

FIELD SCREENING OF PEA, *PISUM SATIVUM* L. VARIETIES FOR RESISTANCE AGAINST MAJOR INSECT PESTS

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ABSTRACT

Field screening of 15 varieties of pea (*Pisum sativum* L.) for resistance to major insects pests against pea leaf miner, *Lyriomyza* spp and pod borers like (*Helicoverpa armigera*, *Lampodius boeticus* and *Cydia nigricana*) was carried out at Entomology Block, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during Kharif 2014-2015 and 2015-2016. The varieties Arka Sampoorna, Arka Karthika, Arka Ajit, and GS-10 were found to be moderately resistant with the infestation index of 0.36, 0.39, 0.45 and 0.47 respectively. The remaining 11 varieties are grouped under susceptible genotypes against pea leaf miner. Against pod borers the three varieties Arka Karthika, Arka Ajit and Arka Sampoorna were observed as resistant with the per cent pod damage of 19.58, 17.08 and 16.56 respectively. Followed by two varieties GS-10 and DS-10 as moderately resistant with the per cent pod damage of 30.37 and 36.35. The five varieties observed as intermediate and five as susceptible based on percent pod damage. The maximum pod yield (26.87 q/ ha) was recorded in the variety Arka Sampoorna which was found to be moderately resistant to leaf miner and resistant to pod borers.

INTRODUCTION

Pea is an important pulse crop in India grown during *kharif* and *rabi* season for vegetable and gram purposes. Cooked green peas are rich source of proteins. It occupies an unique position for its high quality nutrition in terms of valuable and easily digestible protein content of 22.5 per cent, fat 1.2 per cent and minerals like calcium, iron and vitamins *viz.*, riboflavin, thiamine and niacin. It has the second importance among all the grain legumes after soybean. Among the insect pests of this crop, pea leaf miner (*Chromatomyia horticola*) and pod borer complex (*Helicoverpa armigera*, *Lampodius boeticus* and *Cydia nigricana*) are serious and often cause substantial yield loss to the crop. Pea leaf miner caused more than 20% loss in pea grain yield (Mehta *et al.*, 1994). Pod damage to the tune of 13.45 to 40.38 % inflicted by pod borer complex has been reported by (Dahiya and Naresh, 1993). Similarly, Pod damage caused by *H. armigera* and *L. boeticus* were found to be 7.50 and 6.38%, respectively in pigeon pea has been reported by (Sandip *et al.*, 2016). Khan *et al.* (2014) who reported that 5.50 to 12.50 % pod damaged by Lepidopterous podborer. The approaches to control these pests were mostly insecticidal (Khajuria and Sharma 1995, Mehta *et al.*, 1995). But Host Plant Resistance (HPR) in crop plants is ecofriendly and economically sound component of integrated pest management (IPM). Therefore considering the importance of the crop, hence the present study was undertaken to screen the pea varieties to check the resistance against major insect pests to reduce the quantum of insecticides and additional cost to the farmers.

MATERIALS AND METHODS

Fifteen varieties were screened to study their reaction to different key pests of pea during *kharif* 2014 and 2015 at Entomology Block, MARS, Dharwad. Each genotype was sown in two rows of three meter length and replicated thrice and randomized. Recommended cultural practices were followed for raising the crop except for the plant protection measures. The varieties used were Nobel- Emerald, Sweet pearl, NP-20, DS-10, GS-10, Classic, PSM-3, Ankur, AP-3, AP-3 Nice, AP-3 Anishka, Arkel, Arka Karthika, Arka Sampoorna and Arka Ajit.

The methodology followed for screening of varieties against leaf miner was according to Bhalla and Verma (1991). The observations on pea leaf miner was recorded from 10 leaves from upper, middle and lower portions of the 10 plants were selected at random in each plot. Total number of leaves and those of infested with leaf miner were counted to access the per cent leaf infestation. Observations on maggot population were also recorded by counting the number of maggots in the sampled leaves.

In screening trials final categorization of the genotypes was done by calculating infestation index values for each cultivar. Infestation index = $\log [\text{mean no. of maggot/leaves} \times \text{relative leaflet infestation} + 1] / 100$

The methodology followed for screening of varieties against pod borers was according to Jackai (1981). The resistance or susceptibility of pea genotypes was studied based on the percentage of pods damaged by the pod borers and was estimated by counting the number of pods damaged out of total number of pods separately from randomly selected ten

Category	Characteristics	Range of infestation index
I	Resistant	< 0.25
II	Moderately Resistant	0.26-0.50
III	Susceptible	0.51-0.75
IV	Highly Susceptible	> 0.75

plants at the time of harvesting. The criteria used in the identification of resistant lines were based on scale as described below.

Characteristics	Range of infestation index
Resistant	0-20 per cent pods bored
Moderately Resistant	21-40 per cent pods bored
Intermediate	41-60 per cent pods bored
Susceptible	61-80 per cent pods bored
Highly Susceptible	81-100 per cent pods bored

For comparison of yield in different varieties, all the plants were harvested at maturity. The pods were weighed separately from each varieties and then converted to per hectare for statistical analysis. All the data collected were subjected to suitable statistics analysis .

RESULTS AND DISCUSSION

Screening of pea varieties against leaf miner, *Lyriomyza spp.* during *kharif* 2014 and 2015

During 2014, out of 15 entries four entries *viz.*, Arka Sampoorna, Arka Karthika, Arka Ajit, and GS-10 were found to be moderately resistant with infestation index of 0.35, 0.37, 0.45 and 0.48 respectively (Table 1). The remaining 11 varieties *viz.*, AP- 3, Emerald 10, NP-20, Arkel, Sweet pearl, PSM-3, AP-3 Anishka, DS-10, Classic, Ankur and AP-3 Nice are grouped under susceptible with infestation index of 0.70, 0.53, 0.60, 0.57, 0.64, 0.67, 0.68, 0.69, 0.66, 0.65 and 0.67 respectively.

In the year 2015, same trend was followed out of 15 entries four entries *viz.*, Arka Sampoorna, Arka Karthika, Arka Ajit, and GS-10 were found to be moderately resistant with infestation index of 0.37, 0.40, 0.46 and 0.47. The remaining 11 varieties *viz.*, AP- 3, Emerald 10, NP-20, Arkel, Sweet pearl,

PSM-3, AP-3 Anishka, DS-10, Classic, Ankur and AP-3 Nice are grouped under susceptible genotypes with infestation index of 0.72, 0.55, 0.62, 0.59, 0.63, 0.68, 0.69, 0.70, 0.68, 0.66 and 0.69 respectively.

The pooled results also indicated same that, out of 15 entries four entries *viz.*, Arka Sampoorna, Arka Karthika, Arka Ajit and GS-10 were found to be moderately resistant with infestation index of 0.36, 0.39, 0.45 and 0.47. The remaining 11 varieties *viz.*, AP- 3, Emerald 10, NP-20, Arkel, Sweet pearl, PSM-3, AP-3 Anishka, DS-10, Classic, Ankur and AP-3 Nice are grouped under susceptible genotypes with infestation index of 0.71, 0.54, 0.61, 0.58, 0.63, 0.67, 0.69, 0.70, 0.67, 0.66 and 0.68 respectively. The present results are in conformity with the findings of Bhat (1988) screened twenty lines of peas for resistance to *Chromatomyia horticola* Kashmir and found that none of the cultivars tested was resistant to these pests, but the level of infestation varied between cultivars. The present finding were further supported by Vishal and Ram (2005) screened 165 germplasm of pea for resistance to major insect pest pea leaf miner (*Chromatomyia horticola*) and found that 18 dwarf germplasm as least susceptible mainly to leaf miner. On the basis of leaf miner infestation index values only one germplasm (P-4107) proved resistant as it had leaf miner infestation index of 0.20. Similarly Ashraf Khan *et al.* (2015) screened seven pea varieties including Climax (New Zealand NTL), Classic, Leader, Azad P-1, PF-400, Meteor and Peshawar Local (Check) and reported that density of pea leaf miner, *Chromatomyia horticola* was significantly higher on Azad P-1 (7.21 leaflet-1) and lower on Climax (5.85 leaflet-1). Climax gave significantly higher (4235.81 kg/ha) pea yield and concluded that Climax yielded more and also found comparatively more resistant to the attack of insect pests as compared to all other varieties.

Screening of pea varieties against pod borers during *kharif* 2014 and 2015

During 2014, the per cent pod damage varied from 15.76 to 64.14 per cent. In the category of resistant Arka Sampoorna and Arka Ajit were found to be superior with significantly least 15.76 and 16.66 per cent pod damage and found to be best over other varieties followed by Arka karthika which

Table 1: Screening of Pea varieties against leaf miner, *Lyriomyza spp.* during 2014 and 2015.

Categories	varieties	2014 Leaf infestation(%)	No. of maggots /10 leaves	Infestation index	2015 Leaf infestation (%)	No. of maggots /10 leaves	Infestation index	Pooled Leaf infestation (%)	No. of maggots /10 leaves	Infestation index
Moderately Resistant (0.26-0.50)	Arka karthika	33.33	4.23	0.37	35.33	4.43	0.4	34.33	4.33	0.39
	Arka Ajit	36.33	4.63	0.45	36.33	5.23	0.46	36.33	5.15	0.45
	Arka Sampoorna	32.33	3.9	0.35	34.67	4.1	0.37	33.5	4	0.36
	GS-10	40.33	5.07	0.48	41.33	4.7	0.47	40.83	4.9	0.47
Susceptible (0.51-0.75)	Emerald 10	44.33	5.4	0.53	47.33	5.47	0.55	45.83	5.43	0.54
	NP-20	49.33	6.17	0.6	52.33	6.23	0.62	51	6.2	0.61
	AP-3	56.67	7.9	0.7	58.67	7.97	0.72	57.67	7.93	0.71
	Arkel	46.67	5.97	0.57	47.67	6.13	0.59	47.17	6.05	0.58
	Sweet pearl	45.67	7.67	0.64	48.33	6.97	0.63	46.5	7.32	0.63
	PSM-3	50.67	7.33	0.67	52.67	7.37	0.68	51.67	7.35	0.67
	AP-3 Anishka	50.33	7.5	0.68	52.33	7.6	0.69	51.33	7.55	0.69
	DS-10	49.67	7.17	0.69	51.33	7.4	0.7	50.5	7.9	0.7
	Classic	46.33	7.8	0.66	49.33	7.83	0.68	47.83	7.82	0.67
	Ankur	47	7.43	0.65	48.67	7.53	0.66	47.83	7.48	0.66
	AP-3 Nice	51.33	7.27	0.67	54.33	7.37	0.69	52.83	7.32	0.68

Table 2: Screening of Pea varieties against pod borers during Kharif 2014 and 2015.

Categories	varieties	% Pod damage			Pod yield (q/ha)		
		2014	2015	Pooled	2014	2015	Pooled
Resistant (0 -20.0)	Arka karthika	19.3 (26.02) ^l	19.86 (26.39) ^l	19.58 (26.25) ^l	24.19 ^a	22.78 ^a	23.49 ^a
	Arka Ajit	16.66 (24.08) ^m	17.49 (24.69) ^m	17.08 (24.40) ^m	25.67 ^a	24.89 ^a	25.28 ^a
	Arka Sampoorna	15.76 (23.35) ^m	17.37 (24.60) ^m	16.56 (24.00) ^m	27.99 ^a	25.74 ^a	26.87 ^a
Moderately resistant (21 – 40)	GS-10	29.54 (32.91) ^j	31.21 (33.94) ^j	30.37 (33.43) ^j	17.41 ^b	16.98 ^b	17.20 ^b
	DS-10	35.66 (36.65) ^j	37.03 (37.46) ^j	36.35 (37.06) ^j	18.43 ^b	18.30 ^b	18.36 ^b
	Emerald 10	41.18 (39.90) ^h	42.49 (40.66) ^h	41.83 (40.28) ^h	16.88 ^{bc}	16.42 ^{bc}	16.65 ^{bc}
Intermediate (41 – 60)	Classic	41.95 (40.34) ^h	42.72 (40.79) ^h	42.34 (40.58) ^h	15.22 ^{cd}	14.76 ^{cd}	14.99 ^{cd}
	Arkel	42.53 (40.88) ^g	43.37 (41.17) ^g	42.95 (40.93) ^g	14.17 ^{de}	13.71 ^{de}	13.94 ^{de}
	NP-20	43.03 (40.97) ^f	44.16 (41.62) ^f	43.6 (41.30) ^g	13.71 ^{de}	13.28 ^{de}	13.50 ^{de}
	Sweet pearl	49.84 (44.89) ^e	52.93 (46.66) ^e	51.39 (45.78) ^e	18.39 ^b	17.93 ^b	18.16 ^b
Susceptible (60 – 80)	AP-3	61.17 (51.44) ^d	61.92 (51.88) ^d	61.55 (51.66) ^f	12.61 ^e	12.34 ^e	12.48 ^e
	AP-3 Anishka	62.04 (51.91) ^c	62.31 (52.11) ^c	62.18 (52.03) ^c	12.95 ^e	12.55 ^e	12.75 ^e
	AP-3 Nice	62.26 (52.08) ^c	60.91 (51.29) ^c	61.59 (51.68) ^c	12.72 ^e	12.38 ^e	12.55 ^e
	PSM-3	63.54 (52.85) ^b	63.76 (52.98) ^b	63.65 (52.90) ^b	12.98 ^e	12.45 ^e	12.72 ^e
	Ankur	64.14 (53.20) ^a	64.89 (53.65) ^a	64.51 (53.42) ^a	12.80 ^e	12.35 ^e	12.58 ^e
	SEm ± CD(0.05)	0.9 2.62	0.98 2.85	0.82 2.38	0.65 1.91	0.71 2.08	0.65 1.81

Note: Figures in the parentheses are Arc sine transformed values; In vertical columns, means followed by similar alphabets are not different statistically (0.05) as per DMRT

recorded 19.30 per cent (Table 2).

Among the moderately resistant varieties minimum percent pod damage was recorded in GS-10 (29.54 %) and maximum per cent of pod damage was 35.66 per cent observed in DS-10.

Minimum percent pod damage was recorded in Emerald 10 (41.18 %) followed by Classic (41.95 %), Arkel (42.53 %), NP-20 (43.03 %) and maximum per cent of pod damage (49.84 %) was recorded in variety Sweet pearl which was categorized under intermediate resistant varieties.

Among susceptible varieties maximum per cent of pod damage was observed in Ankur (64.14 %) followed by PSM-3 (63.54 %), AP-3 Nice (62.26 %), AP-3 Anishka (62.04 %) and least per cent pod damage was (61.17 %) noticed in AP-3 variety.

During 2015, similar trend was observed, per cent pod damage varied from 17.37 to 64.89 per cent. Among all the varieties Arka Sampoorna and Arka Ajit was found to be resistant with least per cent pod damage (17.37 % and 17.49 %) and susceptible with maximum per cent pod damage was (64.89 %) recorded in Ankur variety.

Similarly pooled data also revealed same trend that the per cent pod damage varied from 16.56 to 64.51 per cent. Among the 15 varieties Arka Sampoorna and Arka Ajit was found to be resistant with least per cent pod damage (16.56 % and 17.08 %) and susceptible with maximum per cent pod damage

was (64.51 %) recorded in Ankur variety. The present findings are in agreement with Vishal and Ram (2005) screened 165 germplasm of pea for resistance to pod borer (*H. armigera*) and found out of 18 dwarf germplasm, two germplasm viz., P-4039 and P-4107 were found resistant for *H. armigera*. Further these observations were in close agreement with Lalasangi (1984) from Dharwad reported that the varieties 52-38, P-869 and MS-90-82/2 had recorded less percentage of pod damage due to pod borers in cowpea.

Pod yield (q/ha)

During 2014, the significantly maximum pod yield was observed in the varieties viz., Arka Sampoorna, Arka Ajit and Arka Karthika which recorded 27.99 q/ ha, 25.67 q/ ha and 24.19 q/ ha and found to be on par with each other. The significantly minimum pod yield was noticed in the variety AP-3 (12.61 q/ha), AP-3 Nice (12.72 q/ha), Ankur (12.80 q/ha), AP-3 Anishka (12.95 q/ha) and PSM-3 (12.98 q/ha) were on par with each other (Table 2).

During 2015, the similar trend was noticed the significantly highest pod yield (25.74 q/ ha) was recorded in the variety Arka Sampoorna and the significantly minimum pod yield was noticed in the variety AP-3 (12.34 q/ha).

The pooled results also revealed same trend the variety Arka Sampoorna was found to be superior among all the varieties which recorded highest pod yield (26.87 q/ ha) and the

significantly minimum pod yield was noticed in the variety AP-3 (12.48 q/ha).

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