RESEARCH ARTICLE

SCREENING OF PIGEONPEA VARIETIES AGAINST POD FLY INFESTATION UNDER FIELD CONDITION IN NIMAR REGION

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Abstract: The present study indicates that pod fly under the condition of Khargone region had severely affected the pigeonpea crop. Pigeonpea pod fly was appeared late in crop season. Pigeonpea pod fly (*Melanagromyzaobtusa*) was identified at harvesting stage in different varieties. Highest pod damage in Pusa 16 (23.33%) and lowest damage in TJT- 501 (14.67%). Grain damage by Pod fly highest in Pusa 16 and lowest in TJT-501 and followed by JKM-189 (T_5), Rajeevlochan (T_6), Rajeshwari (T_4), GJP-1 (T_3), Pusa 992 (T_2), and Pusa 16 (T_1) last week of January 2021.

Keywords: Pigeonpea, Screening, Pod fly, *Melanagromyza obtusa*, Infestation

INTRODUCTION

Pigeonpea, *Cajanus cajan* (L.) Millsp is one of the most important legume crops of India. It belongs to the genus *Cajanus* of family Fabaceae and is commonly known as red gram, tur, arhar. It is an important legume food crop of the semi-arid tropical and sub-tropical farming systems under varied agro-ecological environments. Pigeonpea is the second most important pulse crop of India after chickpea. India is the largest producer and also the largest consumer of pulses in the world. Globally, the area and production of pigeonpea have increased from 4.43 million hectares (mha) and 3.16 million tonnes (mt) in 2002 to 5.32 mha and 4.32 mt in 2012, respectively. It accounts for 33 percent of the world areas and 25 percent share in global production.

Pandey (2017) observe that as many as 250 insect species have been recorded to attack pigeonpeaamong which the pod-borers and pod fly are the most damaging pests, inflicting considerable damage to the reproductive parts of the plant. The pigeonpeapod fly (*Melanagromyzaobtusa)* Malloch (Diptera: Agromyzidae) is found throughout south and central Asia. The main country suffering from its pestilence is India because of widespread pigeonpea cultivation (>90% of the world production). Females deposit eggs on the pigeonpeagreen pods and the developing larva initially feeds just under the epidermis of the seed like a leaf miner. Generally, pod yield losses due to this vary between 5-30 per cent during winter and spring from several countries.

Pod fly infested pods do not showexternal evidence of damage until the fully grown larvae chewholes in the pod walls. This hole provides an emergence"window" through which the adults exit the pod. To confrontagainst the attack of podfly, chemical insecticides have beenused injudiciously and thus have taken a part in degradingthe environmental stability (Chandler *et al.,* 2015). To tacklesuch problems, the utilization of host- plant resistance as thefirst line of defense is inevitable and should be exploited.Hence, the present experiment was conducted to identify thepigeonpeavarieties that can effectively control the pod flypopulation and damage in pigeonpea.

MATERIALS AND METHODS

The experimentwas carried out in the Instructional Farm, Zonal Agricultural Research Station Khargone, (under R.V.S.Krishi Vishwa Vidyalaya, Gwalior), Madhya Pradesh, during the *Kharif*season in the year 2020 -21.

The soil of the experimental plot was medium black with proper drainage. The organic matter and potash content were medium in availability. The pH 6.80and soluble soil nutrients were normal in range.The experimental field was ploughed well with the help of mould board plough after ploughing the tractor drawn cultivator was operated, followed by removal of crop residues and grasses from the field. The experimental field was prepared following the recommended package and practices for the crop. Provision was made for proper drainage by making the drainage channels in the field.In order to get uniform plant population gap filling and thinning operation were done after emergence of seedlings.

The details of the trial are given below:

Location	:	ZARS, Khargone (M.P.)
Design	:	Randomized Block Design (R.B.D.)
Replications	:	03
Treatments	:	07 (Varieties)

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Plant spacing : 75 cm x 20 cm
Time of Sowing : Last week of June 2020
Time of Germination : July first week 2020
Time of Harvesting : 23 Jan. to 10 Feb. 2021

Treat.no.	Varieties/ Treatment	Release year
1.	Pusa 16	2017
2.	Pusa 992	2007
3.	GJP-1	2015
4.	Rajeshwari	2007
5.	JKM-189	2007
6.	Rajeev Lochan	2011
7.	TJT-501	2008

Method of observation: Observation of pod fly from five plant of each variety at harvesting stage, fifty pods are collected to each plot were evaluated damaged by pod fly and their bases obtained pod damage, seed damage and yield of a particular varieties. The data obtained on the number of insects, percent pod damage and grain damage were transformed toarc sin transformed value.

Observations on pod damage at maturity

Pod damage at maturity of the crop was recorded from pods of 5 plants per plot at random in each plot. Fifty pods were picked out randomly from each plot at the time of harvest and the per cent pod damage and seed damage was calculated by the formula as given below.

$$\text{Per cent pod damage (\%)} = \frac{\text{Number of damaged pods} \times 100}{\text{Total number of pods}}$$

$$\text{Per cent grain damage (\%)} = \frac{\text{Number of damaged grains} \times 100}{\text{Total number of grains}}$$

Sample pods were examined for the damage of pod fly *M. obtuse.* The following criteria used by Yadav et al. (1988) were adopted.

1. Healthy clear pods without any external damage symptom.
2. Pods attacked by *M. obtusa* include dark brown encrustation on the pod wall.
3. Dry pods having small pin head size holes, seeds with stripes and are partially eaten.

Observations on grain yield

The grain yield of different treatments was obtained by harvesting the central rows after leaving the border rows on each side at maturity. After harvesting the grains were dried in open sunlight to stabilize the moisture content. The weight of grain of sample and plot was taken after this period. The total yield per plot included in the yield of sample grains and it was then computed on kg per ha basis.The data obtained on the number of insects, percent pod damage and grain damage were transformed toarc sin transformed value.

RESULTS AND DISCUSSION

The experimental results obtained during the course of investigation on "Field screening of pigeonpea varieties against the infestation of pod fly (*Melanagromyza obtusa*). The data obtained was statistically analyzed as per the statistical design adopted. The findings obtained were presented in Table 1.

Table 1. Percent damage of Pigeonpea pod fly, *Melanagromyzaobtusa* at harvesting stage
Mean percent pod damage, seed damage and yield by pod fly, *M. obtusa* on different varieties of pigeonpea

Treatment	Mean pod damage %	Mean seed damage %	Yield kg/ha
Pusa 16	23.33(2.79)	28.89(3.11)	1313
Pusa 992	21.33(2.66)	20.89(2.65)	1452
GJP-1	20.00(2.55)	14.22(2.19)	1653
Rajeshwari	18.67(2.49)	12.67(2.06)	1546
JKM-189	15.33(2.26)	10.89(1.90)	1645
Rajeev Lochan	16.67(2.37)	10.22(1.85)	1574
TJT-501	14.67(2.22)	9.33(1.77)	1837
SEm±	0.31	0.22	
CD at5%	0.95	0.67	
C.V. %	21.59	16.88	

Note: Figure in parenthesis are arc sin transformed value.

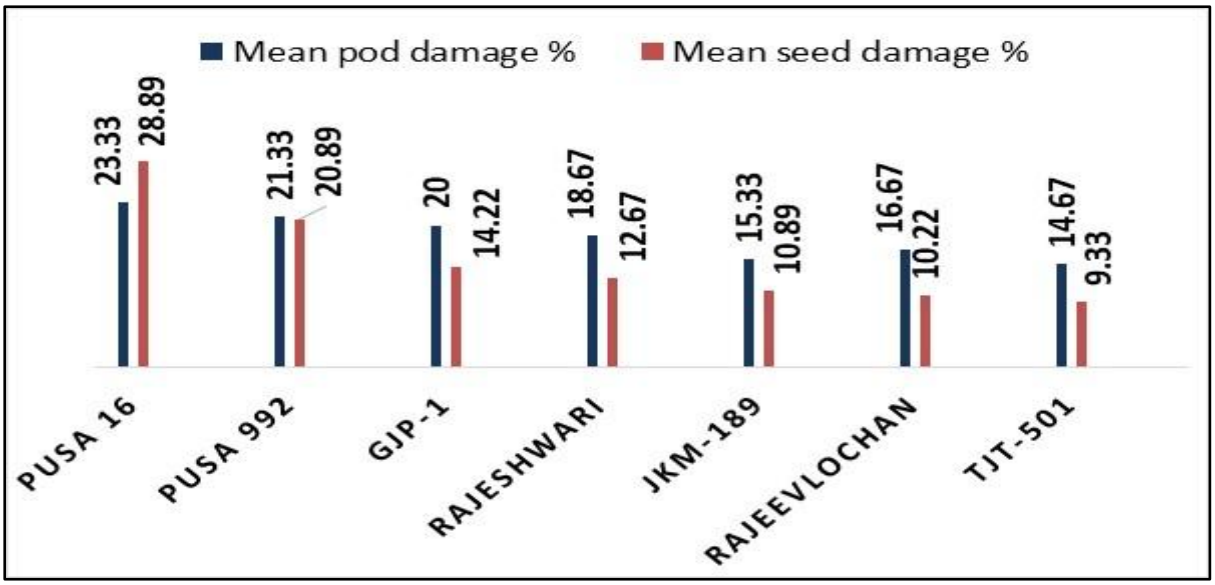

Fig. 1: Percent damage of *Melanagromyzaobtusa*

The data reveal that none of the variety was found free from incidence of pod fly damage. However, among all the varieties of pigeonpea, TJT - 501 recorded lower per cent pod damage due to pod fly (14.67%). The highest pod damage was recorded on variety Pusa 16(23.33%). The remaining varietiesRajeev Lochan, JKM-189, Rajeshwari, GJP-1 and Pusa 992 were found susceptible to pod fly with 16.67 to 21.33 per cent pod damage.

Seed damage per cent was highest in Pusa 16(28.89) and lowest in TJT-501. The other varieties were also damaged by pod fly. Similarly the highest grain yield was obtained in TJT-501 (T_7)and lowest in Pusa 16 (T_1).

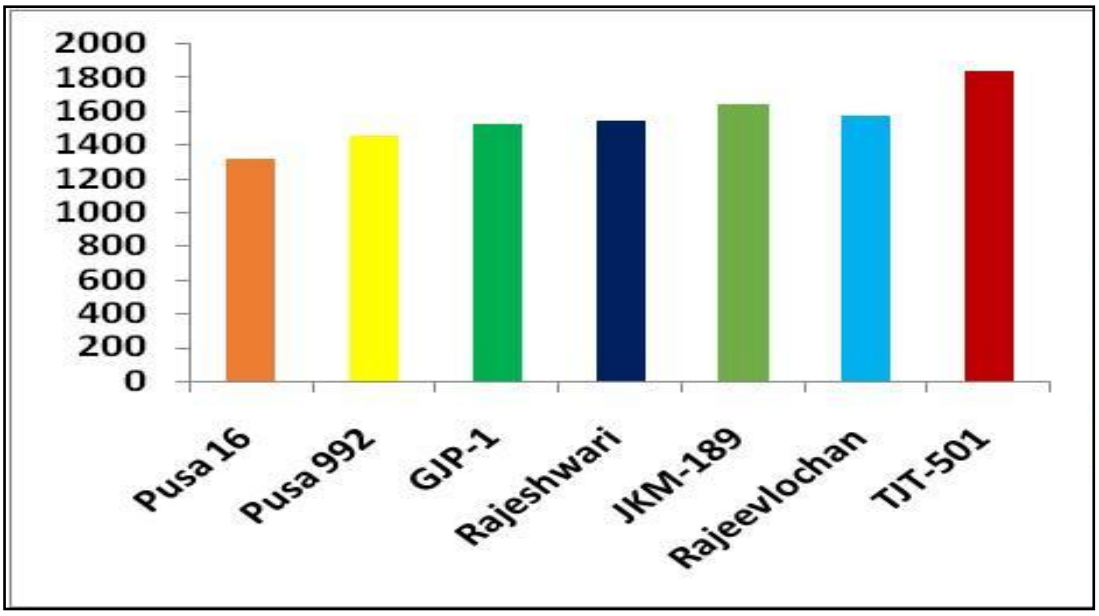

Fig 2. Yield of different treatments

Table 2. Mean pod damage of *Melanagromyzaobtusa*.

Treatment	Mean of pod damage
Pusa 16	11.67
Pusa 992	10.67
GJP-1	10.00
Rajeshwari	9.33
JKM-189	7.67
Rajeev Lochan	8.33
TJT-501	7.33

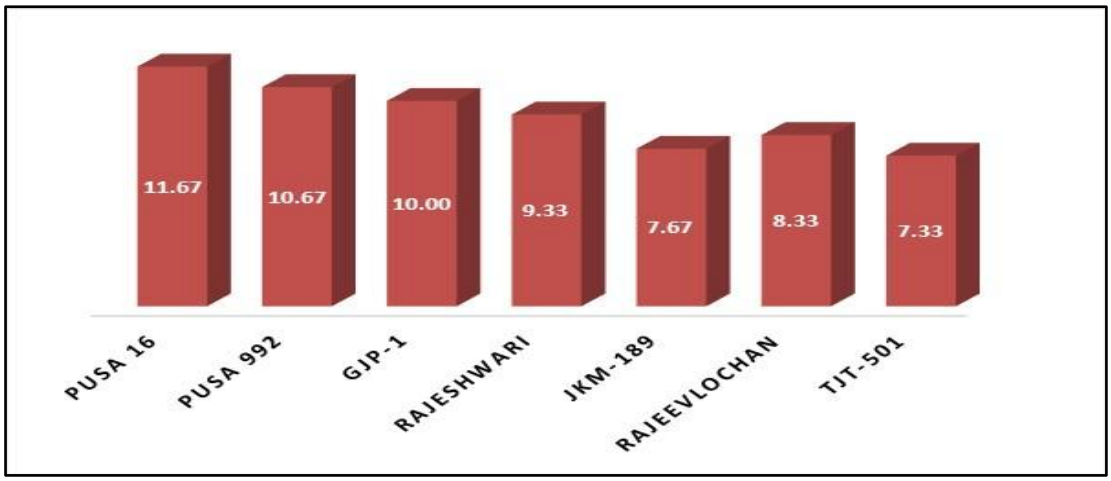

Fig 3. Mean pod damage of *Melanagromyzaobtusa*

Theidentification of pigeonpea genotypes which are resistant to insect pests would be of particular importance to most farmers in Kenya who are unable to access inputs like conventional pesticides. The study was therefore carried out byCheboi *et al.* (2016) to evaluate pigeonpea genotypes for resistance to insect pest complex in dry parts of North Rift Valley, Kenya. The genotypes showed different levels of resistance / susceptibility to the insect pest complex at different locations. Some genotypes showed tolerance to pod borer, but were highly susceptible to pod fly and sucking bug. This suggests that tolerance does not hold against other insect groups. The sites varied significantly in incidence and severity of the insect pests, with Marigat showing high incidence of pod borer and sucking bug, Koibatek incidence of pod fly andsucking bug while Fluorspar had incidence ofpod fly and pod borer. Three promisinggenotypes (ICEAPs 00902, 01541 and 1154-2)have been identified with potential of toleranceto insect pest complex across the three sites These sources of resistance canbe explored and used in breeding programs fordevelopment of resistant lines.

Rathod *etal.* (2014) observed the varieties of pigeonpea resistance against pod borers, and found that BSMR-853 was least susceptible (1.39 larvae/plant) and it was at par with variety AGT-2 (1.61 larvae/plant). The varieties ICPL-87119 was found highly susceptible with 5.63 larvae per plant. However, among all the varieties of pigeonpea, BSMR-853 recorded lower per cent pod damage due to pod borer (18.59 %) which was at par with AGT-2 (20.9 %). The highest pod damage was recorded on variety ICPL – 87119(36.56 %).in case of per cent seed damage, among all the varieties of pigeonpea, BSMR-853 recorded lower per cent seed damage due to pod fly (7.50 %) which was at par with AGT-2 (8.55 %). The highest pod damage was recorded on variety ICPL– 87119.

The experiment was conducted by Bantewad (2017) to screen twelve promising varieties of pigeonpea for their resistance/tolerance against pod borer complex under natural infestation in pesticides free open field condition. The population of *H. armigera*, *Marucavitrata* and *Melanagromyzaobtusa* were lowest population recorded on AKTE 12-02 which was equal with BDN 2014-1. In respect of grain damage due to pod borer the less grain damage was recorded in BDN 711(14.85 per cent) which was statistically at par with BDN 2014-1 (16.22 per cent) and followed by AKTE 12-02 and BDN 2011-1 (17.26 and 17.67 per cent), respectively.

Studied the pest marked its first appearance during 4th standard week and recorded highest mean maggot population in genotype ICPL 84060-1 (1.3 maggots /plant) followed by T-21 (1.2 maggots /plant), ICPHaRL 4979-2 (1.1 maggots /plant), Bahar (check) (1.0 maggots /plant) and lowest in genotype ICP 7035-1 andICPHaRL 4987-11 (0.2 maggots /plant) followed by genotype ICPHaRL 4989-7, ICPL 88039-1 and ICPX 77303 (0.3 maggots / plant) in the population dynamics study. The per cent pod damage and grain damage due to pod fly on different pigeonpea genotypes differed significantly and ranged from 19.5 per cent in genotype ICP 7035-1 to 54.0 per cent in genotype ICPL 84060-1 and 6.82 per cent in genotype ICP 7035-1 to 26.72 per cent in genotype ICPL 84060-1 respectively. Due to the adverse weather conditions, very low grain yields were recorded but they differed significantly and ranged from 105.6 kg/ha in the genotype ICPL 85063 to 338.9 kg/ha in ICP 7035-1. Genotype ICP 7035-1 performed best in comparison to other genotypes against pod fly infestation.

Badaya*etal*. (1990) conducted field experiments in Khargone, (M.P.). India.The losses due to *Heliothisarmigera* and *Melanagromyzaobtusa* in 12 medium maturing pigeonpeacultivars were assessed. *M.obtusa* causedleast grain damage (17.71%) and least loss of grain weight (19.31%) to the cultivars AKT-6 and AGS-498, resp. *H. armigera* caused least grain damage (19.30%) and least loss of grain weight (18.55%) in AGS-498 and MTH-11, resp. The least overall grain damage was recorded in AGS-498. Overall loss of

grain weight ranged from 33.96% in AKT-1 to 53.62% in AGS-498.

Kooner and Cheema (2006) observed on the basis of per cent pod damage and Pest Susceptibility Rating (PSR), that entries AL 1498, AL 1502 and AL 1340 were found promising with mean pod damage of 11.21 to 13.71% (PSR 3 - 3.50) as compared to 17.67 to 26.25% (PSR 4.00 to 5.50) on the check varieties (AL15, AL201 and T21) and 28.21% (PSR 6.00) on the Infester. Therefore, genotypes AL 1498, AL 1502 and AL 1340 may be used as resistant donors in the crossing programme to evolve pod borer resistant/ tolerant varieties of pigeonpea.

Six promising short duration pigeonpea genotypes were screened by Sunitha *etal.* (2008) for their reaction against *Marucavitrata* (Geyer) under field, greenhouse and laboratory conditions. Field and greenhouse experiments showed significantly lower pod damage by *Maruca* in ICPL 98003 and ICPL 98008 as compared to the susceptible genotype ICPL 88034. In addition, greenhouse and laboratory studies showed less consumption of food and reduced larval and pupal weights of *M. vitrata* when reared on resistant genotypes like ICPL 98003 and ICPL 98008.

CONCLUSIONS

The present study entitled "Field Screening of Pigeonpea Varieties against the Infestation of Pod fly (*Melanagromyzaobtusa*) in nimar region (M.P.) clearly indicates that pod fly under the condition of Khargone region had severely affected on pigeonpea crop. Among different pest, Pigeonpea pod fly was appeared in late in crop season.

Pigeonpea pod fly (*Melanagromyzaobtusa*) was identified at harvesting stage in different varieties. Highest pod damage observed in Pusa 16(23.33%) and lowest damage was recorded in TJT-501(14.67%). Seed damage per cent was highest in Pusa 16 (28.89) and lowest in TJT-501. The other varieties were also damaged by pod fly. Similarly, the highest grain yield was obtained in TJT-501 (T_7)and lowest in Pusa 16 (T_1).

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