inbreeding resulting in general reduction of performance in successive generations.

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Introduction

Brassica juncea, an important oil-yielding crop, is considered as panmictic and random mating; its reproductive biology dominants by a mixture of breeding systems varying from high cross pollination to high self-pollination (Doloi and Rai, 1981a). Even in the same population, there may be gradations of cross or self-pollination in various individual plants. Deliberate experimental inbreeding in this crop often resulted in depressing effect on growth and reproduction and the consequence of inbreeding start right from the early embryo development stage, as a result seed yield is significantly reduced (Doloi and Rai, 1981b).

In Bangladesh, farmers mostly in small fields grow *B. juncea*. The farmers usually keep their own seed in small amounts for next year's cultivation so these may be treated as small populations. This process ultimately results in formation of local races known as "land races". These small populations are highly likely to be affected by inbreeding depression, because billions of flowers open during a single morning and lack of pollinators (Zuberi and Sarker, 1982; Zuberi *et al.,* 1987) often result in high degree of selfing by auto-pollination as the position of long anthers and stigma favours selfing. The present investigation was undertaken to study the effects of selection and predominant self-pollination on some morphological characters of *Brassica juncea* under reduced pollinator activities.

Materials and methods

The experimental field was divided into plots of 1m^2 in size. Fifteen plots were used. Seed samples of advanced generations of *Brassica juncea* maintained in the Genetics Laboratory of Rajshahi University were sown during the winters of 1997-'98, 1998-'99 and 1999-2000. The families were grouped into three classes according to their flowering time viz. Early families, Intermediate families and Late families. Each year ten plants were randomly selected from each plot, except the border plants, for collection of data. Seven characters were scored from mature plants; plant height (cm), branch number, leaf number, fruit number, total fruit weight and seed weight (gm) per plants. Inbreeding depression was calculated by the formula: $(S_t-S_{t+1})/S_t$ and expressed in percentage for each character (where t represents generation).

Results and discussion

The mean performances of different characters scored from the randomly selected plants are given in Table 1. The change in performance of the characters in S_2 (1999-2000) and S_1 (1998-99) generations over S_0 (1997-98) generation are given in Table-2 with their level of significance.

Early families

It is indicated that all the characters exhibited reduction in performance from 1997-98 to 1998-99 generation. Plant height, fruit number and fruit weight showed highly significant decrease from S_0 to S_1 generation. Similarly, the characters in S_2 generation also exhibited significant reduction from S_0 generation except for leaf number and days to maturation.

Late families

All the characters except plant height were significantly reduced in S_1 generation. In S_2 generation all the characters except plant height ad leaf number were significantly reduced.

All the morphological characters exhibited the depressing effects in S_1 or in S_2 or in both generations. Yield too showed marked depression. Mohammed (1935) observed 19.5% reduction in plant height in *B. campestris* L. var. Brown Sarson and Toria in the progenies raised from self-seed. Similar result was reported by Doloi and Rai (1981b) in rapeseed.

Brassica crops, under the influence of reduced pollinator activity (Zuberi and Sarker, 1982; Zuberi *et al.,* 1987), are likely to experience high degree of self-pollination. In this crop the flower type is introse i.e. the anthers burst facing toward the stigma and the pollen grains easily fall on the stigma. As a consequence, in absence of adequate pollinator activity, high degree of self-pollination should be observed. But the populations exhibited significant inbreeding depression. This implies that appreciable amount of cross-pollination did take place under open pollination condition earlier, thus resulting in high degree of heterozygosity.

Table 1. Mean performance for six characters in the Early, Intermediate and late families, (n = 50).

Characters	1997-1998			1998-1999			1999-2000		
	Early	Inter-mediate	Late	Early	Inter-mediate	Late	Early	Inter-mediate	Late
Plant height	132.73	138.21	155.62	114.03	127.50	147.50	96.77	106.80	147.06
Branch number	4.70	4.00	7.70	3.40	3.24	4.30	3.64	3.56	4.46
Leaf number	14.08	13.38	25.44	11.96	11.80	19.48	12.72	13.88	21.32
Fruit number	84.42	90.40	138.96	50.10	45.66	80.64	52.40	42.78	58.48
Fruit weight	3.39	5.91	8.06	2.25	1.64	3.83	1.53	1.75	2.90
Seed weight	1.85	2.90	3.61	1.31	0.81	2.56	0.50	0.64	1.35

Table 2. Average reduction (+) or increase (-) in percentage of S1 and S2 over S0 generation for various characters. Early selection (E), Intermediate (I) and Late selection (L).

Characters	Inbreeding depression (%)			t-values and significant		
	S_0 Vs S_1	S_0 Vs S_2	S_1 Vs S_2	S_0 Vs S_1	S_0 Vs S_2	S_1 Vs S_2
Plant height (cm)	E = 14.08	27.09	15.13	3.94***	11.63***	3.86***
	I = 11.93	22.72	12.25	4.03***	8.84***	4.26***
	L = 55.21	5.50	0.29	1.07	1.34	0.85
Branch number	E = 27.65	22.55	-07.05	3.25***	2.71***	-0.64***
	I = 20.00	11.00	-09.87	2.23*	1.29	-0.82
	L = 44.01	42.07	-03.72	4.47***	4.20***	-0.44
Leaf number	E = 15.05	09.66	-06.35	2.78*	1.74	-0.95
	I = 11.80	-03.73	-17.62	2.22*	-0.67	-3.01
	L = 22.01	16.19	-07.45	2.09*	1.92	-0.67
Fruit number	E = 40.65	37.92	-4.59	3.89*	3.84**	-0.33
	I = 49.49	52.67	6.30	4.14***	4.38***	0.56
	L = 41.96	57.91	27.48	3.44**	5.10***	2.67*
Fruit weight (ga)	E = 33.62	55.16	32.00	3.88***	6.88***	3.42**
	I = 89.17	70.38	-6.70	5.47***	5.26***	-0.52
	L = 52.48	64.01	24.28	4.02***	5.37***	1.75
Seed weight (ga)	E = 29.18	72.97	61.83	2.25*	6.42***	6.75***
	I = 72.06	77.93	20.98	5.52***	5.94***	1.88
	L = 29.08	62.60	47.26	2.10*	5.02***	4.17***
Days to saturation	E = 1.02	-0.20	-1.24	1.38	-0.30	-2.19
	I = 2.60	0.93	-1.72	3.88***	1.04	-2.49
	L = 2.07	-0.51	-2.82	4.36***	-1.03	-4.94

S_0 = Year 1997-98, S_1 = Year 1998-99, S_2 = Year 1999-2000
*, ** and *** indicate significant at 5%, 1% and 0.1% levels respectively.

This result is important in agriculture because in addition to reduction in fruit and seed yield, if lack of pollinators persists for a long period, genetic deterioration of vigour and yield will be common. The widespread destruction of natural vegetation and tree populations with the expansion of agriculture and fuel needs of the burgeoning population pressure and indiscriminate use of insecticide will further reduce the pollinator concentration. The need of protection of environment is thus urgently required for sustainable and high agricultural yield.

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References

Doloi PC, Rai B. 1981a. Effect of inbreeding and cross-breeding in ovule development in rapeseed. Indian Journal of Genetics and Plant Breeding **41(1),** 75-77.

Doloi PC, Rai B. 1981b. Inbreeding depression on rapeseed. Indian Journal of Genetics **41,** 368-373.

Mohammed A. 1935. Pollination studies in tora (*Brassica napus* var. Sarson Prain). Indian Journal of Agricultural Sciences **5,** 125-154.

Zuberi MI, Sarker R. 1982. Preliminary studies on the level of cross-pollination in self-incompitable *Brassica campestris* L. Toria, SABRAO Journal **14(1),** 15-19.

Zuberi MI, Rahman MT, Islam MR, Hossain MM. 1987. Level of cross-pollination and frequency of ovule development in oleiferous Brassica. Indian Journal of Agricultural Sciences **57(8),** 594-5.