

ACKNOWLEDGEMENT

The authors are grateful to Dr. I. D. Gauld, Commonwealth Institute of Entomology, London for identification of the parasite.

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J. Biol. Control, 1(1), 10-16. 1987

Parasites of the Pigeonpea Podfly, *Melanagromyza obtusa* (Malloch), in India*

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ABSTRACT

In a survey of parasites on the pigeonpea podfly, *Melanagromyza obtusa* (Malloch) (Diptera: Agromyzidae) in India, six genera - *Euderus* (Eulophidae), *Eupelmus* (Eupelmidae), *Eurytoma*, *Plutarchia* (Eurytomidae), *Antistrophoplex* (Torymidae) and *Ormyrus* (Ormyridae) were recorded during 1977-83. Data on monthly overall parasitism revealed peaks during February-March, when the pest populations are also usually high. In a two year (1980-82) study at ICRISAT Center, *Euderus* and *Ormyrus* were found to be the dominant parasites on *M. obtusa*. Difference in extent of parasitism was observed between samples from two pigeonpea cultivars- ICP 1 and HY 3C, which was probably related to host abundance. Surveys revealed that the genera - *Euderus* and *Ormyrus* are also dominant and widely spread in India and these should be conserved. The possibility of augmentation is also mentioned.

Key words: *Melanagromyza*, Parasites, *Eupelmus*, *Eurytoma*, *Antistrophoplex*, *Ormyrus*, influence of Host Plant Variety.

The podfly, *Melanagromyza obtusa* (Malloch) (Diptera: Agromyzidae) is a major pest of pigeonpea in India, particularly in the northern and central areas (Lateef and Reed, 1983).

This insect is difficult to control with most insecticides because all the immature stages develop concealed inside the pods. The potential of natural control elements in suppressing this pest has not been assessed adequately. Information on parasites

* Submitted as J. A. No. 710 by the ICRISAT.

occurring on *M. obtusa* has mostly been restricted to occasional local records with little quantitative data on the seasonal and regional pattern of their occurrence. The genera reported in India include *Euderus* and *Dyglyphus* (Eulophidae), *Ormyrus* (Ormyridae), *Eurytoma* (Eurytomidae), *Eupelmus* (Eupelmidae), and *Trichopria* (Diapriidae) (Ahmad, 1940; Gangrade, 1960, 1962; Bindra and Singh, 1972; Singh, 1982; Thakur and Odak, 1982; Khan, 1985). In Sri Lanka, *Euderus*, *Ormyrus*, *Eurytoma* and *Eupelmus* were recorded as parasitising *M. obtusa* (Fellowes and Amarasena, 1982). A preliminary survey of *M. obtusa* parasitism in a few states in India during one season has been reported by Sithanatham *et al.* (1983). The biology and behaviour of two species of *Euderus* have also been described.

The study reported in this paper was taken up with the purpose of monitoring the natural parasitism levels (and the range of parasites occurring) on podfly for a few years at ICRISAT Center and assess the distribution of the common parasites at a number of locations throughout India, so that their potential for biocontrol of the pest could be judged.

MATERIALS AND METHODS

At ICRISAT Center. In each year from 1977 to 1982 the incidence of natural parasitism on *M. obtusa* was recorded at ICRISAT Center in each month in which pods were available. Samples of 300 to 500 pods, mature but not dry, were collected from pesticide-free pigeonpea fields and brought into the laboratory. They

were opened and all the podfly larvae and pupae were collected and incubated in petri dishes either until a podfly or a parasite adult emerged, or until the larvae or pupae died and dried up. In some months, several such samples were collected and recorded. In the 1980-81 season, samples were also collected separately from two cultivars - ICP 1, an indeterminate type with an open branching habit and HY 3C, a semi-determinate, compact type and parasitisation was recorded.

Surveys across India. A survey to estimate the incidence of parasitism in *M. obtusa* collected from several states of India was organized during 1980-83 in collaboration with the entomologists of the All India Coordinated Pulses Improvement Project (AICPIP). Freshly collected pods were mailed to ICRISAT, and the podfly larvae and pupae were collected and incubated for parasitism studies. During 1981-82 a total of 100 samples from 11 states arrived in sufficiently good condition to be used for such recording. Fewer samples were obtained during the other two years.

RESULTS AND DISCUSSION

The parasites that bred from *M. obtusa* at ICRISAT Center were *Euderus* spp. (Eulophidae), *Eupelmus* sp. (Eupelmidae), *Eurytoma* sp. *robusta* Mayr Group (Eurytomidae), *Plutarchia* sp. nr. *indefensa* (Walker) (Eurytomidae), *Antistrophoplex* sp. (Torymidae) and *Ormyrus? orientalis* (Walker) (Ormyridae). Of these six genera, *Euderus* is known to occur commonly on *M. obtusa* and has been suggested as a potential candidate

for the biocontrol of this pest (Ahmad, 1940; Gangrade, 1960; Bindra and Singh, 1972). The three genera - *Eurytoma*, *Ormyrus* and *Antistrophoplex* are generally known to be associated with cynipid galls (personal communication, CIE, and Dr. S. I. Farooqi, IARI, New Delhi). In our studies we ascertained that these genera emerge from the pupal stage of *M. obtusa* and therefore are clearly endoparasites of this insect. We reported first (Pulse Entomology Departmental Progress Report, 1978-79) that *Eurytoma* and *Ormyrus* occur as parasites on *M. obtusa* in south India (Patancheru). These were later confirmed by observations in north India (Singh, 1982; Thakur and Odak, 1982). The rare occurrence of *Antistrophoplex* has also been reported from limited surveys by Sithanantham *et al* (1983). The status of *Plutarchia* as a primary parasite needs to be clarified. There is no other record of it having been bred from an agromyzid.

The five year study of monthly parasitism of *M. obtusa* at ICRISAT Center is summarised in Table 1.

Except for early season (November) peaks in percentage parasitism, occurring at a time when pest densities are low, the major peaks occurred in February-March each year. The pest population builds up slowly from October-November to reach peak densities in February - March in the long duration pigeonpea cultivars that are podding at that time at ICRISAT Center. In northern India the podfly populations increase after the winter (Dec-Jan/Feb) and observations by Singh (1982) at Agra have shown that peak parasitism occurs during February-April when podfly numbers are also high. As such, *M. obtusa* parasitism appears to be related to host density and any augmentation of of parasites should be attempted before the pest builds up in February, as suggested by Ahmad (1940). In addition to this monthly information, we observed that the overall annual parasitism during the five years' study tended to decline from about 30% in 1977-78 to about 11% in 1981-82. This could be due to the increased use of insecticides, growth of crop and

Table 1. Abundance of parasites on *Melanagromyza obtusa* at ICRISAT Center, 1977-82.

Month	1977-78		1978-79		1979-80		1980-81		1981-82	
	n	%	n	%	n	%	n	%	n	%
Nov.	1007	14.6	1980	16.2	1009	18.4	133	12.8	48	6.3
Dec.	1981	18.8	3339	17.5	2849	10.4	2625	9.6	252	7.5
Jan.	3121	26.3	3376	15.9	4159	7.5	411	13.9	345	10.1
Feb.	4039	36.9	1824	10.4	1430	16.2	661	10.4	404	17.3
Mar.	4195	46.3	2369	22.2	2122	14.4	318	18.9	120	3.3
Apr.	4275	21.8	NR	NR	1669	14.3	NR	NR	NR	NR
May-Oct.	(Crop/host not available for sampling)									
Total	18618	30.6	12888	16.8	13238	12.6	4148	11.5	1169	11.2

n = Total no. of podfly developing stages observed.
 % = % Parasitised.
 NR = No records.

abiotic factors in and around the ICRISAT farm during this period.

Two genera - *Euderus* and *Ormyrus* were found to be dominant and *Eurytoma* was relatively uncommon among the major podfly parasites recovered in monthly samples during 1980-82 (Table 2). Thakur and Odak (1972) have observed *Euderus* to be the dominant parasite on this pest at Jabalpur (Northern India). A similar study from Sri Lanka indicated *Ormyrus* to be dominant while *Euderus* and *Eurytoma* were less common (Fellowes and Amarasena, 1982). Unfortunately, neither of these published reports listed parasitism records on a monthly basis or from more than one season. It will be important to ascertain the dominant species especially in other areas of northern India where podfly is a major problem.

In the comparison of parasitism on the two cultivars, parasitism percent

tended to be more in the indeterminate cv, ICP 1 (Table 3). This was mainly the result of greater frequency of *Ormyrus* parasitism. Cultivar differences resulting in this overall trend were probably related to differences in host abundance. Assessment of podfly incidence during February-March in these two cultivars revealed an average of three podfly developing stages (larvae + puparia) in 100 pods in ICP 1 as compared to 11 in Hy 3C. In general, February-March was a period when peak parasitism occurred in this location. However, *Ormyrus* declined in its overall importance in ICP 1 and *Euderus* became dominant contributing to much higher levels of parasitism than it did in HY 3C. Singh (1982) recorded differences in parasitism between cultivars belonging to different maturity groups. Our present finding is probably the first on parasitism differences (in any agro-

Table 2. Abundance of major genera of parasites on *Melanagromyza obtusa* at ICRISAT Center, 1980-82.

Year	Month	Total no. of podfly larvae and pupae	% parasitism by		
			<i>Eur.</i>	<i>Orm.</i>	<i>Eud.</i>
1980-81	Nov.	133	0.0	9.8	3.0
	Dec.	2625	0.6	4.7	4.2
	Jan.	411	0.5	3.9	9.5
	Feb.	661	0.8	6.2	3.5
	Mar.	318	3.1	7.9	7.9
	Total (mean)	4148	(0.8)	(5.3)	(4.8)
1981-82	Nov.	48	2.1	0.0	4.2
	Dec.	252	0.0	1.6	3.2
	Jan.	345	0.0	3.5	2.3
	Feb.	404	0.7	9.4	4.7
	Mar.	120	0.0	3.3	0.0
	Total (mean)	1169	(0.3)	(5.0)	(3.2)

Eur. = *Eurytoma* sp. (Eurytomidae: Hym.)

Orm. = *Ormyrus orientalis* (Ormyridae: Hym.)

Eud. = *Euderus* spp. (Eulophidae: Hym.)

Table 3. Parasites emerging from *Melanagromyza obtusa* larvae and pupae collected from two pigeonpea cultivars in 1980/81 at ICRISAT Center.

Month	Cultivar	Total immature podfly	% parasitism			Total
			<i>Ormyrus</i>	<i>Euderus</i>	<i>Eurytoma</i>	
Nov-Jan.	HY 3C	2668	4.2	5.3	0.6	10.1
	ICP-1	501	8.4	2.6	0.4	11.4
Feb-Mar.	HY 3C	862	7.2	3.6	1.6	12.4
	ICP-1	117	3.4	14.5	0.9	18.8
Total	HY 3C	3530	4.9	4.9	0.9	10.7
	ICP-1	618	7.4	4.9	0.5	12.8

myzid) between cultivars of the same maturity group. If any particular podfly parasite is to be augmented, it seems useful to check its compatibility with the crop cultivar concerned.

The data recorded from the surveys across India showed that *Euderus* and *Ormyrus* were most common and were intercepted in most of the states surveyed; *Eurytoma* and *Antistropheplex* were relatively rare (Table 4). An earlier report (Sithanantham *et al.*, 1983), which was based on limited samples in six states, reported that *Ormyrus* was as widespread and common as *Euderus* spp. The species

of *Euderus* intercepted in this survey could not be determined. Besides earlier reports of two species, *E. lividus* (Ahmad, 1940) and *E. agromyzae* (Gangrade, 1960), Thakur and Odak (1982) reported *Euderus* sp. nr *mestor* Walker occurring in the Jabalpur area. The species distinction and distribution within the two major genera-*Euderus* and *Ormyrus*-need to be clarified. *Eupelmus* and *Plutarchia*, which were recorded at ICRISAT Center, were not intercepted in the national surveys (Fig. 1.) and so may only be of local relevance.

Table 4. Podfly parasitism in different states of India (ICRISAT-AICPIP collaborative study, 1981-82).

State	Total podfly larvae/pupae observed	% parasitism				Total
		<i>Euderus</i>	<i>Ormyrus</i>	<i>Eurytoma</i>	<i>Antistropheplex</i>	
Andhra Pradesh	260	4.6	3.8	0.0	0.0	8.5
Bihar	229	3.9	5.2	0.4	0.0	9.6
Gujarat	671	4.3	0.7	0.0	1.0	6.1
Haryana	452	4.6	1.3	0.0	2.9	8.8
Karnataka	348	4.0	1.1	0.9	0.0	6.0
Madhyapradesh	3353	5.9	3.3	0.1	0.0	9.4
Maharashtra	151	9.3	1.3	1.3	0.0	11.9
Orissa	307	0.7	0.0	0.0	0.0	0.7
Rajasthan	597	0.0	0.3	0.3	0.3	1.0
Uttarpradesh	2543	2.7	2.4	0.6	0.0	5.6
West Bengal	380	2.9	0.5	0.3	0.0	3.7
Overall	9291	4.1	2.3	0.3	0.2	6.9

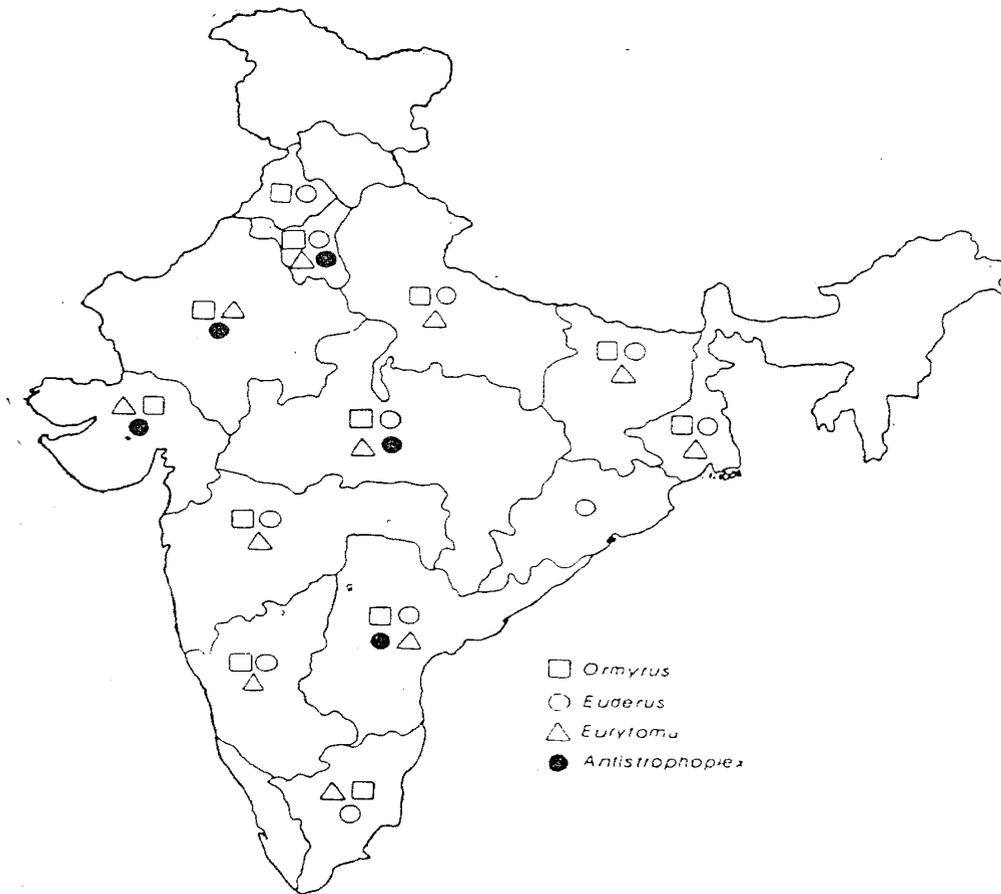


Fig. 1. Distribution of parasites of *Melanagromyza obtusa* based on ICRISAT surveys in India, 1980-83.

These results show the dominance and well spread nature of *Ormyrus* and *Euderus* in India. Parasitism peaks are usually observed in February - March, when podfly numbers are also high. At present, mass production of the dominant parasite genera is not feasible. With this in mind, the best policy is to conserve parasite populations by restricting insecticide use. The choice of cultivar and perhaps the related cropping practices should also be investigated further to find ways of enhancing the rate of parasitism. Parasites occurring on a

related species of podfly (*M. chalcosoma*) in Africa, such as *Bracon* sp. (ICRISAT unpublished), may be candidates for introduction into India to augment the endemic natural control agents.

ACKNOWLEDGEMENTS

We are thankful to Drs. Z. Boucek and B. R. Subba Rao of CIE, London, and S. I. Farooqi of IARI, New Delhi, for their kind help in identifying the parasites reported herein. We gratefully appreciate the national programme (AICPIP) entomologists for

their cooperation in the survey for parasitism in different states. The assistance by staff of pulse entomology unit at ICRISAT in many of the observations is thankfully acknowledged.

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J. Biol. Control, **1** (1), 16-19, 1987

Relative Contact Toxicity of Four Common Insecticides to *Apanteles* sp. (*vitripennis* sp group) and its Host *Spodoptera litura* (F.).

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ABSTRACT

Four insecticides each in three concentrations i. e., carbaryl and malathion (0.05, 0.07 and 0.10%) and endosulfan and phosalone (0.02, 0.04 and 0.05%) were evaluated in the laboratory for their efficacy against the tobacco caterpillar, *Spodoptera litura* (F) simultaneous to safety considerations to the associated parasite, *Apanteles* sp. (*vitripennis* sp. group). All the insecticides proved significantly toxic to the parasite as well as to its host at all concentrations. Considering the relative safety in terms of percentage mortality inflicted to the parasite, phosalone proved to be distinctly safer of the four insecticides. Considering the maximum safety to the parasite and control of the pest, it was concluded that phosalone (0.05%) was the best.

Key words: Safety, contact Pesticides Carbaryl, Malathion, Endosulfan, Phosalone
Parasite *Apanteles* sp. Toxicity *Spodoptera litura*.

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