

Survey of Insect Species Associated with the Perennial Weed, *Plantago* spp. in Damascus Region, Syria

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ABSTRACT

A study to survey the insect species attack the perennial weed, *Plantago* spp. was carried out in Damascus region, Syria in year 2010. Nine insect species belong to 6 orders; Coleoptera, Diptera, Lepidoptera, Homoptera, Thysanoptera and Orthoptera and 7 families; Curculionidae, Chrysomelidae, Agromyzidae, Pyralidae, Aphididae, Thripidae and Acrididae were recorded attacking *Plantago* spp. Four hymenopterans parasitoid species belong to 3 families; Eulophidae, Braconidae and Ichneumonidae were found associated with *Plantago* spp. Also, 9 predatory species belong to 2 orders; Coleoptera and Diptera and 5 families; Carabidae, Malachiidae, Cantharidae, Coccinellidae and Syrphidae were reported associated with the weed plants. Seasonal occurrence and abundance of different species were recorded in three locations at the study's region.

Key words: *Plantago* spp., Survey, Insects, Damascus, Syria.

INTRODUCTION

Plantago spp. (Plantaginaceae) are common perennial plant species, distributed worldwide and have a large ecological amplitude. They reproduce by seeds and buds. They are weeds of arable fields and grassland (Long, 1938). Natives of Eurasia, *Plantago lanceolata* and *P. major* have become naturalized throughout North America, South America, Australia, New Zealand, Hawaii, Southeast Asia, and eastern Africa (Webb *et al.*, 1988, Wagner *et al.*, 1990, Chapman, 1991, Arnold and Wet, 1993, Pereira and Romaniuc, 1993 and Chua *et al.*, 1994). *P. lanceolata* and *P. major* are widely distributed in Syria (USDA-ARS, 2003).

Plantago spp. are tolerant to high nutrient conditions and are found in improved grasslands (Aart and Vulto, 1992). Low growing and rosette forming habit makes these species well adapted to resist intensive treading, grazing and cutting (Thomet, 1978). They are also plants of man-made habitats such as; urban areas and disturbed the ground (Bastin and Thomas, 1999). *P. lanceolata* was reported as a weed of Lucerne in Iran (Mirkamaly and Maddah, 1973) and of citrus and mango in Mauritius (McIntyre and Barbe, 1994).

Plantago spp. bloom from May to August (Long, 1938) but flowering begins in April and continues till the first frosts (Sagar and Harper, 1964). The weevils *Trichosirocalus troglodytes*, *Alophus triguttatus* and *Mecinus circulatus* (Coleoptera: Curculionidae) are important herbivores of *P. lanceolata* (Linders *et al.*, 1995 and Morris, 1997).

This study aimed to survey the insect species associated with *Plantago* spp. and to evaluate their

potential as natural enemies of the weed in Damascus region, Syria.

MATERIALS AND METHODS

The study was carried out in Damascus and Damascus Countryside region, Syria; at the garden of the Faculty of Agriculture (Abo Jarash) in Masaken Barzeh {location (1)} and Tishreen garden in Alumaween {location (2)} at Damascus as well in almond orchard in Saasa-Damascus Countryside {location (3)} in year 2010.

Samples of *Plantago* plants were collected weekly at random from each location, as three squares (each square 1 m²)/ sampling date. Collected samples were inspected for insect species found feeding or resting on the plant parts. Phenological plant stages and number of healthy and unhealthy plants were also recorded. Collected plants were placed in sacks and transferred to the laboratory at the Biological Control Studies and Research Center, Faculty of Agriculture, Damascus University, Damascus, Syria for inspection. All information (sample number, collection place and date, etc) were recorded. Plants were inspected for all stages of insect species found associated with the plants either attacking and/ or resting on them. Identification of insect species that caused damage, data of insect instars and rate of damage for each insect species/sampling were recorded. Also, insect individuals were checked for parasitoids as they were isolated in special containers until adults' emergence. Rate of parasitism was recorded. As well, predators found associated with *Plantago* spp. were also recorded. All insect species found associated with weed plants; insects attacked *Plantago* spp. and/ or parasitoids and predators, were identified using proper references.

RESULTS AND DISCUSSION

The survey of *Plantago* species showed that *P. lanceolata* was the common species at Damascus, while *P. major* was the common one at Damascus Countryside. The survey also revealed the presence of nine insect species belongs to 6 orders and 7 families, found attacking the weed in location (1). Two insects were identified up to the generic level and 7 up to the species level as follows: *Lixus* sp., *Chrysolina* sp., *Gastrophysa polygoni*, *Podagrica fuscicornis* (Coleoptera: Curculionidae), *Phytomyza plantaginis* (Diptera: Agromyzidae), *Dolicharthria punctalis* (Lepidoptera: Pyralidae), *Brevicoryne brassicae* (Homoptera: Aphididae), *Thrips nigropilosus* (Thysanoptera: Thripidae) and *Dociostaurus maroccanus* (Orthoptera: Acrididae). Four insect species attacked *P. lanceolata* in location (2), those were: *Lixus* sp., *Ph. plantaginis*, *D. punctalis* and *D. maroccanus*, while *Ph. plantaginis* was the only species recorded in location (3).

Lixus sp. was recorded as the most common and abundant insect species found feeding on the weed in all locations. Larvae and adults bore irregular tunnels in buds and root stocks, also in flower stalks and spikes, while adults bore in the leaves, especially in leaves veins. Thus, this insect species could be considered as the most important natural enemy of *P. lanceolata* as it has a potential to damage the seeds and buds of the weed. Bullock (1992) reported that the curculionid, *Mecinus circulator* attacked *P. lanceolata* in East Norfolk in England.

First appearance of *Lixus* sp. adults was found by early April in the two locations at Damascus. Highest population of the adults (4.66±1.17 and 4.70±0.80 adults/ plant) was found in August in locations (1) and (2), respectively. Insignificant difference ($P = 0.872$) was found between means of adult numbers in location (1) and (2) at $P = 0.05$. Respective highest population of larvae (5.50±0.51 and 5.65±0.95 larvae/plant) was recorded also in August in location (1) and (2). No significant difference ($P = 0.875$) was found between means of larvae numbers in the two locations at $P = 0.05$ (Table, 1).

Occurrence of *Lixus* sp. adults in the two locations at Damascus extended from April to October. Highest rate of damage (71.16±14.7 and 63.33±5.86%) was found in August in location (1) and in July in location (2), respectively. Insignificant difference ($P = 0.682$) was found between rates of damage in locations (1) and (2) at $P = 0.05$ (Fig. 1).

Chrysolina sp., *G. polygoni* and *P. fuscicornis* adults feed on leaves making very small circular

holes. *Chrysolina staphylaea* attacks *P. lanceolata* in East Norfolk in England (Cox, 2007). First appearance of *Chrysolina* adults was found by early January, while it was by early April for *G. polygoni* and *P. fuscicornis*. Highest population of *Chrysolina* sp. adults (4.10±0.22 adults/ plant) was recorded in April, while it was (3.52±0.12 adults/ plant) for *G. polygoni* and (2.17±0.98 adults/ plant) for *P. fuscicornis* in June (Table 1).

Occurrence of *Chrysolina* sp. adults extended from January to December and from April to July for *G. polygoni* and *P. fuscicornis*. Highest rates of damage (55.14±9.03, 7.49±53.74 and 8.32±52.94%) were recorded in June for *Chrysolina* sp., *G. polygoni* and *P. fuscicornis*, respectively (Fig. 2 and 3).

Larvae of *Ph. plantaginis* bore irregular narrow tunnels in both surfaces of the leaves. *Ph. plantaginis* was recorded attacking *P. lanceolata* and *P. major* in East Norfolk in England (Spencer, 1972). First appearance of the larvae was found by early April in all locations. Highest population (4.99±1.00 larvae/ plant) was recorded in location (1) in August in Damascus, 3.74±0.58 and 7.24±0.74 larvae/ plant in locations (2) and (3) in July in Damascus Countryside, respectively. Insignificant difference ($P = 0.145$) was found among means of larval counts in the three locations at $P = 0.05$, (Table, 2).

Occurrence of *Ph. plantaginis* larvae extended from April to October in all locations. Highest rates of damage (65.44±27.70, 59.05±8.59 and 75.90±6.82%) were in June in location (1) and (3) and in August in location (2), respectively. There were significant differences ($P = 0.043$) among the rates of damage in the three locations at $P = 0.05$, (Figs. 4 and 5).

D. punctalis larvae bore tunnels in buds and root region. *P. lanceolata* and *P. major* were recorded as hosts to arctiid and nymphalid butterfly larvae *Junonia coenia* (Nymphalidae) (Stamp and Bowers, 1992). First appearance of *D. punctalis* larvae was found by early May in the two locations at Damascus. Highest population (3.03±0.73 and 3.62±0.66 larvae/ plant) was recorded in June in location (1) and in July in location (2), respectively. Insignificant difference ($P = 0.275$) was found between means number of larvae in the two locations at $P = 0.05$, (Table 3).

Occurrence of *D. punctalis* larvae extended from May to October. Highest rate of damage (62.04±6.61%) was recorded in June in location (1) and (63.64±14.56%) in July in location (2). Insignificant difference ($P = 0.456$) was found between the rates of damage in the two locations at $P = 0.05$, (Fig. 6).

Table (1): Mean \pm SE numbers of larvae and adults of coleopteran insect species attacked *Plantago* spp. in Damascus region in year 2010

Month	<i>Lixus</i> sp.				<i>Chrysolina</i> sp.	<i>G. polygona</i>	<i>P. fuscicornis</i>
	A1		A2		A1	A1	A1
	Larvae	Adults	Larvae	Adults	Adults	Adults	Adults
January	-	-	-	-	1.04 \pm 0.08	-	-
February	-	-	-	-	1.34 \pm 0.22	-	-
March	-	-	-	-	1.61 \pm 0.21	-	-
April	1.66 \pm 0.24	1.61 \pm 0.30	1.56 \pm 0.39	1.91 \pm 0.52	4.10 \pm 0.22	1.98 \pm 0.46	1.08 \pm 0.16
May	2.20 \pm 0.58	1.82 \pm 0.60	2.54 \pm 0.50	2.50 \pm 0.42	3.50 \pm 0.29	3.34 \pm 0.28	2.03 \pm 0.27
June	3.79 \pm 0.56	3.59 \pm 0.44	4.35 \pm 0.72	3.57 \pm 0.44	2.80 \pm 0.46	3.52 \pm 0.12	2.17 \pm 0.98
July	4.32 \pm 0.41	3.60 \pm 0.42	4.11 \pm 1.11	3.55 \pm 0.34	1.79 \pm 0.45	2.30 \pm 0.30	1.43 \pm 0.60
August	5.50 \pm 0.51	4.66 \pm 1.17	5.65 \pm 0.95	4.70 \pm 0.80	1.53 \pm 0.60	-	-
September	4.86 \pm 0.72	4.11 \pm 1.16	5.00 \pm 0.60	4.16 \pm 1.11	1.60 \pm 0.57	-	-
October	1.91 \pm 0.74	2.33 \pm 0.91	1.97 \pm 0.44	2.13 \pm 0.83	1.26 \pm 0.33	-	-
November	-	-	-	-	1.10 \pm 0.20	-	-
December	-	-	-	-	1.08 \pm 0.16	-	-

(A1= Location 1 & A2= Location 2)

Table (2): Mean \pm SE numbers of larvae of *Ph. plantaginidis* in all locations in year 2010

Month	<i>Ph. plantaginidis</i>		
	Location 1	Location 2	Location 3
April	1.14 \pm 0.17	1.08 \pm 0.16	1.58 \pm 0.68
May	1.34 \pm 0.21	1.12 \pm 0.15	2.37 \pm 0.34
June	3.85 \pm 0.67	2.68 \pm 0.59	3.77 \pm 0.45
July	3.54 \pm 0.45	3.13 \pm 0.16	7.24 \pm 0.74
August	4.99 \pm 1.00	3.74 \pm 0.58	6.46 \pm 0.59
September	2.54 \pm 0.41	1.62 \pm 0.94	2.93 \pm 1.14
October	2.17 \pm 1.09	1.43 \pm 0.66	2.78 \pm 0.92

Table (3): Mean \pm SE larval numbers of *D. punctalis* in two locations at Damascus in year 2010

Month	<i>D. punctalis</i>	
	Location 1	Location 2
May	2.32 \pm 0.65	1.7 \pm 0.84
June	3.03 \pm 0.73	2.84 \pm 0.79
July	1.33 \pm 0.47	3.62 \pm 0.66
August	1.58 \pm 0.55	3.08 \pm 0.47
September	1.21 \pm 0.43	1.65 \pm 0.59
October	1.06 \pm 0.12	1.08 \pm 0.16

Table (4): Mean \pm SE nymph counts and damage rates by *B. brassicae* and *Th. nigropilosus* in location (1) in year 2010

Sampling date	<i>B. brassicae</i>		<i>Th. nigropilosus</i>	
	Nymphal counts/ plant	Damage rate (%)	Nymphal counts/ plant	Damage rate (%)
July: 9th	7.25	14.28	-	-
16th	8.16	25	4.36	75
25th	8.12	33.33	4	68.66
July average/ plant	7.84 \pm 0.51	24.20 \pm 9.54	4.18 \pm 0.25	71.8 \pm 34.48
August: 2th	8.22	60	3.6	16.66
9th	6.7	37.5	3.4	58.83
16th	16.84	61.85	-	-
August average/ plant	10.58 \pm 5.6	53.11 \pm 13.55	3.50 \pm 0.14	37.74 \pm 29.81
September: 1th	8.33	25	-	-
8th	7.25	14.28	-	-
16th	3.33	14.28	-	-
23th	3	17.66	-	-
September average/ plant	4.72 \pm 3.72	17.80 \pm 5.05	-	-

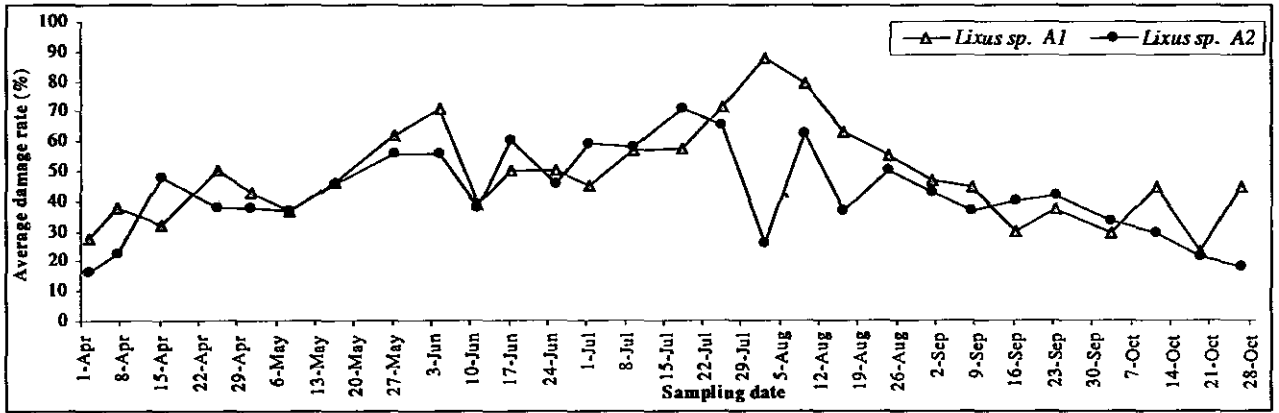


Fig. (1): Average damage rates of *Lixus sp.* in the two locations at Damascus in year 2010.

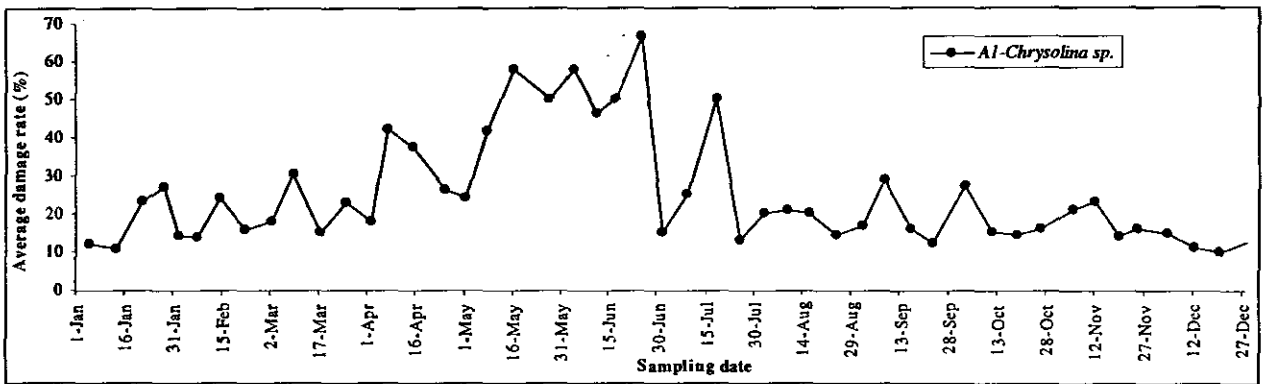


Fig. (2): Average damage rates of *Chrysolina sp.* in location (1) in year 2010.

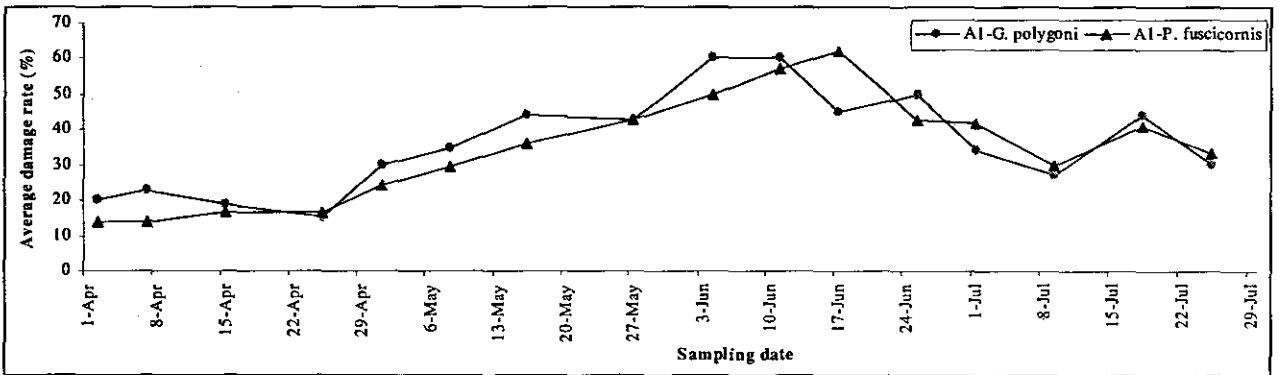


Fig. (3): Average damage rates of *G. polygoni*, *P. fuscicornis* in location (1) in year 2010.

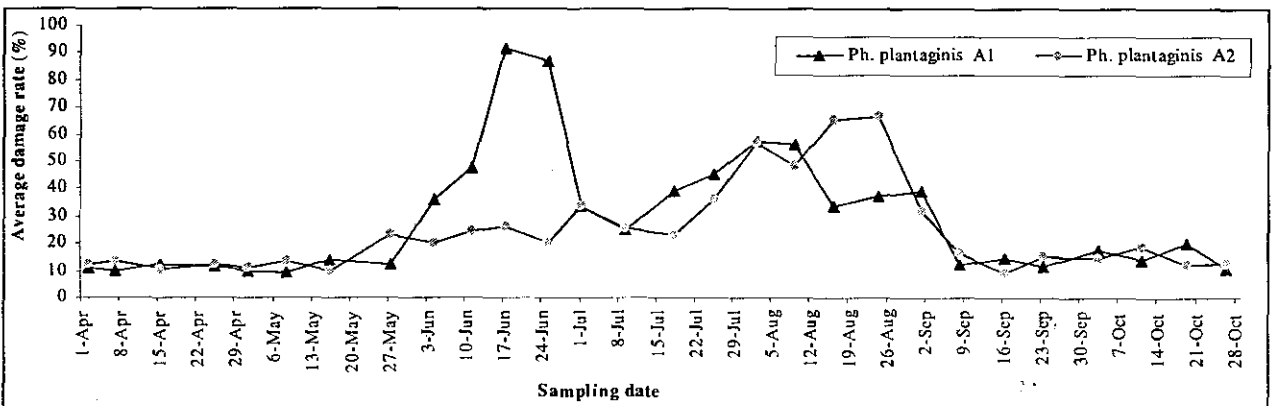


Fig. (4): Average damage rates of *Ph. plantaginis* in two locations at Damascus in year 2010.

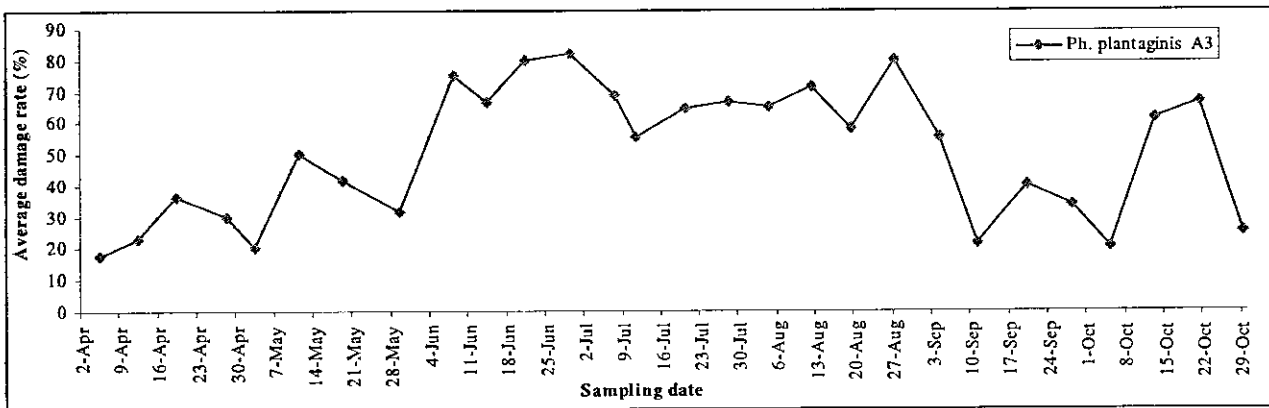


Fig. (5): Average damage rates of *Ph. plantaginis* in location (3) in year 2010

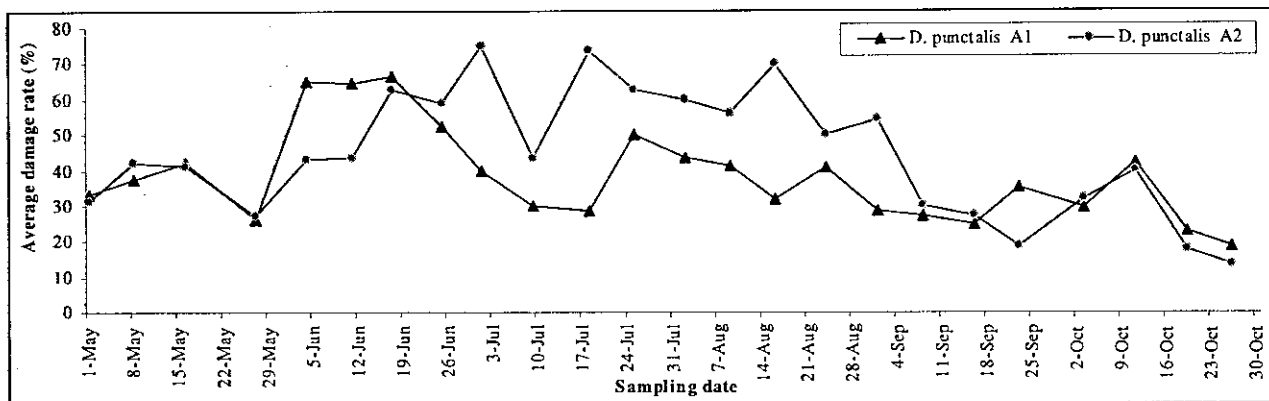


Fig. (6): Average damage rates of *D. punctalis* in all location in year 2010.

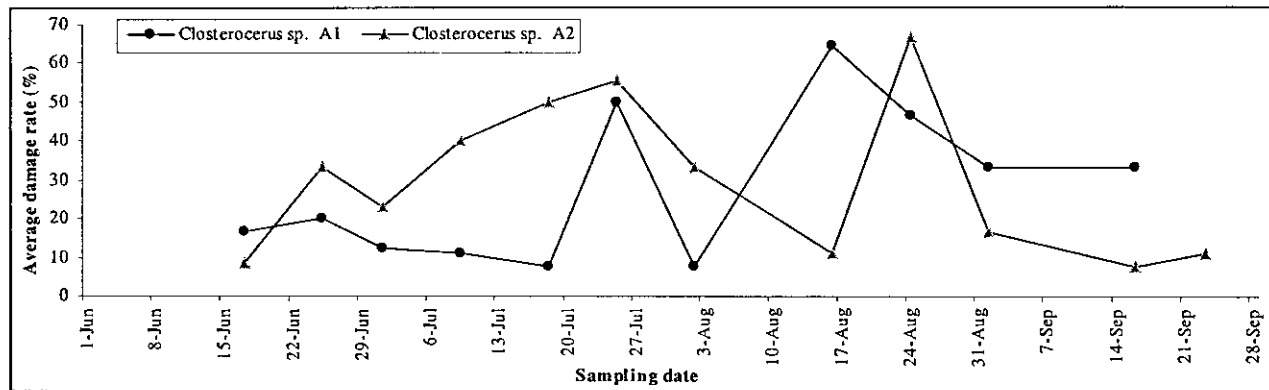


Fig. (7): Percentages of parasitism with *Closterocerus* sp. in the two locations at Damascus in year 2010.

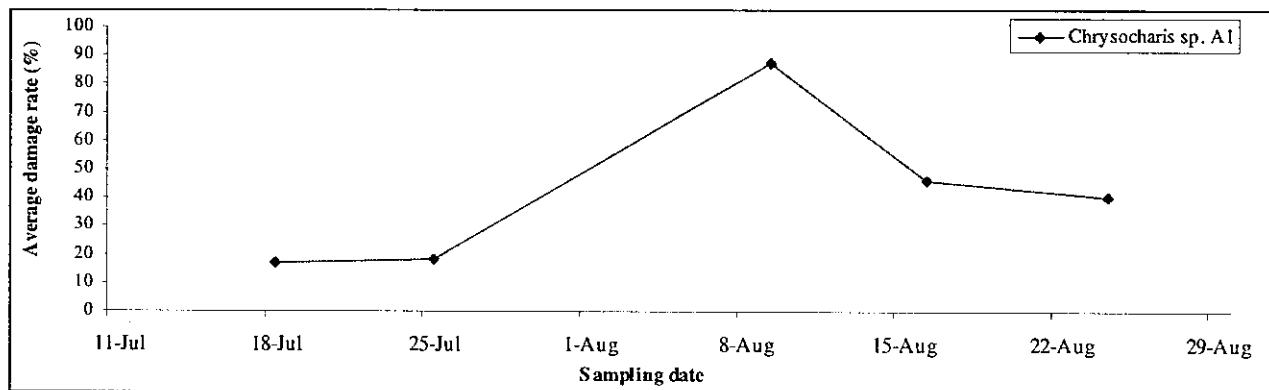


Fig. (8): Percentages of parasitism with *Chrysocharis* sp. in location (1) in year 2010.

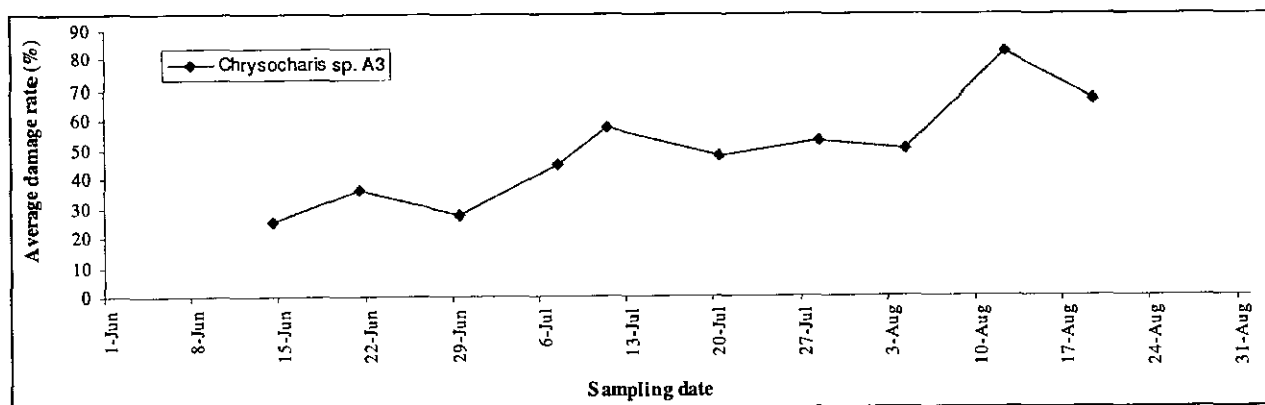


Fig. (9): Percentages of parasitism with *Chrysocharis sp.* in location (3) in year 2010.

Table (5): Mean \pm SE nymph counts and damage rates by *D. maroccanus* in two locations at Damascus in year 2010

Sampling date	<i>D. maroccanus</i>			
	Location 1		Location 2	
	Nymphal counts/ plant	Damage rate (%)	Nymphal counts/ plant	Damage rate (%)
July: 9th	1.33	15.79	2.4	31.14
17th	2	30.41	1	11.54
25th	2.66	18.76	-	-
July average/ plant	1.99 \pm 0.66	21.65 \pm 7.72	1.70 \pm 0.98	21.34 \pm 13.85
August: 2th	1.66	16.66	-	-
9th	1	12.5	-	-
August average/ plant	1.33 \pm 0.46	14.58 \pm 2.94	-	-

Table (6): Mean \pm SE of larval numbers of *Closterocerus sp.* and *Chrysocharis sp.* in all locations in year 2010

Month	<i>Closterocerus sp.</i>		<i>Chrysocharis sp.</i>	
	Location 1	Location 2	Location 1	Location 3
June	1.00 \pm 0.00	1.50 \pm 0.70	-	3.33 \pm 0.57
July	3.00 \pm 3.46	4.50 \pm 1.29	2.00 \pm 0.00	9.50 \pm 1.73
August	5.66 \pm 4.16	4.00 \pm 3.60	6.33 \pm 0.57	10.33 \pm 3.21
September	2.50 \pm 0.70	1.33 \pm 0.57	-	-

B. brassicae nymphs suck the plant sap from leaves, crown and root region. Symptoms appeared as honeydew on the leaves and swells on crown and root region. First appearance of *B. brassicae* nymphs was in July in location (1). Highest population of the nymphs (10.58 \pm 5.6 nymphs/ plant) was in August. Maximum rate of damage (53.11 \pm 13.55%) was in August (Table 4).

Th. nigropilosus nymphs feed on leaves. Their feeding caused a silvery or bronzed appearance on the surface of the plant, especially on the midrib and veins of leaves. *Th. nigropilosus* attacked *P. lanceolata* (Mound *et al.*, 1976).

First appearance of *Th. nigropilosus* nymphs was in July in location (1). Highest population of the nymphs (4.18 \pm 0.25 nymphs/ plant) and maximum rate of damage (4.48 \pm 71.83%) was recorded in July (Table 4).

D. maroccanus nymphs feed only on leaves of *P. lanceolata*. First appearance of *D. maroccanus* nymphs was in July in the two locations of Damascus. Highest population of nymphs (1.99 \pm 0.66 nymphs/ plant) was in July. Occurrence of nymphs (1.70 \pm 0.98 nymphs/plant) was only in July in location (2). Highest rate of damage (21.65 \pm 7.72%) was also in July in location (1) and 21.34 \pm 13.85% in location (2) (Table 5).

Two parasitoid species; *Closterocerus sp.* and *Chrysocharis sp.* (Hymenoptera: Eulophidae) were recorded associated with the insects found on *Plantago spp.* in the locations of the study.

Closterocerus sp. was an ecto-pupal-parasitoid. It parasitized the pupae of *Lixus sp.* located at the basic root near buds of *P. lanceolata*. According to literature, its host range includes various mining Diptera (Agromyzidae), Lepidoptera (Gracillariidae)

and Coleophoridae), Coleoptera and Hymenoptera; but it is also a hyperparasitoid of some hymenopterans of the families; Braconidae, Eulophidae and Encyrtidae (Boucek and Askew, 1968 and Hansson, 1994).

First appearance of *Closterocerus* sp. larvae was found by early June in the two locations of Damascus. Highest population of larvae (5.66 ± 4.16) was in August in location (1) and 4.50 ± 1.29 in July in location (2). Insignificant difference ($P = 0.275$) was found between means of larval numbers in location (1) and (2) at $P = 0.05$, (Table 6).

Occurrence of *Closterocerus* sp. in the two locations of Damascus extended from June to September. Highest rate of parasitism ($39.54 \pm 28.95\%$) was recorded in August in location (1) and ($42.15 \pm 14.25\%$) in July in location (2). Insignificant difference ($P = 0.876$) was found between rates of parasitism in location (1) and (2) at $P = 0.05$, (Fig 7).

Chrysocharis sp. is an ecto-larval-pupal-parasitoid. It parasitized *Ph. plantaginis* larvae. This finding agrees with that reported by Çıkman (2006) in Turkey. First appearance of the parasitoid species was found by early July in location (1) and by early June in location (3). Highest population of larvae (6.33 ± 0.57) and (10.33 ± 3.21) was recorded in August in location (1) and (3), respectively. No significant difference ($P = 0.357$) was found between means of larvae numbers in location (1) and (3) at $P = 0.05$ (Table 6). Highest rate of parasitism ($57.88 \pm 25.83\%$) and ($66.33 \pm 16.17\%$) was found in August in the two locations (1) and (3), respectively. Insignificant difference ($P = 0.623$) was found between rates of parasitism in the two locations at $P = 0.05$, (Fig. 8 and 9).

Another two hymenopteran parasitoid species; *Dacnusa sibirica* (Braconidae) and *Diplazon laetatorius* (Ichneuomonidae) were found feeding only on the nectar of *P. lanceolata* flowers, without attacking any of the recorded insect species. Their appearance was in April and July in relatively very few individuals.

Nine predatory species belong to 2 orders; Coleoptera and Diptera and 5 families; Carabidae, Malachiidae, Cantharidae, Coccinellidae and Syrphidae were found associated with *P. lanceolata*. All the recorded predatory species were collected from healthy and unhealthy plants, without preying on the insect species recorded on *Plantago* spp. Their appearance was mostly in April in relatively very few individuals.

It could be concluded that most of the recorded insect species associated with *Plantago* spp. damage

them, to certain extent, at the studied region as natural enemies for the weed and might play a role in its control.

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