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Management of Pod Borer *(Helicoverpa Armigera)* in Pigeon Pea Cajanus Cajan

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ABSTRACT

Data collected from replication sites and processed, it has been revealed that treatment T_2 i.e. installation of H. armigera pheromone traps @ 10 traps / ha unable to manage the H.armigera population. Traps are source of monitoring .There was a big challenge for the researcher to enhance the yield of pigeon pea because H. armigera is a cosmopolitan & poly phagou in nature. Caring a research at farmer's field is also a big task because most of farmers are marginal in nature and their lands are not suitable for growing pigeon pea in Sheohar district of Bihar. Among other treatments, T_4 i.e. Spraying of Profenophos 50% EC @ 2ml/L water after 25% of pod stage and second spray after 15 days with Indoxacarb14.5% SC @ 0.3 ml/L water showed better results over other treatments. A minimum number of damaged pods and shriveled grains have been recorded in treatment T_4 and yielded a maximum (20.18 q/ha). Analysis shows a significant difference over the check.T_4 i.e. Spraying of Profenophos 50% EC @ 2ml/L water after 25% of pod stage and second spray after 15 days with Indoxacarb14.5% SC @ 0.3 ml/L water is recommended for pod borer management in pigeon pea. Tunneling in Pods, the larval population in pods, caterpillar destroying buds, flowers, pods and reduction in yield was maximum in treatment T_1.

Keywords: *Helicoverpa armigera, Indoxacarb, Pheromone traps, Pigeon pea, Profenophos, Pod, Larva, Moth, Yield, Tunneling, Standard week*

INTRODUCTION

Pigeon pea is a major legume crop in the tropics and subtropics and accounts for 5 percent of world legume production [1]. Out of the world's total area of 2.8 million hectares under pigeon peas, India has about 2.5 million hectares under this crop. In terms of nutritive value Carbohydrate 57.60%, Calcium73mg/100g, Phosphorus 304mg/100g Protein 22.3% Iron 508mg/100g, Fat 1.7%, Minerals 3.5%, Fiber 1.5%

Among pests, gram pod borer, *H. armigera* is one of the most dreaded insect pests in agriculture, accounting for the consumption of over 30 per cent to the total insecticide use worldwide. Frequent and rapid changes in cropping patterns and agro ecosystems, the polyphagous nature of the pest, and its cosmopolitan abundance have multiplied the problem by manifolds globally. The problems of this pest are magnified due to its direct attack on fruiting structures, its voracious feeding habits, its high mobility, and fecundity; it's multivoltine, overlapping generations with facultative diapauses, its nocturnal behavior, migration and propensity for acquiring resistance against insecticides [2]. The other lepidopteron borer viz., spotted pod borer, plume moth, pod fly, and blue butterflies are also potential pests causing heavy losses which may range up to 20 - 30 percent.

Pigeon pea (Arhar) is also known as red gram or tur.It is an important pulse crop after gram in India. It is mainly eaten in the form of a deal. Pulse is also known as poor men's meat because it is rich in iodine, iron essential amino acids, protein, fat, minerals, fiber, and carbohydrate. India ranked first in area & production in the world. More than 80% of tur production comes from 6 states of Maharashtra, MP, Karnataka, UP, Gujarat and Jharkhand. Maharashtra is the largest producer of tur daal the principal source of protein in a vegetarian diet in India. The state produces 28% of the national output. The net per capita per day availability of pulses has decreased from 61 gm to 32 gm from 1951 to 2010, with decreased production there has been an imbalance in demand and supply resulting in soaring import bills, unpredictable price rises and low net profit compared to competing crops. Bihar contributes about 3.06 percent in production and 2.35 percent in area. Pigeon pea is one of the most preferred pulses consumed in Bihar but the area and production have been reduced to 21.9 thousand ha and 36.5 tons respectively in 2013-14 which was in 1965-66 172 thousand ha and production of 147.8 thousand tones. In Bihar traditionally long duration varieties (>200 days) of pigeon pea are grown which are highly photoperiod-sensitive taking about 40 weeks to mature exposes in the crop to terminal drought stress and frosts. Almost every year the crop is damaged by frost leading to lower yields and poor quality seeds. There is a need to identify sources of tolerance/ resistance for this constraint and design appropriate breeding strategies to develop suitable varieties. Besides a number of biotic and abiotic factors also deter farmers to take up pigeon pea cultivation. The ability of red gram to produce high economic yields under soil moisture deficit makes it an important crop in rained and dry land

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agriculture. World's major red gram-producing countries are India (37.50 lakh tones), Myanmar (6.76 lakh tones), Malawi (4.34 lakh tones), Tanzania (3.15 lakh tones), and Haiti (0.87 lakh tones)

MATERIALS AND METHODS

During on-farm trial, fields were selected in five different locations with an area of 0.1ha in each village i.e. MadhopurAnant, PavitraNager, Shahpur, Pardesiya, Tajpur of Sheohar block of Sheohar district of Bihar. Seeds of red gram Rajendra arhar have been supplied to the selected farmers of the above villages. Seeds were given for the September sowing of red gram. The experiments were designed for RBD with four treatments and five replications. Farmers' practice was treated as a check. All the recommended packages and practices were followed for the cultivation of red gram with recommended RDF, Farmers were given Pheromone traps with *Helicoverpa Armigera* lure, in treatment T2 installation of *Helicoverpa Armigera lure* pheromone traps @ 10 traps/ ha, T3:Spraying of emamectin benzoate 5% SG @ 1.5 g / L water+ Cypermethrin 25 EC @ 1.5 ml / L water at the time of flower initiation, T4: Spraying of profenophos 50% EC @ 2ml/L water after 25% of pod stage and spray after 15 days with indoxacarb 14.5% SC @ 0.3 ml/L water, T5 Spraying of bio-pesticide(Bt @ 5g/ L water with 0.5% jiggery. The experiments were carried out for two years i.e. .2019-2020 and 2020-2021 at the same selected farmer's fields. The data were recorded from selected fields and processed for analysis of variance.

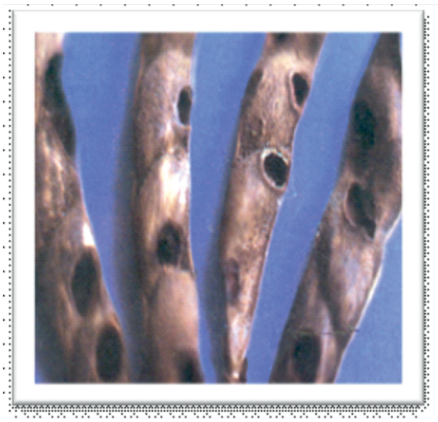
Gram pod borer: *Helicoverpa armigera*

Symptoms of damage

Defoliation in the early stages

Larva's head alone thrust inside the pod and the rest of the body hanging out.

Pods with round holes



Boreholes on the pod

Damaged pod

Larva feeding the pod

Identification of pest

Eggs – are spherical in shape and creamy white in color, laid singly

Larva - shows color variation from greenish to brown. Green with dark brown-grey lines laterally on the body with lateral white lines and also has dark and pale bands.

Pupa – brown in color, occurs in soil, leaf, pod, and crop debris

Adult - light pale brownish yellow stout moth. Fore wing grey to pale brown with V-shaped speck. Hind wings are pale smoky white with a broad blackish outer margin.

Table 1: Economics of cost-benefit ratio of the management aspect of pod borer in pigeon pea

Technological option	Yield (q/ha)	Percent increase	Gross Cost (Rs./ha)	Gross Return (Rs/ha)	BC ratio
FP : NPK@18:46:0 kg/ha					
To_1: Farmers Practice: Improper use of insecticide	9.07	-	33436	57141	1.70
To_2 : Installation of *Helicoverpa Armigera lure* pheromone traps @ 10 traps/ ha	14.26	57.22	37590	89838	2.38
To_3 : Spraying of Emamectin benzoate 5% SG @ 1.5 g/ L water+ Cypermethrin 25 EC @ 1.5 ml / L water at the time of flower initiation	15.44	70.23	37602	97272	2.58
To_4 : Spraying of Profenophos 50% EC @ 2ml/L water after 25% of pod stage and spray after 15 days with Indoxacarb 14.5% SC @ 0.3 ml/L water	20.18	122.49	43280	127134	2.93
To_5: Spraying of bio-pesticide(Bt @ 5g/ L water with 0.5% jiggery)	14.92	64.49	38990	93996	2.41

Table 2: Effect of different intervention on the management of pod borer in pigeon pea

Treatments	No. of tunneling in pods/ plant	Chaffy & shriveled grains / plant	Yield (q/ ha)	Pest incidence level (0-5 scale)
To_1	63.60	65.60	9.07	5
To_2	58.80	57.80	14.26	5
To_3	52.80	49.40	15.44	3
To_4	40.40	31.20	20.18	2
To_5	40.40	31.20	20.18	2
CD at 5%	**7.64**	**5.88**	**2.02**	

Table 2a: Effect of different intervention during the year 2019-20 on the management of pod borer in pigeon pea

Treatments	No. of tunneling in pods/ plant	Chaffy & shriveled grains / plant	Yield (q/ ha)	Pest incidence level (0-5 scale)
	2019-20	**2019-20**	**2019-20**	**2019-20**
TO_1	63	67	9.1	5
TO_2	57	57	14.32	5
TO_3	52	47	15.2	4
TO_4	41	29	20.11	3
TO_5	38	31	20.26	2

Table 2b: Effect of different interventions during the year 2020-21 on the management of pod borer in pigeon pea

Treatments	No. of tunneling in pods/plant	Chaffy & shriveled grains / plant	Yield (q/ ha)	Pest incidence level (0-5 scale)
	2020-21	**2020-21**	**2020-21**	**2020-21**
TO_1	65	65	9.04	5
TO_2	60	59	14.2	5
TO_3	54	51	15.68	2
TO_4	39	32	20.25	1
TO_5	42	30	20.1	2

Fig.02 Effect of different intervention on the management of pod borer in pigeon pea

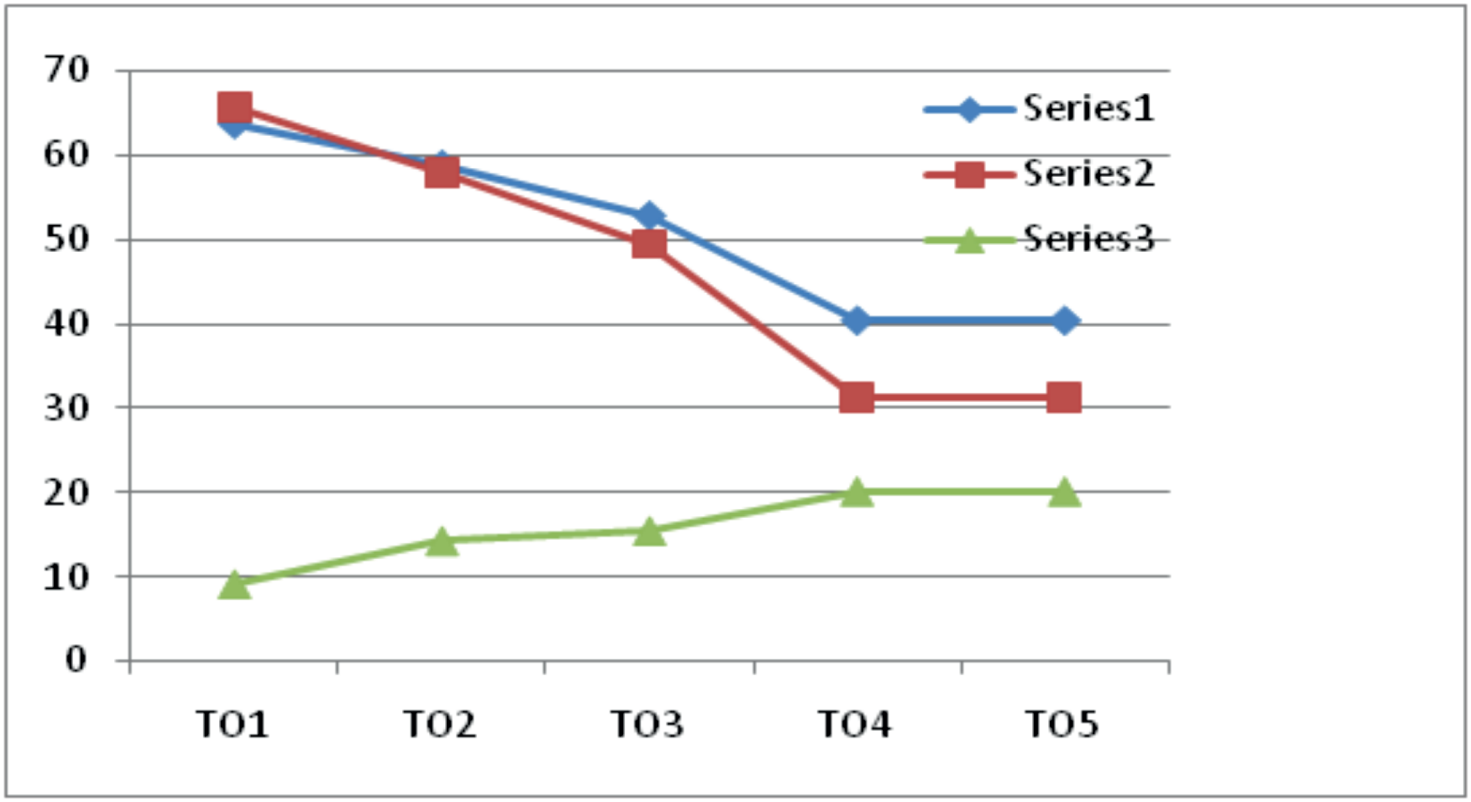


Table.3 Effect of different treatments on the management of pod borer & yield of pigeon pea

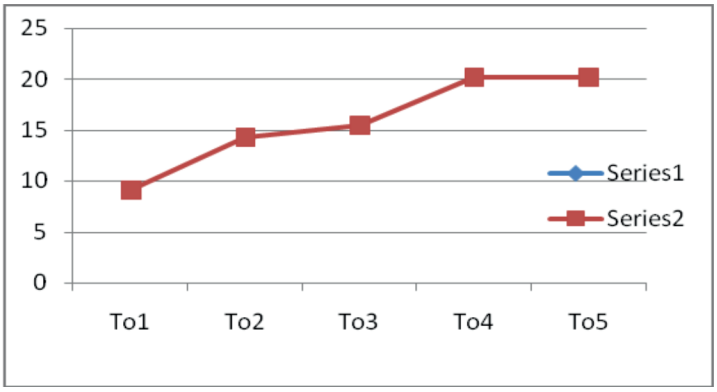
Intervention	No. of tunneling in pods/ plant	Chaffy & shriveled grains / plant	Yield (q/ ha)
TO_1	63.6	65.6	9.07

TO_2	58.8	57.8	14.26
TO_3	52.8	49.4	15.44
TO_4	40.4	31.2	20.18
TO_5	40.4	31.2	20.18

Table. 4 Effect of different treatments on the management of pod borer & yield of pigeon pea

Intervention	Yield q/ha
To_1	9.07
To_2	14.26
To_3	15.44
To_4	20.18
To_5	20.18

Fig.03 Effect of different treatments on the management of pod borer & yield of pigeon pea



RESULTS AND DISCUSSION

The population of gram pod borer, *H. armigera* was monitored using pheromone traps installed in the pigeon pea (Cv. Rajendra Arhar) field, five treatments were evaluated with five replications in Randomized Block Design starting from 1st standard week (bud initiation stage) to the 15th standard week (pod maturity stage). During 2019-20 the adult male moth activities were first noticed during 4th standard week (1.0 moth/ trap). The population rose gradually up to the 12th standard week (7.5 moths/ trap), then after it declined sharply. High moth populations were also recorded during 10th standard week (5.5 moths/ trap) and 11th standard week (6.0 moths/ trap). The average moth catches per standard week was worked out to be 2.9. Similar trend of adult moth population of *H. armigera* was also recorded during 2020-21. The peak population of moth catches was noticed in the 12th standard week (10 moths/ trap) followed by the 13th standard week (9 moths/ trap) and 11th standard week (8 moths/ trap). findings of [3] who reported that the activity of *H. armigera* moth was present in good number during the entire month of March and the first fortnight of April at Faizabad in Uttar Pradesh, thereby suggesting that the management activities should be taken up during this period only. Similarly, [4] also found that the pheromone traps data showed clear-cut two periods of activity of *H. armigera* moths, first from 14th to 19th standard week in 2011 and second from 6th to 16th standard week in 2012. [5] Have also reported that pheromone trap catches are positively correlated with the number of eggs laid and the subsequent larval population in pigeon pea. Similarly, the relationship between pheromone trap catches and egg and larval counts of *H. armigera* have been worked out on short-duration pigeon pea.

Among the insect species infesting pigeon pea, the pod borer complex is reported to reduce the yield up to 27.77 per cent [6] and among the borers, gram pod borer (*Helicoverpa armigera* Hubner) is considered as most destructive. Thus, attempts were made in the present investigation to study the efficacy of certain insecticides and bio pesticides against *H. armigera*. Spraying of Profenophos 50% EC @ 2ml/L water after 25% of pod stage and second spray after 15 days with Indoxacarb14.5% SC @ 0.3 ml/L water showed better results over other treatments. Observations on pod borer larvae were recorded from five randomly selected plants from each treatment at one day before and 3, 7 and 10 days after spraying. The data was converted into percent mortality by using the following formula given by [7] and modified by [8]. Data collected from replication sites and processed, it has been revealed that treatment T_2 i.e. installation of *H. armigera* pheromone traps @ 10 traps /ha could not be able to manage *H. armigera* population it simply shows the occurrence. Spraying of Profenophos 50% EC @ 2ml/L water after 25% of pod stage and second spray after 15 days with Indoxacarb14.5% SC @ 0.3 ml/L water showed better result over other treatments. No of tunneling in pods was least i.e. 40.40 chaffy and shriveled grains per plant was also least i.e. 31.20 consequently yield was recorded maximum i.e. 20.18 q/hate percentage increase was 122.49 over the farmer's practice. The gross cost and gross return were 43280 and 127134 with B: C of 2.93. Statistical analysis of data shows significant differences over check. Tunneling in pods, larval population caterpillar destroying buds, flowers, pods and reduction in yield was maximum in treatments T_1 i.e. farmers practice

It was very evident that if pod borer is being managed, the production of pigeon pea will ultimately increase .Now a day's India imports pulse from other countries which ultimately reduces the foreign exchange of India. Hence, management of pod borer is very crucial for the production of pigeon pea. Farmers are reluctant for the cultivation of pulse crop due severe attack of this pest.pigeon pea is a long duration crop & it is nonsyncronus in flowering and poding hence there is congenial for multiplication of several generation of pest on pigeon pea.

This research work is essential as farmers are leaving cultivation due to severe attack of this pest

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