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Screening of different germplasm/varieties against *H. armigera* in chickpea

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Abstract

The study was carried out to evaluate some bio-efficacy insecticides against *H. armigera* in chickpea during *rabi* 2014-2015 and 2015-2016 at Students' Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture and Technology Kanpur. The fifty genotypes/cultivars of chickpea were screened against *H. armigera*. Among all the genotypes/cultivars the lowest (4.50% 1st and 4.00% in 2nd year) pod damage was recorded in Avrodhi variety, whereas HC- 3 genotype recorded the highest (24.00% 1st and 23.00% in 2nd year) pod damage in chickpea. Only one variety Avrodhi in all cultivar was estimated highly resistant to chickpea with rating scale-2 as well as the higher grain yield (38.33 q/ha 1st and 38.50 in 2nd year) was recorded from this cultivar. Further, the rating scale of HC-3 genotype was 8. The HC-3 genotype was found highly susceptible and also gave lowest grain yield (11.00 q/ha 1st and 12.00 in 2nd year).

Keywords: Screening, germplasms/varieties, *H. armigera* and chickpea

1. Introduction

Pulses are an important group among the food crops which occupy a unique position in agriculture by virtue of their high protein content. Chickpea (*Cicer arietinum* L.), commonly known as Bengal gram, gram or chana, originated from South Western Asia, is an important *rabi* pulse crop of India, which has been considered as king of Pulses [4]. Chickpea was cultivated in an area of 135.4 lakh hectares with a production of 131.02 lakh tones and a productivity of 968 kg/ha in World [12]. Chickpea was cultivated in an area of 73.7 lakh hectares with a production of 58.9 lakh tones and a productivity of 799.19 kg/ha in India. In North India state like Uttar Pradesh, chickpea is cultivated in an area of 5.05 lakh hectares with a production of 3.78 lakh tones with a productivity of 748.51 kg/ha [3]. Gram pod borer is widely distributed and is a serious pest of chickpea causing heavy crop losses (20-60%) throughout India [2]. There are several reports which showed that *H. armigera* has developed resistance to all the major insecticide classes and it has become increasingly difficult to control its population in India [11], because of a combined effect of decreased sensitivity to acetyl cholinesterase, higher levels of esterase, phosphates and the expression of P-glycoprotein in resistant larvae [10]. Screened 16 genotypes of chickpea against *H. armigera*. Based on larval population, percentage of pod damage and yield components, genotypes CM 2100/96 and CM-4068/97 were relatively resistant, while, lines No. 96051 and PBC-2000 rated as susceptible against *H. armigera*. [9]

2. Material and Methods

The study was carried out at the Students' Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture and Technology Kanpur during 2014-15 and 2015-16 in *rabi* season. Studies on relative resistance of different chickpea genotypes against gram pod borer was made under the following criteria

1. Per cent incidence of gram pod borer in chickpea.
2. 50 genotypes was screened to check the relative resistance of different chickpea genotype against gram pod borer. The crop was sown in row/line pattern.

2.1 Experimental details

Table 1: Details of screened germplasm/verities:

S. No	Genotypes	S.N.	Genotypes
1	Pusa 240	26.	H-822
2	HC-3	27.	RSG-973
3	C-235	28.	GNG-146
4	Sada bahar	29.	GL-769
5	RVG-203	30.	GG-3
6	Avrodhi	31.	RSG-44
7	RSG-959	32.	Radhey
8	Doted yellow	33.	Pusa-391
9	RSG-931	34.	GCP-101
10	Chatta	35.	CSG-8962
11	Pusa 209	36.	PGD-4
12	RSG-10	37.	GNG-1958
13	HC-5	38.	GMG-1581
14	BGD-112	39.	Pantg-114
15	Vaibhav	40.	JG-218
16	Pusa-261	41.	GPF-2
17	AKG9303-12	42.	PBG-1
18	JG-11	43.	Pusa-362
19	BGM-413	44.	BGM-408
20	GCP-105	45.	CSJ-515
21.	Pusa-72	46.	RSG-963
22.	DCP-923	47.	AKGS-1
23.	PDG-5	48.	JG-14
24.	RVG-201	49.	RSG-807
25.	BG-5028	50.	RSG-11
		51	Check variety-Udai

To record the screening, the pod damage was expressed in percentage. Five plants were selected randomly and tagged from each line. Total number of pods and number of damaged pods per plant infested by pod borer were counted and the per cent infestation of pod damage was calculated by using the following formula:

$$\text{Per cent infested pod} = \frac{\text{Number of infested pods}}{\text{total number of pods}} \times 100$$

Resistance/ susceptibility of each test variety was determined by using the pest susceptibility rating (PSR) per cent as suggested by [6]:

$$\text{Insect pest Susceptibility Rating} = \frac{\text{Pod damage (\% in check variety)} - \text{Pod damage (\% in test variety)}}{\text{Pod damage (\% in check variety)}} \times 100$$

Table 2: Pest Susceptibility Rating

Pest Resistance (%) / susceptibility (%)	Relative resistance/susceptibility rating	Category
100%	1	Highly resistant
75 to 100%	2	Highly resistant
50 to 75%	3	Least susceptible
25 to 50%	4	Least susceptible
10 to 25%	5	Least susceptible
-10 to 10%	6	Moderately susceptible
-25 to -10%	7	Moderately susceptible
-50 to -10%	8	Highly susceptible
Less than -50%	9	Highly susceptible

3. Results and Discussion

The resistance/susceptibility of 50 chickpea germplasm/verities including a check against gram pod borer for the varietal screening was carried out under natural field conditions during *rabi*, 2014-15 and 2015-16.

Performance of chickpea varieties against the pod borer, *H. armigera* was estimated on the basis of mean per cent of pod damage and yield kg/ha. (Table-3 & 4) indicate that the variety Avrodhi recorded lowest (4.50% 1st and 4.00% in 2nd year) pod damage, however, it was at par with JG-218, RSG-44 and JG-11, whereas HC- 3 recorded highest (24.00% 1st and 23.00% in 2nd year) pod damage however, it was at par with PGDM-4, GNG- 1958 and H- 822. On the basis of insect-pests susceptibility rating (PSR), out of 50 varieties/ germplasm only one variety Avrodhi had rating scale 2 with highly resistant capacity, 23 varieties/ germplasm had rating scale 3 with least susceptibility, 11 varieties/ germplasm were found with rating scale 4 and were observed least susceptible, 9 varieties/ germplasm had rating scale 6 and were recognized moderate susceptible, 4 varieties/ germplasm were found with rating scale 7 and were identified moderate susceptible. Rest two varieties/ germplasm had rating scale 8 and were recorded highly susceptible, whereas data indicated that all the varieties/ germplasm showed significant during both years. The maximum yield was recorded from Avrodhi (38.33 q/ha 1st and 38.50 in 2nd year), however it was at par with HC-3, Pusa-261, PGD-4 and Pusa- 72. The minimum yield was recorded from HC-3 (11.00 q/ha 1st and 12.00 in 2nd year), however it was at par with BGM- 408 and AKGS-1 during both years. [8] Reported that screened 11 advance strains and one approved variety of chickpea (Bittle-98) for pod damage caused by *H. armigera* under field conditions of Bahawalpur (Pakistan) and indicated that pod damage ranged from 9.38 to 21.49%. Most susceptible strain was BRC-4 with corresponding seed yields of 0.137 and 0.333 kg plot⁻¹ among the 11 strains tested. [1] Reported that screened eight lines of chickpea against *H. armigera* and found that two cultivar lines (Pb-2000 and 96051) were highly resistant, three advanced lines (9075, 96052 and BC-6-5) were resistant, two advanced lines (90395-K and 97047) were moderately resistant and only advanced line (88194) was susceptible. [5] Reported that screened fourteen chickpea genotypes against *H. armigera*, and found BG-1047, BGD-74, BGD-330, FG-344, FG-451, H-92-67, H-97-71, H-92-106, IG-443, KW-109, RG-9210, RG-9213, RSG-798 and JG-74. BGD74 had the minimum pod damage of 6.64% and the highest yield of 1433 kg per hectare. [7] Reported that also found two genotypes (PS83149 and Bhawanipatna) were resistant, 6 were moderately resistant, 7 were moderately susceptible and 3 were in susceptible to the pest.

Table 3: Effect of screening of different germplasm/varieties against *H. armigera* in chickpea during *rabi*, 2014-15

S. No	Variety	Pod infestation	Insect Pest resistance/ susceptibility percent	Pest susceptibility rating	Pest resistance/ Susceptibility	Yield kg/ha	Yield q/ha
1	Pusa-240	6.9 (15.21)**	61	3	Least susceptible	2050	20.50
2	HC-3	24.00 (29.28)	-33	8	Highly Susceptible	1100	11.00
3	C-235	18.40 (25.38)	-02	6	Moderately. Susceptible	1530	15.30
4	Soda bahar	10.20 (18.61)	43	4	L. S.	2666	26.66
5	RVG-203	6.90 (15.22)	61	3	L. S.	2580	25.80
6	Avrodhi	4.50 (12.23)	75	2	Highly resistant	3833	38.33
7	RSG-959	17.40 (24.64)	05	6	M. S.	1666	16.66
8	Dahod yellow	17.40 (24.64)	03	6	M. S.	1600	16.00
9	RSG-931	16.50 (23.95)	08	6	M. S.	1750	17.50
10	Chatta	6.90 (15.22)	61	3	L. S.	2690	26.90
11	Pusa-209	5.20 (13.17)	71	3	L. S.	2000	20.00
12	RSG-10	8.40 (16.84)	53	3	L. S.	3000	30.00
13	HC-5	10.20 (18.62)	43	4	L. S.	2100	21.00
14	BGD-112	17.20 (24.49)	04	6	M. S.	1766	17.66
15	Vaibhav	5.90 (14.05)	67	3	L. S.	2333	23.33
16	Pusa-261	5.40 (13.43)	70	3	L. S.	3310	33.10
17	AKG-930312	7.40 (15.77)	58	3	L. S.	2640	26.40
18	JG-11	5.00 (12.90)	72	3	L. S.	2600	26.00
19	BGM-413	5.90 (14.04)	67	3	L. S.	2340	23.40
20	GCP-105	5.90 (14.04)	67	3	L. S.	2510	25.10
21	Pusa-72	10.70 (19.08)	40	4	L. S.	3330	33.30
22	DCP-923	19.20 (25.97)	-06	7	M. S.	2766	27.66
23	PDG-5	7.00 (15.33)	61	3	L. S.	3000	30.00
24	RVG-201	8.40 (16.84)	53	3	L. S.	2640	26.40
25	BG_5028	5.90 (14.04)	67	3	L. S.	2040	20.40
26	H-822	20.00 (26.55)	-11	7	M. S.	1680	16.80
27	RSG-973	10.50 (18.89)	41	4	L. S.	2600	26.00
28	GNG-146	9.00 (17.44)	50	4	L. S.	2080	20.80
29	GL-769	9.50 (17.94)	47	4	L. S.	2680	26.80
30	GG-3	6.90 (15.22)	61	3	L. S.	2333	23.33
31	RSG-44	5.00 (12.90)	72	3	L. S.	3000	30.00
32	Radhey	9.50 (17.94)	61	3	L. S.	2500	25.00
33	Pusa-391	16.40 (23.88)	47	4	L. S.	2766	27.66
34	GCP-101	8.00 (16.41)	55	3	L. S.	2020	20.20
35	CSG-8962	9.00 (17.44)	50	4	L. S.	2566	25.66
36	PGD-4	23.20 (28.78)	-28	8	H. S.	3600	36.00
37	GNG-1958	21.40 (27.54)	-18	7	M. S.	1330	13.30
38	GMG-1581	18.90 (25.75)	-05	7	M. S.	1810	18.10
39	Pantg-114	6.90 (15.22)	61	3	L. S.	2686	26.86
40	JG-218	5.00 (12.90)	72	3	L. S.	2710	27.10
41	GPF-2	7.50 (15.88)	58	3	L. S.	2400	24.00
42	PBG-1	5.60 (13.67)	68	3	L. S.	2666	26.66
43	Pusa-362	5.60 (13.68)	68	3	L. S.	2350	23.50
44	BGM-408	18.10 (25.16)	-0.5	6	M. S.	1333	13.33
45	CSJ-515	10.20 (18.61)	43	4	L. S.	2480	24.80
46	RSG-963	19.00 (25.83)	05	6	M.S	1560	15.60
47	AKGS-1	16.80 (24.18)	06	6	M. S.	1444	14.44
48	JG-14	10.00 (18.43)	44	4	L. S.	2550	25.50
49	RSG-807	16.50 (23.95)	08	6	M. S.	1810	18.10
50	RSG-11	11.00 (19.35)	38	4	L. S.	2670	26.70
	Local gram	18.00 (23.43)	-	-	-	1740	17.40
	CD at 5%	0.775	-	-	-	8.885	0.090
	SE(m)	0.277	-	-	-	3.177	0.032

** Data given in parentheses are angular transformed values

Table 4: Effect of screening of different germplasm/varieties against *H. armigera* in chickpea during *rabi*, 2015-16

S. No	Variety	Pod infestation	Insect Pest resistance/susceptibility percent	Pest susceptibility rating	Pest resistance/Susceptibility	Yield kg/ha	Yield q/ha
1	Pusa-240	6.00(14.17)**	64	3	Least susceptible	2250	22.50
2	HC-3	23.00 (28.64)	-35	8	Highly susceptible	1200	12.00
3	C-235	17.40 (24.64)	-02	6	Moderately Susceptible	2000	20.00
4	Soda bahar	8.20 (16.63)	51	3	L.S.	2770	27.70
5	RVG-203	5.90 (14.05)	65	3	L. S.	2666	26.66
6	Avrodhi	4.00 (11.53)	76	2	Highly resistant	3850	38.50
7	RSG-959	18.00 (25.09)	-05	6	M. S.	1860	18.60
8	Dahod yellow	16.50 (23.95)	02	6	M. S.	1750	17.50
9	RSG-931	15.80 (23.41)	07	6	M. S.	1800	18.00
10	Chatta	5.40 (13.43)	68	3	L. S.	2810	28.10
11	Pusa-209	4.90 (12.78)	71	3	L. S.	2160	21.60
12	RSG-10	7.40 (15.77)	56	3	L. S.	3100	31.00
13	HC-5	8.40 (16.84)	47	4	L. S.	2200	22.00
14	BGD-112	16.80 (24.18)	06	6	M. S.	1950	19.50
15	Vaibhav	5.00 (12.91)	70	3	L. S.	2430	24.30
16	Pusa-261	5.00 (12.91)	70	3	L. S.	2450	24.50
17	AKG-930312	6.80 (15.12)	60	3	L. S.	2766	27.66
18	JG-11	4.50 (12.24)	73	3	L. S.	2666	26.66
19	BGM-413	5.00 (12.90)	70	3	L. S.	2333	23.33
20	GCP-105	4.90 (12.78)	71	3	L. S.	3440	34.40
21	Pusa-72	8.40 (16.84)	50	4	L. S.	3430	34.30
22	DCP-923	18.80 (25.68)	-10	6	M. S.	2860	28.60
23	PDG-5	6.20 (14.41)	63	3	L. S.	3000	30.00
24	RVG-201	5.40 (13.43)	68	3	L. S.	2750	27.50
25	BG 5028	4.90 (12.78)	71	3	L. S.	2540	25.40
26	H-822	19.00 (25.83)	-11	7	M. S.	1350	13.50
27	RSG-973	10.00 (18.42)	41	4	L. S.	2710	27.10
28	GNG-146	8.00 (16.42)	50	4	L. S.	2380	23.80
29	GL-769	8.00 (16.42)	50	4	L. S.	2750	27.50
30	GG-3	5.90 (14.05)	65	3	L. S.	2530	25.30
31	RSG-44	4.40 (12.10)	74	3	L. S.	3080	30.80
32	Radhey	6.00 (14.17)	64	3	L. S.	2600	26.00
33	Pusa-391	8.50 (16.94)	50	4	L. S.	2780	27.80
34	GCP-101	6.90 (15.22)	59	3	L. S.	2080	20.80
35	CSG-8962	6.40 (14.64)	48	4	L. S.	2750	27.50
36	PGD-4	22.00 (27.96)	-29	8	H. S.	3700	37.00
37	GNG-1958	18.40 (25.39)	-25	7	M. S.	1540	15.40
38	GMG-1581	15.40 (23.09)	-20	7	M. S.	1980	19.80
39	Pantg-114	6.40 (14.64)	62	3	L. S.	2680	26.80
40	JG-218	4.40 (12.10)	74	3	L. S.	2750	27.50
41	GPF-2	5.80 (13.93)	65	3	L. S.	2510	25.10
42	PBG-1	5.40 (13.43)	68	3	L. S.	2800	28.00
43	Pusa-362	5.00 (12.91)	70	3	L. S.	2480	24.80
44	BGM-408	17.40 (24.64)	-02	6	M. S.	1380	13.80
45	CSJ-515	9.40 (17.84)	44	4	L. S.	2650	26.50
46	RSG-963	16.00 (23.56)	05	6	M. S.	1580	15.80
47	AKGS-1	15.90 (23.48)	06	6	M. S.	1500	15.00
48	JG-14	8.40 (16.84)	50	4	L. S.	2650	26.50
49	RSG-807	15.40 (23.09)	09	6	M. S.	2000	20.00
50	RSG-11	10.00 (18.43)	41	4	L. S.	2750	27.50
	Local gram	17.00 (24.34)				1680	16.80
	CD at 5%	0.091				4.179	0.042
	SE(m)	0.033				1.494	0.015

** Data given in parentheses are angular transformed values

4. Conclusion

It can be concluded that out of 50 germplasms/varieties of chickpea screened against *H. armigera*, none was found completely free from infestation of the gram pod borer. However varieties Avrodhi was recorded lowest percent pod damage, rating scale 2 with highly resistant capacity and higher grain yield than remaining cultivars.

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