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Genotypic and insecticidal management of the stunt disease of field pea

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ABSTRACT : Five pea genotypes, namely, Rachna, Jawahar Matar-10, T-163, Bonneville and Arkel were evaluated for resistance against red clover vein mosaic virus. T-163 gave moderately resistant and rest of the genotypes moderately susceptible reaction under natural disease pressure. Under artificial inoculation condition, however, all the genotypes could be classed as susceptible. Insecticidal sprays resulted in significantly lower pea stunt and stem fly incidence and higher grain yield over water spray alone. Lowest disease and stem fly (*Ophiomyia phaseolii)* incidence resulted from 4 sprays of phosphamidon (300 g a.i./ha) and monocrotophos (400 g a.i./ha), respectively. These insecticides, with per hectare grain yields of 19.400 and 20.116 quintals, respectively, gave highest cost-benefit ratio and per hectare profitably too.

Keywords : *Pisum sativum,* red clover vein mosaic virus, pea stunt disease, genotypic resistance, pea stem fly, insecticidal pest management

Red clover vein mosaic virus (RCVMV) incites a stunt disease of pea (*Pisum sativum* L.) in India (Singh Khan, 1993) and elsewhere (Smith, 1972). It causes yield reductions ranging from 87.8 to 100% in moderately to severely diseased crops (Khan and Singh, 1997). Efforts were made, therefore, to identify genotypes resistant/tolerant to the RCVMV infection and insecticides capable of lowering the pea stunt disease incidence and increasing grain yields.

MATERIALS AND METHODS

Untreated pea seeds, obtained from apparently healthy parents of test-genotypes, were sown in a well levelled field, having uniform fertilty status, for natural field testing. Pea cv Rachna was planted in two lines on both sides of test-strips and sap-inoculated with RCVMV to serve as infector rows. Another set was sown in deep trays, filled with the soil from above field, inside a glasshouse. Two hundred plants per genotype were maintained for testing under both the situations. Usual agronomical practices were followed. Glasshouse trials were sap-inoculated following usual procedures. Field trials were left uninoculated. Test genotypes included T-163, Rachna, Jawahar Matar-10, Arkel and Bonneville. Trials were conducted thrice, once in each *rabi* season, during 1985-86 to 1987-88 period.

Insecticidal trials, using pea cv. Rachna, were conducted in a randomised block design at Crop Research Centre, Masodha, Faizabad during 1987-88, 1988-89 and 1989-90 *rabi* seasons. A plant spacing of 30 cm and 10 cm between rows and plants, respectively, was maintianed in 5 × 4 square metre plots. Trials included five spray tratments, methyl-o-demetan (250 g a.i./ha), monocrotophos (400 g a.i./ha), dimethoate (300 g a.i./ha), phosphamidon (300 g a.i./ha) and water alone in three

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The disease was indexed using the following scale, specially developed for the purpose :

Disease-free (DF)	:	No apparent infection in the host under natural field condition
Resistant (R)	:	Less than 1% plants apparently infected
Moderately resistnat (MR)	:	1 to 5% plants apparently infected
Moderately Susceptible (MS)	:	5 to 20% plants apparently infected
Susceptible (S)	:	20 to 50% plants apparently infected
Highly susceptible (HS)	:	More than 50% plants apparently infected

replications. Insecticidal solutions were sprayed at an interval of 15 days, first spray beginning at 30 days after sowing. Four sprays, in all, employing a high volume sprayer were given. Being a major and recurring pest, observations were also recorded on the damage caused by stem fly. This was done by counting the total plants and infected ones and calculating per cent plant mortality. Observations were recorded 15 days after every spray.

RESULTS

Genotypic resistance

Glasshouse screening for resistance against the RCVMV indicated all the 5 pea genotypes to be susceptible, the per cent infection varying from 28.5 for T-163 to 38.5 for Arkel (Table 1). Other genotypes recorded a per cent infection of 33.7 (Rachna), 34.0 (Jawahar Matar-10) and 37.0 (Bonneville). However, under natural disease incidence conditions in the field, T-163, with an average disease-incidence of 5 per cent could be classified as moderately resistant. Other genotypes too, under this situation, expressed disease incidence much lower to the artificial inoculation condition. Jawahar Matar-10, Rachna, Arkel and Bonneville, with an average disease incidence of 9.0, 9.5, 13.5 and 13.7 per cent, respectively, could be classified as moderately susceptible only.

Insecticidal management

All the insecticidal treatments lead to significantly lower pea stunt and stem fly incidence and higher grain yields over the check, i.e., water spray alone (Table 2). Among the insecticidal treatments, minimum and maximum disease incidence of 2.00 and 2.67 per cent were obseved in the plots sprayed with phosphamidon and dimethoate, respectively. Plots sprayed with monocrotophos and methyl-o-demetan showed a disease incidence of 2.33 per cent. Differences between the performance of different insecticidal treatments, however, were non-signficant.

In case of stem fly too, all the insecticidal treatments lead to significantly lower plant mortality over check. Monocrotophos spray, with lowest plant mortality (7.16%), gave highest stem fly control followed by phosphamidon, methyl-o-demetan and dimethoate, the last one giving a plant mortality of 9.133%. Water spray alone gave the highest plant mortality of 13.01%. Statistically, monocrotophos and phosphamidon were found at par. Likewise, phosphamidon, methyl-o-demetan and dimethoate too were found at par.

The highest grain yield of 20.116 q/ha was obtained from the monocrotophos sprayed plots followed by phosphamidon (19.400 q/ha), methyl-o-demetan (18.933 q/ha), dimethoate (18.233 q/ha) and water spray alone (15.150 q/ha). Among the insecticidal sprays, monocrotophos and phosphamidon, phosphamidon and methyl-o-demetan and methyl-o-demetan and dimethoate were pairs, statistically, at par among themselves.

Highest and lowest profitability per hectare was obtained from monocrotophos (Rs. 2596.66) and dimethoate (Rs. 1545.13) sprays, respectively. However, cost benefit ratio was highest for the

Table 1. Evaluation of pea genotypes for resistnace against RCVMV[1]

S.No.	Cultivars	Under artificial disease pressure		Under natural disease pressure	
		% Mean infection	Reaction group	% Mean infe-ction	Reaction group
1.	Rachna	33.7	S	9.5	MS
2.	Jawahar Matar-10	34.0	S	9.0	MS
3.	T-163	28.5	S	5.0	MR
4.	Bonneville	37.0	S	13.7	MS
5.	Arkel	38.5	S	13.5	MS

[1]Mean data from trials conducted during 1985-86, 1986-87 and 187-88 *rabi* seasons in three replications

Table 2. Effect of insecticidal sprays on the incidence of pea stunt disease, pea stem fly induced plant mortality and grain yield[2]

Sl. No.	Insecticide	Dose (g a.i./ ha)	Mean disease incidence (%)	Mean plant mortality due to stem fly (%)	Mean yield (q/ha)
1.	Methyl-o-demetan (Metasystox 25 EC)	250	2.3	8.43	18.933
2.	Moncrotophos (Nuvacron 36 EC)	400	2.3	7.16	20.116
3.	Dimethoate (Rogor 30 EC)	300	2.7	9.13	18.233
4.	Phosphamidon (Dimecron 85 EC)	300	2.0	8.24	19.400
5.	Water alone	-	7.8	13.01	15.150
	CD at 5% level		1.2	1.21	0.960

[2]Mean data from field trials conducted during 1987-88, 1988-89 and 1989-90 *rabi* seasons in three replications.

phosphamidon (1:6.351), followed by monocrotophos (1:4.113), methyl-o-demetan (1:3.731) and dimethoate (1:3.345).

DISCUSSION

Sap-inoculation of the test plants gives uniform coverage of the leaf surface and, therefore, higher per cent infection. Field infection has to result only through pea aphids. Thus, the lower per cent infection in the field may be a result of some degree of resistance to these vectors, in the test genotypes, as suggested by Singh *et al.* (1983) in a different case. Variable reaction of the genotypes, both under artificial and field conditions, to the RCVMV infection has been noted in USA also (Hagedorn and Walker, 1949; Hagedorn and Hanson, 1951). By way of establishing lower per cent infection under artificial disease pressure and

Table 3. Cost benefit ratio of the insecticidal control of pea stunt disease and pea stem fly[3]

Sl. No.	Insecticide	Additional yield over check (q/ha)	Cost of additional yields (Rs. 650/q)	Cost of insecticide, labour & equipment hire (Rs)	Net profit (Rs)	Cost benfit ratio
1.	Methyl-o-demetan	3.783	2458.95	519.70	1939.25	1:3.731
2.	Monocrotophos	4.966	3227.90	631.24	2596.66	1:4.113
3.	Dimethoate	3.083	2007.03	461.90	1545.13	1:3.345
4.	Phosphamidon	4.250	2762.50	375.81	2386.69	1:6.351

[3]Mean data from the years 1987-88, 1988-89 and 1989-90 *rabi* seasons in three replications.

higher resistance grouping under natural disease pressure, the study has clearly brought out the superiority of pea cv T-163 over other test cultivars in the matter of resistance to RCVMV.

Insecticidal sprays can minimize pea stunt incidence through reduction in the vector population. Highest grain yield, resulting from the monocrotophos spray, though it is second ranking in controlling pea stunt, is because of lower plant mortality due to superior stem fly control. Phosphamidon, with the highest cost benefit ratio of 1:6.351, has emerged as the most desirable insecticide for the control of pea stunt disease and stem fly. But monocrotophos, with a cost benefit ratio of 1:4.113, appears to be equally, if not more, desirable as it gives the highest profitablity per hectare among all the insecticides tested. Pea stem fly is also a serious pest in the area and has been controlled to certain extent using phosphamidon and dimethoate (Singh *et al.,* 1988). Present study has succeeded in identifying monocrotophos as an additional insecticide with superior performance over phosphamidon and dimethoate. Simultaneous evaluation of the insecticides for pea stunt and stem fly control is going a long way in economizing pea cultivation.

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