



Seasonal Incidence and Damage of Major Insect Pests on Pigeonpea (*Cajanus cajan* L.) Cultivars in Hisar, Haryana

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Abstract

A field experiment was carried out at the farmer's Agricultural Farm, Chandan Nagar, Hisar, Haryana to observe the seasonal occurrence and the damage of two pigeonpea varieties; Manak and Paras, by the major insect pests. The flower stage was noted until the maturity of the crop of the three major pests *Helicoverpa armigera*, *Maruca vitrata* and *Clavigralla gibbosa*. Pest populations began to emerge in the beginning of October and peaked in mid-November. The highest larval count of *H. armigera* was 6.2 and 3.2 larvae per 3 plants on Manak and Paras, respectively. On the same note, the maximum number of *M. vitrata* was caught as 11.8 and 5.8 webs on each plant on Manak and Paras, respectively. *H. armigera*, *M. obtuse* and *C. gibbosa* caused more pod damage in Manak (27.3%, 22.7%, and 10.7%, respectively) than Paras (18.0%, 13.6% and 8.6%). Thus, it can be inference that the variety Paras had fewer pests and was relatively less damaged as compared to Manak. Moreover, investigations pointed out the significance of pest surveillance and the selection of varietal in case of integrated pest management (IPM) in pigeonpea insect pests' management.

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1. INTRODUCTION

Pigeonpea (*Cajanus cajan* L.), is one of the significant pulse crops that has been grown in tropical and subtropical areas of the world. India is the highest producer and consumer of pigeonpea and the crop is essential in supplying dietary protein as well as the enhancement of soil fertility in terms of fixation of nitrogen. Nevertheless, the productivity of the pigeonpeas is low because of a variety of biotic and abiotic stress and some of the most severe limitations are insect pests (Sharma, 2005; Lal and Singh, 1998). Pigeonpea is attacked by several insect pests, which inflict a lot of economic losses on the crop at various stages of crop development. These major pests are the pod borer (*Helicoverpa armigera*), the legume pod borer (*Maruca vitrata*), pod bug (*Clavigralla gibbosa*) and blister beetle (*Mylabris pustulata*) (Shanower et al., 1999; Sithanatham et al., 2005). These pests infest the flowers, pods and growing seeds causing massive loss of yield. Out of this group of pests, *H. armigera* has been labelled as the most devastating of pigeonpea

insect pests and can bring about losses of pigeonpea yields of up to 30-80 per cent when highly infested (Reed et al., 1989; Sharma et al., 2010). On the same note, *M. vitrata* destroys flowers and pods by webbing plant parts and feeding on growing seeds (Duraimurugan and Regupathy, 2005). Environmental factors, crop development, and the varietal traits have a significant effect on the occurrence and population of the insect pests. Hence, seasonal occurrence of insect pests is also needed to draw on the management of pests (Kumar and Nath, 2003; Singh and Singh, 2017). With these views in consideration, the current investigation was executed to examine the occurrence of the seasonal infestation of key insect pests and comparing them with regard to their infestation of two pigeonpea grow popular varieties in field conditions at Hisar, Haryana.

2. MATERIALS AND METHODS

This experiment was conducted in the year 2018 at farmer's Agricultural Farm, Chandan Nagar, Hisar, Haryana. The experiment was placed in the form of a Randomized Block Design (RBD) with 4 replications, two varieties of pigeonpea, Manak and Paras, were tested in plot size of 10x10 m². Observations recorded were larval population of *Helicoverpa armigera* was observed at three randomly selected plants in each replication after every one week. During flowering stage, the number of webs that *Maruca vitrata* formed, was counted on ten plants that were tagged. For Pod bug population, the abundance of nymphs and adults of *Clavigralla gibbosa* were noted on a plant. The percentage of pod damage due to *Helicoverpa armigera*, *Melanagromyza obtusa* and *Clavigralla gibbosa* was calculated.

3. RESULTS

3.1 Seasonal Incidence of major insect pests

The observations made weekly showed that first occurrence of insect pests was in early October of the month and the population was growing slowly until the middle of November. *Helicoverpa armigera* was first observed in the middle of the second week of October and it experienced maximal population in the middle of the second week of November. The highest density of the larvae was in Manak with 6.2 larvae per three plants and in Paras with 3.2 larvae. Equally, the case of infestation of *Maruca vitrata* began at the beginning of October month and peaked in the middle of November with 11.8 webs in Manak and 5.8 webs per plant in Paras. The pod bug *Clavigralla gibbosa* emerged in mid-October and peaked in the second week of November.

Table 1: Seasonal incidence of major insect-pests (*Helicoverpa armigera*, *Maruca vitrata* and *Clavigralla gibbosa*) on pigeonpea

Date of observations	Manak			Paras		
	<i>H.armigera</i> larvae /3 plants	<i>M.vitrata</i> webs /plant	<i>C.gibbosa</i> Nymphs & adults/plant	<i>H.armigera</i> larvae /3 plants	<i>M.vitrata</i> webs /plant	<i>C.gibbosa</i> Nymphs & adults/plant
07-10-2018	0.0	0.9	0.0	0.0	0.7	0.0
14-10-2018	0.4	2.7	0.2	0.2	1.3	0.2
21-10-2018	1.8	6.4	0.6	0.8	2.9	0.4
28-10-2018	4.3	8.5	1.1	2.1	5.0	0.9
03-11-2018	5.7	10.6	2.1	3.0	5.3	1.6
10-11-2018	6.2	11.8	3.5	3.2	5.8	2.9
17-11-2018	5.1	7.5	1.8	2.6	3.2	1.3
24-11-2018	3.5	3.1	0.9	1.9	1.4	0.7
01-12-2018	0.4	0.2	0.4	0.1	0.1	0.3
8-12-2018	0.0	0.0	0.0	0.0	0.0	0.0

Table2 -Extent of damage in pigeon pea due to major insect-pests

Sr. No.	Insect-pests	Pod damage (%)	
		Manak	Paras
1	<i>Helicoverpa armigera</i>	27.3	18.0
2	<i>Maruca vitrata</i>	22.7	13.6
3	<i>Clavigralla gibbosa</i>	10.7	8.6

4. DISCUSSION

4.1 Seasonal incidence and varietal comparison

The two pigeonpea cultivars (Manak and Paras) were counted weekly and revealed that all the four pests started to appear in early October and peaked their maximum level in mid-November (50-70 days after sowing, at podding). As an example, the first appearance of *Helicoverpa armigera* larva was noted in the 2nd week of October (0.4 and 0.2 larvae/3 plants on Manak and Paras) and rose to its highest level on 10th November, 2018 (6.2 on Manak vs. 3.2 on Paras). Likewise, *Maruca vitrata* webs had been initially observed at the beginning of October (~0.7 -0.9 webs/plant) and were highest in the week of 10th November (11.8 on Manak vs. 5.8 on Paras). *Clavigralla gibbosa* (pod-bug) nymphs and adults emerged during mid-October and were highest at this time ~10 Nov (3.5 bugs/plant on Manak vs. 2.9 on Paras). Therefore, there were common seasonal trends in all the pests with the greatest activity during the early pod-filling stage. This is consistent with established phenology: the largest pod-borers, such as *H. armigera* and *M. vitrata*, usually attack pigeonpea during flowering-podding and peak at the time of crop maturity (Sharma, 1998; Lal and Yadava, 2006; Chakravarthy and Shanower, 1999). As an example, *H. armigera* was maximum in December (when pods are mature), and *Maruca* is frequent on young pods (Ugale et al., 2024). It has also been known that populations of *Clavigralla* accumulate at flowering and pod stages (Bindra, 1968; Lal and Yadava, 2006). Blister beetles have a peak in flowering (August-September) and a decline in podding (Sachan and Lal, 1990); our relative low counts of *M. pustulata* (maximum of 1.4 in Oct/Nov) could be because of an earlier peak that we missed. It is worth noting that even though Paras had a relatively short duration of crop life, it was always less preferred by pests compared to the longer duration Manak. Mean counts of larvae (October-November) of Manak were approximately twice those of Paras (e.g., 2.7 vs. 1.4 *H. armigera*/3 plants; 5.2 vs. 2.6 *Maruca* webs/plant; table 1). An analysis of the represented counts of each pest confirms that the count of each pest was significantly greater on Manak ($p < 0.01$ of all four, paired by date). This difference in the genotype of pigeonpea concurs with reports that pigeonpea genotypes differ in pest susceptibility (Sharma et al., 2003; Srinivasan et al., 2008). An example is recent trials that were able to detect pigeonpea lines that had extremely low levels of pod-borers (0.4-0.5 larvae/plant) (Srinivasan et al., 2008). Breeders observe that short-duration types (such as Paras) are not caught by peak pest pressure or are more beneficial to natural enemies when intercropped (Sharma et al., 2003). Not only did Paras produce fewer counts of insects on our data, but it also had less damage to the pods. Assessment of final (Table 2) revealed that *H. armigera* inflicted 27.3% damage on pods in Manak and only 18.0% in Paras; *Maruca* inflicted 22.7% damage on pods in Manak and 13.6% in Paras; *Clavigralla* inflicted 10.7% damage on pods in Manak and 8.6% in Paras. Therefore, Paras was much less damaged.

4.2 Pest impact and thresholds

The data of the damage are indicative of known severity of pests *H. armigera* is usually the worst pigeonpea pest with the ability to damage yields heavily (Sharma, 2005; Lal and Yadava, 2006). Indicatively, Sharma (2000) and others note that in *Maruca* up to ~68 percent of the yield loss occurs in early maturing pigeonpea, and in *H. armigera* up to 70-80 per cent of the loss occurs (Sharma, 2000; Reed et al., 1989). *H. armigera* did succumb to the highest pod damage in our trial with *Maruca* and *Clavigralla* coming second and third,

respectively. These losses were very large and this illustrates the significance of control in time. Current IPM protocols provide the following economic variables: *H. armigera* - an approximation of 1 larva per plant or 2 eggs on flowering (=5% pod damage); *M. vitrata* - approximately 1 web per plant; *M. obtusa* (pod fly) - an approximation of 2.5% pods infested; pod-bugs (*Clavigralla* etc.) - an approximation of 2 bugs/plant (ICAR, 2013; Sharma, 2005). Our study also superseded these limits by the maximum: e.g., the *H. armigera* of Manak was approximately 2.1 larvae/plant (6.2/3 plants), a lot higher than the ETL of 0.5-1/plant. Paras had never been above that ETL of about 1.1/plant. To *Maruca*, 11.8 webs/plant of Manak were way beyond 1 web threshold. *Clavigralla* on Manak reached 3.5 bugs/plant which is above 2/plant threshold.

4.3 Interpretation and agronomic context

Such outcomes indicate that the Paras variety possesses partial tolerance or escape which mitigates the pest accumulation. The short-duration or determinate varieties such as Paras flower and set pods within a shorter window and may not be subject to the pest optimum and may favour helpful insects (Sharma et al., 2003; Srinivasan et al., 2008). Manak (longer-duration) stayed in the field longer and had more pest loads by contrast. The same trends have been observed in other varietal experiments (Lal and Yadava, 2006). Agronomic aspects are also important. Pest phenology is affected by the date of planting, weather, and the availability of the host (Reed et al., 1989; Sharma, 2005). Pigeonpea flowers/ pods in north India in September-onwards. Our mid-October & mid-November pest epidemic coincides with optimum egg-laying and larval growth. Pest timing would also change in case of planting or maturity change. As an example, intercropping or border-cropping with non-hosts such as sorghum has been demonstrated to reduce *Maruca* (by reducing the number of webs, approximately by 60% and increasing the populations of predators) (Srinivasan et al., 2008). Similarly, natural enemies (egg parasitoid *Trichogramma* and predators) may also have major impacts on pest success, particularly in short-term systems (Sharma, 2005).

5. CONCLUSION

The experiment indicated that significant insect pests of pigeonpea were observed in early October and the population was at its peak in mid-November. The pests that were recorded causing the greatest damage were *Helicoverpa armigera* then *Maruca vitrata* and *Clavigralla gibbosa*. The variety Paras had relative fewer insect pests and some of the pods were not as damaged as in Manak. As such, development of the tolerant varieties as well as routine pest surveillance and application of the integrated pest management schemes can reduce the losses of crops in pigeonpea.

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