

EFFICIENCY OF PARASITOIDS OF PEA LEAFMINER *PHYTOMYZA HORTICOLA* GOUREAU AND THEIR APPEARANCE TIME IN THE FIELD

*A. F. Mekhlif and **M. S. Abdul-Rassoul

*Department of Biology, College of Education, Mosul University, Mosul

** Iraq Natural History Museum, University of Baghdad, Baghdad, Iraq.

ABSTRACT

Eleven hymenopterous species: two braconids, seven eulophids and two pteromalids parasitized the larvae of *Phytomyza horticola* Goureau. The activity of the parasites began at the end of April and evidently increased during May. The female of the parasites fed and parasitized mostly on the second and third larval instars of *P. horticola*. *Diglyphus isae* Walker and *Cirrospilus vittatus* Walker were dominant larval parasites. *Chrysocharis pentheus* Walker and *Pediobius acantha* Walker were main pupal parasites.

INTRODUCTION

The pea leafminer *Phytomyza horticola* (Diptera, Agromyzidae) is a polyphagous species (Griffiths, 1976), and it may be of economic importance (Spencer, 1973). In Iraq, more than 40 host plant of this pest have been known, including some crops and ornamental plants (Al-Azawi, 1967 and Mekhlif, 1984).

Female of many hymenopterous parasites kill the host, either by oviposition or feeding on host fluids, since reproduction is impossible without protein in their diet (Bartell and Pass, 1978; Sugimoto *et al.*, 1983). However, the growing emphasis on biological control in pest management, demands a greater knowledge of important parasites (Bartella and Pass, 1978). Takada and Kamijo (1979); Drea *et al.* (1982) investigated the parasitic complex of *P. horticola* and its effective parasitoids in Japan and Europe respectively. However, in Iraq *P. horticola* was found to have 15 parasites (Al-Azawi, 1967, 1971; Mekhlif, 1984). Therefore, the aim of this work was to know the effective parasitoids and the time of their appearance in Mosul.

MATERIALS AND METHODS

In spring of 1988 and 1989 regular collection of immature stages of *P. horticola* from various host plants were conducted in order to determine its mortality, parasitism and parasites identification. Adult parasites were obtained by caging the host leaves containing immature stage of the pest during April and May. Larval ectoparasites were confirmed through the dissecting microscope. Pupal endoparasite and larva-pupal endoparasite were determined by the scar on the host pupa. The dead larvae due to host-feeding were clear and their contents were extruded by female parasites.

RESULTS AND DISCUSSION

1. Host Mortality

In March, the activity of the parasitoids had not begun, so that, the mortality of immature stages of *P. horticola* were very low. Yet, in April and in the beginning of May, mortality

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started and increased (table 1). This observation was also reported by Mekhif and Khazraji (1989). Most of the mortalities were due to host-feeding and parasitization. Table 1 also shows that the larval mortality was higher than the pupal mortality. Drea *et al.*, (1982) and Sugimoto, (1979) reported that larval parasites were vary aggressive for some agromyzid leafminers, which one of them *P. horticola*. Most of larval mortality probably was due to host-feeding of parasites as well as parasitization.

Table 1: Mortality of immature stages of *P. horticola* in the field.

* Numbers in paranthesis indicate the mortality of larvae or pupae.

Date of sampling	No. of hosts examined	No. of dead hosts			Total mortality %
		pupae	larvae	pupae	
1989					
18.3	354	2	3(0.8)*	0(0)*	0.8
31.3	369	143	0(0)	0(0)	0.0
20.4	294	144	264 (89.8)	5 (3.5)	61.4
30.4	675	56	596 (88.3)	3 (5.4)	81.0
7.5	906	21	887 (98.0)	9 (42.9)	96.7
10.5	218	3	216 (99.0)	1 (33.3)	98.2

2. Selection of the host instar

Female parasites evidently attacked second and third host instar larvae more than the first instar (table 2). Sugimoto (1979) observed that *Chrysocharis pentheus* experimentally fed on and parasitized second and third instars of runuculus leafminer, *P. ranunculii* (Schr.) this may be attributed to the parasites in having not enough ability to distinguish first instar larvae insides mines. Table 2 also reveals that the first instar larvae were rarely parasitized, on the other hand nearly half of the second instar larvae were parasitized. Parasites oviposited in most of third instar larvae causing their death. Perhaps the parasites preferred third instar larvae to ensure enough nutrients for their progeny to complete their development.

Table 2: Parasitism of *P. horticola* in different larval instars.

Host instar	No. of hosts found killed	No. of hosts parasitized	Parasitism %
I	50	4	8
II	71	37	52
III	118	99	83.9

3. Parasitism mode of dominant parasites

It was found that eulophid parasites *D. iscae* and *C. vittatus* completed their life-cycle on the host larvae (table 3) and *P. acantha* and *C. pentheus* were pupal endoparasites.

These observation were also reported by Takada and Kamijo (1979), for the same host, and Ibrahim and Madje (1979) for the host *P. syngensiae* (Hardy). The braconid *Opius* sp. is larval-pupal endoparasite, which lays its eggs on the host larva, and completes its development up to the adult stage inside the host pupa .

Opius spp. are also found as larval-pupal endoparasites of *Liriomyza munda* (Frick Hardling, 1965).

Table 3: Parasitizing phase of dominant parasites. Ect., Ectoparasite, End., Endoparasite.

Parasites	Developmental stage of host at		Mode of parasitism
	Oviposition	Emergence	
<i>Diglyphus isae</i> Walker	Larvae	Larvae	Ect.
<i>Cirrospilus vittatus</i> Wlk.	Larvae	Larvae	Ect.
<i>Pediopius acantha</i> Wlk.	Pupa	Pupa	End.
<i>Chrysocharis pentheus</i> Wlk.	Pupa	Pupa	End.
<i>Opius</i> sp.	Larva	Pupa	End.

4. Effective parasites

In the field, the efficiency of the parasite is mostly depended upon the period of its appearance, the parasite abundance in a given area and the ability of the female parasite to attack various host species, either for feeding or parasitization. Table 4 reveals the field appearance of the eulophid parasites *D. isae* and *C. vittatus* during April and May and *Opius* sp. during April but was not obtained in May. The parasites *Dacnusa* sp. and *Halticoptera circulus* (Welker) appeared for a short time in samples collected at late April and first third of May. The parasites; *Chrysonotomya formosa* Westwood, *P. acantha*, *C. pentheus* and *Tetrastichus strobilanae* were obtained throughout May while *C. formosa* at first week of the same month.

Table 4: Parasitic efficiency of *P. hottricola* during April and May as indicated by parasitism of each parasitoid.

Family and species	No. of parasites emerging / rearing date				
	20.4	30.4	7.5	10.5	15.5
Braconidae					
<i>Dacnusa</i> sp.	-	3(0.4)	-	1(0.6)	-
<i>Opius</i> sp.	14(8.3)	-	1(0.2)	-	-
Eulophidae					
<i>Chrysocharis pentheus</i>	-	-	-	5(3.2)	5(9.6)
<i>Chrysonotomya formosa</i>	-	-	1(0.2)	-	-
<i>Cirrospilus vittatus</i>	1(0.6)	2(0.2)	8(1.4)	13(8.2)	1(1.9)
<i>Diglyphus isae</i>	154 (91.1)	817 (99.2)	555 (97.0)	121 (76.7)	15 (28.8)
<i>D. crassinervis</i>	-	-	1(0.2)	1(0.6)	1(0.6)
<i>Pedicbius acantha</i>	-	-	2(0.3)	5(3.2)	27(52)
<i>Tetrastichus strobilanae</i>	-	-	1(0.2)	-	1(1.9)
Pteromalidae					
<i>Halticoptera circulus</i>	-	2(0.2)	3(0.5)	3(1.9)	-
<i>Spegigaster</i> sp. nr. <i>orobnchia</i>	-	-	-	-	2(3.9)
Larvae and pupae of host examined	438	731	927	221	60

According to Drea *et al.*, (1986); Ibrahim and Madje (1979); Takada and Kamijo (1979) *D. isae* and *C. vittatus* were the main larval ectoparasites of various agromyzid leafminers. The present study confirms this observation, for the parasite *D. isae*, its percentage to total parasites was more than 98% during April and first week of May, contrary *C. vittatus* rarely reared in some samples at the same time (table 4). The low number of *C. vittatus* may be attributed to competition between the larvae of *D. isae* and *C. vittatus*. *D. isae* is a multiple

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parasite and as many as four parasites was emerged from one host (Mekhlif, 1984). Table 4 also confirm this observation, thus, at 30th April collection, the number of *D. isease* adults were only more than immature stage of the examined host. The main pupal parasites were *P. acantha* and *C. pentheus*, parasitizing nearly all the host pupae during the second half of May (table 4) which agrees with Ibrahim and Madje (1979); Kamijo (1978) they recorded that *Chrysocharis* spp. are main pupal parasites of many leafminers of Diptera, Lepidoptera and Hymenoptera. The braconid parasite *Opius* sp. was active only during April (table 4), but latter disappeared. It is probable that the larval ectoparasite *D. isease* kills the host and *Opius* sp. larvae which needs alive host larva to continue its development.

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المقدّمات فلهو به خير تو لازبالا ورافت اميليط يرامه ف

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جامعة الموصل

الخلاصة

لوحظ نشاط أحد عشر طفيلياً من رتبة غشائية الأجنحة، تقضي على الأطوار غير الكاملة لحفار ورق البازلاء *Phytomyza horticola*. يبدأ نشاط الطفيليات في اية نيسان ويزداد بشكل واضح خلال مايس. غالباً ما تتغذى إناث الطفيليات وتتطفل على اليرقات وهي في الطورين الثاني والثالث. أكثر الطفيليات اليرقية فعالية *Diglyphus isae* و *Cirrospilus vittatus* و أهم الطفيليات التي اجم العذارى *Chrysocharis pentheus* و *Pediobius acantha*.