POD SETTING IN CROSSES OF BENGAL GRAM

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Pod setting by artificial hybridization in Bengal gram (*Cicer arietinum*) is only of the order of 15-25% (van der Maesen, 1972). Ayyar and Balasubramanyan (1935) and Eshel (1968) reported about various aspects of anthesis and pollination in this species. The best stage in floral development for crossing appeared to be the hooded-bud stage. Pollen from half open flowers, in which anthers had just burst, gave the best results for artificial hybridization (Eshel, 1968). This study was undertaken to investigate the causes of lower pod setting and to find out ways to improve setting in artificial hybridization. Effect of (a) removal of stamens after opening the keel petals (b) attempting crosses at two different stages, one at early bloom and other after formation of first pod on the selected branches (c) pollinating varieties having flower buds of different sizes, and (d) application of NAA to flower buds, on pod setting was studied.

Materials and Methods

The material comprised six gram varieties, of which five, *viz*., C235, G130, P813, P851 and P1139 were *desi* and the 6th (P9624) was a *kabuli* type. Out of the six varieties, C235, G130 and P1139 were of Indian origin, P813 and P9624 were Mexican and P851 was a Russian variety. Throughout the investigation emasculation was done in the afternoon (3·00–5·00 p.m.) and pollination the next morning (8·00–10·00 a.m.).

Results and Discussion

(a) *Effect of removal of stamens after opening the keel petals*

Ninety flowers of variety C235 in hooded-bud stage were selected. Out of these 30 were emasculated by removing the stamens with a tweezer after opening the keel petals, 30 were just opened at keel but left unemasculated and remaining 30 were tagged as controls without any physical operation. Next day the 30 emasculated flower buds were pollinated, 10 each with pollen from three varieties, *viz*., C235, G130 and P9624. At the time of pollination, control buds were observed to have longer styles than those emasculated and those unemasculated but keel opened. Emasculated buds and unemasculated but keel opened buds after pollination gave a setting of 13% each. Control buds with no physical operation gave 33% pod setting. It appears that inhibition of style length was due to mechanical injury to the bud during emasculation. Sudhir and Hecht (1965) working on *Oenothera organensis* also reported

that inhibition of style length was due to injury to or drying of flowers. However, Linskens (1964) working on *Petunia*, attributed the reduction in style elongation of the emasculated flowers to lack of growth principle which promoted normal growth of the style in unemasculated flowers.

(b) *Crosses at two different stages, one at early bloom (Stage I) and other after formation of first pod on selected branches (Stage II)*

A few healthy branches were selected for attempting crosses in Stage I and Stage II of the bloom in four varieties, *viz.*, C235, P813, P851, and P1139. Thirty flower buds of each of the four varieties were used as females in crosses with remaining three varieties used as pollen parent. In none of the varieties there was pod setting when flower buds were pollinated in Stage I. However, when crosses were attempted after formation of first pod on selected branches a setting of 12, 18, 24 and 25% was obtained in crosses of C235, P813, P851 and P1139, respectively.

(c) *Pollinating varieties having flower buds of different sizes*

To study the effect of flower buds of different sizes on artificial hybridization, four varieties, *viz.*, C235, P851, P1139 and P9624 having flower buds of comparatively different sizes were selected (Table 1). Each of the four varieties was used as female in crosses with the remaining three varieties. The lowest (10) and the highest (37) per cent pod setting was obtained in the small budded and large budded flowers respectively, with intermediate pod set in the varieties with medium large buds. Probably smaller buds are more prone to injury during crossing.

TABLE 1

Results of attempting crosses with varieties having flower buds of different sizes

Variety used as female	Size of the flower bud	No. of flower buds pollinated	Per cent pod setting
C235	Small	524	10
P851	Medium large	446	30
P1139	Medium large	340	33
P9624	Large	185	37

(d) *Effect of application of NAA to flower buds*

To find out whether a growth regulator could improve pod setting by retarding the abscission layer formation in the pedicel, NAA in solution and paste form was applied to the flower bud. Four concentrations of NAA, *viz.*, 10, 15, 25 and 50 ppm along with an untreated control were tried on three varieties, C235, P851 and P1139. In case of NAA solution, flower pedicels were

drenched before pollination but NAA in paste form was applied immediately after pollination as paste would stick to fingers during pollination if applied earlier. Results of these treatments, summarized in Table 2, indicated no particular trend of any treatment in improving pod setting though encouraging results were found in some cases.

TABLE 2

Results of application of different concentrations of NAA to flowers of three varieties, C235, P851 and P1139

Treatment		C235		P851		P1139	
		No. of flowers polli-nated	Per cent pod setting	No. of flowers polli-nated	Per cent pod setting	No. of flowers polli-nated	Per cent pod setting
*NAA(S)	–10ppm	20	15	20	55	15	20
	–15ppm	20	20	20	20	15	33
	–25ppm	20	25	20	15	15	50
	–50ppm	20	15	20	25	15	33
**NAA(P)	–10ppm	20	30	20	25	15	35
	–15ppm	20	20	20	30	15	40
	–25ppm	20	10	20	35	15	40
	–50ppm	20	5	20	15	15	44
Control		24	20	24	34	25	20

*NAA(S)=NAA in solution. **NAA(P)=NAA in lanolin paste.

SUMMARY

Six varieties of gram (*Cicer arietinum* L.) were used to determine the causes of low pod setting and to find out the ways to improve setting. It was observed that mechanical injury to flower buds during crossing was responsible for lower pod setting. Attempting crosses after the formation of first pod resulted in better setting than when hybridization was done in early bloom. Since pod setting was related to bud size, varieties with bigger flower buds should be used as female parents. Application of NAA to flower buds did not give consistent results and hence requires further investigation.

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REFERENCES

Eshel, Y. (1968). Flower development and pollen viability of chickpea (*Cicer arietinum* L.). *Israel J. agric. Res.* **18:** 31–33.

Linskens, H. F. (1964). *Pollen Physiology and Fertilization.* pp. 230–236. North Holland Publishing House, Amesterdam.

Ramanatha Ayyar, V. and Balasubramanyan, R. (1935). Anthesis and pollination in Bengal gram (*Cicer arietinum*). *Madras agric. J.* **23:** 170–178.

Sudhir Kumar and Hecht, A. (1965). Growth of styles and pollen tubes of *Oenothera organensis* following emasculation. *J. Hered.* **56:** 125–126.

Van Der Maesen, L. J. G. (1972). *Cicer* L., A monograph of the genus with special reference to the chickpea (*Cicer-arietinum* L.), its ecology and cultivation. pp. 243–245. H. Veenman and Zonen N. V. Wageningen. Netherland.