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IMPACT OF WEATHER PARAMETERS ON PARASITOIDS OF PIGEONPEA POD FLY, *MELANAGROMYZA OBTUSA* (MALLOCH)

N. R. PATANGE[1]*, B. CHIRANJEEVI[2] AND S. MANICKAVASAGAM[3]
[1]National Agricultural Research Project, Aurangabad - 431 005 (VNMKV, Parbhani) (M.S.) INDIA
[2]P.G. Department of Entomology, College of Agriculture, Badnapur - 431 202, Jalna (M.S.) INDIA
[3]Department of Entomology,
Faculty of Agriculture, Annamalai University, Annamalai Nagar - 608 002, INDIA
e-mail: drnrp@rediffmail.com

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***Corresponding author**

ABSTRACT
The study revealed the presence of three major hymenopteran parasitoids [*Euderus* sp., *Torymus* sp., and *Ormyrus* sp.]. The parasitoids population increased from December to January (2 to 63 parasitoids per 100 pods), when average minimum, maximum temperatures and relative humidity fluctuated from 6.3 to 15.1ºC, 27.3 to 31.3ºC and 72 to 89 per cent, respectively. From 4th SMW (January) onwards, parasitoids population started dwindling with rise in maximum (above 27ºC) and minimum temperature (above 10ºC) as well as fall in average relative humidity (below 70 per cent), and ultimately parasitoids population crashed to its minimum level (6 parasitoids per 100 pods) by 8th SMW (March) when the minimum, maximum temperature and relative humidity fluctuated around 16.0ºC, 33.4ºC and 77 per cent, respectively, indicating that weather parameters played an important role on parasitoids population and its activity. There was no correlation between parasitoid population with afternoon humidity and wind speed and negative correlation was observed between parasitoid population with rainfall (r= -0.3040), maximum (r= -0.4505) and minimum (r= -0.2416) temperature, morning humidity (r= -0.1106) and evaporation (r= -0.3507). Hence, increase in minimum, maximum temperature and fall in relative humidity reduces parasitoids population*M. obtusa* and vice-versa.

INTRODUCTION

Among the insect pests of pigeonpea pod fly, *Melanagromyza obtusa* (Malloch) [Agromyzidae: Diptera] is the most serious pest in India and losses have been estimated at US $ 256 million annually (Sharma *et al*., 2011). The use of natural enemies of pod fly, as bio-control agents, for its management is a promising and viable strategy (Singh, 1994). More than 20 hymenopteran parasitoids and their level of parasitism on pod fly immature stages have been reported by several workers (Singh, 1991; Yadav *et al*., 1991; Peter, 1992; Durairaj, 2005; Makinson *et al*., 2005; Moudgal *et al*., 2005; Narendran *et al*., 2005; Yadav and Yadav, 2011). Decrease in average temperature from 20.5 to 18.5ºC, leads to gradual and significant increase in pod fly parasitoid population (Das and Katyar, 1998). The impact of parasitoids on the pod fly population was low due to increase in average temperature (Yadav *et al*., 2012). Therefore, present studies were carried out during 2014-15 to know the parasitoids of *M. obtusa* and impact of weather parameters on the activity of parasitoid population.

MATERIALS AND METHODS

The experiment was conducted at Research Farm and Laboratory, Agricultural Entomology Unit, Agricultural Research Station, Badnapur (VNMKV, Parbhani), India during *Kharif* season 2014-15 under normal field conditions. The pigeonpea variety, ICP-8863 (Maruti) was raised with standard agronomical practices. Plant to plant and row to row distance was maintained at 30 cm and 60 cm, respectively. No insecticide was applied to protect the crop from the infestation of pod fly. Pod fly, *Melanagromyza obtusa* (Malloch) parasitoid population was recorded by using destructive sampling method from pod initiation till harvest of the crop (48th to 10th standard meteorological week) on randomly collected 100 pods covering all the plants in net plot at weekly intervals on the basis of standard meteorological week (Anonymous, 2012; Patange, 2012; Yadav and Yadav, 2013). The collected larvae and pupae were maintained at the rate of one per vial and reared at ambient temperature under laboratory condition for observing the emergence of different parasitoids. Parasitoids emerged from these immature stages were identified based on taxonomic features. The data thus generated was processed appropriately for interpretation of results.

RESULTS AND DISCUSSION

The data on population of pod fly in untreated plot of pigeonpea Cv. ICP-8863 under natural weather condition is presented in Table 1. Results revealed that the population of *Melanagromyza obtusa* was active from 48th SMW (26 pod flies [larvae + pupae] per 100 pods) which increased gradually and attained a peak on 1st and 3rd SMW with 100 pod flies [larvae + pupae] per 100 pods.The pod fly population declined later and was 11 pod flies [larvae + pupae] per 100

Table 1: Parasitoid population of pod fly, *M. obtusa* (Malloch) in relation to weather parameters

SMW	No of parasitoids emerged	Pod Fly Population*	Rainfall (mm)	Temperature (°C)		Humidity (%)		Evaporation (mm)	Wind Speed (kmph)
				Max	Min	AM	PM		
48	0	26	0.0	31.3	10.8	80	23	5.1	2.9
49	0	24	0.0	31.1	09.9	81	25	4.9	3.0
50	2	42	0.0	29.9	14.8	80	43	4.9	4.7
51	8	97	0.0	27.3	06.3	74	23	4.7	3.8
52	23	67	0.0	28.8	08.9	72	24	4.6	4.0
1	37	100	9.2	27.0	15.1	89	52	3.1	3.7
2	45	76	0.0	28.3	05.8	76	20	4.7	3.1
3	63	100	0.0	28.9	10.2	72	29	5.2	4.4
4	42	88	0.0	31.1	14.1	76	26	5.1	4.4
5	32	98	0.0	30.8	13.0	71	27	5.9	4.3
6	21	92	0.0	32.2	14.1	65	27	6.5	5.7
7	15	52	0.0	33.1	12.3	73	18	6.6	3.8
8	6	23	0.0	35.0	14.6	66	18	7.7	3.9
9	0	17	24.3	30.9	15.0	79	38	6.3	4.4
10	0	11	16.6	33.4	16.0	77	29	6.5	5.4
Mean	19.60	60.87	3.34	30.61	12.06	75.40	28.13	5.45	4.10
'r' values		0.7836	-0.3040	-0.4505	-0.2416	-0.1106	0.0385	-0.3507	0.0125

*larvae + pupae

pods as observed on 10th SMW. The mean pod fly (larvae + pupae) population during crop season over a period of 15 meteorological weeks (48th to 10th SMW) was 60.87 pod flies per 100 pods. The average minimum and maximum temperatures ranged from 6.3 to 15.1°C and 27.3 to 31.3°C, respectively during this period; whereas the average relative humidity fluctuated between 72 and 89 per cent, indicating that low temperature and high relative humidity influences more on immature stages of *M. obtusa*. From 4th SMW (January) onwards, the population started dwindling with rise in maximum and minimum temperature above 27°C and 10°C and the fall in average relative humidity below 70 per cent, and ultimately it crashed to its minimum level (11 pod flies per 100 pods) by the 10th SMW (March) when the minimum, maximum temperature and relative humidity fluctuated around 16.0°C, 33.4°C and 77 per cent, respectively, indicating that increasing temperature and reduction in relative humidity influences less pest population.

The results obtained in the present investigation are in concurrence with Yadav *et al*. (2011) where it was found that maximum temperature below 30°C and minimum temperature between 8.1°C and 17.0°C and average relative humidity around 60 to 70 per cent is conducive for population build up of *M. obtusa*. Also, the present results are in accordance with earlier workers *viz*., Das and Katyar (1998), who noticed pod fly in the 43rd SMW, while maximum pods (16 per cent) infestation with larvae was observed during 5th SMW. Similarly, Pillai and Agnihotri (2013) reported the peak activity during 46th standard week while the population of *M. obtusa* was minimum (31 per 100 pods) during 49th standard week.

The present study revealed the presence of three major hymenopteran parasitoids *viz*., *Euderus* sp., *Torymus* sp. (larval parasitoids) and *Ormyrus* sp. (pupal parasitoid) on *Melanagromyza obtusa*.

The parasitoids observed in the present investigation in relation to natural parasitization of *M. obtusa* on pigeonpea are in conformity with the earlier reports *viz*., Sebastian (1993) who reported the eulophid *Euderus lividus* and the ormyrid *Ormyrus orientalis* on *M. obtusa*. Singh (1994) reared and studied *Ormyrus orientalis*, *Euderus lividus* and *Senegalella* sp. on *M. obtusa* (Malloch) as its parasitoids. Similarly, Yadav *et al*. (2012) found hymenopteran parasitoids *viz*., larval parasitoid, *Euderus lividus* and pupal parasitoids, *Ormyrus orientalis*, *Eurytoma* sp. and *Pseudotorymus* sp., respectively on *M. obtusa*.

The parasitoid population of *M. obtusa* was active from 50th SMW (2 parasitoids per 100 pods) which increased gradually and attained a peak on 3rd SMW with 63 parasitoids per 100 pods (Table 1). The population declined later and was 6 parasitoids per 100 pods as observed on 8th SMW. The mean population of pod fly parasitoids during the season (48th to 10th SMW) was 19.60 parasitoids per 100 pods. Moreover, the parasitoid population synchronized with availability of the host. In general, the population of parasitoids was found to increase from 50th SMW (December) to 3rd SMW (January) of 2014-15, when the average minimum and maximum temperatures ranged from 6.3 to 15.1°C and 27.3 to 31.3°C, respectively; whereas the average relative humidity fluctuated between 72 and 89 per cent, indicating that low temperatures and high relative humidity leads to more occurrence of *M. obtusa* parasitoids. From 4th SMW (January) onwards, its population started dwindling with the rise in maximum and minimum temperature above 27°C and 10°C, respectively and the fall in average relative humidity below 70 per cent, and ultimately it crashed to its minimum level (6 pod fly parasitoids per 100 pods) by the 8th SMW (March) when the minimum, maximum temperatures and relative humidity fluctuated around 16.0°C, 33.4°C and 77 per cent, respectively, indicating that high temperature and low relative humidity leads to less occurrence of pod fly parasitoids and their activity.

The results are in accordance with Das and Katyar (1998) who reported that with decrease in average temperature from 20.5 to 18.5°C, there was a gradual and significant increase in pod fly parasitoid population, with peaks at 51st, 2nd and 7th

SW. Yadav *et al*. (2012) reported that on short duration variety, larval parasitism was minimum (15.00 percent) in October whereas it was maximum (40.00 per cent) in December. The pupal parasitism was maximum 29.48 per cent in November and it reduced to 15.93 per cent in December near the harvesting time. The short duration variety also showed the dominance of larval parasitoids like late variety in all months *i.e.* October to December. Among parasitoids, monthly total parasitism revealed that on late variety maximum larval parasitism was noticed (54.83 per cent) in May as compared to pupal parasitism (40.42 per cent). Similarly, Yadav and Yadav (2013) recorded a maximum of 20.00 and 55.55 per cent parasitism of *E. lividus* and *O. orientalis*, respectively during December.

The results in respect of simple correlation between parasitoids population of *M. obtusa* infesting pigeonpea and weather parameters during *Kharif* season 2014-15 are presented in Table 1. The analysis of data indicated a strong positive correlation between parasitoid population with pod fly population (r = 0.7836), indicating that with availability of adequate host, the parasitoid population of *M. obtusa* increases leading to more chances of parasitization. Similarly, the correlation between parasitoid population with afternoon humidity and wind speed showed weak positive correlation with regression coefficients of 0.0385, and 0.0125, respectively, indicating that increase in afternoon humidity and wind speed leads to more occurrence of pod fly parasitoids population. Negative correlation was observed between parasitoids population and rainfall (r = -0.3040), maximum temperature (r = -0.4505), minimum temperature (r = -0.2416), morning humidity (r = -0.1106) and evaporation (r = -0.3507), respectively, indicating that increase in temperature, morning humidity, evaporation and rainfall leads to less occurrence of pod fly parasitoids and vise-versa.

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