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Inheritance of days to flowering and rust resistance in Pea

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Abstract

The present investigation of inheritance of days to flowering and resistance to rust in peas was conducted at Pili Kothi from Tilakdhari P.G. College, Jaunpur during Rabi season 2009-10. F_2 and F_3 generation of Arkel x JPBB-3 and Bonnevilla x JPBB-4 were utilize for determining the inheritance of days to flowering and resistance to rust respectively. Arkel was an early rust susceptible variety, Bonneville, late and rust susceptible variety and JPBB-3 and JPBB-4, late and rust resistant cultivar. Days to flowering was govern by a single gene, late not being dominant over earliness. Inheritance date on reaction to rust was in consistent over the generation and also in term of nature of dominance. The number of gene varied from 1 to 2 over the crosses.

Key word- Inheritance, days of flowering, rust resistance

Introduction

Pea (*Piasum sativum* L.) is an important leguminous crop grown throughout the world in the cool season. In vegetable pea an array of disease (wilt, root-rot, stem rots, downy mildew, powdery mildew, leaf spot, blight, rust and mosaic) caused by fungi, bacteria and viruses adversely affect the yield in potential of pulses including pea (Singh, 1995). Disease can be controlled by application of fungicide, manipulation of cultural practices or by use of host plant resistance in the form of tolerant/resistant cultivars. Application of fungicide in nature is not preferred over use of resistant varieties. Development of resistant cultivar requires a dependable source of resistance and a sound knowledge of the genetics of disease resistance. Resistance breeding usually begins with selection from introduction but subsequently it is dominated by hybridization as this offer an opportunity to combine desirable traits from two or more parents in one line. Most of the commonly cultivated pea varieties including modern ones are susceptible to rust. Thus, there is an urgent need to address the problem through breeding of cultivars having resistance to rust. It was therefore, considered important to carry out a study on the inheritance of resistance to rust and days to flowering in pea with an idea of combining early maturity with resistance to rust.

Materials and Methods

The present investigation was carried out at Pilikothi farm Tilakdhari Post Graduate College, Jaunpur during *rabi* season 2009-10. Jaunpur is situated in the centre of north gangetic alluvial plain on the right side of river Gomati at the latitude of 25^0 43' 58" N along with longitude of 25^0 43' 58" N along with longitude of 82^0 41' 10" E at an attitude of 83m mean sea level.

The experimental materials comparised F_2 and F_3 generation of Arkel x JPBB-3, Bonnevelle x JPBB-3, Bonneiville x JPBB-4 were evaluated for days to flowering and resistance to rust. The F_2's were sown during the first week of November,2009 in row spaced 60 cm apart row length was 4m, within row, plant to plant spacing was 10 cm parental line were also sown only with F_2 rows. F_3 progenies were sown in individual plant progeny row. Each row represented one F_3 progeny. These rows were also spaced 60 cm apart. Planting of F_3 rows was also done during the same year.

Results and Discussion

The number of days to flowering in the parental, F_2 and F_3 generation of crosses Arkel x JPBB-3 is given table 45.1. Arkel took 35 days to flowering in contrast to 64 days taken by JPBB-3. These observations were noted on row basis and therefore, it was not possible to give a range of days to flowering for both the parental line. However, differences between both the parental cultivars were quite distinct and obvious. Therefore, Arkel, the major variety in vegetable type was classified as early type and JPBB-3 was classified as late type with respect to days to flowering in the present investigation.

The frequency distribution of days to flowering of 400 F_2 plants of the crops (Arkel x JPBB-3) is given in Table 4.2 and with frequency curve has been showing in Fig. 4.1 In the range of 30-35 days. The next majority of plants were in the range of 35-40 (53 plants) and 45-45 class interval (51 plants). The frequency curve also shows that there were 2 peak, one around 45 days and other around 70 days. The f_2 range was beyond the parental mean for days to flowering. Therefore, all the F_2 plants coming to flowering in less than 45 days were considered as early type. The number of such plant in the F_2 germination was found to be 108. Remaining 292 F_2 plants were considered to be late in flowering. The chisqure test of goodness of fit assuming a ratio of 3 late; 1 early gave a chisquare value of 852 which was found to be non significant at 5% level of probability. Therefore, it was reasoned out that one single dominant gene was responsible for governing lateness in the cross Arkel x JPBB-3

Table .1 Days to flowering in parent, F_2 and F_3 generations of Arkel x JPBB-3

Parent and generation	Days of Flowering		Number of Plant in F_2 generation		Number of Lines in F_3 generation			X_2	Ratio
	Late	Early	Late	Early	True breeding early	Sgrega-ting type	True breedin g late		
Arkel		35							
JPBB-3	64								
F_2 generation Arkel x JPBB-3			292	108				0.85	3:1
F_3 generation Arkel x JPBB-3					6	38	5	13.86** 4.90	1:2:1 1:14:1

In order to confirm the result of F_2 generation 49 F_3 rows were also planted alongwith the parent and the F_2 generation. These individual plant progenies were classified as true breeding early, segregating type and true breeding late. These were 6 rows under true breeding early category, 38 rows were segregating type and 5 rows under true breeding late category. Assuming a ratio of 3:1 (late: early) F_3 rows were expected to give a segregation ratio of 1:2:1 for true breeding early, segregating type and true breeding late line, respectively. The chisquare value calculated on the basis of 1:2:1 ratio in F_3 progeny row was 13.86 which was highly significant at 1% level of probability. Thus F_3 result could not confirm the F_2 result. This could have been possible on account of mis classification of certain true breeding early, and true breeding late line as segregating type giving rise to abnormally large number of segregating row. However, a ratio of 1:14:1 gave good fit in F_3 rows on the basis of involvement of two genes.

Inheritance of resistance to rust

The data on reaction to rust for parental line and F_2 and F_3 generation of 3 crosses are given in table 4.3 Arkel and Bonnevill were found to be susceptible to disease however, JPBB-3 and JPBB-4 although were not completely free from infection by rust were classified as resistance types.

Table 2 Reaction to rust in parental, F_2 and F_3 generation of three crosses of pea

Genotype and Generation	Reaction to Rust	Reaction to rust in F2 generation		Reaction to rust in F3 generation			X2	Ratio
		Resistant	Suscep-tible	True breeding resistant	Sgregating type	True breeding susceptible		
Arkel	Susceptible							
Bonneville	Susceptible							
JPBB-3	Resistant							
JPBB-4	Resistant							
F2 generation Arkel x JPBB-3		94	56				10.37** 2.508	3:1 9:7
Bonneville x JPBB-3		8	22				0.444	1:3
Bonneville x JPBB-4		4	11				0.017	1:3
F3 generation Arkel x JPBB-3				31	10	6	40.43** 286.92**	1:2:1 1:8:7
Bonneville x JPBB-3				14	13	22	14.42**	1:2:1
Bonneville x JPBB-4				6	4	19	28.81*	1:2:1

The F_2 generation of Arkel x JPBB-3 failed to give a 3:1 ratio as calculated chisquare was 10.37 which was highly significant. However, this cross gave goodness of fit on the basis of 9:7 ratio based on the assumption that genotype carrying 2 dominant genes only were resistant and those with one dominant gene are no dominance gene were susceptible. In the F_2 generation of remaining 2 crosses (Bonneville x JPBB-3 and Bonneville x JPBB-4) a ratio of 1 resistant to 3 susceptible could be fitted satisfactorily and this indicated that resistance is conditioned by a recessive gene in these 2 crosses.

The F_3 generation was expected to follow a segregation ratio of 1:8:7 in Arkel x JPBB-3 and 1:2:1 in Bonneville x JPBB3 and Bonneville x JPBB-4. However, none of these ratios could be fitted. Thus, F_2 results were at variance with those of F_2 generation.

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