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IN-VITRO EFFECT OF SOME SECONDARY METABOLISM PRODUCTS OF *CORDIA MYXA* ON SOME ASPECTS OF LIFE PERFORMANCE OF *APHIS CRACCIVORA* KOCH (HOMOPTERA: APHIDIDAE)

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Abstract

This study evaluated different concentrations of the crude phenolic and terpenoid extracts of the leaf *Cordia myxa* in some biological aspects of *Aphis craccivora* under laboratory conditions. The results showed that all plant extract concentrations were effective on adult of *Aphis craccivora* compared with control treatment. The mortality rates were of the adult when used 10 mg/ ml concentration of the crude phenolic and terpenoid extracts after 48 hrs of exposure 52.82 and 53.59% Compared with 6.02 and 7.61 % in control treatment respectively. Also, The crude phenolic and terpenoid extracts have affected reduced the number of birth reached 5.67 and 5.00 nymph/ Female at concentration 10 mg/ ml of the crude phenolic and terpenoid extracts Compared with 12.67 and 12.67 nymph/ Female in the control treatment respectively.
Keyword: *Cordia myxa*, crude phenolic, crude terpenoid, *Aphis craccivora*, plant protection

Introduction

Aphis craccivora Koch is an economically important pest that infects many crops reach over 400 plant species in the world (Blackman and Eastop, 2000). Nymphs and adults of *A. craccivora* cause serious damage of cowpea seedlings due to loss of sap and toxins injected (Silva *et al*., 2005), young seedlings succumb to death, with the population increases the older plants appear symptoms such as stunting, crinkling of leaves, delayed flowering, shriveling of pods and finally resulting in yield reduction as high as 50% (Saranya *et al*., 2010, Berlandier and Sweetingham 2003), Compounding the damage it transmission of viruses from plant to plant such as cowpea mosaic virus (CPMV) and cowpea aphid borne mosaic virus (CABMV) (Surekha *et al.,* 2018, Kitajima *et al.,* 2008). In recent years, local farmers complain of insect pests became resistant to the most insecticides, as a result, the overuse of pesticides, Besides, pesticides use highly toxic and hazardous chemicals, which may pose potential and environmental risks (Usha Rani *et al.,* 2016). Environmentalists and the agricultural interested have moved towards finding safe and environmentally friendly alternatives and effective in the control of the pest, such as entomopathogenic (Mohmed 2019a) and plant extracts because they contain compounds similar to those found in industrial pesticides (El-Wakeil, 2013), There are many plants which source of a wide range of compounds resulting from secondary metabolism as flavonoids, terpenoids, and phenolics which work to kill or repelling the pests (Acheuk *et al.,* 2017). One of these plants *Cordia myxa* L. belong to Boraginaceae family, it has medicinal and insecticidal properties because it contains compounds as glycosides, flavonoids, sterols, saponins, terpenoids, alkaloids, phenolic acids, coumarins and tannins (Al-Snafi, 2016). A study aimed to evaluate the bioefficacy of different concentrations of the crude phenolic and terpenoid extract of leaves *C. myxa* on some biological aspects of *A. craccivora* under laboratory conditions.

Materials and Methods

Insect collection and rearing

Nymphs and adults of *A. craccivora* were collected from the fields of cowpea in the College of Agriculture, Al Qasim Green University. The aphids were reared on cowpea plants in 45x45 cm cages under greenhouse conditions (25±2^{O}C and humidity 65±5% RH with 12 h daily photoperiod) for several generations.

Preparation of Plant Extracts

The *C. myxa* leaves were collected from Hillah city, a center of Iraq. The leaves were washed completely with running water and once with sterile refined water, and dried under shade. Phenolic extraction from *C. myxa* leaves was done according to (Ribereau–Gayone, 1972). The Terpenoid compounds were extracted according to (Harborne, 1984). Then, The extracts were filtered and the filtrate was evaporated under reduced pressure to obtain the crude. A stock solution of phenolic plant extract was prepared by dissolving 1 g of sticky leaf extract with 3 ml of ethanol solvents Complete the volume to 100 ml by adding sterile water of a final concentration of 10 mg/ml, The above process was repeated several times to obtain other dilutions 7.5, 5 mg/ml. The control treatment consisted of 97 ml of distilled water and 3 ml of ethanol. While, a stock solution of terpenoid plant extract was prepared by dissolving 1 g of sticky leaf extract with 1.5 ml of ethanol solvents with 1.5ml of chloroform solvents Complete the volume to 100 ml by adding sterile water of a final concentration of 10 mg/ml, from this stock solution two different concentrations were prepared 7.5,5 mg/ml. The control treatment consisted of 97 ml of distilled water and 1.5 ml of ethanol solvents with 1.5ml of chloroform solvents liquid.Paraffin1% and 1-2 drops of tween were added to each concentration as an adhesive agent and surfactant respectively.

Bioassay Test

The effects of crude phenolic and terpenoid with their different concentrations were evaluated against adults of *A. craccivora* by treated 10 adults by the different extracts and concentrations and placed on the leaves cowpea prepared in Petri dishes 9 cm diameter with a piece of wet cotton was placed under it. Four replicates for each concentration. These replicates were treated quantity by 1 ml per replicate. Petri dishes were closed after making holes for ventilation. The dishes were surrounded using Adhesive tape to prevent the adults from going out of the dishes. Then transferred the dishes to the incubator with a temperature of 25±2^{O}C and humidity 65±5%. The mortality of adults was calculated after 48 hours of treatment. To calculate the cumulative mortality of immature stages and female productivity treated 20 first-instar nymphs and by the extract and concentration as in previous experience. The mortality ratios of the different instars nymph were recorded and growth has been pursued to reach the adult stage. Adults were isolated after it appeared, then It was taken from them 4 adults/concentration and three replicates to find out the effect of the crude phenolic and terpenoid extracts of the leaf *C. myxa* on female productivity Through account the number of nymphs.

Data analysis

The data obtained were analyzed using GenStat package 3 (3rh edition) by Completely Randomized Design and Factorial randomized design experiments with two factors. The percentage effects of the crude extracts were calculated and corrected by Abbott's formula (Abbot 1925). Angular transformation was used for mortality statistical analysis except female productivity, Where data analyzed without transformation angular. The treatment means were compared by least significant difference (L.S.D) at significance $P \leq 0.05$.

Results and Discussion

Show table1 the effects of different concentrations of the crude phenolic and terpenoid extracts of the leaf *C. myxa* on the mortality percentage of adults of *A. craccivora*. The mortality rates were significantly varied with concentrations used in the treatments ($P \leq 0.05$). A direct correlation was found between the increase in adults mortality with the increase in the concentration of the crude phenolic and terpenoid extracts. Adult mortality in the crude phenolic extracts ranged between 6.02 % in control treatment to 52.82 % at a concentration of 10 mg/ ml. the greatest percentages of mortality of adult 53.59 % at the highest concentrations 10 mg/ml of the crude terpenoid extract plant compared with7.61% in the control treatment. These results are in agreement with (Mohmed, 2019b) with different plant extract and pests who reported that the crude phenolic and terpenoid extracts of the leaf *Carissa macrocarpa* increased in the percentage of the mortality rates of adult *Aphis fabae*. Rashid *et al.,* 2014 found that the Crude phenols extracted from the leaf parts of *C. myxa* increased mortality larval stages of the *C. pipelines* and showed significant compared with the control treatment. Increasing in mortality of adult *A. craccivora* may be due to the *C. myxa* extracts contain on many natural compounds similar to a compounds used in insecticide manufacturing such as glycosides, flavonoids, sterols, saponins, terpenoids, alkaloids, phenolic acids, coumarins, tannins, (Tiwari *et al.,* 1967), Which have toxic and deadly effects for treated insects.

Table 1 : The effects of leaves crude phenolics and terpenoid extracts of *C. myxa* on the mortality of adult *A. craccivora* at 48 hrs.

Extract concentration mg/ml	Crude phenolics Extracts	Crude terpenoid Extracts	Mean Concentration
0.0	6.02	7.61	6.81
5.0	37.87	38.51	38.19
7.5	45.83	47.22	46.52
10	52.82	53.59	53.21
Mean Extracts	35.64	36.73	
L.S.D ($P \leq 0.05$)	concentration= 3.3 , Extract =2.3 , Interaction = 4.7		

Figure (1) shows an increased in the cumulative mortality of *A. craccivora* with increasing concentrations of plant extracts of the leaf *C. myxa*. It recorded 50, 60 and 70% compared with 15% in the control treatment at crude phenolic extracts of the leaf *C. myxa*. while recorded 55, 65 and 75% compared with 20% in the control treatment at crude terpenoid extracts of the leaf *C. myxa*.

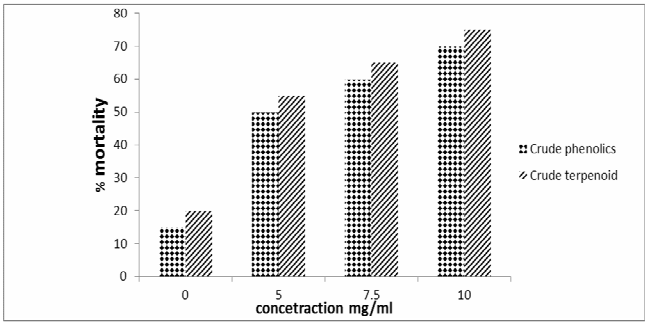

Fig. 1 : Cumulative mortality of *A. craccivora* treated with of leaves crude phenolics and terpenoid extracts of *C. myxa*

Table 2 shows that different concentrations of the crude phenolic and terpenoid extracts of the leaf *C. myxa* significantly affected the female productivity of adults *A. craccivora*. The effect was inverse, Where productivity decreased as the concentration increased. the average number of births adult female of *A. craccivora* significantly reduced from 12.67 and 12.67 nymph/female in the control treatment to 5.67 and 5.00 nymph/Female respectively, at 10 mg/ml concentration of crude phenolics and terpenoid extracts of C. myxa. Rashid *et al* 2015 mentioned that the crude alkaloid compounds of *C. myxa* leave reduced productivity from 320 egg/female to 0 egg/female in the C. pipelines. Natural pesticides act by disrupting the growth and development of insects with deterrent effects on oviposition and feedancy (Morgan 2009). also leads to physiological effects in the insect's midgut, which causes a reduction in the post-ingestive digestive efficiency and is due to disturbances in the hormonal as well as physiological systems. These disturbances include hindrance in the food movement through the insect's midgut and inhibition in the production of digestive enzymes (Schmutterer, 1985).

Table 2 : Productivity (nymph / Female) of adult *A. craccivora* treated with leaves crude phenolics and terpenoid extracts of *C. myxa*

Treatment	concentration mg/ml				Mean Extracts
	0	5	7.5	10	
Crude phenolics extracts	12.67	10.00	8.00	5.67	9.08
Crude terpenoid extracts	12.67	9.33	7.00	5.00	8.50
Mean concentration	12.67	9.67	7.50	5.33	
L.S.D ($P \leq 0.05$)	concentration= 1.2, Extract = 0.8, Interaction = 1.7				

Conclusion

This study concluded that the crude phenolic and terpenoid extracts of the leaf *C. myxa* is a potential candidate for control of *A. craccivora*

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