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Influence of resistant and susceptible pigeonpea cultivars on the parasitization efficiency of some parasitoids on Podfly, *Melanagromyza obtusa* (Malloch)

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ABSTRACT: Three parasitoids, *viz. Ormyrus orientalis* Walker, *Euderus agromyzae* Gangrade and *Eurytoma ranjithi* Narendran were found parasitzing podfly, *Melanagromza obtusa* (Malloch) on all the three cultivars of pigeonpea. Parasitization increased with the increase in pest population irrespective of the parasitoid species. *Ormyrus orientalis* was recorded as the key parasitoid. There was a significant effect of resistant and susceptible varieties on parasitization of podfly. The mean parasitization by all the three species in 2000-01 was 24.0 per cent on NA1 followed by Bahar (22.5%) and SL12-1 (8.4%). Similarly, in the following year, the mean parasitization was 25.0 per cent on NA1 which was on par with Bahar (24.3%) but significantly superior (p=0.05) to SL12-1 (9.3%). A distinct variation in the population of pest, *Melanagromyza obtusa* with respect to pigeonpea cultivars was observed, however, the oviposition trend recorded at weekly interval was found almost same. The average oviposition was 14-15 per cent in case of the susceptible varieties (Bahar and NA1) whereas; the resistant variety SL12-1 exhibited only 4 per cent oviposition by podfly. The results clearly indicated that greater parasitism of *M. obtusa* occurred on susceptible genotypes than resistant cultivar.

KEY WORDS: *Euderus agromyzae, Eurytoma ranjithi, Ormyrus orientalis, M. obtusa*, pigeonpea

INTRODUCTION

Pigeonpea (*Cajanus cajan* (L.) Millspaugh) is one of the major grain legume crops of the tropics and subtropics. Endowed with several unique characteristics, it finds an important place in the farming systems adopted by small farmers in a larger number of developing countries. Among the insect pests attacking pigeonpea, the podfly, *Melanagromyza obtusa* (Malloch) is the most predominant and major pest in north India contributing nearly 40-75 per cent of total crop loss in late maturing pigeonpea in Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan and Maharashtra (Lal and Katti, 1997). *M. obtusa* is basically hidden pest completing its entire life cycle within pods except adults, and damage is realized only at the time of threshing and winnowing. This pest is protected from predators and contact insecticides, most parts of its life. Since, the pest cannot be reared under

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artificial conditions, multiplication and augmentation of its parasitoids is difficult. It is important to ascertain the natural parasitization of podfly in pigeonpea, especially in the northern areas of India where podfly is a major problem. The present study was therefore conducted on the influence of pigeonpea cultivars on major parasitoids of *M. obtusa.*

MATERIALS AND METHODS

To study the parasitoids and influence of cultivars on the parasitization of podfly, one resistant (SL12-1) and two susceptible genotypes (Bahar and NA1) were sown on 15 July in large plots (100 X 50 m) in the experimental fields of Indian Institute of Pulses Research, Kanpur in the two cropping seasons (2000-01 & 2001-02). Each plot was further divided into ten equal sub-plots. Five hundred pods with developing grains (30-40 days old) from each sub-plot for each variety were collected randomly from the field and critically examined under stereo zoom microscope to observe the immature stages of the parasitoids. These observations were taken at weekly interval starting from January. Simultaneously, the maggots and pupae were transferred to individual Petri-dishes kept in atmospheric chamber (25°C and 75% RH) till the emergence of adults of podfly or parasitoids. The adults of parasitoids, obtained from each variety, were kept separately. The per cent parasitization of an individual species was worked out. Each parasitoid was recorded according to the cultivar from which its host had been recovered. This way, the level of field parasitization was computed on each cultivar. The parasitoids collected were preserved in alcohol (70%) with a few drops of glycerine and later sent to Dr. T. C. Narendran, University of Calicut, Kerala for identification.

The data on weekly count of parasitoids were analysed by square root x+1 transformation. Data on per cent parasitism were subjected to analysis of variance (ANOVA) to know the difference in cultivar preference for parasitism.

RESULTS AND DICUSSION

Influence of cultivars on parasitization

Three parasitoids, *viz. Ormyrus orientalis* Walker, *Euderus agromyzae* Gangrade and *Eurytoma ranjithi* Narendran were found parasitzing podfly on all the three cultivars. There was a differential response of varieties *vis-à-vis* pest and parasitoid species on parasitization at weekly interval (Fig. 1-3). When a comparison between parasitization and varieties was made with respect to the time intervals, it was revealed that in 2000-01, the extent of parasitization in the month of January could reach to 9.8 per cent on Bahar, 2.6 per cent on NA1 and 0.7 per cent on SL12-1. The corresponding figures in 2001-02 were 7.3, 4.8, and 1.3 percent. A significant increase in parasitization was observed in the month of February reflecting 16.0, 17.1, 6.9 in 2000-01, and 16.1, 17.5 and 7.8 in 2001-02 on Bahar, NA1 and SL12-1, respectively. In March, a substantial increase in parasitization was observed in both the years. The parasitization reached to a level of 35.4 per cent on Bahar, 46.4 per cent (NA1) and 16.5 per cent (SL12-1) in 2000-01. Similarly, in the following year, the respective values were 39.8, 45.7, and 16.5 per cent. The parasitization reached to its maximum in April, interestingly in both the years. It was recorded as 57.6 per cent on Bahar, 60.7 per cent on NA1 and 18.8 per cent on SL12-1 in 2000-01, whereas, the corresponding values were 68.4, 64.5 and 23.5 per cent in 2001-02. The average parasitization on, Bahar, NA1 and SL12-1 was 22.5, 24.1 and 8.4 per cent in 2000-01 and 24.3, 25.1 and 9.4 per cent during 2001-02, respectively. The parasitization was found increasing with the maturity of the crop and reached its peak at the end of the crop. Similar findings were observed by Bindra and Singh (1972), Singh (1982) and Sebestian (1993). However, they have not studied the impact of cultivars. There was a distinct variation in the population of pest with respect to pigeonpea cultivars. However, the oviposition trend was found almost same recorded at weekly interval. The average oviposition was 14-15 per cent in case of the susceptible varieties Bahar and NA1, whereas, the resistant variety SL12-1 exhibited only 4 per cent.

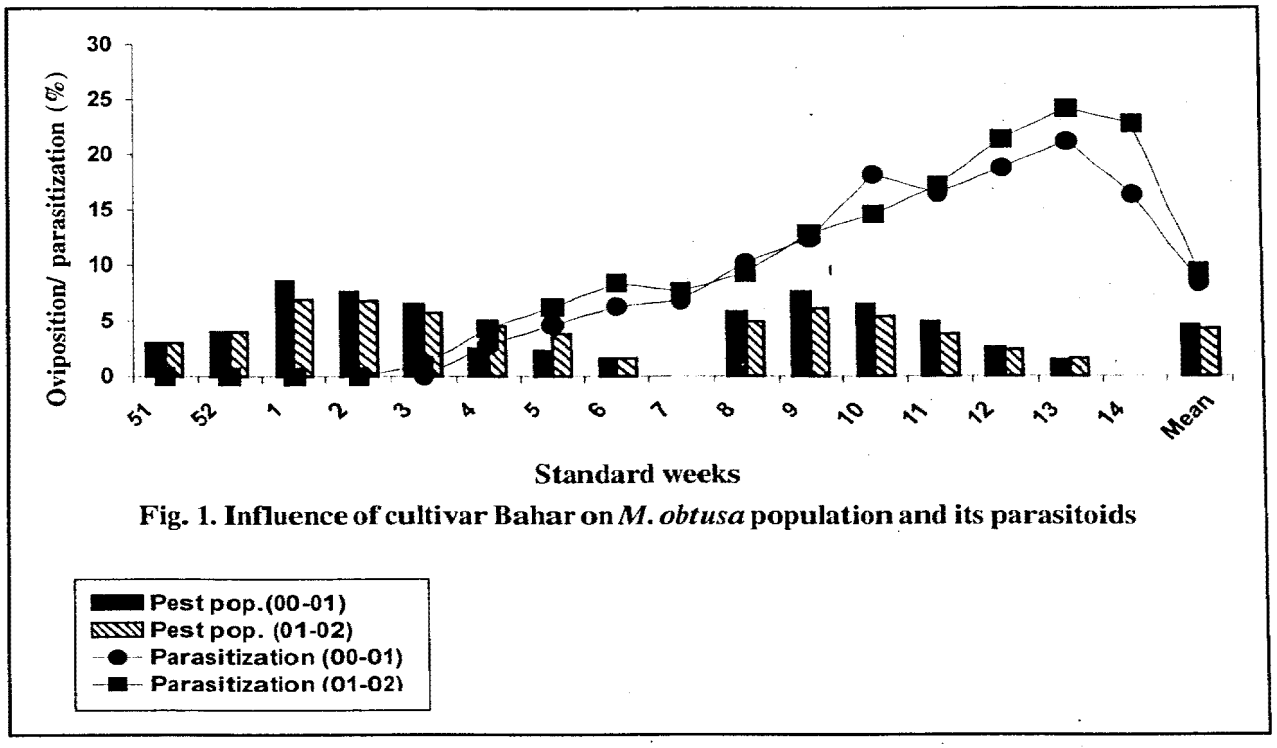

Fig. 1. Influence of cultivar Bahar on *M. obtusa* population and its parasitoids

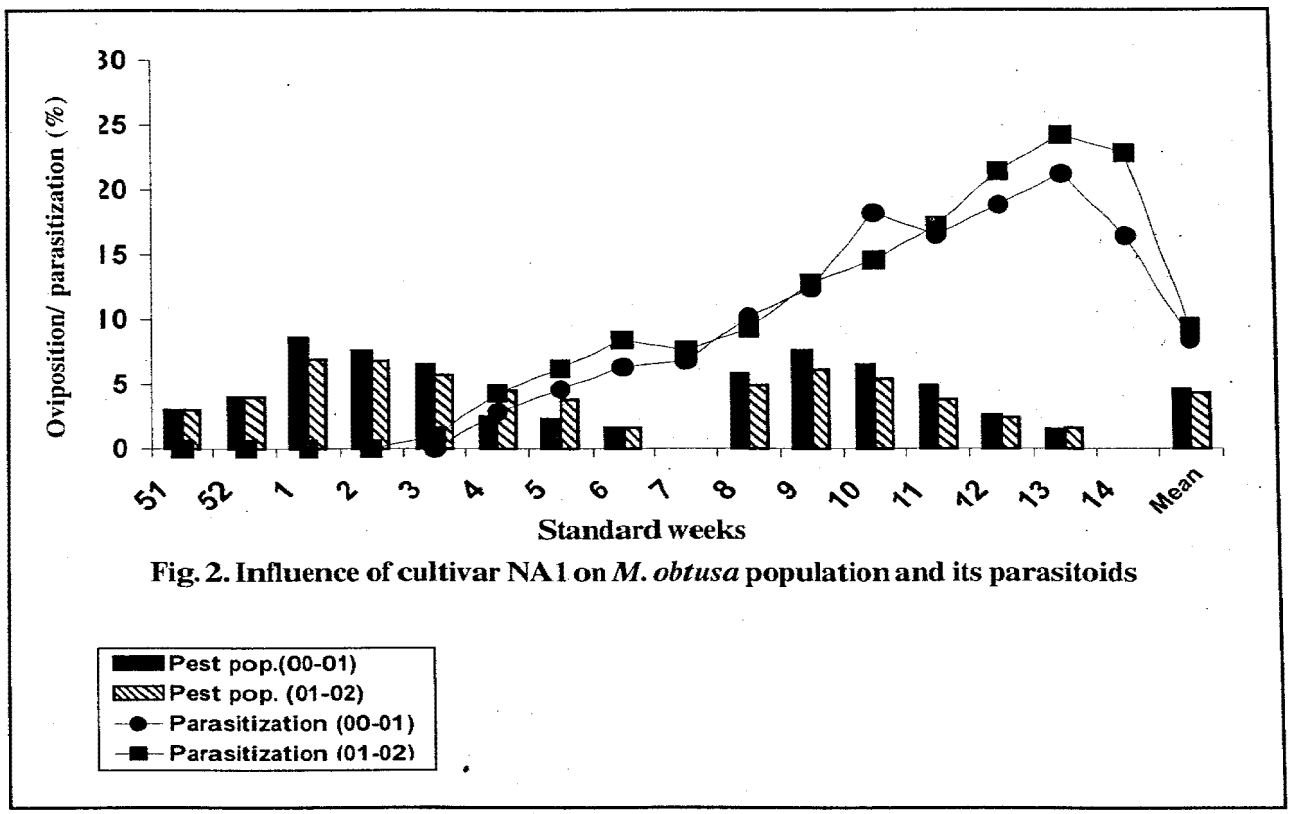

Fig. 2. Influence of cultivar NA1 on *M. obtusa* population and its parasitoids

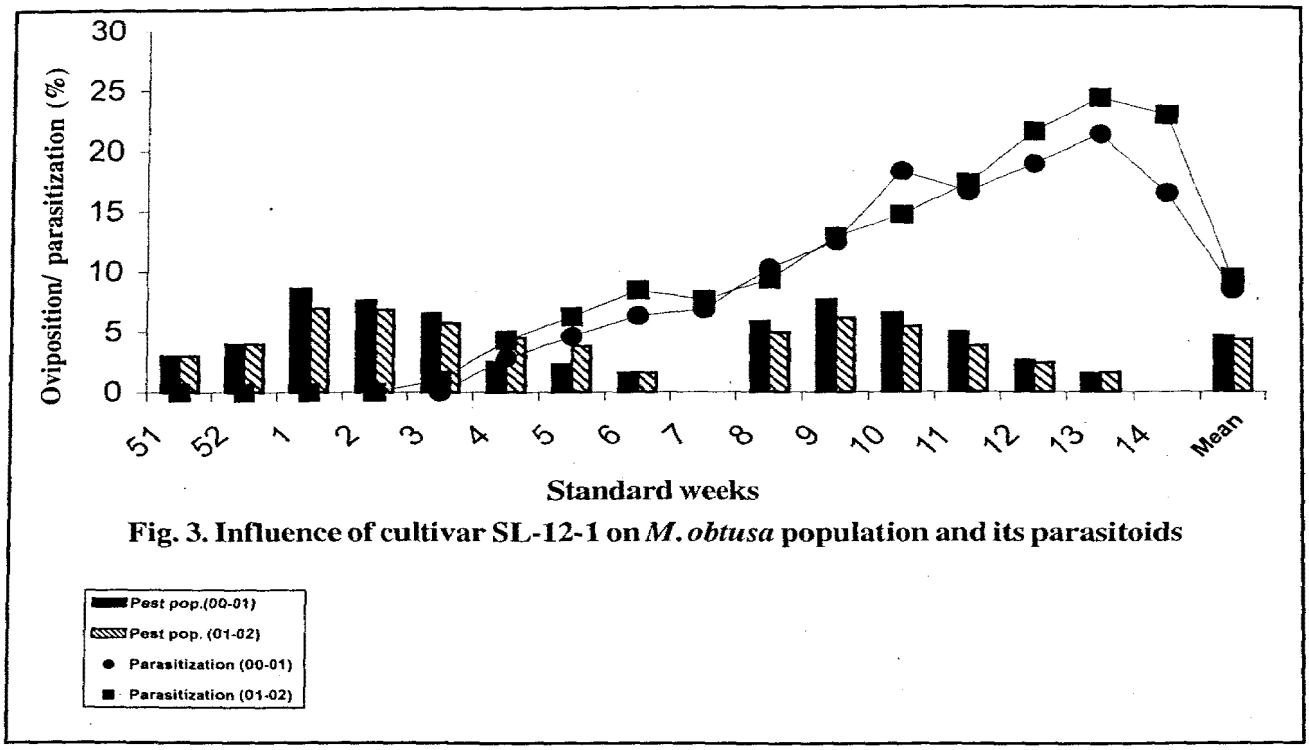

Fig. 3. Influence of cultivar SL-12-1 on *M. obtusa* population and its parasitoids

O. orientalis started attacking the pupae of *M. obtusa* from 2nd standard week (SW) on Bahar, in both the years, whereas, on SL12-1 from 4 SW in 2000-01 and 3 SW in 2001-02 (Fig. 2 & 3). In January, the parasitization was 5.9, 1.3 and 0.5 per cent (2000-01) and 3.4, 2.0 and 0.6 per cent (2001-02) on Bahar, NA1 and SL12-1, respectively. Subsequently, in March 2000-01 the parasitization increased further to 20.7, 25.9 and 9.2 per cent on Bahar, NA1 and SL12-1, respectively. Similar was the trend with respect to 2001-02; the respective values were 22.1, 22.6 and 10.5 per cent. The highest degree of parasitization was witnessed during April, exhibiting 29.3 per cent on Bahar, 38.8 per cent on NA1 and 9.4 per cent on SL12-1 (2000-01) and 38.2, 36.3 and 14.2 per cent in 2001-02, respectively. The average parasitization in 2000-01 was 12.3, 13.9 and 4.4 per cent on Bahar, NA1 and SL12-1, respectively and in 2001-02, the corresponding figures were 13.4, 13.2 and 5.6 per cent.

There was relatively less parasitization by *E. agromyzae* as compared to *O. orientalis,* though; the trend of parasitization in different weeks remained the same. In 2000-01, it started parasitizing podfly larvae from 2 and 3 SWs on Bahar and NA1, respectively, and from 6 SW on SL12-1. Conversely, in 2001-02, the parasitization was observed on 2, 3 and 4 SWs on Bahar, NA1 and SL12-1, respectively.

In January 2000-01, the parasitization by *E. ranjithi* of podfly was 2.5 and 1.0 per cent on Bahar and NA1, respectively, however, podfly on SL12-1 did not record any parasitization. In the following year (2001-02), it was 3.4 per cent on Bahar, 1.5 per cent on NA1and 0.25 per cent on SL12-1. The parasitization elevated slightly in February exhibiting 4.8 and 4.7 per cent in 2000-01 and 5.3 and 4.7 per cent in 2001-02 on NA1 and Bahar, respectively, whereas, on SL12-1 it could parasitize only 1.2 and 1.3 per cent of podfly. The parasitization intensified in March showing respective figures as 10.1, 11.7, 2.4 per cent (2000-01) and 11.5, 14.3, 2.0 per cent (2001-02) on Bahar, NA1 and SL12-1. Similarly in April, the parasitization further elevated and ranged between 3.7 to 19.3 per cent in first year and 3.8 and 17.5 per cent in second year. The mean parasitization was 6.6 per cent on

Bahar, 6.8 per cent on NA1 and 1.3 per cent on SL12-1 in 2000-01 and the corresponding values for the year 2001-02 were 6.8, 7.4 and 1.3 per cent.

A marked difference in parasitization by *E. ranjithi* was observed on different cultivars. It was more on Bahar and NA1 as compared to SL12-1. The parasitoid started parasitizing *M.obtusa* in January, in both the years. The level of parasitization was, however, very low. It was 1.3, 1.4, 0.25 per cent (2000-01) and 1.5, 0.4, 0.5 per cent (2001-02) on Bahar, NA1 and SL12-1, respectively. The average parasitization in two successive cropping seasons was 3.5, 6.8, 2.6 per cent and 4.1, 3.4 and 2.4 per cent on Bahar, NA-1 and SL12-1, respectively.

Influence of cultivars on over all parasitization

There was a significant (p=0.05) effect of varieties on parasitization of podfly (Table 1). The maximum parasitization by all the three species in 2000-01 was on NA1 (24.0%) followed by Bahar (22.5%) and SL12-1 (8.4%). Similarly, in the following year, the maximum parasitization was on NA1 (25.0%), which was on par with Bahar (24.3%) but significantly superior to SL12-1 (9.3%). The varieties also showed a significant difference in parasitization caused by *O. orientalis* exhibiting maximum on NA1 (13.8%) followed by Bahar (12.3%) in 2000-01, significantly superior to SL12-I (4.4%). Similar were the observations in 2001-02, wherein, parasitization on Bahar (13.4%) and NA1 (13.1%) were on par with each other and statistically superior to SL12-1 (5.6 %). Likewise, a significant difference was observed in the parasitization on different cultivars, caused by *E. agromyzae* in both the years. The parasitization was high, (6.7%) on NA1 followed by Bahar (6.6%) and SL12-1 (1.2%) in 2000-01 as compared to 7.4 per cent on Bahar, 6.7 per cent on NA1 and 1.2 per cent on SL12-1 (2001-02). The cultivars, however, did not show a significant effect on parasitization by *E. ranjithi* exhibiting 3.4 per cent on both Bahar and NA1 against 2.5 per cent on SL12-1 (2000-01). Similarly, in 2001-02, the corresponding values were 4.4, 4.1 and 2.3 per cent on NA1, Bahar and SL12-1.

These parasitoids except *E. ranjithi* were also reported on podfly by (Gangrade, 1960; Fellowes and Amarasena, 1977; Singh, 1982; Peter, 1982; Sithanantham *et al.*, 1987; Kumar and Nath, 2002). *O. orientalis* was recorded a key parasitoid of podfly in our study. The appearance of parasitoids apparently synchronized with the availability of immature stages of *M. obtusa*. Similar observations were made in resistant variety. It is in conformity with earlier findings (Lal and Yadava, 2001) that recorded 26.8, 24.1 and 14.9 per cent parasitization on Bahar, NA1 and SL12-1, respectively.

Table 1. Effect of resistance and susceptible cultivars of pigeonpea on parasitization of podfly

Variety	Total parasitization	2000-01			Total parasitization	2001-02		
		Per cent parasitization				Per cent parasitization by		
		O. orientalis	*E. agromyzae*	*E. ranjithi*		*O. orientalis*	*E. agromyzae*	*E. ranjithi*
Bahar	22.3 (28.3)*	12.3 (20.5)	6.6 (14.8)	3.4 (10.6)	24.2 (29.5)	13.4 (21.4)	6.7 (15.0)	4.1 (11.6)
NA1	23.9 (29.3)	13.8 (21.8)	6.7 (15.0)	3.4 (10.5)	24.9 (30.0)	13.1 (21.2)	7.4 (15.7)	4.4 (12.1)
SL12-1	8.1 (16.8)	4.4 (12.1)	1.2 (6.2)	2.5 (9.1)	9.1 (17.7)	5.6 (13.6)	1.2 (6.2)	2.3 (8.7)
CD(P=0.05)	8.2	7.0	3.8	NS	10.4	7.2	3.6	NS

* Figures in parentheses are the angular transformed values.

However, they have not studied the impact of cultivars on individual parasitoid species, which is new information.

The cultivars exhibited a significant variation in parasitization caused by *E. agromyzae*. Since this is larval ecto-parasitoid, it might have been difficult for female parasitoids to insert eggs into these pods because of the deep constriction between the locules and pod wall toughness, which is also the resistant factor for podfly (Lal and Katti, 1997). However, the reasons for similar response by *O. orientalis*, a pupal parasitoid may not be easily established. This parasitoid is supposed to parasitize the pre-pupal stage of the podfly just at the time of making exit hole. It is therefore important to further investigate the reasons for the influence on the parasitization shown by cultivars. The efficiency of *T. chilonis* on pigeonpea was dependent on the plant structure on which the host eggs were found. Volatile infochemicals and hexane surface extracts from pods of two wild *Cajanus* species, *C. scarabaeoides* and *C. platycarpus*, were similarly deterrent to *T. chilonis*. The movement of the parasitoids on pigeonpea pods and calyces was inhibited by long trichomes and wasps were trapped by sticky trichome exudates (Romies *et al.*, 1998). Sathe and Santhakumar (1990) found that it was the odour of the pigeonpea plant that was mainly responsible for stimulating the females to perform searching followed by stabbing intention movements and the factors responsible for host finding by *C. chlorideae* are olfactory rather than visual.

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