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Estimation of population density of apricot leaves aphid *Hyalopterus pruni* Geoffroy and effectiveness of some chemical pesticides in control

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Abstract

The study, which was conducted in Baghdad/Jadiriyah Governorate, aimed to estimate the population density of *Hyalopterus pruni* and its natural enemies. Its highest rates reached in the third week of April, reaching 166.1 and 150.20 for nymphs and adults, respectively. A number of predators have been recorded including *Coccinella septempunctata*, *Coccinella undecimpunctata*, *Ccymnus syricus*, *Chrysoperla carnea* and *Orius albidipennis*. results of evaluating the efficacy of pesticides Levo, Recharg and Decisan showed effectiveness of pesticides on nymphs was 92.67%, 90.00% and 87.33%, respectively, and on adults 96.33%, 93.15% and 90.00%, respectively, after 18 days of control.

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Introduction

Apricot leaves aphid *Hyalopterus pruni* Geoffroy is one of important insects that has a life cycle on more than one host for orchard trees (Wang *et al*., 2015 and Xu *et al*., 2020). It infects almond trees, including apricot, causing big damage to peach, pineapple and apricot trees (Lozier *et al*., 2007). Species was recorded for the first time in Iraq on peach trees in Sinjar and Zafaraniya area in 1957 (Mohammed and Al-Mallah, 1999). Apricots aphid cause damage, especially to young trees and seedlings, as nymphs and adults suck the plant juices and secrete honeydew on leaves and young fruits, which helps the growth of fungi and accumulation of dust, which leads to delaying their growth (Al-Azzawi *et al*., 1990). Apricot leaf aphid is present during the winter and spring on the primary host of almond trees, and during the summer on the secondary host the reed plant (Mahmoud *et al*., 2013). Many pesticides have been used in the control of apricot aphids, including botanical pesticides, which are characterized by having a wide range of effects on insects, in addition to their low impact on non-target insects such as vital enemies and bees (Berenbaum, 1989). Botanical pesticides, such as pesticide containing the active substance Oxymatrin extracted from the plant *Sophra flavescencs*, pesticide affects acetylcholine enzyme in the central nervous system and then fails in respiratory system (Moa and Henderso, 2007). Also, pesticide Recharge is a biocidal that has been effective in combating many insects, including the citrus leaf miner (Al-Barzanji, 2017). Aim of research was to estimate population density of apricot aphid, nymphs and adults during study period, to record predators present in apricot field, and to evaluate effectiveness of some chemical pesticides in controlling it.

Materials and methods

Population density of nymphs and adults of apricot aphid Hyalopterus pruni on apricot leaves

An apricot orchard was chosen at University of Baghdad/Jadiriyah to estimate population density of apricot aphid, nymphs and adults. Three lines of apricot trees were selected, and from each line three trees were chosen randomly, and from each tree ten leaves were randomly taken and samples were taken weekly and placed in nylon bags containing note with date of collection and tree number. numbers of nymphs and adults of apricot leaf aphid were calculated in laboratory for each leaf and on basis of average number of individuals/leaf, population density of insects was calculated from the date 2/4/2019 to 6/6/2019. Averages of maximum and minimum temperatures and relative humidity were calculated from the date of sampling, as well as the accompanying predators were recorded Apricot leaf aphid throughout research period.

Evaluation of efficiency of some chemical pesticides in controlling the apricot leaf aphid H. pruni

Three pesticides of different groups were used in control of apricot aphid, with the recommended concentration, Levo, recommended concentration is 0.25mL/liter of water active substance is hyaloxmethrin, and biocidal Recharge, active substance is a mixture of some microorganisms, bacteria and fungi, recommended concentration is 0.3 g/liter of water. Both are produced by Russell IPM Company, Britain. and pesticide Decis, active substance Deltamethrin recommended concentration is 2.5mL/liter produced by Bayer Company. As for comparison treatment water was used only.

The experiment was divided into four treatments, three replicates for each treatment, with three trees for each replicate. As treatments were sprayed with mentioned pesticides according to recommended concentration, using a 5-liter sprayer, transparent plastic markers were used with replicates symbol written on them in order to distinguish between the replicates for each treatment.

The samples were randomly taken, five leaves from tree/replicates. Percentage of mortality of nymphs and adults of apricot aphid for each treatment was calculated using Henderson and Tilton equation (1955). Samples were taken one day before spraying and (1, 3, 7, 10, 14). 18) day after treatment, leaves were placed inside a nylon bag containing a paper containing date of collection and replicates number for laboratory checkup.

Statistical analysis

Randomized complete block design (R.C.B.D.) was used in field experiment. During this study, data were statistically analyzed using analysis of variance (ANOVA) table to compare results. The least significant difference test (LSD) was adopted at probability level of 0.05 (Al-Sahoki and Waheeb, 1990) and statistical program Genstat 2011 was used.

Results and discussion

The results of Table (1) estimating population density of apricot apid, nymphs and adults on apricot leaves from 4/2/2019 to 6/6/2019 showed that there are significant differences in average population density, as it was 6.82, 3.09 for nymphs and adults, respectively, on 2/4/ 2019, when minimum and maximum temperature was 9.23°C, 20.16°C and relative humidity was 92.41%. Then rate of nymphs and adults began to increase and reached 78.36 and 67.00 respectively in fourth week of March 25/3/2019, when minimum and maximum temperature were 10.11°C, 27.28°C and relative humidity was 98.56%. Their rates continued to increase during April, as they recorded the highest rate on 15/4/2019, which amounted to 166.1, 150.20 nymphs and adults, respectively, when minimum and maximum temperature were 14.05°C, 33.02°C and relative humidity was 91.23%. After that, average density of nymphs and adults decreased, reaching 0.00 and 0.00, respectively, when minimum and maximum temperature were 27.34°C, 42.23°C and relative humidity was 37.33%. We conclude that population density of nymphs and adults of apricot aphid was few in number at beginning of February with low temperatures and humidity, and then began to increase until it reached highest peak of its rates in third week of April with moderate temperatures until it began to decline at its lowest rates in first week of June with degrees High temperature, which indicates its transmission from apricot trees, winter host, to reeds, summer host, which provides them with a suitable shelter. This was indicated by Muhammad and Al-Mallah (1999) that population density of insect on different hosts of almonds, including apricots in city of Mosul, increased in number in first week of February and was present on apricots and began to disappear in second week of June. While their numbers increased from mid-April to first week of May (Mahmoud *et al.*, 2013). Braham *et al.* (2014) found that its population density starts from third week of March, peaks in second week of April and disappears in third week of May on almond trees in Tunisia. Fliah and Mahdi (2021) found that insect numbers were few in first week of February, and then their numbers began to increase, reaching their highest rates in mid-May.

Table 1. Population densities of nymphs and adults of apricot aphid *H. pruni* on apricot leaves.

Sampling Date	Rate of Nymph	Rate of adult	maximum temperature	minimum temperature	Relative humidity
4/2/2019	6.82	3.09	20.16	9.23	92.41
11/2/2019	9.12	4.38	21.2	9.11	93.1
18 / 2 / 2019	13.85	6.18	22.12	8.98	94.6
25 / 2 / 2019	17.05	10.17	23.09	7.96	93.1
4/3/2019	30.21	20.1	22.44	3.66	92
11/3/2019	44.61	30.47	19.15	8.95	99.92
18 / 3 / 2019	62.44	54.35	26.34	14.1	95
25 / 3 / 2019	78.36	67	27.28	10.11	98.56
1/4/2019	103.24	98.64	30.42	18.06	90.21
8/4/2019	140.34	121.76	28.76	14.16	95.21
15 / 4 / 2019	166.1	150.2	33.02	14.05	91.23
22 / 4 / 2019	133.11	132	28.47	13.38	96.5
29 / 4 / 2019	120.43	121.1	28.87	13.54	97.04
6/5/2019	90.61	78.04	34.93	18.84	85.68
12/5/2019	22.6	20.1	35.43	18.3	76.32
19 / 5 / 2019	10.72	8.21	39.74	22.35	40.68
26 / 5 / 2019	7.35	2.31	40.14	24.16	38.42
6/6/2019	0	0	42.23	27.34	37.33
LSD 0.05	6.53	5.21			

The results of Table (2) showed the presence of a number of predators that were present on apricot trees during study period and were feeding on apricot leaves aphid. *Coccinella septempunctata* L. and *Coccinella undecimpunctata* L. were present in apricot orchard during study period, as well as ladybird *Ccymnus syricus* Mulf, green lacewing *Chrysoperla carnea* (Stephens) and *Orius albidipennis* Reuter bug were also recorded. This indicates presence of types of predators, and this came in study conducted by Ben Halima-Kamel *et al.* (2013) in Tunisia, presence of these types of predators in almond orchards was mentioned, and they were found in apricot and peach orchards in Moldova and have a role in reducing numerical densities of insect (Dina *et al*., 2014). Fliah and Mahdi (2021) also found in a study conducted on apricot leaves presence of seven-pointed ladybird *Coccinella septempunctata*.

Table 2. Predators associated with apricot leaf aphids during the study period.

Natural enemies	Family	Order
Coccinella septempunctata L.	Coccinellidae	Coleoptera
Coccinella undecimpunctata L.	Coccinellidae	Coleoptera
Ccymnus syricus Mulf	Coccinellidae	Coleoptera
Chrysoperla carnea(Stephens)	Chrysopidae	Neuroptera
Orius albidipennis Reuter.	Anthocoridae	Hemiptera

Evaluation of efficiency of some pesticides in H. pruni on apricot leaves

The results of Table (3) showed effect of spraying with three types of pesticides belonging to different groups, namely: Levo, Recharg and Decis on apricot aphid nymphs, three pesticides showed high efficiency in affecting nymphs, as relative efficiency of pesticides on 1 April, after 1 day of treatment was 27.50%, 22.00% and 18.50% for the pesticides Levo, Recharg and Decis, respectively.

The relative efficiency of pesticide treatments continued to increase gradually, reaching 47.12%, 41.67% and 36.17% on April 4, after 5 days of treatment, for Levo, Recharg and Decis, respectively. The relative efficiency of pesticides continued to increase until it reached 88.70% for Levo treatment, and 83.33% and 77.83% for Recharg and Decis pesticides, respectively, after 14 days of treatment on April 14. relative efficiency of three pesticides reached 92.67%, 90.00% and 87.33% after 18 days of treatment on April 21.

It is evident from general averages of relative efficiency of apricot aphid nymphs that there are significant differences between three pesticides, which amounted to 61.81%, 56.96% and 52.26% for pesticides Levo, Recharg and Decis, respectively.

Table 3. Effect of relative efficiency of spraying with different pesticides on apricot aphid nymphs.

Sampling Date	% Effect of Pesticides on Nymphs			
	Levo	Recharg	Decis	average
2019 / 4 / 1	27.50	22.00	18.50	22.66
2019 / 4 / 4	38.80	33.33	27.83	33.32
2019 / 4 / 7	47.12	41.67	36.17	41.65
2019 / 4 /10	76.98	71.44	65.94	71.45
2019 / 4 / 14	88.70	83.33	77.83	83.28
2019 / 4 / 21	92.67	90.00	87.33	90.00
average	61.81	56.96	52.26	
LSD 0.05 treat=1.18	LSD 0.05 days- 1.57	LSD treat x daye= 3.14		

The results of Table (4) showed effect of spraying with three types of pesticides, belonging to different groups Levo, Recharg, and Decis in adults of apricot aphid insect, three pesticides showed a high efficiency of effect on adults, as relative efficiency of pesticides on April 1, after 1 day of treatment was 28.75%, 24.25% and 22.10% for pesticides Levo, Recharg and Decis, respectively.

The relative efficiency of pesticide treatments continued to increase gradually, reaching on April 7, after 7 days of treatment, 58.22%, 51.67% and 44.21% for the pesticides Levo, Recharg and Decis, respectively. The relative efficiency of pesticides continued to increase until it reached 89.21% for Levo treatment, 85.36% and 81.44% for Recharg and Decis pesticides, respectively, after 14 days of treatment on

April 14. The relative efficiency of three pesticides reached 96.33%, 93.15% and 90.00% After 21 days of treatment, which was on April 21. It is evident from general averages of relative efficiency of adults of apricot aphid insects that there are significant differences between three pesticides, which reached 65.05%, 60.88% and 56.34% for the pesticides Levo, Recharg and Decis, respectively.

Table 4. Effect of the relative efficiency of spraying with different pesticides on adults of apricot aphid.

Sampling Date	% Effect of Pesticides on Adults			
	Levo	Recharg	Decis	average
2019 / 4 / 1	28.75	24.25	22.10	25.03
2019 / 4 / 4	40.23	36.33	32.00	36.18
2019 / 4 / 7	58.22	51.67	44.21	51.36
2019 / 4 /10	77.61	74.53	68.33	72.48
2019 / 4 / 14	89.21	85.36	81.44	85.33
2019 / 4 / 21	96.33	93.15	90.00	93.16
average	65.05	60.88	56.34	
LSD 0.05treat 2.31	LSD 0.05 days 2.57	LSD 0.05 tXd 4.14		

It is noted from results that Levo pesticide gave highest moryality rate on nymphs and adults of apricot aphid, followed by pesticides Recharg and Decis with significant differences, which indicates that botanical pesticides are effective in affecting apricot aphid. Braham *et al.* (2014) found that when using four pesticides to control apricot aphids, botanical neem pesticide is the most efficient pesticide in reducing aphid numbers. In a study conducted to find out effectiveness of some pesticides in controlling palm dubas, including pesticide Decis, it showed effectiveness in reducing number of nymphs (Alrubeai, *et al.*, 2015). Al-Barzanji (2017) found that Recharg was one of pesticides that showed high efficiency when used in controlling larvae and pupae of Citrus leaf miner.

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