Seasonal incidence and abundance of pod borers and natural enemies in pigeonpea

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ABSTRACT

Pigeonpea {*Cajanus cajan* (L) Millsp} is a vital pulse crop in India, contributing significantly to food and nutritional security. However, its productivity is severely constrained by pod borer infestations, which can cause substantial yield losses. A field experiment was conducted during kharif 2018 at the College of Agriculture, Pune, Maharashtra, to study the seasonal incidence of major pod borers and their natural enemies. Four key pod borers, *Maruca vitrata*, *Exelastis atomosa*, *Helicoverpa armigera* and *Melanagromyza obtusa*, were recorded at different crop stages. *M vitrata* was prevalent during flowering and early pod formation, while *H armigera* and *E atomosa* peaked during the pod development stage. *M obtusa* incidence extended up to pod maturity. Among these, *H armigera* inflicted the highest pod damage (7.60-12.40%), followed by *E atomosa* (2.40-10.20%), *M vitrata* (4.00-6.90%) and *M obtusa* (1.20-6.60%). Natural enemies, including coccinellids, chrysopids and spiders, were active throughout the crop growth period, with peak populations coinciding with higher pest densities. The findings highlight the importance of monitoring seasonal pest dynamics and conserving natural enemies to develop effective and eco-friendly management strategies for pigeonpea production.

Keywords: Pigeonpea; pod borers; seasonal incidence; pod damage; natural enemies

INTRODUCTION

Pigeonpea {*Cajanus cajan* (L) Millsp} is the sixth most important edible legume crop in the world. Commonly known as pigeonpea, it is valued for its adaptability, fast growth and resilience to drought, thanks to its deep and extensive root system (Abebe 2022, Murali et al 2025).

India is the world's largest producer of pigeonpea, harvesting 4.34 million tonnes from 5.05 million hectares during 2023-24, with an average productivity of 859 kg per hectare (Anon 2024).

Within the country, Maharashtra contributed the largest share of production in 2022-23 (27.94%), followed by Karnataka (25.83%) and Uttar Pradesh (10.98%) (Anon 2023).

Despite its importance, pigeonpea productivity is often constrained by several factors, among which insect pests play a major role. They are considered the most serious biotic stress limiting yields. Although more than 250 insect species are known to feed on pigeonpea, only a handful consistently cause significant damage and yield losses (Khamoriya et al 2017). Pigeonpea harbours a large number of pests, some of which may assume serious proportions particularly during reproductive stage of the crop (Reed et al 1981, Durairaj 2006). Major constraint in the production of pigeonpea is the damage caused by pod borers with avoidable losses extending up to 78 per cent in India (Lateef and Reed 1983).

The current study was conducted to find out the pest status, seasonal incidence of major pod borer pests and occurrence of natural enemies on pigeonpea.

MATERIAL and METHODS

An experiment on the seasonal incidence of borer pests infesting pigeonpea was conducted under field conditions at the research farm of the Agricultural Entomology Section, College of Agriculture, Pune, Maharashtra, during kharif 2018. The study aimed to assess the occurrence and infestation levels of pests under natural field conditions. Pigeonpea plots measuring 10 m × 10 m were maintained in three replications. Seeds of pigeonpea variety Vipula were procured from the All India Coordinated Pulses Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri, District Ahmednagar, Maharashtra. The crop was sown on 9 July 2018 using the dibbling method at a spacing of 90 cm (row-to-row) × 20 cm (plant-to-plant). All recommended agronomic practices, except pesticide application, were followed to ensure a healthy crop.

The incidence of tissue borers was recorded during both the vegetative and pod-filling stages. Observations on larval population were taken from 10 randomly selected plants in each replication. For pod borer infestation, data were collected weekly from bud initiation to final harvest by counting healthy and infested pods. Mature pods were also examined after harvest and those showing characteristic holes plugged with larval excreta were classified as damaged. The percentage of pod infestation was calculated by separating and counting healthy and damaged pods.

In addition, while recording the seasonal incidence of pests, the populations of major natural enemies such as coccinellids, chrysopids and spiders were also monitored from the same 10 randomly selected plants in each replication throughout the crop growth period.

RESULTS and DISCUSSION

The incidence of *Maruca vitrata* (Geyer), *Exelastis atomosa* (Walsingham), *Helicoverpa armigera* (Hubner) and *Melanagromyza obtusa* (Malloch) in terms of larval population and pod damage was recorded during the crop season and the data are presented in Table 1.

***M vitrata*:** In case of incidence of spotted pod borer, *M vitrata* occurred initially in 36th meteorological week (MW) ie 8 weeks after sowing of pigeonpea seeds and went on increasing up to 5th week of October (43rd MW). The average larval population of *M vitrata* per plant ranged between 1.2 and 2.8 from 36th to 43rd MWs. Peak infestation (2.8 larvae/plant) was recorded in the 43rd MW (5th week of October). The larval population was observed relatively higher (2.2 and 2.8 larvae/plant) during 42nd and 43rd MWs respectively than rest of the crop period. Minimum larval population (1.2 larvae/plant) was recorded during 36th and 40th MWs. The pod damage due to *M vitrata* was registered from 39th MW (first week of October). It ranged from 4.00 to 6.90 per cent during 39th to 43rd MWs. The damage was maximum (6.90%) in 43rd MW (5th week of October) and minimum (4.00%) in 39th MW (first week of October). Thus the pod damage due to *M vitrata* went on increasing in the pod development stage of the crop, while it was not observed at pod maturity stage.

***E atomosa*:** The plume moth, *E atomosa* population recorded in various MWs ranged from 2.0 to 6.0 larvae per plant. It was first noticed in 37th MW (third week of September) and peak population (6.0 larvae/plant) was recorded during 46th MW (third week of November). The incidence was observed relatively higher (4.0 to 6.0 larvae/plant) during 42nd to 46th MWs than rest of the crop period. The pest incidence was minimum (2.0 larvae/plant) in 37th MW. The larval population was initially observed low (2.0 to 3.4/ plant) for four weeks (37th to 40th MWs), which increased gradually during pod filling stage of the crop till 46th MW. The pod damage due to *E atomosa* was noticed from 42nd MW (fourth week of October). It ranged from 2.40 to 10.20 per cent during 42nd to 49th MWs. It was maximum (10.20%) in 46th MW (third week of November) and minimum (2.40%) in 42nd MW. It indicates that the pod damage due to *E atomosa* went on increasing in pod development stage of the crop, but it declined with the maturity of pods.

***H armigera*:** The seasonal incidence of gram pod borer, *H armigera* was noticed first in 38th MW in September, 10 weeks after sowing of pigeonpea seeds, which went on increasing up to 3rd week of November (46th MW) and then declined gradually. The average population of gram pod borer ranged from 1.4 to 4.0 larvae per plant from 38th to 48th MWs. Peak infestation of the pest (4.0 larvae/plant) was noticed in the 46th MW. The pest population was comparatively higher from 3.0 to 4.0 larvae per plant (40th to 47th MWs) and minimum (1.4 larvae/plant) in 48th MW. The pod damage due to gram pod borer was recorded minimum (7.60%) during 41st MW (3rd week of October). It

Table 1. Seasonal incidence of pod borer species in pigeonpea (mean of 10 plants)

Month/week	MW	*M vitrata*		*E atomosa*		*H armigera*		*M obtusa*	
		Mean larval population /plant	Pod damage (%)	Mean larval population /plant	Pod damage (%)	Mean larval population /plant	Pod damage (%)	Mean larval population /plant	Pod damage (%)
July 2018									
II	28	0	0	0	0	0	0	0	0
III	29	0	0	0	0	0	0	0	0
IV	30	0	0	0	0	0	0	0	0
August 2018									
I	31	0	0	0	0	0	0	0	0
II	32	0	0	0	0	0	0	0	0
III	33	0	0	0	0	0	0	0	0
IV	34	0	0	0	0	0	0	0	0
September 2018									
I	35	0	0	0	0	0	0	0	0
II	36	1.2	0	0	0	0	0	0	0
III	37	1.6	0	2.0	0	0	0	0	0
IV	38	1.7	0	2.9	0	2.6	0	0	0
October 2018									
I	39	1.8	4.00	3.4	0	2.8	0	0	0
II	40	1.2	5.10	3.0	0	3.0	0	0	0
III	41	1.6	5.70	3.6	0	3.2	7.60	0	0
IV	42	2.2	6.20	4.0	2.40	3.4	8.40	2.6	0
V	43	2.8	6.90	4.4	6.00	3.0	8.20	3.0	0
November 2018									
I	44	0	0	5.0	8.00	3.2	9.10	4.0	0
II	45	0	0	5.5	8.40	3.1	9.30	4.6	1.20
III	46	0	0	6.0	10.20	4.0	12.40	4.9	2.40
IV	47	0	0	0	8.60	3.6	11.40	5.0	6.60
December 2018									
I	48	0	0	0	9.00	1.4	12.20	2.0	2.60
II	49	0	0	0	8.30	0	8.10	0	3.10

MW = Meteorological week

increased gradually and reached at its peak (12.40%) in 46th MW. Thereafter, the damage decreased and reached 8.10 per cent in 49th MW at the termination of the crop.

***M obtusa*:** The incidence of pod fly, *M obtusa* ranged from 2.0 to 5.0 maggots per plant during 42nd to 48th MWs. Peak population (5.0 maggots/plant) was observed during 47th MW (fourth week of November). The population was observed comparatively higher during 44th to 47th MWs (4.0 to 5.0 maggots/plant) than remaining MWs. Minimum population (2.0 maggots/plant) was recorded during 48th MW (first week of December). The pod damage due to *M obtusa* was noticed from 45th MW (second week of November). It ranged from 1.20 to 6.60 per cent during 45th to 49th MWs. It was maximum (6.60%) in 47th MW (fourth week of November) and minimum (1.20%) in 45th MW. Thus the pod damage due to *M obtusa* increased during pod development to pod maturity stage of the crop.

It is evident from the results that the incidence of pod borer complex of pigeonpea consisting of *M vitrata, E atomosa, H armigera* and *M obtusa* was recorded from flowering stage (36th, 37th, 38th and 42nd MWs respectively) till maturity of the crop except *M vitrata.* However, their period of occurrence and infestation varied according to the site of oviposition as well as feeding of larval stages of the respective

pests. The spotted pod borer, *M vitrata* was noticed during September-October (36th to 43rd MWs) as its infestation was restricted to flowering and pod formation stages of the crop.

The gram pod borer, *H armigera* (38th to 48th MWs) and plume moth, *E atomosa* (37th to 46th MWs) were recorded from second fortnight of September and continued up to harvest of the crop. The pod fly, *M obtusa* incidence was observed from 4th week of October (42nd MW) till first week of December (48th MW). Maximum larval population of gram pod borer (4.0/plant) and plume moth (6.0/plant) was recorded during 46th MW, while that of spotted pod borer (2.8/plant) and pod fly (5.0/plant) was recorded in 43rd and 47th MWs respectively. The infestation of gram pod borer, spotted pod borer, pod fly and plume moth was observed comparatively higher during pod development stage of the crop. Amongst these, pod borer, *H armigera* inflicted highest pod damage (7.60 to 12.40%), followed by *E atomosa* (2.40 to 10.20%) and *M vitrata* (4.00 to 6.90%), while least damage (1.20 to 6.60%) was recorded due to *M obtusa.*

H armigera, E atomosa and *M obtusa* incidence on pigeonpea ranged from 0.6 to 4.08, 0.19 to 3.87 and 1.84 to 3.20 larvae per quadrate respectively, in one generation. The maximum population of these pests was noticed during 45th, 49th and 50th SMWs respectively (Shinde et al 2017). The first appearance of pod fly, *M obtusa* was observed in the 42nd SMW with mean population of 0.10 maggot per plant and its population peaked in 45th SMW with mean population of 0.30 maggot per plant (Pandey et al 2016). Spotted pod borer (*M testulalis*) incidence started in the 39th SMW on pigeonpea crop, while pod borer (*H armigera*), plume moth (*E atomosa*) and Tur pod fly (*M obtusa*) commenced during 32nd, 40th and 41st SMWs respectively (Rathore et al 2017).

The results related to seasonal abundance of natural enemies viz coccinellids, lady bird beetles, *Coccinella septempunctata* L and *Cheilominus sexmaculatus* Fabricius; chrysopid, *Chrysoperla zastrowi sillemi* (Esben-Peterson) and spiders, yellow sac spider, *Chiracanthium inclusum* (Hentz) and web weaving spider, *Argiope anasuja* (Thorell) are presented in Table 2.

Data depict that occurrence of lady bird beetle was observed from 42nd MW up to harvest of the crop. The average predator's population ranged from 0.3 to 2.1 coccinellids per plant. Highest population of the coccinellids (2.1/plant) was noted in 49th MW (second week of December). The average population of chrysopids ranged from 0.2 to 1.3 per plant during 38th to 49th MWs. Maximum population of the chrysopids (1.3/plant) was recorded during 46th MW and minimum (0.2/plant) in 38th MW. The population of predatory spiders ranged from 0.4 to 1.6 spiders per plant during 38th to 49th MWs. Their highest population (1.6 spiders/plant) was observed in 46th MW and minimum (0.4 spiders/plant) in 38th MW. The coccinellids, chrysopids and spiders recorded in the current investigations are the general entomophagous predators feeding on immature stages of various pod borers of pigeonpea.

Pawar et al (2014) reported that the natural enemies, lady bird beetle and parasitic wasp, *Cotesia* sp remained active from vegetative to reproductive stage of the crop. Jalondhara (2015) observed the population of spiders, coccinellids and chrysopids from 7th to 17th, 14th to 19th and 11th and 17th weeks respectively after sowing of the pigeonpea crop. Khajuria et al (2015) stated that pigeonpea crop harbours many predators including lady bird beetles, ants, praying mantids, spiders, green lacewing etc. Thus these observations made by the earlier workers support the findings of the current investigations. However, there was noticeable deviation in the incidence of pest population in the present study, which might be due to location specific conditions like cropping pattern, occurrence of the insect species, crop season and variety that could have influenced the abundance of natural enemies population.

CONCLUSION

The present investigations revealed that pigeonpea is attacked by a complex of pod borers, with incidence patterns varying according to crop stage. *Helicoverpa armigera* emerged as the most destructive species, followed by *Exelastis atomosa*, *Maruca vitrata* and *Melanagromyza obtusa*. The infestation was generally higher during the pod development stage, making it a critical phase for pest management. Natural enemies such as coccinellids, chrysopids and spiders were consistently present and showed peaks corresponding with pest abundance, underscoring their potential role in natural suppression. Thus location-specific monitoring of pest-predator dynamics, coupled with conservation of natural enemies, can form the basis of sustainable and integrated pest management strategies in pigeonpea.

Table 2. Occurrence of natural enemies on pigeonpea

Month/week	Meteorological week	Average population of natural enemies/plant (mean of 10 plants)		
		Coccinellids	Chrysopids	Spiders
July 2018				
II	28	0	0	0
III	29	0	0	0
IV	30	0	0	0
August 2018	31	0	0	0
I				
II	32	0	0	0
III	33	0	0	0
IV	34	0	0	0
September 2018	35	0	0	0
I				
II	36	0	0	0
III	37	0	0	0
IV	38	0	0.2	0.4
October 2018				
I	39	0	0.6	0.6
II	40	0	0.4	0.9
III	41	0	0.7	1.0
IV	42	0.3	0.5	1.1
V	43	0.8	0.8	1.3
November 2018				
I	44	1.1	1.0	1.4
II	45	1.5	1.2	1.1
III	46	1.0	1.3	1.6
IV	47	1.6	1.1	0.9
December 201				
I	48	1.9	0.7	0.8
II	49	2.1	0.3	0.7

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