Screening of Advanced Field Pea (*Pisum sativum* L.) Genotypes against Pod Borers

ABSTRACT

Thirty six advanced field pea (tall and dwarf) genotypes (including HFP 9907B and HFP 529 as checks) were evaluated against gram pod borer (*Helicoverpa armigera*) and lentil pod borer (*Etiella zinckenella*) during *Rabi* season of 2016-17 at CCS Haryana Agricultural University, Hisar for pod damage and seed yield. Pest susceptibility rating of each genotype was calculated on the basis of pod damage. The pod damage in tall field pea by *H. armigera* and *E. zinckenella* was found minimum in genotypes, HFP 1463 (3.62%) and HFP 1445 (3.98%), respectively, whereas maximum in genotypes, HFP 1132 (13.24%) and HFP 1130 (11.11%), respectively. However, among dwarf field pea, genotype, HFP 1428 and HFP 1426 showed minimum pod damage, whereas, genotype HFP 1125 and HFP 1036 showed maximum pod damage by *H. armigera* and *E. zinckenella*, respectively. Maximum field pea yield was obtained from HFP 1445 (2445.83 kg/ha). Pest susceptibility rating ranged from 3 to 9 for pod borers *i.e.* genotypes falls in moderate resistant (MR) to highly susceptible (HS) group. These field pea genotypes (HFP 1428, HFP 1426, HFP 1445 and HFP 1463) can be exploited in developing tolerant/resistant line against pod borers.

KEYWORDS : Screening, Field pea, Pod borer, Gram pod borer, *Helicoverpa armigera*, Lentil pod borer, *Etiella zinckenella*.

1. INTRODUCTION

Field pea, *Pisum sativum* (Linnaeus) is third most popular *Rabi* pulse crop in India after chickpea and lentil. In India, it occupies an area of 7.62 lakh hectares with average production and productivity of 10.04 lakh tons and 1318 kg/ha (Anonymous, 2024). Uttar Pradesh, Madhya Pradesh, Bihar and Maharshtra are the main states in country contributing the major shares in production. Field pea is grown for both purpose *viz*., as vegetables and for grain purpose. Though it is the third most important *Rabi* pulse crop, the average productivity is low as compared to world's productivity. Several factors are held responsible for low productivity of this crop (Kumar and Tiwari, 2021). Among these insect-pests attack during different stages of crop growth are major factor limiting the production of this crop (Manisha et al. 2019). Gram pod borer, *Helicoverpa armigera*, spiny pod borer, *Etiella zinckenella*, blue butterfly, *Lampides*

boeticus, cut worm, *Agrotis ipsilon* and pea stem fly, *Ophiomyia phaseoli* are the major insect-pests damaging this crop (Yadav et al. 2018). In field pea 13.45 to 40.38 per cent pod damage has been reported by pod borer complex (Dahiya and Naresh, 1993). Pod borers, specifically *H. armigera* and *E. zinckenella* have significant economic impacts on field pea production. These pests damage the crop by feeding on the developing pods, causing both direct and indirect losses. In pigeon pea, 7.50 and 6.38 per cent pod damage have been reported due to *H. armigera* and *L. boeticus*, respectively (Sandip *et al.* 2016). Whereas, Khan *et al.* (2014) reported 5.5 to 12.5 per cent pod damage by lepidopterous pests. About 7.20 to 31.17 per cent pod damage in fieldpea have been reported due to pod borers (Pal et al., 2020).Various management practices have been adopted by different workers *viz*., use of biocontrol agents, botanicals, use of resistant/tolerant varieties and spray of insecticides etc. (Kumari et al., 2024). But indiscriminate use of insecticides causes health hazards, pest resurgence, insecticide resistance and environmental pollution etc (Shraddha et al. 2024). Use of resistant/tolerant genotypes as a component of integrated pest management has advantage over insecticides in environmental safety and compatibility with other methods. Overall, the economic impact of pod borers on field pea production is a combination of direct yield losses, increased costs for pest management and reduced market value of the produce. Therefore present study was conducted to evaluate the advance tall genotypes of field pea against *H. armigera* and *E. zinckenella*.

2. MATERIAL AND METHODS

The present study was conducted at the Research Farm, Pulse Section, CCS Haryana Agricultural University, Hisar during the year 2016-17. Thirty six advanced (tall & dwarf) genotypes of fieldpea were sown in randomized block design (RBD) by adopting all the agronomic practices to raise a good crop stand except insecticidal spray to control insect-pests. Row to row and plant to plant spacing was maintained 30 x 10 cm, respectively. The crop was grown in plot size of 2 rows of 4m each with three replications of each genotype. Pods of three plants from each replication were picked and healthy and damaged pods counted separately to ascertain the damage caused by *H. armigera* and *E. zinckenella.* Pod damage caused by *H. armigera* was identified by the presence of round and clear hole on pod. While soft pod with brown spot on entry point and presence of excreta inside after splitting the pods, were categorized as *E. zinckenella* infested pod. Pest Susceptibility Ratings (PSR) was calculated by

keeping HFP 9907 as check. Based on pod damage PSR was counted using a formula derived from Abott (1925) as given below and pest susceptible table as described by Sreekanth *et al.* (2017) :

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

Chart 1: Pest Susceptibility Rating (PSR)

Pest susceptibility rating	Pest susceptibility (%)	Category
1	100	Highly resistant
2	75 to 99.9	Resistant
3	50 to 74.9	Moderately resistant
4	25 to 49.9	Moderately resistant
5	10 to 24.9	Moderately susceptible
6	-10 to 9.9	Moderately susceptible
7	-25 to -9.9	Susceptible
8	-50 to -24.9	Highly susceptible
9	-50 or less	Highly susceptible

3. RESULT AND DISCUSSION

Data predicted in Table 1 & Table 2, indicated that pod damage by pod borer (*H. armigera* and *E. zinckenella*) showed significant differences among different genotypes of field pea (tall & dwarf). Among tall and dwarf genotypes of field pea pod damage by *H. armigera* ranged from 3.62 to 13.24 per cent and 1.90 to 6.28 per cent, respectively. Minimum pod damage by *H. armigera* in field pea tall genotypes was occurred in HFP 1463 (3.62%) and it was statistically at par with all genotypes except HFP 1104, HFP 1132, HFP 1315, HFP 1411 and HFP 9907B (C). Whereas among dwarf field pea, genotype, HFP 1428 showed minimum pod damage (1.90%) by *H. armigera* and it was statistically at par with HFP 1443, HFP 529 (C), HFP 1424, HFP 1425, HFP 1426 and HFP 1407. However, genotype, HFP 1132 (13.24%) and HFP 1125 (6.28%) exhibited maximum pod damage by *H. armigera* among tall and dwarf genotypes of field pea, respectively. The present findings are more or less in accordance with those of Manisha *et al.* (2019) who reported minimum pod damage in genotype, HFB-530B (0.48%), which was at par with HFP-529 (0.85%). In similar studies, Shraddha *et al*. (2024) reported minimum and maximum pod damage by *H. armigera* in field pea genotype, Pant P 484 (2.28%) and KPMR 942 (12.82%), respectively and identified three varieties (Pant P 484, IPFD 20-03 and IPFD 12-02) two varieties (Pant P 480 and IPFD 11-05), four varieties (Pant P 479,

RNCP 14-13, IPFD 20-09 and IPFD 20-02) and four varieties (KPMR 942, HFP 17-11, HFP 16-02 and IPFD 10-12) as highly resistant, least susceptible, moderately susceptible and highly susceptible against *H. armigera*.

Pod damage in tall field pea genotypes by *E. zinckenella* was minimum in HFP 1445 (3.98%) and it was statistically at par with all other genotypes except HFP 1129, HFP 1130, HFP 1315, HFP 1411 and HFP 1444. However, genotype, HFP 1411 recorded maximum pod damage (11.62%) and was at par with HFP 1130, HFP 1129, HFP 1315 and HFP 1444.

Among dwarf field pea genotypes, minimum pod damage by *E. zinckenella* was recorded in HFP 1426 (4.73%) and it was statistically at par with and it was statistically at par with HFP 1302, HFP 1407, HFP 1416, HFP 1424, HFP 1425, HFP 1427, HFP 1428, HFP 1443 and HFP 9907B (C). However, genotype, HFP 1036 recorded maximum pod damage (14.23%) and was at par with HFP 1010A, HFP 1306, HFP 1307, HFP 1316, HFP 1402, HFP 1129, HFP 1130, HFP 1422, HFP 529 and HFP 715. The present findings are in accordance with Manisha *et al.* (2019) who reported maximum pod damage by *E. zinckenella* in genotype, HFP-9426 (22.10%) which was at par with HFP-1024, HFP8712, HFP-1107, HFP-1137, HFP-529, HFP-8909, HFP-1132, HFP-9907B, HFP-4, HFP-1125 and HFP-1129.

Pest susceptibility rating for pod borer ranged from 4 to 9 *i.e.* all the genotypes evaluated were falls in moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) category. PSR indicated that among tall field pea, five genotypes (HFP 1314, HFP 1405, HFP 1408, HFP 1444 and HFP 1449) were MR, five genotypes (HFP 1129, HFP 1445, HFP 1104, HFP 1130 and HFP 1315) were MS and four geontypes (HFP 1132, HFP 141, HFP 1463 and HFP 529©) were HS to *H. armigera.* Whereas among dwarf field pea, six (HFP 1424, HFP 1425, HFP 1426, HFP 1428, HFP 1443, HFP 529), four (HFP 1407, HFP 1316, HFP 8909, HFP 715), six (HFP 1036, HFP 1302, HFP 1306, HFP 1402, HFP 1416, HFP 1427) and four genotypes (HFP 1010A, HFP 1125, HFP 1307, HFP 1422) falls in category of MR, MS, S and HS, category, respectively, against *H. armigera*.

Among tall field pea, four (HFP 1132, HFP 1408, HFP 1445 and HFP 1463), five (HFP 1104, HFP 1314, HFP 1405, HFP 529 and HFP 1449), one (HFP 1444) and four genotypes (HFP 1129, HFP 1130, HFP 1315 and HFP 1411) were identified as moderately resistant (MR), moderately susceptible, susceptible and highly susceptible, respectively against *E. zinckenella.*

Whereas among dwarf field pea, two genotypes (HFP 1416, HFP 1426), five genotypes (HFP 1407, HFP 1425, HFP 1427, HFP 1428, HFP 1443), three genotypes (HFP 1302, HFP 1424, HFP 8909) and eight genotypes (HFP 1010A, HFP 1036, HFP 1125, HFP 1307, HFP 1316, HFP 1402, HFP 1422, HFP 529) were identified as MR, MS, S and HS, respectively. Present results are more or less in accordance with Manisha *et al.* (2019) who reported sixteen genotypes (HFP-1140, HFP914, HFP-1120, HFP-530B, HFP-1129, HFP1010, HFP-1125, HFP-715, HFP-4, HFP-9907B HFP-1132, HFP-1107, HFP-1137, HFP-8712, HFP-8909 and HFP-529) as MR and one variety HFP-9426 as HS.

Maximum yield was realized from HFP 1445 (2445.83 kg/ ha) and HFP 1428 (3146.39 kg/ha) among tall and dwarf field pea genotypes, respectively.

Table-1: Screening of field pea genotypes (tall) against pod borers (*H. armigera* & *E. zinckenella*)

Sr. No.	Genotypes	Pod damage (%)		Pest susceptibility rating/category		Yield (kg/ ha)
		H. armigera	*E. zinckenella*	*H. armigera*	*E. zinckenella*	
1.	HFP 1104	8.04 (16.38)	7.12 (15.13)	6 (MS)	6 (MS)	1991.67
2.	HFP 1129	5.75 (13.77)	9.64 (18.04)	5 (MS)	8 (HS)	1598.61
3.	HFP 1130	6.94 (15.06)	11.11 (19.16)	6 (MS)	9 (HS)	1434.72
4.	HFP 1132	13.24 (21.05)	5.03 (12.91)	9 (HS)	4 (MR)	1051.39
5.	HFP 1314	4.95 (12.64)	7.31 (15.17)	4 (MR)	6 (MS)	2397.22
6.	HFP 1315	7.54 (15.82)	9.22 (17.43)	6 (MS)	8 (HS)	1495.83
7.	HFP 1405	4.27 (11.54)	7.51 (15.75)	4 (MR)	6 (MS)	1968.06
8.	HFP 1408	4.04 (11.48)	4.48 (11.55)	4 (MR)	4 (MR)	1673.61
9.	HFP 1411	10.23 (18.61)	11.62 (19.88)	8 (HS)	9 (HS)	2298.61
10	HFP 1444	5.10 (13.03)	8.58 (16.78)	4 (MR)	7 (S)	2298.61
11	HFP 1445	6.53 (14.69)	3.98 (10.54)	5 (MS)	4 (MR)	2445.83
12	HFP 1449	4.02 (11.39)	7.31 (15.43)	4 (MR)	6 (MS)	2076.39
13	HFP 1463	3.62 (10.81)	4.92 (12.41)	9 (HS)	4 (MR)	2247.22

14	HFP 9907 B (C)	7.42 (15.69)	7.24 (15.38)	0	0	1591.67
15	HFP 529 (C)	3.70 (10.81)	5.56 (13.44)	9 (HS)	5 (MS)	1895.83
C.D. at 5%		(4.35)	(5.37)	-	-	767.39
S.E.(m)		(1.49)	(1.84)	-	-	263.54

Figures in parentheses are angular transformed values.

Table-2: Screening of field pea genotypes (dwarf) against pod borers (*H. armigera* & *E. zinckenella*)

Sr. No.	Genotypes	Pod damage (%)		Pest susceptibility rating/category		Yield (kg/ ha)
		H. armigera	*E. zinckenella*	*H. armigera*	*E. zinckenella*	
1.	HFP 1010A	5.92 (13.85)	11.13 (19.36)	9 (HS)	9 (HS)	2466.67
2.	HFP 1036	4.69 (12.44)	14.23 (22.06)	7 (S)	9 (HS)	2040.00
3.	HFP 1125	6.28 (14.50)	9.35 (17.74)	9 (HS)	8 (HS)	2220.28
4.	HFP 1302	4.34 (11.70)	8.86 (16.60)	7 (S)	7 (S)	2436.81
5.	HFP 1306	4.91 (12.77)	12.44 (20.53)	7 (S)	9 (HS)	2592.08
6.	HFP 1307	6.09 (14.19)	9.54 (17.94)	9 (HS)	8 (HS)	2681.53
7.	HFP 1316	3.76 (10.99)	10.35 (18.71)	6 (MS)	8 (HS)	2364.31
8.	HFP 1402	4.82 (12.57)	11.32 (19.65)	7 (S)	9 (HS)	2120.28
9.	HFP 1407	3.24 (10.13)	6.47 (14.65)	5 (MS)	5 (MS)	2857.22
10.	HFP 1416	4.53 (12.27)	4.96 (12.79)	7 (S)	4 (MR)	2311.25
11.	HFP 1422	5.77 (13.84)	9.92 (18.17)	8 (HS)	8 (HS)	2354.17
12.	HFP 1424	2.23 (8.58)	8.02 (16.25)	4 (MR)	7 (S)	1794.31
13	HFP 1425	2.46 (8.99)	6.01 (13.92)	4 (MR)	5 (MS)	2047.22
14	HFP 1426	2.43 (8.81)	4.73 (12.54)	4 (MR)	4 (MR)	2694.58
15	HFP 1427	4.55 (12.27)	6.44 (14.50)	7 (S)	5 (MS)	2422.36
16	HFP 1428	1.90 (7.91)	5.71 (13.79)	3 (MR)	5 (MS)	3146.39
17	HFP 1443	2.69 (9.43)	7.92 (16.25)	4 (MR)	6 (MS)	2241.39
18	HFP 529 (C)	2.67 (9.27)	13.32 (21.40)	4 (MR)	9 (HS)	1532.08

19	HFP 8909	3.68 (10.99)	8.39 (16.81)	6 (MS)	7 (S)	1561.25
20	HFP 715	3.91 (11.17)	9.87 (18.31)	6 (MS)	8 (HS)	2098.61
21	HFP 9907B (C)	3.94 (11.36)	7.26 (15.61)	0	0	2281.39
C.D. at 5%		(3.07)	(4.26)	-	-	802.30
S.E.(m)		(1.07)	(1.48)	-	-	279.67

Figures in parentheses are angular transformed values.

4. CONCLUSION

Thirty six advanced field pea (tall and dwarf) genotypes were evaluated against pod borer (*Helicoverpa armigera* and *Etiella zinckenella*). Genotypes, HFP 1463 (Tall), HFP 1445 (Tall), HFP 1428 (Dwarf) HFP 1426 (Dwarf) showed minimum pod damage and further can be exploited for developing resistant / tolerant genotypes against pod borer in field pea.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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