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Effect of Abiotic Factors on The Incidence of Pod Fly, *Melanagromyza Obtusa* (Malloch) in Early and Late Sown Pigeonpea Cultivars

G Siva Kumar, P Rajendra Prasad, T Murali Krishna, L Prasanthi and K Devaki
Department of Entomology, S V Agricultural College, Tirupati 517 502, Andhra Pradesh

ABSTRACT

Investigations were carried out to study the impact of various meteorological factors on incidence of pod fly, *Melanagromyza obtusa* (malloch) in early and late sown pigeonpea cultivars *viz*., LRG 41 and TRG 38. In both the cultivars the occurrence of maggot and pupae was first observed in the 48th standard week *i.e.* first week of December in both the sowing dates and pest remains active throughout the cropping season. Maximum incidence in terms of maggot population was recorded in 4th standard week *i.e*., fourth week of January, in both the cultivars with two sowing dates, whereas, peak pupal activity was recorded in 5th standard week *i.e*., first week of February. In both cultivars late sown crop suffered more when compared to early sown crop in terms of both maggot and pupal activity, whereas, in between the two cultivars TRG 38 suffered more than the LRG 41. Correlation studies of weather parameters with pod fly showed that morning relative humidity exhibited significant positive effect with maggot and pupal occurrence in both the cultivars, whereas, minimum temperature exhibited significant negative effect with only maggot population in early and late sown LRG 41. Multiple regression analysis using the step wise regression models can be considered as best fit for predicting population of pod fly, *M. obtusa*.

Key words : Seasonal incidence, Pigeonpea, Pod fly.

Pigeonpea, *Cajanus cajan* (L.) is one of the most important pulse crops grown widely in India during *kharif* season and is known to harbour many pod borers during reproductive phase. The losses caused by the pod borer complex ranged between 5 to 95% (Odak, 1972). Among the pod borer complex, pod fly, *Melanagromyza obtusa* (Malloch) (Diptera: Agromyzidae) is the most abnoxious pest causing the grain damage ranging from 20 to 80% (Subharani and Singh, 2009a). The pod fly attack remains unnoticed by the farmer owing to concealed mode of life with in the pods and thus, it becomes difficult to manage the pest in time. For effective pest management, study on the influence of the various factors responsible for population fluctuation on a particular crop might assist in prediction of its occurrence in a given area. The most important components deciding the population build up of insect-pests infecting the crop beside the susceptible host are the climatic factors. Generally it is very difficult to establish the direct relationship between a single climatic factor and insect population as their effects are confounded and synergetic. Hence, the present studies were aimed towards host susceptibility and seasonal incidence of pod fly, *M. obtusa* in relation to the abiotic factors.

MATERIAL AND METHODS

The studies on the seasonal incidence of pod fly, *M. obtusa* on pigeonpea was carried out during *Kharif*, 2012-13 at wetland farm, S.V. Agricultural College, Tirupati. Two pigeonpea cultivars, LRG-41 and TRG-38 each with two different dates of sowing, one at July second fortnight and another at August first fortnight were grown with a spacing of 120cm in between the rows and 20cm in between the plants. The crop was raised without any insecticidal treatment and twenty pods were plucked randomly in both the cultivars in each sowing date and examined for the presence of maggot and pupae in each meteorological week from pod formation to pod maturity stage.

The data on maggot population and pupal count were subjected to statistical analysis to work out the correlation with abiotic factors (maximum and minimum temperature, morning and evening relative humidity, rainfall, wind velocity, sunshine

hours and rainy days) of the respective standard week. The correlation coefficients were calculated and regression equations were derived using SAS software. Weekly weather data was obtained from meteorological observatory, RARS, Tirupati.

RESULTS AND DISCUSSION

Seasonal incidence of pod fly, *M. obtusa* in pigeonpea cv. LRG 41

The data regarding maggot population and occurrence of pupae during the period of study were presented in the Table 1 and Fig 1. The information revealed that first incidence of maggots (0.33 per 20 pods) and pupae (0.33 per 20 pods) were observed at 48th standard week *i.e.*, in first week of December in July sown crop and remained till harvest of the crop and similar trend was recorded in August sown crop with initial population of 0.67 maggots and 0.33 pupae (per 20 pods) in 48th standard week. The peak incidence was recorded in terms of maggot population in 4th standard week in both July and August sown crop with 7.00 and 8.33 maggots per 20 pods, respectively, whereas peak occurrence of pupae per 20 pods were recorded in 5th standard week with 10.33 pupae in July sown crop and 11.00 pupae in August sown crop, respectively. The present results are in slight agreement with the findings of Subharani and Singh (2009b) who reported peak incidence of pod fly during the third week of January with 15.6 per cent in the first and 13.7 per cent in the second year.

The correlation of pod fly, *Melanagromyza obtusa* maggots and pupae with abiotic factors (Table 2) showed that in both July and August sown crops, morning relative humidity showed significant positive relationship with both maggot population and pupae whereas, minimum temperature exhibited significant negative correlation with only maggot population. The other parameters like maximum temperature, sunshine hours and wind velocity showed non significant positive correlation and evening relative humidity, rainfall and rainy days showed non significant negative correlation with both maggot population and pupae. The present results are in conformity with the findings of Singh and Singh (1978), Naresh and Singh (1984) and Sahoo (1998) who reported negative effect with temperature and positive effect with morning relative humidity. On contrary, Ram Keval and Srivastava (2011) observed that the larval population had significant positive correlation with temperature and significant negative correlation with relative humidity and sunshine hours during 2009-10, this might be due to variations in the agro-climatic conditions.

The association between maggot population in July sown crop and weather parameters could be explained by forward selection model (y= -46.035 -0.486 min temp + 0.523 mor RH + 0.252 eve RH -0.035 RF) to an extent of 82.8 per cent. In case of occurrence of pupae forward selection model fitted was, y= -70.702 -0.435 min temp + 0.794 mor RH + 0.289 eve RH -0.049 RF (R^2 value of 0.820).

The variability in maggot population in August sown crop due to abiotic factors was best explained by the forward selection model (y= -54.351 -0.711 min temp + 0.616 mor RH + 0.354 eve RH -0.047 RF) to an extent of 84.6 per cent. Similarly, fluctuations in the occurrence of pupae due to abiotic factors was explained to an extent of 87.8 per cent by forward selection model (y= -83.271 +0.825 mor RH +0.226 eve RH -0.051 RF +1.372 WV).

Seasonal incidence of pod fly, *M. obtusa* in pigeonpea cv. TRG 38

It was evident that first incidence of maggots was observed in 48th standard week with incidence of 0.67 maggots per 20 pods in both July and August sown crops and pupal occurrence was also initiated in 48th standard week *i.e.*, in first week of December with an incidence of 0.33 pupae per 20 pods in July sown crop and 0.67 pupae in August sown crop and remained till harvest of the crop. The peak incidence was recorded in terms of maggot population in 4th standard week in both July and August sown crop with 8.00 and 8.67 maggots per 20 pods, respectively, whereas peak occurrence of pupae (No. per 20 pods) recorded in 5th standard week with 10.67 pupae in July sown crop and 11.67 pupae in August sown crop. Lal *et al*. (1981) and Akhauri *et al.* (1994) also observed the similar peak activity of pod fly during February. The data regarding occurrence of maggot and occurrence of pupae during the period of study were presented in the table 1 and fig 2.

Table 1. Seasonal incidence of Pod fly, *M. obtusa* in two pigeonpea cultivars with two different dates of sowing.

Date of observation	LRG-41*				TRG-38*			
	July sown crop		August sown crop		July sown crop		August sown crop	
	Maggots	Pupae	Maggots	Pupae	Maggots	Pupae	Maggots	Pupae
11-Nov (45 SW)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18-Nov (46 SW)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-Nov (47 SW)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02-Dec (48 SW)	0.33	0.33	0.67	0.33	0.67	0.33	0.67	0.67
09-Dec (49 SW)	0.67	0.67	1.00	1.33	1.33	1.00	1.67	2.00
16-Dec (50 SW)	1.67	2.00	2.33	2.67	2.00	2.33	2.67	3.33
23-Dec (51 SW)	1.67	2.33	3.33	3.67	2.33	2.33	3.67	4.33
30-Dec (52 SW)	2.67	3.33	3.33	4.33	3.33	3.67	4.67	4.67
06-Jan (1 SW)	4.00	5.00	4.67	5.33	4.33	4.67	5.33	6.00
13-Jan (2 SW)	4.67	6.33	6.00	6.33	5.00	6.67	6.00	7.33
20-Jan (3 SW)	5.33	7.67	7.33	8.33	5.67	8.00	7.67	8.33
27-Jan (4 SW)	7.00	8.67	8.33	9.33	8.00	8.67	8.67	10.00
03-Feb (5 SW)	6.67	10.33	7.67	11.00	7.33	10.67	8.00	11.67
10-Feb (6 SW)	5.33	9.67	6.33	10.33	6.00	9.67	6.67	10.67

*Mean value of three replications with reference to number per 20 pods

The correlation studies (Table 3) revealed that only morning relative humidity exhibited significant positive correlation with maggot population (r= 0.804) and pupae (r= 0.820) in July sown TRG 38 and similar trend was observed with maggot (r= 0.768) as well as pupal (r= 0.804) occurrence in August sown TRG 38 also. Remaining weather parameters showed non significant relationship with incidence of pod fly in both sowing dates.

The association between maggot population in July sown crop and weather parameters could be better explained by forward selection model (y= -17.126 -0.928 max temp -0.035 min temp + 0.578 mor RH - 0.022 RF) to an extent of 85.0 per cent. In case of occurrence of pupae forward selection model fitted was, y= -49.291 -0.508 max temp +0.766 mor RH -0.028 RF +0.848 WV (R^2 value of 0.852).

The variability in maggot population in August sown crop due to abiotic factors could be better explained by the forward selection model (y= -30.306 -1.101 max temp -0.287 min temp + 0.702 mor RH + 0.253 eve RH -0.049 RF) to an extent of 88.1 per cent. Similarly, fluctuations in the occurrence of pupae due to abiotic factors was explained to an extent of 84.1 per cent by forward selection model (y= -47.871 -1.212 max temp + 0.933 mor RH + 0.198 Eve RH -0.056 RF).

In both pigeonpea cultivars even in two different sowing dates incidence was first appeared in terms of maggot population and pupae during first week of December. The present results are in conformity with the findings of Ashwani Kumar *et al.* (2011) observed that infestation of seeds started in December and continued till March when the crop matured. Akhauri *et al.* (1997) also reported pod fly activity started from January and continued till March when the crop matured.

Table 2. Correlation of maggot population and pupae of pod fly, *M. obtusa* with weather parameters in pigeonpea cv. LRG 41 sown at two different dates.

Particulars	July sown LRG 41				August sown LRG 41			
	No. of maggots		No. of Pupae		No. of maggots		No. of Pupae	
	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]
Maximum temperature	0.068	0.819	0.147	0.616	0.007	0.982	0.077	0.794
Minimum temperature	-0.544*	0.044	-0.486	0.078	-0.580*	0.030	-0.464	0.095
Morning relative humidity (mor RH)	0.814**	0.00	0.829**	0.001	0.799**	0.001	0.804**	0.001
Evening relative humidity (eve RH)	-0.522	0.056	-0.526	0.053	-0.529	0.052	-0.488	0.077
Rain fall (RF)	-0.399	0.157	-0.403	0.153	-0.415	0.140	-0.383	0.176
No. of rainy days (RD)	-0.500	0.069	-0.506	0.065	-0.521	0.056	-0.487	0.078
Sun shine hours (SSH)	0.483	0.080	0.501	0.068	0.447	0.109	0.442	0.114
Wind velocity (WV)	0.214	0.462	0.264	0.361	0.235	0.419	0.310	0.280

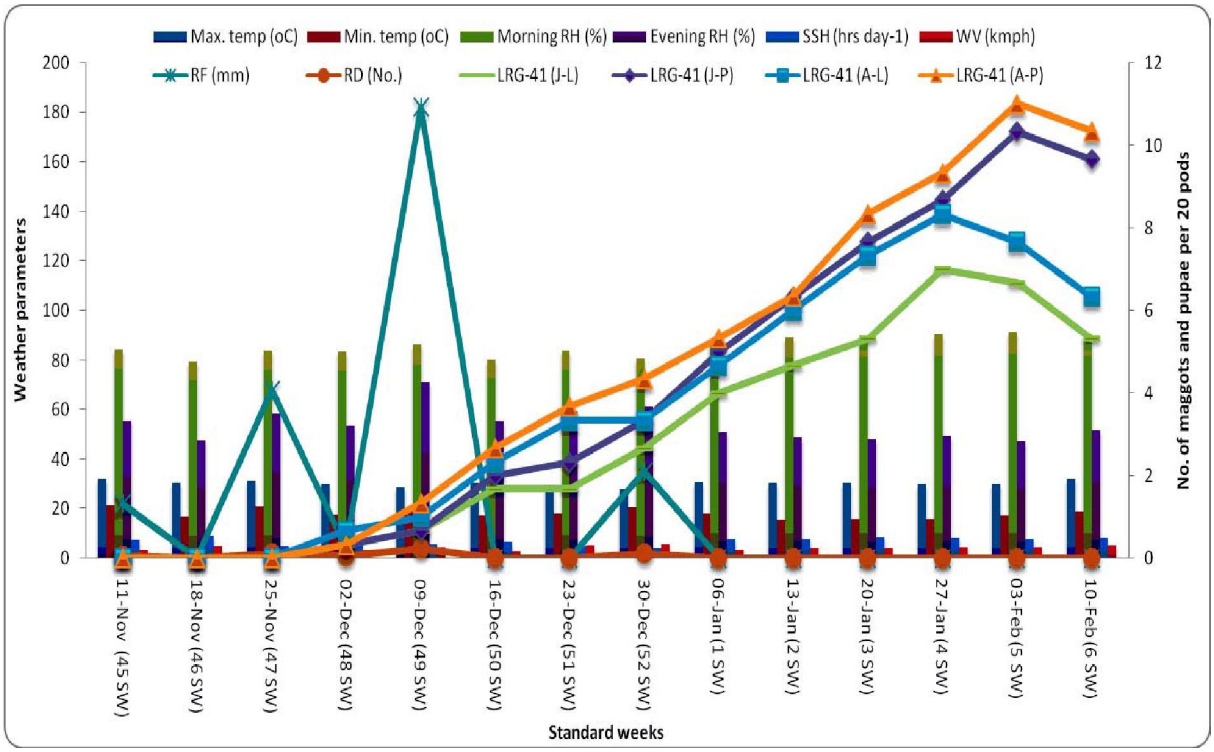
*Significant at 5% level; ** Significant at 1% level

Table 3. Correlation of maggot population and pupae of pod fly, *M. obtusa* with weather parameters in pigeonpea cv. TRG 38 sown at two different dates.

Particulars	July sown TRG 38				August sown TRG 38			
	No. of maggots		No. of Pupae		No. of maggots		No. of Pupae	
	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]	Correlation coefficient (r)	Prob>[r]
Maximum temperature	0.011	0.97	0.122	0.679	-0.065	0.825	0.049	0.869
Minimum temperature	-0.525	0.054	-0.488	0.076	-0.530	0.051	-0.479	0.083
Morning relative humidity (mor RH)	0.804**	0.001	0.820**	0.001	0.768**	0.001	0.804**	0.001
Evening relative humidity (eve RH)	-0.476	0.086	-0.508	0.064	-0.461	0.097	-0.473	0.088
Rain fall (RF)	-0.363	0.202	-0.385	0.174	-0.371	0.191	-0.37	0.192
No. of rainy days (RD)	-0.462	0.096	-0.487	0.077	-0.465	0.094	-0.48	0.082
Sun shine hours (SSH)	0.437	0.118	0.487	0.078	0.382	0.178	0.425	0.130
Wind velocity (WV)	0.252	0.385	0.268	0.353	0.278	0.337	0.301	0.296

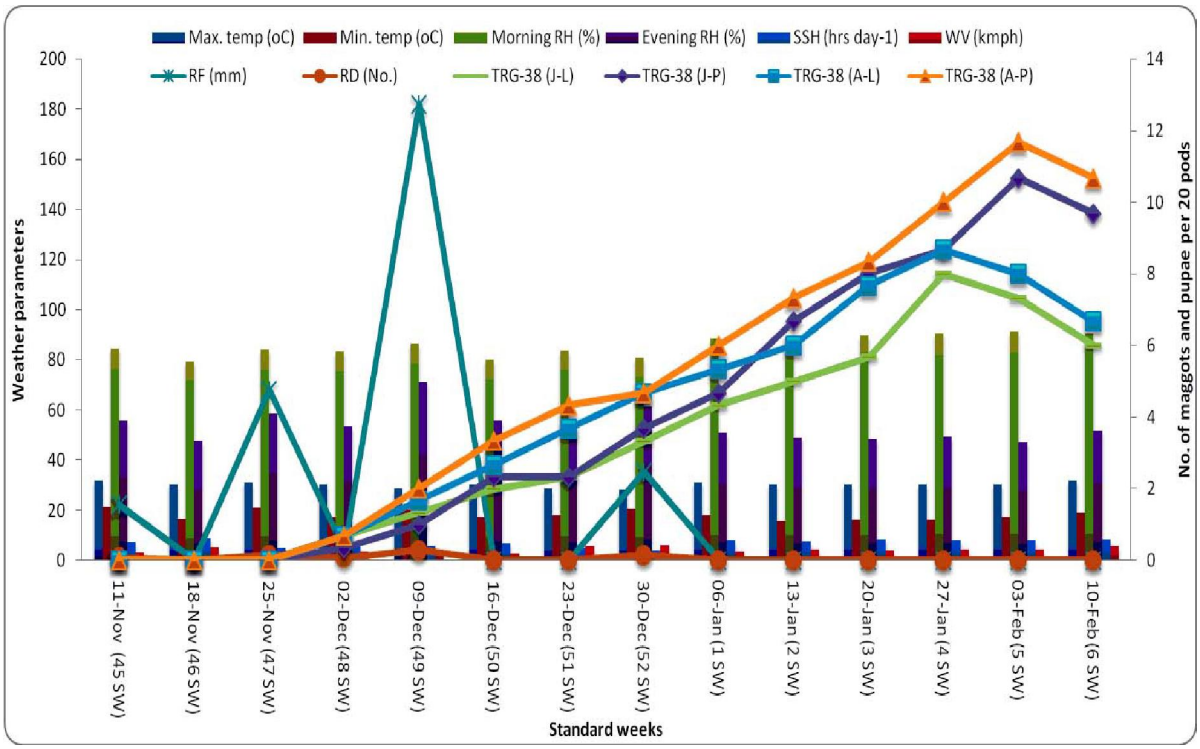
*Significant at 5% level; ** Significant at 1% level

Fig 1. Seasonal incidence of pod fly, *M. obtusa* in pigeonpea cv.LRG 41 in relation to abiotic factors during 2012-13.



LRG 41 (J-L): Maggot count in July sown crop LRG 41 (J-P): Pupal count in July sown crop
LRG 41 (A-L): Maggot count in August sown crop LRG 41 (A-P): Pupal count in August sown crop

Fig 2. Seasonal incidence of pod fly, *M. obtusa* in pigeonpea cv.TRG 38 in relation to abiotic factors during 2012-13.



TRG 38 (J-L): Maggot count in July sown crop TRG 38 (J-P): Pupal count in July sown crop
TRG 38 (A-L): Maggot count in August sown crop TRG 38 (A-P): Pupal count in August sown crop

Whatever may be the sowing date in both the cultivars peak incidence of maggot population was recorded in 4th standard week *i.e.*, fourth week of January there after reduced slightly and peak occurrence of pupae was recorded in 5th standard week *i.e.*, first week of February. It implies that, appearance of pest coincide with grain formation stage causing damage to grains irrespective of the sowing date. According to Sahoo and Patnaik (1993), medium and late maturing cultivars of pigeonpea were severely damaged by pod fly during first week of December to first week of March with peak larval population in second and fourth week of January, respectively.

In both the cultivars, August sown crop suffered more than the July sown crop *i.e.*, in terms of both pupae and maggot population, this can be concluded that late sown crop suffered much when compared to early sown crop. The present findings were in accordance with Singh *et al.* (1993) who observed that when the crop was sown in last week of July, only late maturing cultivars were severely damaged, whereas in the August sown crop all the early, medium and late maturing cultivars suffered with very high damage due to pod fly. Among the two cultivars TRG 38 suffered more compared to LRG 41 with reference to both maggot population and number of pupae in both sowing dates. It could be concluded that population build up of pest varied remarkably, probably due to sowing dates, crop types and agroclimatic conditions (Naresh and Singh, 1984 and Akhauri *et al.*, 2001).

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