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THE EFFECT OF SOME ATTRACTANT PLANTS *Lysiphlebus fabarum* PARASITISM ON GREEN PEACH AHIDS *Myzus persicae* AND BLACK BEAN APHIDS *Aphis fabae*

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ABSTRACT

This study was conducted in the fields of the College of Agriculture and Forestry / the University of Mosul, to identify the effect of plant species that attract parasites, which included (chamomile, coriander, and basil) in increasing the efficiency of the parasite *Lysiphlebus fabarum* in biological control programs. The results indicated that the chamomile as an *L. fabarum* attracting plant gave a height average mummy to *Myzus persicae* and *Aphis fabae* gave (45.06 ± 8.78, 262.00 ± 12.16) mummy, followed by the coriander plant which showed (35.80 ± 9.15 and 215.00 ± 8.71) mummy for each *Myzus persicae* and *Aphis fabae*, respectively. The basil plant showed the least average number of mummies for the two insects (25.78 ± 2.77 and 192.33 ± 13.65) mummy reach of the *Myzus persicae* and *Aphis fabae*. However, it was higher than the control upon the *Myzus persicae* and *Aphis fabae* (14.71 ± 2.70 and 124.33 ± 22.27) mummy, respectively. The parasitism rate was affected by the increase in the number of mummies, where the chamomile plant showed the highest parasitization rate on *Myzus persicae* (70.47 ± 4.05) %, followed by the coriander plant (65.90 ± 5.63%), then basil plant (52.77 ±2.24) %, while the control treatment was the least in parasitism (30.38 ± 4.09) %. On the other hand, the percentage of parasitism on *Aphis fabae* was superior in all treatments of *Aphis fabae* above the control group (63.29 ± 2.22, 62.16 ± 1.82, 59.66 ± 5.79 and 30.29 ± 1.52).

INTRODUCTION

Aphids belong to the Aphidoidea family in order Hemiptera. They are one of the most important economic pests with a wide plant range. Because of the special features that enhance their performance as plant insects such as small size, feeding habits, and reproduction methods, as well as they, have a role in transmitting viral diseases causing severe damage to plants and crops. About 100 species have successfully exploited the agricultural environment to the extent that it has become of great economic importance. Aphids especially feed on sap, which leads to yield losses in many crops (Guerrieri and Digilio, 2000 and Kumar, 2019).

1- **The green peach aphids *Myzus persicae* (sulze):** Verdugo *et al.* (2016) and AlMallah (2018) reported that the green peach aphids, *Myzus persicae* (Sulzer) is one of the most important species of aphid and is considered a polyphagous insect, *Prunus persica* is its primary host. In addition, the aphid infects nearly 400 plants belonging to different families, causing direct damage to the peach orchards as a

result of feeding on the plant sap, leading to deformation in the affected plant part, and thus the fall of leaves and fruits in addition to weakening the affected trees.

2- **The black bean aphids *Aphis fabae* (Scop.):** Are considered one of the main pests of *Vicia fabae*, sugar beet, and beetroot, in addition to beetroot, beans, other crops, and wild herbs. Aphids cause serious and direct damage to bean plants because they absorb plant sap, which leads to reduced crop yield and plant death, on the other hand, indirect damage is through the transmission of viruses (Matin *et al.*, 2009).

Natural enemies play an important role in maintaining the critical economic limit of aphids. Therefore, it is the safest biological control as it very efficiently regulates the population density of aphids, especially parasites, due to their short life cycle, high female fecundity, and their large number of egg production during their life (McAuer and Volkel, 1993). Seeking insects are distinguished by their ability to recognize and respond to chemical signals from healthy plants and differentiate them from chemical signals from insect-infested plants due to the presence of stimuli associated with insect feeding (Pare´ and Tumlinson, 1999). Indirect plant defenses release volatiles that attract natural enemies for herbivores and insects. The plants, also respond to herbivores through a variety of phenotypic, biochemical and molecular mechanisms (War *et al.*, 2012).

The parasite *Lysiphlebus fabarum* (Marshal) of Hymenoptera: Braconidae is one of the most prevalent parasites of *A. fabae* in agricultural ecosystems. This wasp was characterized by asexual reproduction mainly in Middle Europe; this parasite had been recorded on 44 different families of aphids, as well as its parasitism on *A. fabae* and various crops and herbs. *L. fabarum* benefits from the presence of ants (protecting *A. fabae* colonies from natural enemies) and parasitizes *A. fabae* at higher rates than in absence of ants, the parasite possesses specific chemical and behavioral adaptations, which in general avoids the aggressive responses of different ant species. The *L. fabarum* is an active parasite. Females appear with several hundred mature eggs in their ovaries due to their feeding on honeydew, which is the main source of sugar. The honeydew is an alternative source of feeding on flower nectar, which provides energy (Rasekh *et al.*, 2010 a,b).

While Albittar *et al.* (2016) found three types of parasites, *Aphidius colemani*, *Lysiphlebus testaceipes*, and *Lysiphlebus fabarum* (Hymenoptera: Braconidae: Aphidiinae). They can be used as biological control agents against at least one species of aphids that infect the bean and sugar beets, which are infected with *Aphis fabae* and *Myzus persicae* (Hemiptera: Aphididae), and can be present on the same host at the same time.

Parasitic wasps of the genus *Lysiphlebus fabarum* and *Aphidius ervi* are Endoparasites of the family Braconidae they are parasites closely related to aphids. The parasite *Lysiphlebus fabarum* differs from the parasite *Aphidius ervi* in some characteristics, including the parasite *Aphidius ervi* reproduces only by sexual reproduction, while the parasite *Lysiphlebus fabarum* is capable of sexual and asexual reproduction, especially in wild species, asexual reproduction is common (Dennis *et al.*, 2020).

MATERIALS AND METHODS

This experiment was conducted to identify the parasitic effect of *Lysiphlebus fabarum* on two insects, green peach aphids (*Myzus persicae*) and black bean aphids

(*aphis fabae*) in a plastic house of the Faculty of Agriculture and Forestry with (5 x 6) m dimensions, using four wooden containers (250 x 60 x 15) cm dimensions a container for each treatment. These containers were filled with soil consisting of 50% Patmos and 50% mixture soil. Potatoes and broad bean plants (each in their season) were planted in three longitudinally parallel straight lines in each container. Each line contains (9) plants with 3 replications per treatment. In addition, one container for each transaction and addition to the control treatment.

Attractive plants were planted between the lines 2-3 attractants within each (replicate) line in the same wooden plot, the treatments were:

1- Treatment of the chamomile plant in the first wooden plot (with the potato or the broad bean)
2- Treatment of coriander plant in the second wooden plot (with potato or broad bean)
3- Treatment of basil plants in the third wooden plot (with a potato or a broad bean).
4- Control treatment in the fourth wooden plot, in which potatoes or broad beans were planted without any attractive plants.

PREPARING FARMS FOR THE GREEN PEACH APHIDS *MYZUS PERSICAE* AND THE BLACK BEAN APHIDS *APHIS FABAE*

Aphids obtained from Gubba farms and fields of the College of Agriculture and Forestry / the University of Mosul were seeded on radish and chard plants grown as seedlings in Patmos. After the plant reached three Leaves stages, the seedings were transferred to a 0.5 kg pot containing mixed soil and Patmos at a rate of 50%-50% for each of the radish and chard. Insects of *Myzus persicae* were introduced to the radish plant and *Aphis fabae* to the chard plant (each in its season), and (20) pots for each plant were placed in wooden cages to raise aphids with dimensions (105 x 60 x 90) cm covered with a layer of white muslin for each plant separately.

PREPARATION OF PARASITE CULTURES

The parasite *Lysiphlebus fabarum* was raised on *M. persicae* and *A. fabae* in large clear plastic containers of different sizes. Including large containers (45 x 30 x 30) cm or small containers (25 x 25 x 45) cm open from the top. Covered from the top with a white muslin fixed with a rubber band, to keep the humidity in these containers. An inverted glass tube was fixed in one of the container walls (with transparent tape) sterilized containing water and covered with cotton.

Parasitoid farms supply the parasites in two ways. The first method is to isolate the mummy of the parasitoid found within the aphid colonies using a soft brush, or by cutting part of a plant leaf, where the mummy is located, and introducing it to the aphid's farm.

Aphids are added to the parasite farm on an ongoing basis, taking into account the removal of dead plant leaves to ensure that the farm is not contaminated with fungi and bacteria.

Created infection Aphids were caused by *Myzus persicae* and *Aphis fabae* from previously prepared aphid breeding farms on cultivated plants.

Aphids and parasites were Reservation after noticing the aphid's parasitism on the affected leaves in each replicate by wrapping the plant leaf containing the aphids and the parasitoid in small bags made of white muslin with dimensions (15 x 20 cm) and tying them with rubber band. The rates of parasitism on aphids were calculated after 15-20 A days for each replicate and each type of attractive plant, counting the

number of mummies, the number of emerging individuals, and the parasitism rate of the parasite.

STATISTICAL ANALYSIS

Complete randomized design (CRD) was used with a simple experiment to analyze the data, to identify the significance of differences between the mean of the treatments, Duncan's multiple range test (Al-Rawi *et al.*, 2000) and (Ashmawi *et al.*, 2008) was used, using the SAS9 program. Also, the arcsin analysis was conducted for the traits that were measured as percentages.

RESULTS AND DISCUSSION:

The effect of parasite-attracting plants on the total number of mummies: Table (1). Showed that the number of mummies on the potato plant in the chamomile treatment was significantly superior ($P \leq 0.05$) to the number of mummies in the coriander and basil treatment. The coriander treatment was significantly superior ($P \leq 0.05$) to the basil treatment, and all treatments of the attractant plants were significantly superior to the control treatment. The averages were (45.06, 35.80, 25.78, and 14.71) mummy/potato plants planted near the attractant and control treatment, respectively.

While Table (2). Showed that the number of mummies on the bean plant in the treatment of the chamomile plant was significantly superior ($P \leq 0.05$) to the coriander and basil treatments. Both treatments of coriander and basil were significantly superior ($P \leq 0.05$) to the control treatment.

The averages of the mummies were (262.00, 215.00, 192.33, and 124.33) mummy/broad beans planted near the attracting plants and control treatment, respectively. The reason for obtaining these results may be due to that the color of flowers affects parasite selection (Lunau and Wacht, 1994 and Colley and Luna, 2000). On the other hand, Insects have characterized visual preference for yellow and white flowers. Such as Chamomile, basil and fennel. Which showed attractiveness to all tested natural enemies (Wäckers, 1994).

These results agreed with El-Kareim *et al.*, (2011) who indicated that the adult females of the parasite *Aphidius* sp. showed the highest attractiveness towards flowers of chamomile, fennel, and coriander plants, while geranium and sweet basil were less attractive to *Aphidius* sp.

The number of mummies emerging on the plants

Chamomile and coriander treatments were significantly superior ($P \leq 0.05$) over the treatment of basils, which showed a significant superiority ($P \leq 0.05$) over the control treatment where the means numbers of mummy emerging on the potato plant were (39.86, 31.00, 20.64 and 8.78) Mummy/potato for chamomile, coriander, basils and control treatments respectively.

With the number of mummies emerging on the broad bean, the results showed significantly superior ($P \leq 0.05$) for the chamomile treatments over the rest of the treatments. The treatment of the coriander plant was significantly superior ($P \leq 0.05$) to the treatment of basil, which was superior significantly the control treatment, the mean was reached (258.00, 214.66, 190.00 and 120.66) mummy/broad bean for chamomile, coriander, basil and control) treatments, respectively.

There was no significant difference in the number of non-emergent mummies on the potato and the bean plant and for all treatments (chamomile, coriander, basil and control) treatments as shown in Tables (1 and 2).

Effect of parasite-attracting plants on the rate of parasitism

The rate of parasitism of *Myzus persicae* on potatoes with the chamomile treatments increased significantly ($P \leq 0.05$) from the rest of the treatments, followed by the coriander and basil treatments than the control treatment. The averages of treatments were (70.49, 65.90, 52.77, and 30.38%) for the chamomile, coriander, basil and control treatments, respectively (Table 1).

While the percentage of parasitism on the *Aphis fabae* on the broad bean was significantly ($P \leq 0.05$) superior to each of the chamomile, coriander, and basil treatments than the control treatment, where the averages of the treatments were (63.29, 62.16, 59.66, 30.29%), respectively (Table 2).

Compared to the control treatment, the superiority of attractive plant treatments (chamomile, coriander, and basil) may be that the white flowers played a role in attracting the parasite (Colley and Luna, 2000). These results agreed with El-Kareim *et al.*, (2011) where significant differences were observed in the parasitism rate of the parasite Aphidius sp. Where the treatment of coriander, followed by the treatment of chamomile plant, compared to the control treatment.

Table (1): The effect of parasites attracting plants on the number of mummies, the number of emerging and non-emergent mummies, and the parasitism rate of *Lysiphlebus fabarum* on potatoes (mean + SD).

Plant Treatments	No. mummies	No. emerging mummies	No. non-emerging mummies	Parasitizing %
Chamomilla	45.06 +8.78 a	39.86+12.16 a	5.20 +10.12 a	70.49 +4.05 a
Coriander	35.80 +9.15 b	31.00 +11.1 a	4.80 +4.32 a	65.90 +5.63 b
Basil	25.78 +2.77 c	20.64 +4.76 b	5.14 +4.91 a	52.77 +2.24 c
Control	14.71 +2.70 d	8.78 +4.19 c	5.92 +4.53 a	30.38 +4.09 d

According to Duncan's test, vertically letters written on the averages indicate significant differences in the coefficients at PP ($a \leq 0.05$) and vice versa.

Table (2): The effect of parasites attracting plants on the number of mummies, the number of emerging and non-emergent mummies, and the parasitism rate of *Lysiphlebus fabarum* on broad beans (mean + SD).

Plant Treatments	No. mummies	No. emerging mummies	No. non-emerging mummies	Parasitizing %
chamomilla	262.00±12.16 a	258.00±12.16 a	4.00±2.00 a	63.29±2.22 a
Coriander	215.00±18.71 b	214.66±12.96b	0.33±0.57 a	62.16±1.82 a
Basil	192.33±13.65 c	190.00±15.52 c	2.33±2.30 a	59.66±5.79 a
Control	124.33±22.27 d	120.66±23.75d	3.66± 3.78a	30.29±1.52 b

According to Duncan's test, vertically letters written on the averages indicate significant differences in the coefficients at PP ($a \leq 0.05$) and vice versa.

CONCLUSIONS

The study showed that the presence of plants that attract the parasite (chamomile plant, coriander plant, and basil plant) in the field greatly raised the percentage of vital enemies inside the field. The parasite Lysiphlebus fabarum is one of the parasites that can parasitize several types of aphids in the absence of its main host it is one of the black bean Aphis fabae; where the parasite is effective and active in reducing the spread of aphids, as it benefited from these plants. Some of these plants may exist naturally in the fields; as it works to increase the efficiency of biological control programs by attracting natural vital enemies, especially insects. It belongs order Hymenoptera, as females are attracted to the flowers of these plants to benefit from the nectar of flowers for nutrition in addition to filling their various needs of carbohydrates.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

تأثير بعض النباتات الجاذبة للطفيل *Lysiphlebus fabarum* على حشرة مَنْ الخوخ الأخضر *Myzus persicae* ومَنْ الباقلاء الأسود *Aphis fabae*

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الخلاصة

أجريت هذه الدراسة الحقلية والمختبرية في كلية الزراعة والغابات/ جامعة الموصل، للتعرف على تأثير أنواع النباتات الجاذبة للطفيل والتي شملت كل من نبات (البابونج، الكزبرة، الريحان) في زيادة كفاءة الطفيل Lysiphlebus fabarum في برامج المكافحة الحيوية. وجد ان نبات البابونج الجاذب للطفيل اعطى نسبة في متوسط اعداد المومياءات لحشرات من الخوخ الأخضر ولحشرات من لباقلاء الاسود بلغت (45.06 + 8.78 و 262.00 ± 12.16) مومياء وعلى التوالي، تلاه نبات الكزبرة بمتوسط (35.80 ± 9.15 و 215.00 ± 8.71) مومياء لكل من حشرتي من الخوخ الاخر وحشرة مَنْ الباقلاء الأسود، واعطى نبات الريحان اقل متوسط لأعداد المومياءات لكلا الحشرتين (25.78 ± 2.77 و 192.33 ± 13.65) مومياء ولكنها كانت اعلى من معاملة السيطرة في المومياءات على كل من حشرات مَن الخوخ الأخضر وحشرة مَن الباقلاء الأسود حيث بلغت (14.71 ± 2.70 و 124.33 ± 22.27) مومياء وعلى التوالي.

تأثرت نسبة التطفل بزيادة اعداد المومياءات فقد اعطى نبات البابونج اعلى نسبة تطفل لحشرة من الخوخ الأخضر (70.49 ± 4.05) % تلاها نبات الكزبرة (65.90 ± 5.63) % ثم نبات الريحان (52.77 ± 2.24) % في حين ان معاملة السيطرة أعطت اقل نسبة تطفل وبفرق معنوي واضح (30.38 ± 4.09) %.

في حين ان نسبة التطفل على حشرات من الباقلاء الأسود تفوقت في جميع معاملات النباتات الجاذبة للطفيل على معاملة السيطرة (63.29 ± 2.22، 62.16 ± 1.82، 50.66 ± 5.79 و30.29 ± 1.52) % على التوالي، ولم تختلف فيما بينها معنوياً.

الكلمات المفتاحية: نباتات جاذبة، تطفل، Lysiphlebus fabarum، Myzus persicae، Aphis fabae.

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