

CONSEQUENCES OF ENFORCED INBREEDING ON OVULE DEVELOPMENT IN CERTAIN OUTCROSSING POPULATIONS OF INDIAN RAPESEED (*BRASSICA CAMPESTRIS* L. PRAIN)

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ABSTRACT

Among the open pollinated varieties of Indian rapeseed studied, the depressing effect of enforced selfing on ovule size was observed to vary between 9.9% in toria variety D.T.S. to 2.1% in the yellow seeded variety Binoy. The mean value of inbreeding depression was 7.0% in toria, 4.4% in brown sarson and 2.0% in yellow sarson. The trend of the depressing effect on the ovule development was also reflected in the similar magnitude in respect of seeds/siliqua, 1000-seed weight and oil content.

Key words: Indian rapeseed, heterozygosity, inbreeding depression, ovule development.

The process of enforced inbreeding in the outcrossing populations leads to homozygosity of recessive genes and hence causes inbreeding depression. In oilseed Brassicas, the depressing effect of enforced inbreeding on meiosis, ovule development and other seed attributes has been reported [1-5]. In the present study, an effort has been made to estimate the extent of depression due to enforced inbreeding on development of the ovules in some outbreeding populations of Indian rapeseed.

MATERIALS AND METHODS

Eight varieties (5 indigenous and 3 exotic) of *Brassica campestris* L., PT 303, PT 30, D.T.S., Binoy, YST 151, Candle, Torch and Tobin, grown in R.B.D., were used for enforced selfing by bud pollination and cross pollination. Ten plants from each replication were randomly taken and eight to ten appropriate buds were selected for selfing and cross pollination. The selfed and the cross pollinated buds were collected 48 h after pollination and fixed in acetoalcohol (1:3) solution. Thereafter, the standard procedure of microtomy was followed

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to prepare slides for each treatment. Eight slides from each of the microtomed section were examined under microscope. The diameter of ovules was measured in ocular micrometer divisions calibrated with the stage micrometer. The mean values were recorded in μm and analysed statistically by the standard procedure.

RESULTS AND DISCUSSION

The results are presented in Table 1. The average size of the ovules was observed to be $306.6 \mu\text{m}$ under cross pollination and $290.9 \mu\text{m}$ under enforced selfing with an average inbreeding depression value of 4.8%. Three toria varieties studied, the corresponding ovule sizes were 304.4 and $282.9 \mu\text{m}$, respectively, and inbreeding depression 7.0%. In the exotic brown sarson varieties studied, the ovule sizes under the two pollination systems were 309.6 and $284.3 \mu\text{m}$, respectively, and in yellow sarson 304.6 and $297.7 \mu\text{m}$, respectively. The inbreeding depression was 4.4% in brown sarson and 2.2% in yellow sarson. The range of inbreeding depression varied from 2.1% in the yellow sarson Binoy to 9.9% in the toria variety D.T.S. Taking the highly cross-pollinated groups of toria and exotic brown sarson together, the mean inbreeding depression was 5.6% as compared to 2.2% in yellow sarson. This could be expected, because the often cross-pollinated crops like yellow sarson with introrse anthers and 80 to 85% self-pollination are more tolerant to selfing than the highly cross-pollinated toria and brown sarson varieties with extrorse anthers and self-incompatibility genes. This perpetuates a delicate balance of heterozygosity generation after generation.

In general, the extent of inbreeding depression in all the 8 varieties studied was relatively smaller under selfing as compared to under cross-pollination. It could, therefore,

Table 1. Average ovule size under cross-pollination and enforced selfing in 8 varieties of Indian rapeseed (*Brassica campestris* L.)

Variety	Pollination system	Mean ovule size 48 h after pollination (μm)		Inbreeding depression due to selfing (%)
		cross pollination	enforced selfing	
Indigenous toria:				
PT 303	HCP	313.3	294.6	5.96
PT 30	HCP	304.3	289.0	5.02
D.T.S.	HCP	295.6	265.3	9.94
Mean	—	304.4	282.9	6.97
Exotic brown sarson:				
Candle	HCP	304.3	292.6	2.25
Torch	HCP	310.6	299.0	3.73
Tobin	HCP	314.0	291.3	7.22
Mean	—	309.6	294.3	4.40
Yellow sarson:				
YST 151	OCP	323.6	316.3	2.25
Binoy	OCP	285.6	279.6	2.10
Mean	—	304.6	297.9	2.17
Overall mean		306.6	290.9	4.81
C.D. at 5% for pollination systems			11.6	
C.D. at 5% for varieties			13.3	

HCP — highly cross-pollinated.

OCP — often cross-pollinated.

be inferred that the depressing effect of enforced selfing on seed size starts right from the early stages of ovule development. Under self-pollination, the cell division in the ovules is at slower pace, while under cross pollination it is enhanced and is faster, as a consequence, the ovule develops at a much faster rate. Similar situation has been reported in alfalfa [6] which has more or less similar breeding system as the cross-pollinated rapeseed.

With a view to compare whether the depressing effect in ovule development is also reflected in other seed attributes, such as, number of seeds/silique, 1000-seed weight and oil content, equal number of selfed and crossed buds on the plants from where they were collected were left in the field to attain full maturity and data were recorded on these seed attributes. Mean inbreeding depression 14.3% was recorded for seeds/silique, 10.2% for 1000- seed weight, and 1.7% for oil content. As was expected, the mean inbreeding depression was relatively greater in the highly cross pollinated group of toria and brown sarson than in the often cross-pollinated yellow sarson. In general, the lowest inbreeding depression was observed in yellow sarson (Binoy) and highest in the toria variety D.T.S. This, in a way, shows good correspondence with what was also observed in the study on ovule development.

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