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STUDY OF INBREEDING DEPRESSION FROM F_1 TO F_3 GENERATION IN SOME INTERVARIETAL CROSSES OF INDIAN RAPESEED *B. CAMPESTRIS* L. PRAIN

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ABSTRACT

Among 28 intervarietal crosses studied, the average inbreeding depression for seed yield from F_1 to F_2 generation was 14.74%, and from F_2 to F_3 6.09%. The mean inbreeding depression for the major yield components (except 1000-seed weight) in the high range. The cross combinations Candle x Torch, YST-151 x Candle, and PT-30 x Candle could be considered to be desirable crosses from the composite breeding point of view.

Key words: *Brassica*, intervarietal crosses, inbreeding depression, nonadditive gene action.

The relative information on the extent of inbreeding depression in the often cross-pollinated crops is very useful. It usually provides the valuable indication about how much the farmer will loose in terms of seed yield or oil content, if he prefers to go in for planting the F_2 seed of their home grown commercial F_1 hybrid. The extent of inbreeding depression from F_1 to F_2 also genetically indicates that those crosses, which show high degree of inbreeding depression for seed yield contain a higher component of nonadditive gene action and those showing lower values of inbreeding depression, could have predominantly higher amount of additive genetic component. In the present study an effort has been made to estimate the extent of inbreeding depression from F_1 to F_2 in some intervarietal crosses of *Brassica campestris* L.

MATERIALS AND METHODS

Eight varieties (5 indigenous and 3 exotic) of the *Brassica campestris*, PT-303, PT-30, D.T.S., Binoy, YST-151, Candle, Torch and Tobin were used to make 28 F_1 crosses in diallel-mating design. The F_1 seeds obtained were divided into two halves. One half was

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stored in cold storage while the other half was used to obtain F_2 seeds. Similarly, F_3 seeds were also obtained by selfing the F_2 plants. In the final trial, 28 F_1s, 28 F_2s and 28 F_3 populations were planted in randomized block design with three replications. Each replication was planted in two-row 5 m long plots. The row-to-row distance was 45 cm. Plant-to-plant distance within a row was 10 cm. Twenty plants were selected randomly for data collection in each replication. All the data were collected by utilising the standard procedures.

Inbreeding depression was calculated using the following formulae:

(i) Inbreeding depression from F_1 to F_2 generation $= \dfrac{\bar{F}_1 - \bar{F}_2}{\bar{F}_1} \times 100$

(ii) Inbreeding depression from F_1 to F_3 generation $= \dfrac{\bar{F}_1 - \bar{F}_3}{\bar{F}_1} \times 100$

(iii) Inbreeding depression from F_2 to F_3 generation $= \dfrac{\bar{F}_2 - \bar{F}_3}{\bar{F}_2} \times 100$

RESULTS AND DISCUSSION

The results obtained in this study have been briefly presented in Tables 1, 2 and 3. The mean inbreeding depression for seed yield from F_1 to F_2 (14.74%) is relatively more than that from F_2 to F_3 generation (6.09%). This is expected. The extent of inbreeding depression for seed yield from F_1 to F_3 (i.e. 19.93%) indicates that the yield losses, in general, in the advanced generations could be high. Considerable extent of inbreeding depression in quantitative attributes in rapeseed has also been indicated by Doloi and Rai [1]. For the characters number of branches, number of siliquae, and yield per plant, there was marked inbreeding depression from F_1 to F_3 generation but for 1000-seed weight the value of inbreeding depression obtained was lower in magnitude. Seed yield is predominantly governed by nonadditive gene action while 1000-seed weight is predominantly controlled by additive gene action. This behaviour is expected. In literature, expression of seed yield in *Brassica* has been reported that it is governed by the complex, quantitative gene action with considerably larger proportion of the nonadditive gene action [2–4]. The crosses showing low inbreeding depression and significantly high mean values in F_2 than those of the ruling checks can be utilised for the development of composites. Judged from this angle, some of the crosses desirable from the composite breeding point of view are Candle x Torch, YST-151 x Candle and PT-30 x Candle. These crosses have very high F_2 mean values and very low inbreeding depression for seed yield.

Table 1. Extent of inbreeding depression from F_1 to F_2 in crosses of rapeseed mustard

Cross	Inbreeding depression from F_1 to F_2 (%)				
	branches per plant	siliqua per plant	seeds per siliqua	1000-seed weight	yield per plant
PT-303 x PT-30	24.86	5.93	15.85	10.37	10.41
PT-303 x D.T.S.	12.64	13.09	2.45	2.94	7.24
PT-303 x Binoy	19.60	14.41	1.29	7.09	3.86
PT-303 x YST-151	23.50	14.12	12.02	9.32	18.31
PT-303 x Candle	4.91	19.17	15.11	6.69	12.14
PT-303 x Torch	22.18	11.22	15.94	7.66	3.41
PT 303 x Tobin	12.69	15.96	8.77	1.92	15.86
PT-30 x D.T.S.	0.75	3.86	11.36	5.88	14.33
PT-30 x Binoy	11.95	6.27	5.75	3.41	20.32
PT-30 xYST-151	24.61	15.55	3.12	4.38	17.37
PT-30 x Candle	5.58	17.26	5.00	4.85	19.90
PT-30 x Torch	24.08	20.22	0.70	4.56	20.15
PT-30 x Tobin	12.95	19.99	4.34	9.85	25.69
D.T.S. x Binoy	17.57	14.12	10.52	6.14	5.62
D.T.S. x YST-151	1.29	4.48	9.45	5.83	22.96
D.T.S. x Candle	8.52	8.54	14.52	4.59	21.15
D.T.S. x Torch	16.90	3.00	8.38	– 0.98	21.26
D.T.S. x Tobin	0.58	3.36	12.60	5.53	18.18
Binoy x YST-151	21.60	5.14	8.00	9.01	7.84
Binoy x Candle	11.44	14.16	2.02	4.33	19.33
Binoy x Torch	15.98	9.45	0.01	3.38	14.43
Binoy x Tobin	1.46	8.33	12.31	9.06	10.90
YST-151 x Candle	26.12	18.72	5.17	9.52	12.83
YST-151 x Torch	7.74	24.00	7.02	3.32	11.03
YST-151 x Tobin	6.97	12.72	10.91	– 2.02	7.81
Candle x Torch	17.88	24.02	10.92	– 0.78	17.02
Candle x Tobin	18.67	19.13	5.63	3.30	10.80
Torch x Tobin	11.60	12.42	5.26	7.19	22.70
Mean	13.73	12.74	8.01	5.22	14.74

Table 2. Extent of inbreeding depression from F_2 to F_3 in crosses of rapeseed mustard

Cross	Inbreeding depression from F_2 to F_3 (%)				
	branches per plant	siliquas per plant	seeds per siliqua	1000-seed weight	yield per plant
PT-303 x PT-30	8.08	6.53	5.79	– 0.82	6.54
PT-303 x D.T.S.	10.52	7.07	10.06	2.02	6.92
PT-303 x Binoy	7.92	4.87	– 1.31	1.99	12.47
PT-303 x YST-151	6.34	5.92	3.72	– 0.96	5.10
PT-303 x Candle	16.81	8.89	6.16	1.19	2.52
PT-303 x Torch	3.61	7.34	5.17	5.13	3.21
PT 303 x Tobin	6.81	6.62	10.57	1.96	6.66
PT-30 x D.T.S.	4.58	10.72	11.53	0.69	2.14
PT-30 x Binoy	3.70	12.17	3.81	4.82	3.53
PT-30 xYST-151	16.32	7.70	4.51	0.91	6.74
PT-30 x Candle	12.31	12.31	0.65	4.42	13.34
PT-30 x Torch	12.90	8.21	5.67	2.67	11.66
PT-30 x Tobin	9.52	1.41	3.03	3.23	1.55
D.T.S. x Binoy	11.02	4.90	8.82	3.11	1.29
D.T.S. x YST-151	26.31	7.75	4.39	2.47	5.48
D.T.S. x Candle	12.42	5.72	13.72	0.34	5.83
D.T.S. x Torch	2.90	9.21	11.26	2.28	7.08
D.T.S. x Tobin	5.26	2.13	12.50	3.25	0.20
Binoy x YST-151	11.02	4.08	– 1.24	1.85	6.73
Binoy x Candle	19.10	7.12	6.24	2.58	5.62
Binoy x Torch	8.29	5.29	15.74	4.14	7.36
Binoy x Tobin	14.35	11.72	12.39	2.49	8.01
YST-151 x Candle	11.58	6.97	3.03	0.32	0.97
YST-151 x Torch	8.39	7.18	6.39	0.38	6.19
YST-151 x Tobin	11.25	1.28	7.74	5.96	5.90
Candle x Torch	16.44	8.29	7.54	1.56	8.12
Candle x Tobin	12.24	8.72	11.19	6.52	11.06
Torch x Tobin	8.58	12.59	9.52	0.36	8.45
Mean	10.66	7.22	7.09	2.23	6.09

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