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EVALUATION OF YIELD LOSS DUE TO GRAM POD BORER *HELICOVERPA ARMIGERA* (HUBNER) ON CHICKPEA

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ABSTRACT

An experiment was conducted to evaluate the yield loss in chickpea (*Cicer arietinum L.)* varieties due to the gram pod borer *Helicoverpa armigera* (Hubner) at the R.A.K. College of Agriculture, Sehore during post rainy season of 2016-17. The results on the seasonal incidence revealed that the pod borer remained active from 51st (third week of December) to 9th (first week of March) Standard Meteorological Week (SMW), with two peaks, i.e., first at 75% flowering (4thSMW) and second at 30% podding (6th SMW). At pod formation stage, higher ratio of late larval instars was observed.Seven varieties were evaluated for tolerance/ resistance, with observations on the larval population, starting from second week of December 2016, and on pod damage, yield loss and grain yield at maturity. The least larval incidence was observed on treated and untreated crops of the variety RVG-202, while the maximum was with RVSIKG-102, followed by RVG-202, RVKG-101, JG-130, JAKI-9218, and JGK-3. The pod damage was the least in the variety JGK-3, followed by JAKI-9218 and JG 130; and maximum pod damage and yield loss was observed in the untreated variety RVSIKG-102, followed by RVKG-101.

Keywords: Chickpea, *Helicoverpa armigera*, varieties, yield loss, tolerance, larval incidence, seasonal incidence, grain loss, pod damage

Chickpea *Cicer arietinum* L., the major *rabi* crop of India (Gowda et al., 2015; FAOSTA, 2015). Madhya Pradesh is the single largest producer with >40% production, with yield of 1040 kg/ha (Anonymous, 2015). Uncertain weather conditions and high incidence of insect pests and diseases are major production risks. The infestation of *Helicoverpa armigera* (Hubner) on chickpea starts in the second fortnight of November and reached its peak in the last week of February, with larva occurring throughout (Yadav and Jat, 2009). It is essential to find a relatively tolerant/resistant sourceandfor this purpose twenty genotypes were screened in the field (Chhapriya et al., 2016). The present study evaluates some varieties for their tolerance to *H. armigera*along with their seasonal incidence and yield loss.

MATERIALS AND METHODS

The experiments were laid out at the Research farm area of R.A.K. College of Agriculture, Sehore, Madhya Pradesh under the All India Coordinated Research Project (AICRP) on chickpea, during *rabi* season of 2016-2017. The assessment of avoidable losses in seed yield was done on seven varieties viz., JAKI- 9218, JGK- 3, JG- 130, RVKG- 101, RVG- 201, RVSJKG- 102, RVG- 202.The experiment was laid out in randomized block design, under protected and unprotected conditions. The crop was sown in the second week of November. Plot size was 5.0x2.4 (8 rows, 5m. long) and there were three replications. In under protected conditions, plots were kept free from pests by spraying it two times withquinalphos 25 EC @ 1.5l/ha at 15 days interval and seed treatment with Vitavax 4g/kg seed. The unprotected plots were allowed for a natural infestation of pests. About 5-10 randomly selected plants from each variety were used for evaluation of pod damage. For analysis of data simple randomized block design was used and SE (m) and $\pm \sqrt{\frac{VE}{r}}$ $\sqrt{Em.\frac{s}{r}}$ CD were computed.

Maximini- Minimaxi Method was used for evaluation of varieties. The main purpose of selection for tolerance is to maximize yield while minimizing yield loss. It can be conceptualized as maximization of minimum expected yield (maximini) and minimization of maximum expected yield loss (minimax). The maximini approach is to obtain the yield potential of each variety relative to the tolerant check, while the minimax approach is to obtain percentage yield loss relative to the susceptible check.The relative yield of i[th] variety may be obtained as-$RY_i = 100Y_i / YT$, where Y_i is the yield of i variety under unprotected conditions and YT is the yield of tolerant check. Similarly, the relative % yield loss will be calculated as- $RP_i = 100P_i/PS$, where P_i is the % yield loss in i[th] variety and PS is in the susceptible check.In the absence of susceptible and tolerant checks against the target pest, the highest yielding variety under un-protected plots is designated as the tolerant check and the variety with the highest percentage of yield loss is designated as the susceptible check. The higher the value of relative yield (RY) and the lower relative yield loss (RP) for any variety for selection, and based on this the varieties are categorized in to tolerant and high yielding (R-HY), susceptible high yielding (S-HY), tolerant low yield (T-LY), and susceptible low yielding (S-LY). Setting a *priori* an acceptable lower limit L for TY and upper limit U for RP, a scatter plot of RY against RP, maximin- minimax plot can be divided in to quadrants (Odukaja and Nokoe, 1993).

RESULTS ANDDISCUSSION

Assessment of loss in yield: The data on the larval incidence, pod damage and yield loss ae depicted in Table 1 which reveal that two sprays of quinalphos 25 EC @ 1.5l/ha increased grain yield in all the varieties (Table 1). The larvae appeared on foliage in the fourth week of December 2016, and reached its peak in the second week of January,2017 when the crop was at podding stage; thereafter it declined gradually up to first week of February(2.1 larvae/mrl),; but then increased abruptly in the second week of February and disappeared in the third week of February. The mean larval population on the unprotected crop during the period of investigation was 0.55 larvae/mrl. Significantly more larval population (0.77 larval/mrl) was observed with the variety RVSIKG-102 while the variety RVG-202 harbored significantly less (0.41 larval/mrl) at par with JG-130 (0.47 larval/mrl) and RVG-201 (0.51 larval/mrl). The damage to pods in the unprotected crop was 10.95%, and loss in grain yield was 14.67%. The grain yield ranged from 1000 to 2167 kg/ha and 917 to 2000 kg/ha in treated and untreated varieties, respectively. The grain yield loss ranged from 7.70 to 31.20%, maximum yield (2167.24 kg/ha) was obtained from RVG-202, on par with RVG-201 (2167.24 kg/ha) and JAKI-9218 (2083.58 kg/ha). Maximum yield from untreated varieties (2000.25 kg/ha) was obtained with RVG-202, on par with RVG-201 (1917.92 kg/ha) and JAKI-9218 (1750.59 kg/ha).The lowest grain yield (917.29 kg/ha) was recorded from RVSIKG-102, at par with RVKG-101 (917.29 kg/ha), JGK-3 (1417.94 kg/ha) and JG-130 (1667.26 kg/ha).

Tolerance: The data on yield and yield loss reveal

Table 1. *H. armigera*- larval incidence, pod damage and yield in chickpea (2016-17)

S. No.	Varieties	Larval population/ mrl	Pod damage (%)	Yield (kg/ha)		Yield loss (%)
				Treated	Untreated	
1	JAKI-9218	0.54 (1.01)*	3.94 (2.10)*	2083	1750	15.98
2	JGK-3	0.57 (1.03)*	3.01 (1.90)*	1667	1417	14.99
3	JG-130	0.47 (0.98)*	4.44 (2.22)*	1917	1667	13.04
4	RVKG-101	0.58 (1.03)*	4.89 (2.30)*	1333	917	31.20
5	RVG-201	0.51 (1.00)*	5.57 (2.80)*	2167	1917	11.53
6	RVSIKG-102	0.77 (1.12)*	10.95 (2.50)*	1000	917	8.30
7	RVG-202	0.41 (0.95)*	4.66 (2.22)*	2167	2000	7.70
	Mean	0.55 (1.01)*	5.35 (2.28)*	1762	1512	14.67
	SE(m)± ±	(0.018)	(0.36)	108	233.31	
	CD	(0.052)	NS	325	655.73	

*Figures in parentheses $\sqrt{Em.s/r}$arc sin transformation.

that the maximum grain yield (2000.25 kg/ha) under unprotected condition was with the variety RVG-202 (considered as the resistant check), while the maximum yield loss (45.34%) was with RVKG-101 (considered as susceptible check) (Table 2). On the basis of maximini-minimax method all the seven varieties were grouped into four categories namely relative high yielding (RVG-202), susceptible high yielding (RVG-201, JG-130 and JAKI-9218) and RVSIKG-102, JGK-3 and RVKG-101 were grouped under susceptible low yielding category. None of the varieties was categorized as relative low yielding (Fig. 1).

The observations reveal that *H. armigera* remained active throughout the crop season with two peaks coinciding with the reproductive phase. The least of the larval incidence was observed on treated and untreated RVG-202, while the maximum was with RVSIKG-102, followed by RVG-202, RVKG-101, JG-130, JAKI-9218, AND JGK-3.The pod damage was the least with JGK-3, followed by JAKI-9218 and JG 130, and the maximum was with the untreated RVSIKG-102, followed by RVKG-101. The RVG-202, and RVG 201 are less yield loss assessed, while RVSIKG -102 and RVKG -101 are highest yield loss assessed.

Table 2. *H. armigera*- yield and yield loss in chickpea (2016-17)

S.No.	Varieties	Treated yield kg/ha (X)	Untreated yield kg/ha (Y)	Yield loss kg/ha (X-Y)	Yield loss (%)	Relative yield to resistant check	% yield loss to susceptible check	Reaction to pest and yield
1	JAKI–9218	2083.58	1750.59	332.99	19.02	87.57	41.94	S-HY
2	JGK – 3	1667.93	1417.94	249.99	17.63	70.88	38.87	S-LY
3	JG – 130	1917.58	1667.26	250.32	15.01	83.35	33.10	S-HY
4	RVKG-101	1333.28	917.29	415.99	45.34	45.85	100	S-LY
5	RVG-201	2167.24	1917.92	249.32	12.99	95.88	28.66	S-HY
6	RVSIKG-102	1000.29	917.29	83.00	9.04	45.85	19.95	S-LY
7	RVG-202	2167.24	2000.25	166.99	8.34	100	18.40	R-HY
	SE(m)±	108	233.31					
	C.D.	325	655.73					

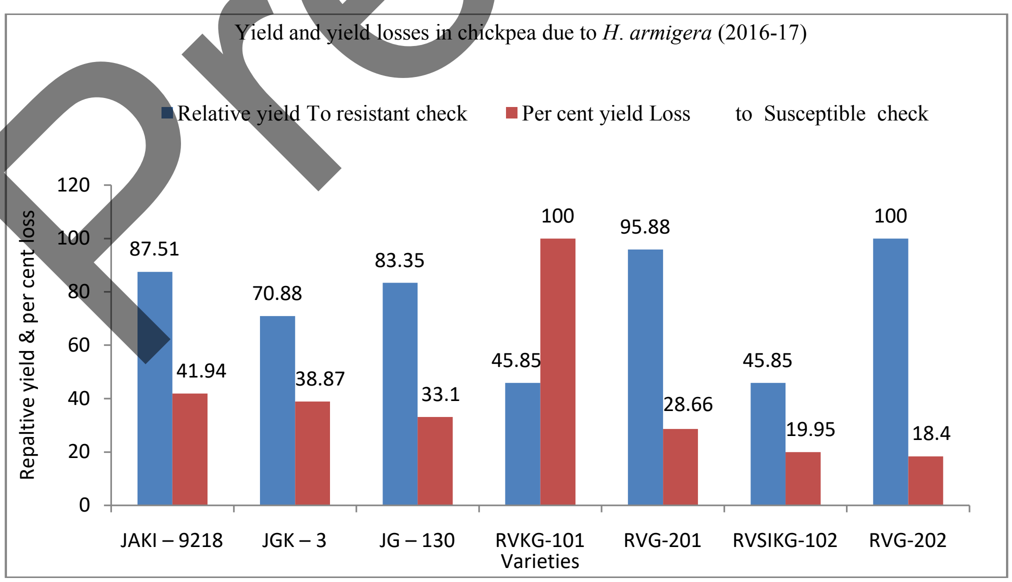

Fig. 1. Maximum – Minimax plot for 7 chickpea varieties

R-LY (Relative low yield) = 0; R-HY (Relative high yield)= 1; S-LY (Susceptible low yield)= 3; S-HY (Susceptible high yield) = 3

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