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Research Article

Seasonal incidence of pod fly, *Melanagromyza obtusa* (Malloch) and its hymenopteran parasitoids on pigeonpea

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ABSTRACT: The activity of pod fly, *Melanagromyza obtusa* (Malloch) (Diptera: Agromyzidae) attained peak level during 46th standard week while the population of *M. obtusa* was minimum (31/100 pods) during 49th standard week. The peak level of weekly per cent parasitization (18.18%) was observed during 51st standard week while minimum level of weekly per cent parasitization (6.52%) was observed during 47th standard week. Simple correlation was worked out between *M. obtusa* population and weather parameters and it revealed that positive significant correlation with minimum temperature (r = 0.769). Correlation between parasitization and percent was not significant. The regression revealed that the various abiotic factors was found to be most influencing factor, which contributed (R^2 = 0.885 and 0.863) 88.5 and 86.3 per cent variation in *M. obtusa* population and per cent parasitization, respectively.

KEY WORDS: *Melanagromyza obtusa*, seasonal incidence, parasitization, pigeonpea

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INTRODUCTION

In India, pigeonpea crop was infested with more than 300 species of insect pests out of which 17 species have been recognized as major (Lal and Singh, 1998) but the maximum yield loss is caused by pod borer complex. The borer complexes are of regular occurrence and cause extensive damage in pigeonpea. Among the pod borers, *Melanogromyza obtusa* (Maltoch.) is one of the major insect pests causing yield losses between 14 and 46 per cent in farmers field (Lal *et al.,* 1992). Shanower *et al.* (1998) listed more than 14 species of parasitoids from *M. obtusa* but, two are considered as important *viz., Euderus* sp. (Hymenoptera: Eulophidae) and *Ormyrus* sp. (Hymenoptera: Ormyridae) (Thakur and Odak, 1982) and its parasitization reported up to maximum of 80 per cent and 46.66 per cent, respectively (Yadav *et al.,* 2012). The parasitism of *M. obtusa* was observed by several workers (Singh, 1991, 1992; Durairaj, 2005; Tiwari, 2006; Yadav *et al.,* 2010, 2012). Since, the pod fly cannot be reared under artificial conditions, multiplication and augmentation of its parasitoids is difficult. It is important to ascertain natural parasitization of *M. obtusa* in pigeonpea, especially in the northern parts of India where pod fly is a major problem. The present study was therefore conducted on the influence of weather parameters on pod fly and its parasitoids.

MATERIALS AND METHODS

The experiments were conducted at Norman E. Borlaug Crop Research Centre (NEB-CRC), Pantnagar, Uttarakhand to study the seasonal incidence of *M. obtusa* and its parasitoids. Short duration pigeonpea cultivar Manak was used for the study and the field was kept free from pesticide sprays. One hundred pods were randomly collected on weekly interval from the field and placed in rearing jars covered with muslin cloth. Samples were maintained at room temperature till the emergence of *M. obtusa* or parasitoids. Emerging adults of *M. obtusa* and parasitoids were kept separately in small vials containing 70% alcohol for identification. The weekly minimum and maximum temperatures, relative humidity (RH), wind velocity and sunshine hours were recorded during the period at the University Meteorological observatory. Influence of weather parameters on weekly per cent parasitization was worked out. The weekly per cent parasitism was calculated according to Mills (1997) and Van Drieche (1983) with following formula.

$$\text{Per cent parasitization} = \frac{\text{No. of parasitoid adults emerged}}{\text{No. of host adult insects + No. of parasitoid adults}} \times 100$$

RESULTS AND DISCUSSION

The activity of *M. obtusa* commenced during 45th standard week at pod filling stage of the crop. The peak level of its population (99/100 pods) was observed during 46th standard week whereas, the minimum population of *M. obtusa* was noticed during 49th standard week (Table 1). The peak level of weekly parasitization (18.18%) was recorded during 51st standard week at maturity stage of the crop followed by 49th standard week (16.22%.). *M. obtusa* population started to decline from 48th standard week. This might be due to low temperature recorded below 10^0 C and increase in per cent parasitization. It shows that temperature significantly reduces the *M. obtusa* population and at the same time it favours the parasitoids. During the course of investigation *Euderus* spp. (Eulophidae: Hymenoptera) were recorded on *M. obtusa*. Tiwari *et al.* (2006) reported that the activity of *Eurytoma* sp. was started during 11th and 12th standard week from pigeonpea cultivars *viz.*, Bahar and NDA-1 and the level of parasitization was 6.66 and 15.78%, respectively.

Simple correlation was worked out between *M. obtusa* population and weather parameters presented in Table 2. It revealed that there was positive significant correlation with minimum temperature (r = 0.769) and positive non-significant correlation with maximum temperature (r = 0.458) and minimum RH (r = 0.105), whereas negative non-significant correlation was observed with maximum RH (r = – 0.699), sunshine hours (r = – 0.466) and wind velocity (r = – 0.437). Correlation between per cent parasitization and weather parameters revealed that positive non-significant correlation was existed with maximum RH (r = 0.590), minimum RH (r = 0.331), sunshine hours (r = 0.024) and wind velocity (r = 0.436).

The regression revealed that the various abiotic factors were found to be most influencing factor, which contributed (R^2 = 0.885 and 0.863) 88.5 and 86.3 per cent variation in *M. obtusa* population and per cent parasitization, respectively.

Table 1: Seasonal incidence of *Melanogtromyza obtusa* and its hymenopteran parasitoids on pigeonpea crop during kharif 2011

Sl. No.	Standard mean week	No. of Pod fly emerged	No. of Parasitoids emerged	Per cent parasiti-zation	Temperature		Relative humidity		Sun shine hours	Wind velocity
					Maximum	Minimum	Maximum	Minimum		
1	45	76	9	10.59	27.2	13.9	88	54	3.6	1.8
2	46	99	9	8.33	26.7	14.1	90	57	2.1	2.3
3	47	43	3	6.52	27.1	11.9	91	49	4.8	2.3
4	48	33	5	13.16	26.1	9.3	91	48	6.8	2.8
5	49	31	6	16.22	25.7	10.6	93	53	4.9	2
6	50	38	5	11.63	20.3	9.6	94	70	1	3.1
7	51	36	8	18.18	18.1	6.6	94	65	3.1	3.4
8	52	33	4	10.81	22.6	5.5	92	42	7.7	2.5
Total	389	49								

Table 2. Correlation coefficients of *Melanogrtomyza obtusa* population and its parasitization with abiotic factors

Abiotic factors	*M. obtusa* population	*M. obtusa* parasitization
Maximum Temperature (°C)	0.458ns	–0.587ns
Minimum Temperature (°C)	0.769*	–0.529ns
Maximum RH (%)	–0.699ns	0.590ns
Minimum RH (%)	0.105ns	0.331ns
Sunshine hours	–0.466ns	0.024ns
Wind velocity (km/hr)	–0.437ns	0.436ns

* = significant at 5% level, ns = non significant

The regression equation was fitted to study the effectiveness of weather parameters indicated that for every 1°C increase in maximum temperature, maximum relative humidity, minimum relative humidity and sunshine hour there would be an decrease of 3.616, 7.391, 3.837 and 16.840 *M. obtusa* population, respectively, while for every 1°C increase in minimum temperature and wind velocity there would be a increase of 2.147 and 8.396 *M. obtusa* population, respectively (Table 3). For every 1°C increase in minimum temperature, maximum relative humidity, minimum relative humidity and sunshine hour there would be an increase of 5.971, 1.460, 0.804 and 8.430 per cent parasitization, respectively, while for every 1°C increase in maximum temperature and wind velocity there would be a decrease of 4.491and 2.708 per cent parasitization, respectively (Table 4).

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Table 3. Multiple regressions of *Melanogromyza obtusa* with abiotic factors

Multiple regression	Temperature (°C)		Relative humidity (%)		Sunshine hours (X_5)	Wind velocity(km/hr)(X_6)
	Maximum (X_1)	Minimum (X_2)	Maximum (X_3)	Minimum (X_4)		
Coefficient	–3.616	2.147	–7.391	–3.837	–16.840	8.396
Standard Error	38.301	51.754	14.609	5.810	38.591	36.341
T-value	0.998	–0.094	–0.506	–0.660	–0.436	0.231
F value	1.285					
R^2	0.885					
Regression equation	Y_1= 1052.034 – 3.616 (X_1) + 2.147 (X_2) – 7.391 (X_3) – 3.837 (X_4) – 16.840 (X_5) + 8.396 (X_6)					

Y_1 : pod fly population

Table 4. Multiple regressions of *Melanogromyza obtusa* parasitization with abiotic factors

Multiple regression	Temperature (°C)		Relative humidity (%)		Sunshine hours (X_5)	Wind velocity(km/hr)(X_6)
	Maximum (X_1)	Minimum (X_2)	Maximum (X_3)	Minimum (X_4)		
Coefficient	–4.491	5.971	1.460	0.804	8.430	–2.708
Standard Error	6.462	8.732	2.465	0.980	6.511	6.131
T-value	–0.695	0.684	0.592	0.820	1.295	–0.442
F value	1.046					
R^2	0.863					
Regression equation	Y_2= -146.852 - 4.491 (X1) + 5.971 (X2) + 1.460 (X3) + 0.804 (X4) + 8.430 (X5) -2.708 (X6)					

Y_2 : *M. obtusa* parasitization

REFERENCES

Dar MH, Rizvi RQ, Saxena H, Naqvi NA. 2005. Influence of resistant and susceptible pigeonpea cultivars on the parasitization efficiency of some parasitoids on pod fly, *Melanagromyza obtusa* (Malloch). *J Biol Control* **19**: 87–92.

Durairaj C. 2005. Seasonal incidence of pupal parasitoids of pigeonpea pod fly, *Melanagromyza obtusa* (Malloch) in Tamil Nadu. *Indian J Pulses Res.* **18**(2): 266.

Lal SS, Singh NB. 1998. The pigeonpea and future strategies, pp. 65–80. In: *National Symposium on management of*

biotic and abiotic stresses in pulse crops. IIPR, Kanpur, India.

Lal SS, Yadava CP, Sachan JN. 1992. Assessment of pod borers damage on pigeonpea in different agro-ecological zones of Uttar Pradesh. *Indian J Pulses Res.* **5**: 174–178.

Mills N. 1997.Technique to evaluate the efficiency of natural enemies, pp. 271–291. In: Dent, DR, Watton, MP (Eds.). *Methods in ecological and agricultural entomology*. CAB International, UK.

Sachan JN, Lal S. 1993. Role of botanicals in *H. armigera* management. Indian society of Tobacco Science. pp. 261–269. Fide Review of Applied Entomology. (A: Agriculture) 81 (8): 883, Abstract.7921; 1993.

Shanower TG, Lal SS, Bhagwat VR. 1998. Biology and management of *M. obtusa* (Malloch) (Diptera: Agromyzidae). *Crop Prot.* **17**(3): 249–63.

Singh D. 1991. Three hymenopteran parasitoids of *Melanagromyza obtusa* (Malloch), a pest of tur, *Cajanus cajan* (L) Millsp. *J Ent Res.* **15**(4): 282–286.

Singh D. 1992. Relationship between the incidence of pod infestation of *Cajanus cajan* (L.) Millsp. by *Melanagromyza obtusa* (Malloch) and the rate of parasitism. *J Ent Res.* **16**(2): 166–171.

Thakur BS, Odak SC. 1982. New record of the parasites of *Melanagromyza obtusa* (Malloch). *Sci Culture*. **48**: 80.

Tiwari G, Singh DC, Singh R, Kumar P. 2006. Role of abiotic & biotic factors on population dynamics of pigeonpea pod fly, *Melanagromyza obtusa* (Malloch). *J Recent Adv Appl Sci.* **21**(1,2): 12–14.

Van Driesche RGV. 1983. Meaning of percent parasitism in studies of insect parasitoids. *Env Ent*. **12**: 1611–1622.

Yadav AK, Yadav S, Singh MK. 2010. Impact of climatic variation on the parasitoid – complex of *Melanagromyza obtusa* (Diptera : Agromyzidae). *J Ecobiol*. **29**: 161–162.

Yadav AK, Yadav S, Singh MK. 2012. Effect of temperature on the population of parasitoids and their impact on the pest *Melanagromyza obtusa* (Diptera : Agromyzidae). *J Env Sci.* **1**: 45–50.