Original Research Article

Screening of fieldpea (*Pisum sativum* L.) genotype against pod borer complex

Abstract

Eighteen ~~fieldpea~~field pea genotypes were evaluated to know their reaction to pod borer complex (*Helicoverpa armigera, Etiella zinckenella* and *Polyommatus boeticus*). Four genotypes (HFP-1140, HFP-914, HFP-1120 and HFP-530B) were found least susceptible, 12 genotypes (HFP-1129, HFP-1010, HFP-1125, HFP-715, HFP-4, HFP-9907B, HFP-1132, HFP-1107, HFP-1137, HFP-8712, HFP-8909 and HFP-529) were categorized as moderately resistant to *E. zinckenella*. However, 13 genotypes *viz.* HFP-1137, HFP-530B, HFP-529, HFP-1132, HFP-1129, HFP-1140, HFP-1010, HFP-914, HFP-1120, HFP-715, HFP-9426, HFP-8909 and HFP-1107 were least susceptible, three genotypes (HFP-1125, HFP-9907B and HFP-4) moderately resistant and one genotype (HFP 8712) as highly susceptible to *H. armigera*. On the basis ~~of Pest~~of Pest Susceptibility Rating (PSR) 5 genotypes *viz.* HFP-1137, HFP-1120, HFP-530B, HFP-715 and HFP-529 were categorised as least susceptible. Seven genotypes *viz.*, HFP-1107, HFP-4, HFP-9426, HFP-8909, HFP-9907B, HFP-1132 and HFP-1140 were categorized as moderately resistant to *P. boeticus.*

Kew words: ~~Fieldpea~~Field pea, *Pisum* sativum, s~~S~~creening, *Helicoverpa armigera, Etiella zinckenella, Polyommatus boeticus*

Introduction

~~Fieldpea~~Field pea, *Pisum sativum* (Linnaeus) is one of the most important pulse crop grown in India for vegetable as well as a pulse crop. After soybean it has the second important crop among all the grain legumes. It occupies an area of 0.47 million hectares in India (Anonymous, 2015a) and 14.05 thousand hectares in Haryana (Anonymous, 2015b). Large numbers of insect-pests are found feeding on this crop, resulting in low productivity of this crop. Pod damage in ~~fieldpea~~field pea by pod borer complex has been reported to be 13.45 to 40.38% (Dahiya and Naresh, 1993). Similarly, pod damage in ~~pigeonpea~~pigeon pea by *H. armigera* and *L. boeticus* were found to be 7.50 and 6.38%, respectively (Sandip *et al*., 2016). Pod damage (5.5 to 12.5%) by lepidopterous pod borer has also been reported by Khan *et al*. (2014). The approaches adopted to control these pests mostly include the application of insecticides. But insecticides cause harmful side effects, pest resurgence, environmental pollution and health hazards. Growing of resistant genotypes is an important component of integrated pest management because of environmental safety and compatibility with other methods. Keeping in view all these facts ~~fieldpea~~field pea genotypes were screened for their relative susceptibility towards pod borer complex (*Helicoverpa armigera, Etiella zinckenella* and *Polyommatus boeticus*). *E. zinckenella, H. armigera* and *P. boeticus* are important pest infest fieldpea at flowering and pod formation stages, and are considered as main reason of low productivity, besides reduction in yield, the quality of the grains is also affected.

Materials and methods

The study was conducted under field conditions during *rabi*, 2015-16. ~~Fieldpea~~Field pea genotypes were grown in plot size of 6 m^2 with five rows each with 30 X 10cm spacing and replicated four times in randomized block design. All the recommended agronomical practices were adopted for raising the good crop. The borers attack was compared on the basis of infestation of pods. The larval population of each borer was recorded at maturity stage, from randomly selected 3 plants per plot per replication. The larval population of *H. armigera* was counted by ground sheet method. Population of *E. zinckenella* and *P. boeticus* was counted by ground sheet as well as by visual count method (by opening 5 pods from randomly selected 5 plants of each replication). The pod damage was recorded at harvesting stage from 5 plants selected at random. Total pods and damaged pods were counted to calculate the per cent pod damage of each insect and the data was analysed statistically. The damage of pod borer complex was differentiated ~~as :~~as: ***H. armigera* :** Pods with round holes**;** ***E. zinckenella* :** older pods marked with a brown spot at larvae entry point; ***P. boeticus* :** Buds, flowers and young pods with boreholes, presence of slug like caterpillar.

Based on pod damage the pest susceptibility rating (PSR) was counted as suggested by using a formula derived from Abott (1925) as given ~~below :~~below:

Pest susceptibility rating:-

$$\text{Pest resistance (\%)} = \frac{\text{Per cent pod damage in check- Per cent pod damage in test entry}}{\text{Per cent pod damage in check}} \times 100$$

Chart: Pest resistance and Relative resistance/susceptibility rating

Pest resistance (%)	**Relative resistance/ susceptibility rating**	
100	1	Increasing resistance
75 to 99	2	
50 to 75	3	Moderately resistant
25 to 50	4	
10 to 25	5	
-10 to 10	6	Equal to check
-25 to -10	7	Highly susceptible
-50 to -25	8	
-50 to less	9	

Results and discussion

Larval population of pod borer complex

Maximum larval population of *H. armigera* was found on two genotypes HFP-8712 and HFP-529 (1.22 larvae/ plant), while it was minimum on HFP-530B (0.11 larvae/ plant). Larval population of *E. zincknella* was maximum on HFP-1107 (1.44 larvae/ plant). However, no larval population was found on HFP-1137, HFP-914, HFP-9426**.** Maximum population of *P. boeticus* was recorded on four genotypes HFP-1024, HFP-1140, HFP-1010 and HFP-4 (0.33 larvae/ plant). No larval population was found on eight genotypes (HFP-1132, HFP-1107, HFP-1137, HFP-914, HFP-1120, HFP-9426, HFP-9907B and HFP-8712) (Table 1).

Pod damage (%) by the pod borer complex

The data presented in Table 2, indicated that none of the genotypes was found completely free from incidence of pod borer complex. Maximum pod damage by *H. armigera* was recorded in genotype HFP-8712 (7.53%) and it was found at par with HFP-1024 (5.29 %). Minimum pod damage was observed in genotype HFB-530B (0.48%) and it was found at par with HFP-529 (0.85 %). Similarly pod damage by *E. zincknella* was found maximum in HFP-9426 (22.10%) which was at par with HFP-1024 (22.02 %), HFP-8712 (19.59 %), HFP-1107 (17.66 %), HFP-1137 (17.43 %), HFP-529 (17.48 %), HFP-8909 (17.92 %), HFP-1132 (16.81 %), HFP-9907B (15.55 %), HFP-4 (14.56 %), HFP-1125 (14.54 %) and HFP-1129 (13.55 %). Whereas minimum pod damage (7.31%) was recorded in HFP-914 which was at par with HFP-1140 (10.52 %), HFP-1010 (11.51 %), HFP-1120 (8.71 %), HFP-530B (7.94 %) and HFP-715 (11.25 %). Pod damage by *P. boeticus* was found maximum in genotype HFP-914 (1.60 %) and minimum in genotypes HFP-1137, HFP-1120, HFP-530B, HFP-715 and HFP-529 (0.50 %). The present findings are in accordance with Singh *et al*. (2013) who reported minimum (1.91% : in Pant P-183, Pant P-184, RFP-61, KPMR-913 and VL-54) and maximum pod damage (12.0% : HFP-716). Whereas above finding differ from Singh *et al.* (2004) who evaluated the 19 early maturing ~~fieldpea~~field pea genotypes (dwarf) and 13 late maturing genotypes (tall) against pea leaf miner, *Chromatomyia horticola* and pod borer, *Etiella zinckenella*, the observed~~they observed the~~ per cent pod damage done by pod borer in early 7 maturing genotypes was minimum (1 %) in Pant P-11 HUDP-15, LFP-283, KPMR-526 and KPMR-593 and maximum in HUDP 17 (4.0 %).

Pest Susceptibility Ratings (PSR) was calculated on the basis of total pod damage by pod borer complex, by taking HFP-1024 as check. PSR ranged from 2 to 8, 3 to 6 and 3 to 7 for *H. armigera*, *E. zinckenella* and *P. boeticus*, respectively. Three genotypes (HFP-1137, HFP-530B and HFP-529) were considered as resistant (PSR 2), eleven genotypes as moderately resistant (PSR 3-5) and one genotype (HFP-8712) as highly susceptible (PSR-8) against *H. armigera*. Similarly sixteen genotypes (HFP-1140, HFP-914, HFP-1120, HFP-530B, HFP-1129, HFP-1010, HFP-1125, HFP-715, HFP-4, HFP-9907B HFP-1132, HFP-1107, HFP-1137, HFP-8712, HFP-8909 and HFP-529) were ranked into moderately resistant (PSR : 3-5) and two varieties (HFP-1024, HFP-9426) equal to check (PSR : 6) against *E. zincknella*. The present findings were in close agreement with Abhilasha and Shekharappa (2017) who reported that three varieties Arka Karthika, Arka Ajit and Arka Sampoorna were observed as resistant against pod borers *(Helicoverpa armigera, Lampodies boeticus and Cydia nigricana)* with the per cent pod damage of 19.58, 17.08 and 16.56 respectively whereas, 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. However, the present findings are in accordance with Vishal and Ram (2005) finding, which screened 165 germplasm of pea for resistance, and found out of 18 dwarf germplasm, two germplasm viz., P4039 and P-4107 were resistant for *H. armigera*.

Eleven genotypes (HFP-1137, HFP-1120, HFP-530B, HFP-715, HFP-529, HFP-1107, HFP-9426, HFP-4, HFP-9907B, HFP-8909, HFP-1132 and HFP-1140 were categorised as moderately resistant (PSR : 3-5), five genotypes (HFP-1129, HFP-1010, HFP-914, HFP-8712 and HFP-1024) were observed as equal to check (PSR : 6) and one (HFP-

1125) as highly susceptible (PSR : 7) to *P. boeticus* on the basis of PSR. These results are more or less in agreement with Kooner and Cheema (2006) who evaluated the resistance of ~~pigeonpea~~pigeon pea genotypes against pod borer complex and reported three genotypes (AL 1498, AL 1502 and AL ~~1340 :~~1340: PSR 3.0-3.5) as promising on the basis of PSR compared with check varieties (AL 15, AL 201 and T ~~21 :~~21: PSR 4.0 to 5.5) and infestor (PSR 6.0).

Table 1: Larval population of pod borer complex in fieldpea during 2015-16

Sr. No.	Genotypes	No. of larvae per plants		
		H. armigera	***E. zinckenella***	***P. boeticus***
1	HFP-1132	0.56 (1.25)*	0.89 (1.37)	0.00 (1.00)
2	HFP-1129	0.67 (1.29)	1.11 (1.45)	0.11 (1.05)
3	HFP-1107	0.22 (1.11)	1.44 (1.56)	0.00 (1.00)
4	HFP-1140	0.56 (1.25)	0.78 (1.33)	0.33 (1.15)
5	HFP-1010	0.67 (1.29)	0.33 (1.15)	0.33 (1.15)
6	HFP-1137	0.44 (1.20)	0.00 (1.00)	0.00 (1.00)
7	HFP-914	0.33 (1.15)	0.00 (1.00)	0.00 (1.00)
8	HFP-1125	0.56 (1.25)	0.22 (1.11)	0.11 (1.05)
9	HFP-1120	0.33 (1.15)	0.22 (1.11)	0.00 (1.00)
10	HFP-530B	0.11 (1.05)	0.11 (1.05)	0.11 (1.05)
11	HFP-715	0.67 (1.29)	0.11 (1.05)	0.11 (1.05)
12	HFP-9426	0.89 (1.37)	0.00 (1.00)	0.00 (1.00)
13	HFP-4	0.33 (1.15)	0.33 (1.15)	0.33 (1.15)
14	HFP-9907B	0.56 (1.25)	0.11 (1.05)	0.00 (1.00)
15	HFP-8712	1.22 (1.49)	0.11 (1.05)	0.00 (1.00)
16	HFP-8909	0.78 (1.33)	0.33 (1.15)	0.11 (1.05)
17	HFP-529	1.22 (1.49)	0.22 (1.11)	0.22 (1.11)
18	HFP-1024 (Check)	0.33 (1.15)	0.78 (1.33)	0.33 (1.15)
SE m(±)		(0.07)	(0.08)	(0.03)
CD(P= 0.05)		(0.21)	(0.16)	(0.09)

*Figures in the parentheses are√ + 1 transformed value

Table 2: Pod damage (%) and pest susceptibility rating for pod borer complex in fieldpea

Sr. No.	Genotypes	Pod damage (%) by			PSR		
		H. armigera	***E. zinckenella***	***P. boeticus***	***H. armigera***	***E. zincknella***	***P. boeticus***
1	HFP-1132	1.70 (6.85)*	16.81 (24.13)	1.22 (6.17)	3	5	5
2	HFP-1129	2.59 (9.19)	13.55 (20.89)	1.34 (6.63)	3	4	6

3	HFP-1107	2.38 (8.62)	17.66 (24.56)	0.95 (5.51)	3	5	4
4	HFP-1140	2.30 (8.68)	10.52 (18.49)	1.10 (5.99)	3	3	5
5	HFP-1010	1.80 (7.53)	11.51 (19.44)	1.30 (6.53)	3	4	6
6	HFP-1137	0.94 (5.53)	17.43 (24.46)	0.50 (4.05)	2	5	3
7	HFP-914	2.08 (7.79)	7.31 (15.66)	1.60 (6.72)	3	3	6
8	HFP-1125	3.58 (10.65)	14.54 (21.59)	1.58 (6.71)	4	4	7
9	HFP-1120	1.88 (7.81)	8.71 (16.98)	0.50 (4.05)	3	3	3
10	HFP-530B	0.48 (3.67)	7.94 (16.15)	0.50 (4.05)	2	3	3
11	HFP-715	1.95 (7.89)	11.25 (19.57)	0.50 (4.05)	3	4	3
12	HFP-9426	1.35 (5.98)	22.10 (27.54)	0.87 (5.28)	3	6	4
13	HFP-4	4.02 (11.22)	14.56 (22.00)	0.78 (4.91)	5	4	4
14	HFP-9907B	2.88 (9.72)	15.55 (22.92)	0.88 (5.29)	4	4	4
15	HFP-8712	7.53 (15.90)	19.59 (25.15)	1.26 (6.25)	8	5	6
16	HFP-8909	2.08 (8.25)	17.92 (24.13)	0.76 (4.96)	3	5	4
17	HFP-529	0.85 (5.01)	17.48 (24.35)	0.50 (4.05)	2	5	3
18	HFP-1024 (Check)	5.29 (13.00)	22.02 (27.24)	1.13 (6.06)	6	6	6
SE (±)		(1.29)	(2.39)	(0.71)	-	-	-
CD (P= 0.05)		(3.71)	(6.90)	(2.04)	-	-	-

*Figures in the parentheses are angular transformed values.

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