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FIELD SCREENING AND EVALUATION OF LONG DURATION PIGEONPEA GENOTYPES AGAINST THE INFESTATION OF POD FLY (*MELANAGROMYZA OBTUSA* MALLOCH)

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ABSTRACT

Eighteen promising long duration pigeonpea genotypes were screened for theirreaction against pod fly at Agriculture research farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *kharif* 2013-14 and 2014-15. The results revealed that the incidence of pod fly was significantly highest in genotype IPA 7-10 (1.50 maggot / plant and 1.41 maggot /plant) and lowest in genotype KA 12-2(0.58 maggot/plant and 0.56 maggot/plant), respectively during both the years. The percent pod and grain damage were found significantly highest in genotype IPA 7-10(46.67% and 23.11%) and (45% and 20.96%)lowest pod and grain damage observed in genotype KA 12-2 (25.67% and 11.97%) and (21.33% and 10.07%) respectively, during both the years. The per cent pod damage and grain damage by pod fly in the genotypes screened was found that pod damage and grain damage of KA 12-2 had rating of 4 and 5 respectivelyon the scale during both the year which depicts it is least susceptiblethan local check, 'Bahar'. The grain yield was observed highest in genotype KA 12-2 (1960 kg/ha and 1785 kg/ha) respectively, during both year. This observation reveals that KA 12-2 is most resistant genotype having highest yield.

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INTRODUCTION

Pigeon pea (*Cajanus cajan*L. Mills.) is known by more than 350 dialect names, the crop ranks fourth in importance as edible legume in the world. It is the second most important pulse crop after chickpea in India (Das *et al.,* 2015). It is estimated that India imported about 4 million tonnes of pulses during 2012-13, and the production of Pigeon pea faced a decrease from 3.07 to 3.04 million tonnes during 2012-13 to 2013-14 with an import pressure of 0.33 million tonnes to meet the demand of 3.30 million tonnes (Anonymous, 2015). Pigeonpea production is affected by several biotic and abiotic stresses. Among biotic factors,the seeds and other parts of the plant are fed upon by many insects, withover 200 species having been recorded in India alone. Pod fly *Melanagromyza obtusa* is a widespread and major pest of pigeonpea in Asia. It has a narrow host range and only feeds on pigeonpea and closely related species. Pod fly infested pods do not show external evidence of damage until the fully grown larvae chew holes in the pod walls. This hole provides an emergence "window" through which the adults exit the pod.In a survey conducted by ICRISAT, Melanagromyza obtuse (Malloch) was reported to damage 22.5 per cent pigeon pea pods in north India, 21 per cent in central India and 13.2 per cent in South India (Lateef and Reed, 1981) Shanower *et al.*, 1998; Kumar and Nath 2003 observed that*Melanagromyza obtusa* causes damage to the extent of 24.6% from the pod filling to pod maturity stage particularly on late maturing varieties. The annual loss of pigeon pea production due to pod fly alone has been estimated to the extent of 25 to 30 per cent in U.P. (Lal and Yadav, 1987). Meena *et al.* (2010) reported that tur pod fly, *Mealanagromyza obtusa* is the major insect pest of long duration pigeon pea, especially in north and central India. Pradhan (1971) had very rightly advocated the concept that in agriculture the production technology is inextricably interwoven in the protection technology and therefore, the production technology cannot succeed unless there is adequate progress in protection technology. Much effort has been made to identify sources of resistant to the major pests, particularly to *Melanagromyza obtusa* (Malloch) and to incorporate these resistances in agronomically suitable cultivars. Therefore, keeping these views in mind, present study was conducted to evaluate the infestation of pod fly against different genotypes on long duration pigeonpea.

MATERIALS AND METHODS

The studies were carried out at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, during *kharif*, 2013-2014 and 2014-2015. The Eighteen long duration pigeonpea genotypes/varieties were grown in plots of 5 rows of 4 meters following row to row and plant to plant spacing of 75 cm and 15 cm respectively. The crop was grown following the normal agronomic practices in "Randomized Block Design" with three replications and eighteen treatments. The crop was shown on 26th July during 2013-14 and 1st August during 2014-15 and harvested on 7th April 2014 and 10th April 2015 respectively. The whole plot was exposed to natural infestation and no insecticides applied.For recording the seasonal incidence of pod fly, five plants were randomly selected in

each treatment and tagged.After the formation of seeds, the green pods from five plants were picked randomly at a weekly interval. This practice was continued throughout the pod formation stage. The weekly observation on the number of larvae and pupae in the sampled pods during both the years was taken from 24th January to 28thmarch. The number of insect count recorded from all the three replication for all the genotypes were average separately for each genotype on standard week basis.For determining the damage caused by pod fly, the per cent pod and grain damage by pod fly were considered and observed in the samples collected from all the replication of 18 genotypes/varieties of pigeon pea.

Pod Damage

The observation on pod damage was made by counting total number of pods taken for observation which is harvested from five plants and number of pods damaged based on holes made by the pod pests during feeding or at the time of emergence. Later, the per cent damage was worked out using the formula.

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pod}}{\text{Total number of pods taken for observation}} \times 100$$

Grain Damage

The seed damage was identified based on number of seeds affected in pods which is taken for observation. It was worked out by using the formula.

$$\text{Per cent grain damage} = \frac{\text{Number of damaged grains}}{\text{Total number of grains taken for observation}} \times 100$$

Statistical analysis

All the data recorded were subjected to statistical analysis as per the Randomized Block Design procedure and insect population data were transformed with square root transformed "x+0.5 method and damage assessment data were transformed by arc sin ($q = \sin^{-1}x$) transformed method.

The insect pest resistance/ susceptibility rating was done on 1-9 scale as given below

$$X = \frac{P.D.\ of\ check - P.D.\ of\ test\ genotype}{P.D.\ of\ check} \times 100$$

Where

X = pest resistance percentage

P.D. = mean percentage of pod damage

The insect pest resistance/susceptibility rating was done on 1-9 scale as given by Lateef and Sachan (1990).

Pest resistance percentage 100%	Relative resistance/ susceptibility rating 1	
75 to 99%	2	
50 to 75%	3	increasing resistance
25 to 50 %	4	
10 to 25%	5	
-10 to 10 %	6	equal to check
-25 to -10%	7	
-50 to - 25%	8	increasing susceptibility
-50% or less	9	

RESULTS AND DISCUSSION

Incidence pattern of pod flyon pigeonpea

During 2013-14, the first incidence of Pod fly, *Melanagromyza obtusa* was observed in 4th standard week in all genotype except KA 12-2, BAUPP 09-22 and KA12-3. The pod fly population was noticed from 4th to 13th standard week in all genotype except KA 12-2, BAUPP 09-22 and KA12-3. The peak population of Pod fly was recorded on 10th standard week in all genotypes except NDA 13-2 whose peak was recorded on 10th as well as 11th standard week. Among eighteen genotypes/varieties, the mean population of Pod fly was recorded highest in IPA 7-10 *i.e.* (1.50 maggot /plant) followed by MA 6 (1.39 maggot/plant), NDA 13-1 (1.29 maggot/ plant), and lowest in genotype *i.e.* KA 12-2(0.58 maggot/plant) followed by KA 12-3 (0.65 maggot/plant) and Bahar (0.67 maggot/plant). The mean population of pod fly was recorded highest in 10th standard week *i.e.* 1.90 maggot/plant followed by 9th standard week (1.68 maggot/plant) and lowest population was recorded in 4th standard week *i.e.* (0.22 maggot/ plant).

During 2014-15, the first incidence of pod fly was observed in 4th standard week in all genotypes. The pod fly population was found from 4th to 13th standard weeks in different genotypes. The peak population of pod fly was recorded during 10thstandard week in all genotypes. Among eighteen genotypes/varieties, the mean population of Pod fly was recorded highest in IPA 7-10 *i.e.* (1.41 maggot /plant) followed by MA 6 (1.31 maggot/plant), NDA 13-1 (1.14 maggot/plant), and lowest in genotype *i.e.* KA 12-2(0.56 maggot/plant) followed by KA 12-3(0.60 maggot/plant) and Bahar (0.65 maggot/plant). The mean population of pod fly was recorded highest during 10th standard week *i.e.* 1.82 maggot/plant followed by 9th standard week (1.59 maggot/plant) and lowest population was recorded in 4th standard week *i.e.* (0.21 maggot/ plant).

Kumar and Nath (2003)recorded Pod fly infestation remained from 23 January to 8 April. Its peak population was observed on 22 February. Jaisal*et al.*,(2010)observed the densities of mature and immature stages of the pests weekly from 13 January 2008 until the harvesting stage. The peak in Pod fly population was observed from the 8th standard week to the 12th standard weeks.Raj Kumar and Ram Keval (2013) was reported that the peak population of pod fly was observed from 6th SW to 11th SW.Srujana and Ram Keval (2014)was studied Seasonal incidence pattern of tur pod fly on long duration pigeonpea (Bahar). Highest mean population of Pod fly, *Melanagromyza obtusa* was observed in 9th standard week *i.e.*, 7.0 maggots, followed by 12th standard week 6.8 maggots and lowest population 0.8 maggots, recorded in the 1st standard week.

Extent of damage caused by pod flyon pigeonpea

The per cent pod damage caused by Pod fly on different genotypes observed significant during 2013-14. It ranged from 25.67% in genotype KA 12-2 to 46.67% in genotype IPA 7-10.The highest pod damage by pod fly were seen in IPA 7-10 *i.e.* (46.67%) followed by MA 6 (45.67%), NDA 13-1 & MAL 13 (43%) and lowest pod damage observed in KA 12-2 (25.67%) followed by KA 12-3 (33.67%), BAHAR (35%).

Table 1: Incidence of Pod fly(*Melanagromyza obtusa* Malloch) population on longduration pigeonpea genotypes during *Kharif* 2013-14

Genotypes	Population per plant										Average
	22thJan	29thJan	5thFeb	12thFeb	19thFeb	26thFeb	5thMarch	12thMarch	19thMarch	26thMarch	
DA 13-2	0.30(1.14)	0.39(1.18)	0.51(1.23)	0.65(1.28)	0.82(1.34)	1.79(1.66)	1.89(1.70)	1.72(1.64)	1.28(1.51)	0.61(1.27)	1.00
MAL 40	0.21(1.10)	0.23(1.11)	0.45(1.20)	0.51(1.23)	0.78(1.33)	1.47(1.56)	1.69(1.64)	1.63(1.62)	1.13(1.46)	0.61(1.27)	0.87
BAHAR(ch)	0.10(1.05)	0.12(1.06)	0.29(1.14)	0.36(1.17)	0.67(1.29)	1.24(1.49)	1.39(1.54)	1.25(1.50)	0.90(1.38)	0.42(1.19)	0.67
MA 6 (ch)	0.38(1.18)	0.49(1.22)	0.69(1.29)	0.90(1.38)	1.63(1.62)	2.42(1.84)	2.87(1.97)	2.04(1.74)	1.54(1.59)	0.97(1.40)	1.39
IPA 11-1	0.28(1.13)	0.34(1.16)	0.48(1.22)	0.59(1.26)	0.79(1.34)	1.59(1.60)	1.79(1.67)	1.66(1.63)	1.26(1.50)	0.68(1.30)	0.95
NDA 13-1	0.39(1.18)	0.47(1.21)	0.66(1.29)	0.88(1.36)	1.41(1.55)	2.29(1.81)	2.56(1.88)	1.98(1.73)	1.49(1.57)	0.79(1.33)	1.29
KA 12-2	0.00(1.00)	0.05(1.03)	0.21(1.10)	0.29(1.13)	0.51(1.23)	1.13(1.46)	1.32(1.52)	1.14(1.46)	0.81(1.34)	0.35(1.16)	0.58
NDA 1 (ch)	0.25(1.12)	0.24(1.06)	0.47(1.21)	0.57(1.25)	0.78(1.33)	1.50(1.58)	1.69(1.64)	1.65(1.63)	1.20(1.48)	0.65(1.28)	0.90
MAL 13(ch)	0.39(1.18)	0.46(1.21)	0.62(1.27)	0.75(1.32)	1.12(1.45)	2.21(1.79)	2.45(1.86)	1.93(1.71)	1.45(1.56)	0.75(1.32)	1.21
IPA 7-10	0.41(1.19)	0.56(1.25)	0.70(1.30)	0.97(1.40)	1.79(1.67)	2.61(1.90)	3.19(2.04)	2.19(1.78)	1.60(1.61)	0.98(1.40)	1.50
DA 13-1	0.31(1.14)	0.38(1.17)	0.57(1.25)	0.69(1.30)	0.85(1.36)	1.88(1.68)	2.07(1.75)	1.82(1.68)	1.39(1.54)	0.60(1.27)	1.06
NDA 13-2	0.19(1.09)	0.25(1.12)	0.41(1.19)	0.52(1.23)	0.78(1.33)	1.46(1.56)	1.62(1.61)	1.62(1.62)	1.08(1.44)	0.53(1.24)	0.85
BAUPP 09-22	0.00(1.00)	0.15(1.07)	0.32(1.15)	0.39(1.18)	0.69(1.30)	1.29(1.51)	1.44(1.56)	1.39(1.54)	0.91(1.38)	0.46(1.21)	0.70
MAL 39	0.17(1.08)	0.21(1.10)	0.39(1.18)	0.51(1.23)	0.75(1.32)	1.43(1.53)	1.61(1.61)	1.55(1.59)	1.02(1.42)	0.53(1.24)	0.82
KA 12-4	0.14(1.07)	0.19(1.09)	0.35(1.16)	0.43(1.19)	0.70(1.30)	1.35(1.53)	1.55(1.59)	1.43(1.56)	0.95(1.40)	0.48(1.22)	0.76
KA 12-3	0.00(1.00)	0.09(1.04)	0.29(1.14)	0.33(1.15)	0.66(1.29)	1.24(1.50)	1.34(1.52)	1.21(1.49)	0.88(1.37)	0.41(1.18)	0.65
NDA 2 (ch)	0.16(1.08)	0.19(1.09)	0.36(1.17)	0.47(1.21)	0.72(1.31)	1.37(1.53)	1.61(1.61)	1.51(1.58)	0.97(1.40)	0.52(1.23)	0.79
BHUA 189	0.36(1.17)	0.39(1.18)	0.6(1.26)	0.71(1.31)	0.85(1.36)	1.89(1.69)	2.14(1.77)	1.88(1.69)	1.42(1.55)	0.78(1.33)	1.10
Average	0.22	.29	0.47	0.58	0.91	1.68	1.90	1.64	1.18	0.62	-
SEM±	0.013	0.020	0.033	0.052	0.049	0.079	0.077	0.058	0.049	0.045	-
CD at 5%	0.037	0.059	0.095	0.151	0.142	0.227	0.224	0.168	0.142	0.130	-

Figures in parentheses are "x + 0.5 transformed value

Table 2: Incidence of Pod fly(*Melanagromyza obtusa* Malloch) population on long duration pigeonpea genotypes during *Kharif* 2014-15.

Genotypes	Population per plant										Average
	22thJan	29thJan	5thFeb	12thFeb	19thFeb	26thFeb	5thMarch	12thMarch	19thMarch	26thMarch	
DA 13-2	0.29(1.14)	0.32(1.15)	0.48(1.22)	0.59(1.26)	0.79(1.34)	1.72(1.65)	1.88(1.69)	1.65(1.63)	1.29(1.51)	0.72(1.31)	0.97
MAL 40	0.19(1.09)	0.24(1.11)	0.41(1.19)	0.49(1.22)	0.73(1.31)	1.41(1.55)	1.59(1.61)	1.53(1.59)	1.12(1.46)	0.66(1.29)	0.84
BAHAR(ch)	0.08(1.04)	0.12(1.06)	0.25(1.12)	0.32(1.15)	0.57(1.25)	1.23(1.49)	1.33(1.53)	1.17(1.47)	0.95(1.40)	0.49(1.22)	0.65
MA 6 (ch)	0.35(1.16)	0.42(1.19)	0.60(1.26)	0.82(1.35)	1.55(1.59)	2.35(1.83)	2.78(1.94)	1.94(1.71)	1.45(1.56)	0.87(1.37)	1.31
IPA 11-1	0.26(1.12)	0.30(1.14)	0.45(1.20)	0.56(1.25)	0.77(1.33)	1.49(1.56)	1.71(1.64)	1.6(1.61)	1.21(1.49)	0.71(1.31)	0.91
NDA 13-1	0.25(1.12)	0.36(1.17)	0.27(1.13)	0.78(1.33)	1.35(1.53)	2.15(1.77)	2.48(1.86)	1.88(1.70)	1.00(1.41)	0.85(1.36)	1.14
KA 12-2	0.02(1.01)	0.07(1.03)	0.16(1.08)	0.25(1.12)	0.45(1.20)	1.02(1.42)	1.23(1.49)	1.05(1.43)	0.88(1.37)	0.42(1.19)	0.56
NDA 1 (ch)	0.24(1.11)	0.27(1.13)	0.43(1.20)	0.52(1.23)	0.75(1.32)	1.45(1.57)	1.61(1.61)	1.57(1.60)	1.18(1.48)	0.69(1.30)	0.87
MAL13(ch)	0.28(1.13)	0.37(1.17)	0.56(1.25)	0.70(1.30)	1.02(1.42)	2.00(1.73)	2.34(1.82)	1.85(1.69)	1.40(1.55)	0.82(1.35)	1.13
IPA 7-10	0.38(1.17)	0.49(1.22)	0.65(1.28)	0.85(1.36)	1.72(1.65)	2.55(1.88)	3.09(2.02)	1.99(1.73)	1.49(1.58)	0.88(1.37)	1.41
DA 13-1	0.30(1.14)	0.34(1.16)	0.52(1.23)	0.61(1.27)	0.80(1.34)	1.79(1.67)	2.03(1.71)	1.78(1.67)	1.34(1.53)	0.76(1.33)	1.03
NDA 13-2	0.18(1.09)	0.20(1.09)	0.39(1.18)	0.47(1.21)	0.71(1.31)	1.39(1.55)	1.56(1.60)	1.51(1.57)	1.09(1.45)	0.61(1.27)	0.81
BAUPP 09-22	0.11(1.05)	0.15(1.07)	0.25(1.12)	0.35(1.16)	0.61(1.27)	1.14(1.40)	1.39(1.54)	1.32(1.52)	0.96(1.40)	0.52(1.23)	0.68
MAL 39	0.15(1.07)	0.19(1.09)	0.38(1.17)	0.46(1.21)	0.68(1.30)	1.37(1.54)	1.54(1.59)	1.49(1.58)	1.03(1.43)	0.59(1.26)	0.79
KA 12-4	0.12(1.06)	0.16(1.11)	0.29(1.14)	0.37(1.17)	0.65(1.28)	1.30(1.52)	1.48(1.57)	1.38(1.54)	0.98(1.41)	0.55(1.24)	0.73
KA 12-3	0.05(1.03)	0.09(1.04)	0.18(1.09)	0.28(1.13)	0.56(1.25)	1.12(1.45)	1.25(1.50)	1.10(1.45)	0.90(1.38)	0.47(1.21)	0.60
NDA 2 (ch)	0.13(1.06)	0.18(1.09)	0.29(1.14)	0.39(1.18)	0.66(1.29)	1.33(1.52)	1.51(1.58)	1.45(1.55)	0.99(1.41)	0.56(1.25)	0.75
BHUA 189	0.32(1.15)	0.33(1.15)	0.54(1.24)	0.66(1.29)	0.72(1.31)	1.80(1.67)	1.97(1.72)	1.82(1.68)	1.37(1.54)	0.80(1.34)	1.03
Average	0.21	0.26	0.39	0.53	0.84	1.59	1.82	1.56	1.15	0.67	-
SEM±	0.022	0.016	0.032	0.032	0.040	.057	0.077	0.062	0.029	0.034	-
CD at 5%	0.057	0.046	0.091	0.095	0.116	0.164	0.222	0.178	0.085	0.099	-

The per cent pod damage caused by Pod fly on different genotypes observed significant during 2014-15. It ranged from 21.33 per cent in genotype KA 12-2 to 45.0 per cent in genotype IPA 7-10.The highest pod damage by pod fly were seen in IPA 7-10 *i.e.* (45%) followed by MA 6 (43%), NDA 13-1 & MAL 13 (40.33%) and lowest pod damage observed in KA 12-2 (21.33%) followed by KA 12-3 (30%), BAHAR (31.67%).

The per cent grain damage caused by Pod fly on different genotypes observed significant during 2013-14. It ranged from 11.97% in genotype KA 12-2 to 23.11% in genotype IPA 7-10.The highest grain damage by pod fly were seen in IPA 7-10 *i.e.* (23.11%) followed by MA 6 (22.61%), NDA 13-1 (20.59%) and lowest grain damage observed in KA 12-2 (11.97%) followed by KA 12-3 (15.43%), BAHAR (15.86%).

The per cent grain damage caused by Pod fly on different genotypes observed significant during 2014-15. It ranged from 10.07 per cent in genotype KA 12-2 to 20.96 per cent in genotype IPA 7-10.The highest grain damage by pod fly were seen in IPA 7-10 *i.e.* (20.96%) followed by MA 6 (20.16%),

NDA 13-1 (19.08%) and lowest grain damage observed in KA 12-2 (10.07%) followed by KA 12-3 (12.05%), BAHAR (12.99%).

Jaisal*et al.,* (2010)reported that the incidence of Pod fly *(Melanagromyza obtusa),* Pod bug and lepidopterous pod borer (LBP) on long duration pigeonpea genotypes (MA-20, MAL-13, Bahar, MAL-24 and MA-3) Pod damage by Pod fly, Pod bug and LPB was greatest on MA-20 (50.3%), MAL-24 (31.0%) and MAL-6 (14.1%), respectively.Subharani and Singh (2007)reported that the damage commenced in the pod filling stage (1.23 and 2.0%) in the third week of January in both years.Srivastava and Mohapatra (2002)studied the extent of pod damage inflicted by LPBs and Pod fly varied from 1.0 to 6.3% and 15.1 to 33.1%, respectively.Minja*et al.,* (2000) the insect pests that caused damage on the Pigeonpea (*Cajanus cajan*) lines were pod fly (*Melanagromyza obtusa*), pod borers (*Lampides boeticus* and *Helicoverpa armigera*) and Pod sucking bugs (*Clavigralla gibbosa*). In general, total seed damage was low and the percentage damage by pod fly was 2-7%. Pod fly accounted for 80% of the total seed damage, pod borers 12.7% and pod sucking bugs 6.3%.Various authors all over the country have rated the pod fly as the serious pest in northern part of India (Reddy *et al.*, 1998; Minja*et al.,* 2000).Rathod*et al.* (2014**)** was reported that 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. Mubarak *et. al.* (2014) also advocated the same result.

Yields

The grain yield of different genotype differed significantly during both the year and ranged from 1027 kg/ha in the genotype IPA 7-10 to 1960 kg/ha in KA 12-2 during 2013-14 and 819 kg/ha in the genotype IPA 7-10 to 1785 kg/ha in the genotype KA 12-2 during 2014-15.

On the basis of above observation it may be concluded that incidence of pod fly is increased with the advancement of crop age and the actual damage to the economic produce take place after flowering of the crop. The pod fly directly influenced the grain yield of the crop. Although a number of insect-pests were noticed but it appeared that they hardly had any significant influence on crop yield. In general, the per cent pod and grain damage by pod fly was higher in all genotype. On the basis of above observation, it may be concluded that the pod fly is the major insect pests in this zone and genotype KA 12-2 and KA 12-3 is most resistant to insect pest infestation and should be promoted.

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