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Laboratory study of the effectiveness of confider in controlling leaf-hoppers on a crop of cowpea

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Abstract

Cowpea leafhopper *Amrasca biguttula* is one of the important pests that afflict the cowpea crop in Iraq and cause economic losses. Therefore, chemical control was studied in the laboratory and its effectiveness in control was demonstrated, as a pesticide was used imidacloprid ;Confider of the Neonicotinoid schemical group Confider concentration was used for spray treatment 25ml/L,50,75,100ml/l. The concentration used for soil treatment is 100g/ml,200,300 ,400g/ml. The results were the treatment of the lowest hatching rate was obtained in leafhopper eggs for spray treatment when using a concentration of 100ml (reached 79.44%), observed that the average of mortality rate resulting from the use of a the pesticide Confider reached to (33.47%) , It is noted that the highest mortality rate was achieved after the passage of time 72 hours of treatment and reached (39.73%).

Keywords: *Amrasca biguttula* , leafhopper ,Confider ,Neonicotinoids group

Introduction

Cowpea *Vigna unguiculata* L**.** is a leguminous crop, grown in the semi-arid areas within the tropical zone. It has originated from Africa [1], then moved to other continentals including Asia, Europe and Central and Southern America [2]. Due to high protein and carbohydrate contents, cowpea is cultivated in Iraq as a food source to substitute heat intolerant crops during the dry season. It can be costumed as seeds or green pods. The estimated Iraqi production of cowpea was 246and 46200 tons of dry seeds (FAO 2021) and green pods (CSP 2021), respectively. Cowpea production can be threatened by several pests including cowpea *jassid ,Amrasca biguttula biguttula* Ishida (Hemiptera: Cicadellidae). This insect can cause damage on cowpea through sap-feeding on the lower leaf surface resulted in phototoxic symptoms known as "hopper burn", at mouth part penetration sites [3,4]. Other symptoms include crinkling around margins and upward curling of leaves, leaf tips and margins develop necrotic areas(CABI 2022), or abnormality and browning of vascular bundles [5].This research shows that leafhopper feeding on tree sap has a significant direct impact on the chlorophyll content of grape leaves [6]. Indirect damage may occur through transmission of viruses and phytoplasma disease during insect feeding **[7].** *A. Biguttula biguttula* Ishida has been reported from Iraq for the first time in 2017 [8]. It was found this leafhopper impact many host plants including okra Ablemoschus escu-

lents, eggplant Solanummelongen a,pepper Capsicumannum, cowpea and mallow Malvaparvi flora, causing serious losses. In Iraq, this leafhopper had 5 nymphal instars ranged between 6.66-9.33 days,whereas, adult longevity ranged from 15-19 days Chemical control has been used to control leafhoppers [9]. Plant extracts are also used in the fight against insects [10] .Several neonicotinoid insecticides**,** were used against sap-feeding insects[11].Pesticides have residues on crops that have negative effects on human health [12] .This insect can be a serious threat to cowpea production, through direct damage or as a potential vector to phytoplasmal diseases, in Iraq[13]. Thus, this study was initiated to confirm the identification of *A. Biguttula biguttula*, collected from cowpea, based on molecular approaches and to control it using imidacloprid leaf spring and soil treatments.

Materials and Methods

Collect the leafhopper

A number of cowpea leaves were collected randomly from the infected cowpea field in Baghdad governorate / fields of the College of Agriculture , and placed in breeding cages for laboratory use at any temperature.25m and humidity65% in testing the effectiveness of the pesticide on all stages of the insect.

Bio- evaluation of pesticides

It was used in laboratory experiments to evaluate the effect of the pesticide in the leaf aphid on the cowpea crop. It is a common cultivar grown in Iraq. It is continuously prepared by planting the seeds of this variety in small pots with a diameter of 12 cm and a height of 12 cm containing sterile soil. After germination of the seeds, the plants were thinned to one seed for each pot. Seedlings to the stage of four true leaves were used in life tests. The pesticide has been evaluated Confider of the chemical onicotinoids group on all phases of the leaf hopper in two ways:

1- Treatment of spraying the vegetative system foliar application

2- Soil treatment application

Confider concentration was used for spray treatment 25 ml/L, 50 ml/L,75 ml/L and100 ml/L. The concentration used for soil treatment is 100 g/m, 200 g/m, 300 g/m and the400 g/m Pesticide granules were added directly to the soil. The source has been approved[14]in that. The percentages of mortality were calculated in all life tests and the results were corrected according to an equation

$$\text{(Corrected death rate \% } = \frac{\text{Number of insects in treatment before treatment}}{\text{Number of insects in comparison before treatment}} \text{ X 100 [15].}$$

Assay of Biological Pesticide

Treatment of Leafhopper Eggs

Seedlings of the prepared leaves were used as mentioned in the paragraph above and it was isolated into three groups as follows:

The first group of seedlings was transferred to leafhopper breeding cages (laboratory culture), which contain large numbers of leafhopper adults. were left there for a period of 24 an hour, which is sufficient time for eggs to be laid on them ,and then they were taken out of the cages after moving the plants a little to remove the adults of the leaf hopper from them , They were determined100 an egg on each seedling by using a microscope, and the rest of the eggs were removed from the leaves using a fine needle, Therefore the seedlings were placed in the incubator for four days.

The second groups of seedlings were transferred to the breeding cages also a day after the first group's seedlings were taken, out and they were removed after 24 hours. In the same way, it was determined (100) an egg in each seedling and the seedlings were placed in the incubator for two days.

The third group of seedlings was transferred to the breeding cages a day after the seedlings of the second group were taken, out and they were also removed after24hour, in the same way, was determined (100) an egg on each seedling. Thus, the eggs were obtained at the age of one day, three days, and five days. The seedlings containing the eggs were treated with the pesticide and the concentrations shown above. with four replicates for each concentration. Spraying was done with a plastic hand sprayer, the volume of one liter, until the stage of dripping . Run-off from the surface of the leaf, either the control treatment was sprayed with water only. The seedlings were left to dry for an hour, then they were returned to the incubator, and the number of eggs hatched on the seedlings was calculated one day after the eggs hatched in the control treatment for each group. The corrected hatching percentage was extracted.

Treatment of Leafhopper Nymphs

Leafhopper nymphs of different stages I, II, and V were obtained by inserting cowpea seedlings grown in pots into the insect's breeding cages for two years.24 an hours after laying eggs on the seedlings, they were isolated and divided into three groups. The duration of the incubation of the nymphs was determined after hatching for each group within the conditions of the incubator so that each group of the seedlings contained nymphs of the leafhopper in a certain stage. The nymphs of each stage were treated with the pesticide and the concentrations shown above by spraying using a hand sprayer, at the rate of four replicates (seedlings) for each concentration, each seedling having 50 nymphs were previously identified using a microscope. The extra nymphs were removed from the leaves with a small brush, as for the control treatment, they were sprayed with water only, and the seedlings were left for an hour to dry, then they were returned to the incubator. The seedlings were tested after (24,

48, 72) an hour to calculate the cumulative death rate for each treatment and all nymph instars.

Treatment of Leafhopper Adults

Cowpea seedlings grown in plastic pots were sprayed with the pesticide concentrations shown above and with four replicates for each concentration, the control treatment seedlings were sprayed with water only. The seedlings were left for an hour to dry, and transparent plastic tubes of diameter were placed9cm and height14 cm The pots so that the lower nozzle of the gusset is fixed on the soil of the pot, while the upper nozzle has been closed with a piece of boring cloth fixed with a rubber band. Using an eyedropper transferred20adult leafhoppers of the age (24-48) an hour into each bell, then the bells were placed in the incubator. The percentage of mortality was calculated after6, 24, 48,72 hours of treatment.

Statistical analysis

All experiments in the laboratory were carried out according to a completely Randomized design (CRD) [16]. The ready-made program (SAS) 2001 was used to analyze the statistical data and by computer automated.

Results and Discussion

Bioassay of pesticides on leafhopper phase

Treating Eggs

The results showed that there was a slight decrease in the percentage of hatching of leafhoppers eggs treated with the pesticide by both methods of spraying and soil treatment, with significant differences from the control treatment (Table 1). (The lowest hatching rate was obtained in leafhopper eggs for spray treatment when using a concentration of 100ml (reached 79.44%). (with significant differences from the rest of the concentrations, and the highest hatching rate was obtained in the leaf hopper eggs of the spray treatment when using a concentration of 25ml and reached (85.33%). Mean while the percentage of hatching in the control treatment was (91.89%), and as pointed out [17] they found that the pesticide Confider used spray on cotton plants had a relatively limited effect on the pest eggs For soil treatment the lowest hatching percentage was obtained in leafhopper eggs when using a concentration of (400mg/l (accounted for) 84.78%), (there was a significant differences from the rest of the concentrations .Mean while the highest hatching rate was obtained in leafhopper eggs for soil treatment when using a concentration of (100mg/1 (and reached (88.67%) with a significant difference from the control treatment. In the soil treatment the percentage of hatching in the control treatment was (92.22%). The hatching rate was also associated with the age of the eggs treated by the two methods of spraying and soil treatment, as it was found that the eggs treated at the age of one day were more sensitive and the hatching rate was lower than the eggs treated at the age of three days. Hatch to the three ages of spray treatment83And the84.2And

the85.93Straight . the percentage of hatching for the three ages of soil treatment 85.93,87.93 , 89.53 .

Table (1): The effect of the treatment of Pesticide in hopper eggs leaves laboratory

Exterminator	concentration in ml/L	Age-corrected percentage of eggs hatching			
		day-1	day-3	day-5	the average
Imidacloprid spray	25	84	85	87	85.33
	50	82	83.5	84.5	83.44
	75	80.5	81.5	83	81.78
	100	78	79.5	81	79.44
Control	0	90.3	91.5	94	91.89
the average	0	83	84.2	85.93	
LSD	For age 1.057	for concentration 1.365		to overlap 2.364	
	mg/m2				the average
Imidacloprid soil treatment	100	87	88.5	90.5	88.67
	200	85	87	89	87
	300	84	86.5	88	86.33
	400	82.5	85	86.5	84.78
Control	0	91	92.7	93	92.22
the average	0	85.93	87.93	89.53	
LSD	For age 1,060	for concentration 1.369		to overlap 2.371	

Treatment of Nymphs:

The results showed that the two methods of using the pesticide Confider by spraying and soil treatment, it was effective against leafhopper nymphs and for all nymph stages (Table 2). It is also noted that there is a discrepancy between the mortality rates achieved depending on the concentration used, and they range from low concentration to high concentration. For the first nymph stage, observed that the average of mortality rate resulting from the use of a the pesticide Confider reached to (33.47%). and there was a significant value. As for the second nymph stage, it is

noted that the mortality rates achieved for all pesticide concentrations took the same path, but with lower values and with a significant difference. The rates of mortality rates resulting from the use of a confider pesticide reached (31%). There was a greater decrease in the mortality percentages of the nymphs of the fifth stage, with a significant difference, as it was in the first and second stages, where the death rates of the Confider pesticide reached (26.67%). From these results, it appears that there is a significant difference between the nymph stages of the leafhopper in the degree of their effect and sensitivity to the used pesticide, which was inversely associated with the age of the nymph stage. As mentioned by [18]The advanced nymph stages of the whitefly are less sensitive to the growth regulator the recent phases, as the corrected mortality rate was reached when using the growth regulator in concentration 0.5ml/1 for phases I to IV (92.6,87.9,85.4%) respectively. Treating the soil, where an increase in mortality rates was observed, using a Confider pesticide with increasing user concentration. Also, a significant difference was found between the nymph stages in the degree of their sensitivity to the pesticide, as the first nymph stage was the most sensitive. The general rate of death rate in its individuals reached (48.8%) , while the mortality rate was in the control treatment6%. In the fifth nymph stage, it is the least sensitive and a significant difference, as the percentage reached (42.4%). and the mortality rate was in the control treatment 2.5%. The older nymph stage , the less sensitive it is to the pesticide. This may be because the nymphs of the first stage are still weak and vulnerable, so they remain more influential than the nymphs of the fifth stage, being the largest, with the development of their defensive means that make them more tolerable. As found [19].when evaluating the two pesticide preparations Imidacloprid 2.5% 240 in the soil and sprayed on the plants, both treatments were effective against whiteflies, with the soil treatment being superior to the spray treatment.

Table (2): Effect of pesticide treatment on hopper nymphs leaves Laboratory tested 72 hours after exposure

Exterminator	concentration in ml/L	Corrected percentage of death for the phase nymph			
		the first	Second	Fifth	the average
Imidacloprid spray	25	17	16	11.5	14.89
	50	26	24.5	18.5	22.89
	75	50	44.5	41.3	45.33
	100	68.5	66.3	59.5	64.78
Control	0	5.5	3.5	2.5	4
the average	0	33.47	31	26.67	

LSD	**0**	**for phase 0.927**		**for concentration 1.197**	**for overlap 2.073**
	mg/m2				**the average**
Imidacloprid soil treatment	**100**	**40.3**	**38**	**32.3**	**36.89**
	200	**54**	**51**	**47.5**	**50.78**
	300	**68**	**65**	**60.5**	**64.44**
	400	**75**	**73**	**69**	**72.33**
Control	**0**	**6**	**3**	**2.5**	**3.89**
the average	**0**	**48.6**	**46**	**42.4**	
LSD	**0**	**for phase 0.870**		**for concentration 1.123**	**for overlap 1.945**

Treatment of Adults

The two treatments were spraying and soil treatment of the pesticide Confider highly effective against leafhopper adults with significant differences between them (Table 3) . The mortality rate achieved from the concentrations of the pesticide Confider was (39.73%) after 72 hours of treatment. It is also noted from the table that the percentage of mortality rates differed according to the concentration, as these percentages increased with the increase of the concentration used. The increase in death rates also gradually increased with time. It is noted that the highest mortality rate was achieved after the passage of time 72 hours of treatment and reached (39.73%). That mortality occurs in the first periods of exposure in the case of spraying is due to the effect of contact with this pesticide, and as time progresses, the cumulative death rate increases, as systemic action is[20].For Soil treatment , the percentage of mortality achieved from the use of a pesticide Confider (31.48%). It is also noted that the mortality proportions increased with the increase in concentration and with time, and for all concentrations of the pesticide, it was (7.2%) after24 An hours of treatment and then increased after 36 hours to be (15.87%) and almost doubled after 48 hours and reached (31.67%) and then reached its highest value after 72 hours when (47.47%). This is explained by the fact that this pesticide has a systemic effect, so when the soil is treated with it, it will take time for the pesticide to be absorbed by the root system of the plant, and then it is transmitted to the different parts of the plant until it reaches the pest by absorbing the plant juice, and when it reaches the site of impact in the insect's body, which are the receptors in the device Central nervous system paralysis and then death. where. it was found [21] with the superiority of a pesticide Confider

treating the soil over the spraying treatment, the mortality rate achieved in adults of the white fly reached (93,84%) when used in concentration 25mg/l of water.

Table (3): Effect of pesticide treatments on hopper adults leaves after different durations of laboratory exposure

Exterminator	concentration in ml/L	Corrected percentage of death for the phase nymph			
		6 hours	24 hours	48 hours	72 hours	the average
Imidacloprid spray	25	4	12	24.5	33	18.42
	50	7	18	27.6	41.5	23.5
	75	11	30	39.5	52.5	33.17
	100	15	36	50.3	69.5	42.67
Control	0	0	1.3	1.3	2.3	1.25
the average	0	7.4	19.47	28.6	39.73	29.44
LSD	0	for the duration of 1.038	for concentration 1.161		to overlap 2.321	
	mg/m2	24 hours	36 hours	48 hours	72 hours	the average
Imidacloprid soil treatment	100	5	9	26	42	20.5
	200	7	16	37	51.5	27.83
	300	10	23	46	64.5	35.92
	400	14	30	57	75.5	41.67
Control	0	0	1.3	2.5	3.8	1.83
the average	0	7.2	15.87	31.67	47.47	31.48
LSD	0	for phase 2.945			for concentration 3.293	to overlap 6,586

Through laboratory experiments, the effectiveness of the pesticide was shown in reducing the number of leafhoppers in the nymph stage and adults, and the duration of its effectiveness reaches four weeks, so it can be used in integrated management and contributes to increasing production and protecting the crop.

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