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EFFECT OF FENPYROXIMATE IN NORMAL AND NANOPARTICLES TO THE CONTROL OF GHOBAR MITE *OLIGONYCHUS AFRASIATICUS* (MCGREGOR) (ACARI: TETRANYCHIDAE)

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Abstract

A field experiment was carried out to determine the effect of Fenpyroximate 5% SC in both normal and nanoparticles in the individuals of the dust mite *Oligonychus afrasiaticus* on the date palm trees in one of the Baghdad orchards. The results showed that the pesticide is superior in its nanoparticles when used with half of the recommended concentration on the pesticide in its normal form when used with the recommended concentration in influencing all stages of dust mite. The mortality rate of eggs, Immature moving stages (larvae and nymphs of the first and second phases) and adults (females and males) after 24 hours of spraying was 98.1, 97.1 and 98.3 % respectively when used in the nanoparticles. While 93.4, 95.3 and 98.3% for the stages respectively when used in the normal. Effectiveness of the pesticide continued to control all mite stages until three weeks after treatment.

Key words: *Oligonychus afrasiaticus,* Nanopesticides, Fenpyroximate.

Introduction

Micronanoparticles are called particles of 1-100 nanometers, while particles larger than 100 nanometers are called macronanoparticles. When these particles become small, these particles acquire new physical, chemical and biological properties, as increasing the effective surface area relative to volume will increase chemical stimulation resulting in faster and stronger reactions (Owen and Depledge, 2015; Tawfeeq, 2014). Nanopesticides are formulations of active ingredients and adjuvants with nano particles. Therefore their active compounds are more soluble, increasing their ability to penetration through barriers and their effectiveness against the target pests increases compared to that of the conventional pesticide, these features allow the use of less pesticide without the need to re-apply while reducing the cost and reducing plant poisoning, as well as not to damage the environment and other non-target organisms (Al-Dahwi *et al*., 2009; Al-Dahwi *et al*., 2012). Many nanopesticides have been manufactured as fungicides, insecticides and mitecides and compared with commercial preparations of conventional pesticides. The nanopesticide was found to have a control efficiency that was several times higher than that of the conventional commercial preparation (Gopal *et al*., 2011; Margulis and Magdassi, 2012; Rouhani *et al*., 2012). In order to add more information in this subject carried out the current research to test the efficiency of the pesticide Fenpyroximate 5% SC in both normal and nanoparticles in all stages of the Ghobar Mite *Olgonychus afrasiaticus* on the date palm trees in one of the Baghdad orchards.

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Materials and Methods

Preparation of Fenpyroximate Nanoparticles

Fenpyroximate was converted to nanoparticles physically by exposing it to the Homogenizer Ultrasonic for 20 minutes. This device emits 22-24 kHz ultrasonic waves that break down physically exposed particles or particles and convert them from normal volumes to nanoscale volumes (Jayarambabu *et al*., 2016). This device emits 22-24 kHz ultrasonic waves that break down physically exposed particles or particles and convert them from normal volumes to nanoscale volumes (Jayarambabu *et al*., 2016; Al-Shujairi, 2018).

X-ray Diffraction Analysis

An check up was carried out to confirm the transformation of the Fenpyroximate to the nanoparticles

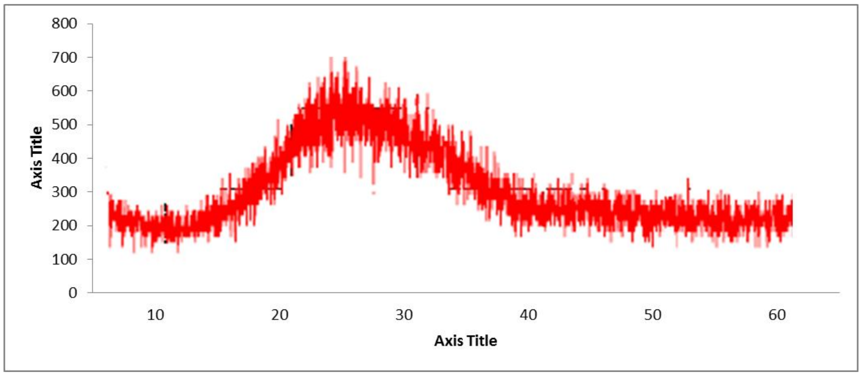

Fig. 1: Shows the X-Ray Diffraction for Normal Fenpyroximate.

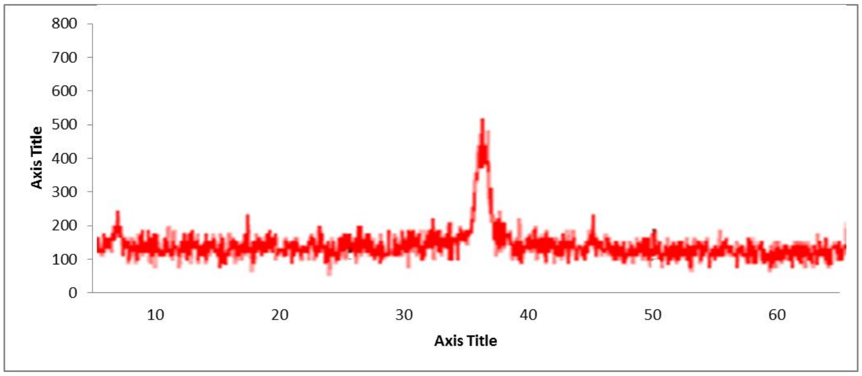

Fig. 2: Shows the X-Ray Diffraction for Nano Fenpyroximate.

using a Shimadzu X-Ray Diffractometer. The samples were prepared for testing by deposition of three drops of the pesticide solution on a glass slide and then dried using a 50°C electric oven for 30 minutes.

Scanning Probe Microscope

A further check up was carried out using a Scanning Probe Microscope (SPM). The samples were prepared for testing by placing several models of the pesticide, both normal and nanoparticles, in 10 ml tubes each separately.

The samples were taken to the Nanotechnology Laboratory of the Department of Chemistry, College of Science, Baghdad University.

Evaluation of Fenpyroximate in both normal and nanoparticles in all stages of *Olgonychus afrasiaticus*:

Selected a suitable orchard area (1) acres in Baghdad containing date palm trees cultivated Barhi noticed infected with the mites through a weekly periodic sampling program started from the beginning of May and continued until the treatment of pesticides on 2/7/2018, Pesticide treatments were distributed to the experimental units in each replicater by the Randomized Complete Block Design (CRBD) as follows:

1. Normal Fenpyroximate at a concentration of 1.5 ml / L water (the recommended concentration of the pesticide).
2. Nanoparticles Fenpyroximate in its was sprayed at a concentration of 0.75 ml / L water (half of the recommended concentration of the pesticide).
3. The comparison was sprayed with water only.

Date samples are taken to the laboratory and examined and calculated the numbers of mites Individuals and corrected the percentage of death according Henderson and Tilton, (1955).

Statistical analysis

The trial experiment was designed according to the complete randomized block design (CRBD). The data were statistically analyzed using the analysis of variance method. The least significant difference LSD was used for at the level of 0.05 probability to compare the means, Genstat v.12.1 software was used in the statistical analysis (Al-Rawi and Khalaf Allah, 2000).

Results and Discussion

Preparation of Fenpyroximate Nanoparticles

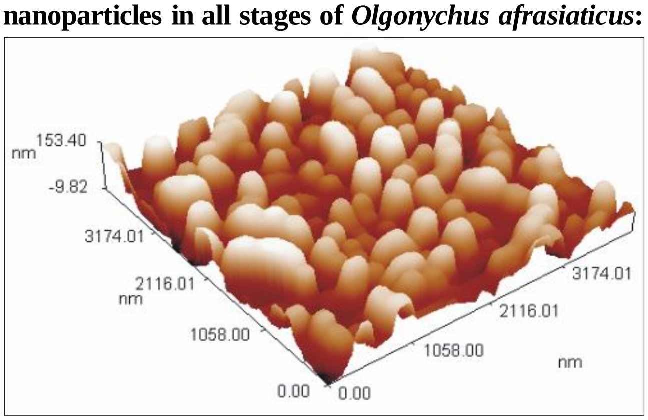

Fig. 3: Shows the 3D image for Normal Fenpyroximate.

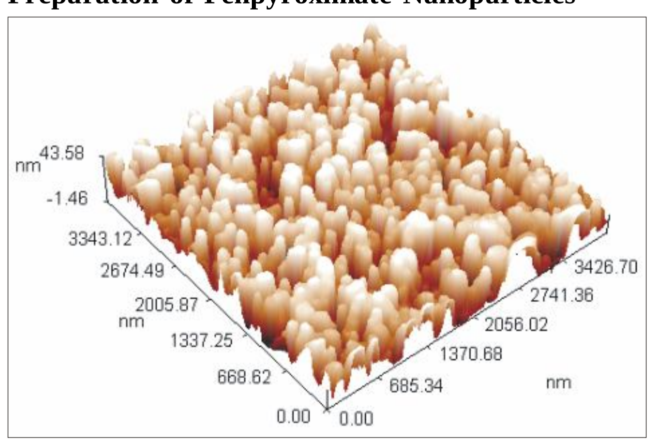

Fig. 4: Shows the 3D image for Nano Fenpyroximate.

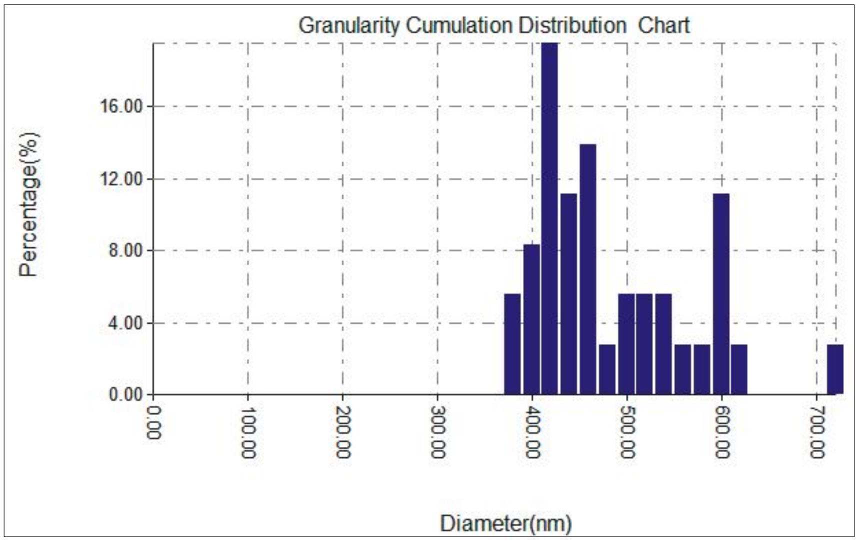

Fig. 5: Granularity Cumulation Distribution Chart for Normal Fenpyroximate.

• X-ray Diffraction Analysis: The fig. 1, 2, shows the X-Ray Diffraction for Normal and Nanoparticles of Fenpyroximate, Diffraction peaks 700 and 500 respectively, are observed at angles 25 and 37 respectively, also found that these angles are similar to those in the JCPDS card. which showed that the Polycrystalline compositions are spherical & cubic centered face, the average size of nanoparticles using the Scherrer equation was 455 and 162 nm, respectively (Kelsall *et al*., 2005).

• Scanning Probe Microscope: The fig. 3, 4, shows the 3D image for Normal and Nanoparticles of Fenpyroximate deposited on glass substrate with 2×2 mm dimensions, also the figure shows that the average size is found to be around 472.83, 178.80 nm respectively, also the figure refers that the shape of thes particles is spherical distribution as matrix on the vertical axis and directed to horizontal and cover all the surface, this means that the thin film is homogenous and uniform.

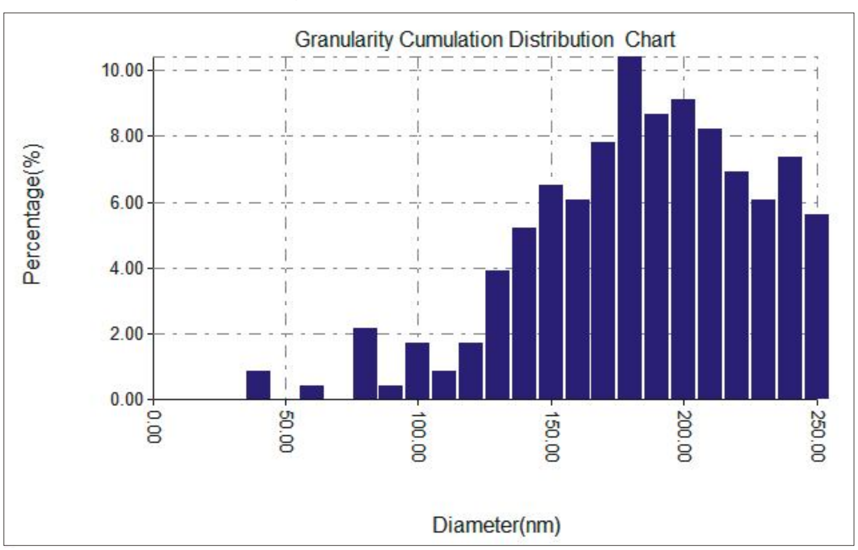

Fig. 6: Granularity Cumulation Distribution Chart for Nano Fenpyroximate.

The fig. 5, 6, shows the Granularity Cumulation Distribution Chart for Normal and Nanoparticles of Fenpyroximate. It appears that 50% of nanopesticide particles are less than 180 nanometers, 90% of them are less than 230 nm, while 50% of normal pesticide nanoparticles are less than 440 nm, 90% of which are less than 580 nm.

It turns out that the nanoparticle particle size is less than half the normal pesticide particle size. This explains why, despite the use of the pesticide in the nanoparticles at half the recommended concentration used in the pesticide in the normal form However, it gave higher control efficiency and effectiveness than the normal pesticide, as will be shown later.

• Evaluation of Fenpyroximate in both normal and nanoparticles in all stages of *Olgonychus afrasiaticus*: The efficiency of the pesticide Fenpyroximate varied in both normal and nanoparticles used in influencing the mite stages in the orchard during different time periods. From the observation of the efficiency of the pesticide in the two forms on the adult pest (females and males) shows the superiority of the nanopesticide on the normal and significant differences. The relative efficiency rate was 74.0% followed by the average pesticide and its efficiency was 68.2% (Table 1). As for the effect of the time period on the efficiency of the pesticide in both forms, the effect of both was equal after one day of treatment. Their efficiency rate was 98.3%. After three days of treatment, the nanopesticide was superior to ordinary pesticide with no significant differences. Their efficiency rate was 93.4 and 91.7% respectively. After five days of treatment, the nanopesticide was significantly superior to the normal and with significant differences. Their efficiency rate was 89.1 and 85.1% respectively. The nanopesticide continued to outperform the normal pesticide in all sampling and testing periods after 7, 14, 21 and 28 days of treatment with significant differences, with an average efficiency of 81.9, 73.9, 65.1 and 16.5%, respectively. The average pesticide efficiency was 76.3, 67.3, 53.6 and 5.4% respectively for the mentioned periods. The activity of Fenpyroximate in its normal and nanoparticles varied in the immature

Table 1: Percentage of corrected mortality of adults *O. afrasiaticus* in Orchard.

The average	Corrected percentage of death after treatment							Conc. ml/L	The treatment
	28 D.	21 D.	14 D.	7 D.	5 D.	3 D.	1 D.		
68.2	5.4	53.6	67.3	76.3	85.1	91.7	98.3	1.5	Normal Fenpyroximate
74.0	16.5	65.1	73.9	81.9	89.1	93.4	98.3	0.75	Nano Fenpyroximate
71.1	11.0	59.4	70.6	79.1	87.1	92.6	98.3	The average	
LSD = 2.4									

moving stages of the pest (larvae, first nymphs, second nymphs). Observing the efficiency of the pesticide in the two forms on the stages of the immature moving pest shows the superiority of the nanopesticide on the normal and significant differences, where the relative efficiency rate of 69.6% followed by the average pesticide and efficiency 63.8% (Table 2). And for all time periods in which the experiment continued. The efficacy of Fenpyroximate in its normal and nanoparticles varies in the eggs of the pest. It is noted that the efficiency of the pesticide in the two images on the eggs of the pest shows the superiority of the nanopesticide on the normal and significant differences. The relative efficiency rate was 69.3% followed by the average pesticide and its efficiency was 60.5% (Table 3). It is worth mentioning that the microscopic examination of eggs treated with Fenpyroximate in both normal and nanoparticles showed a change of color from transparent for newborn eggs and transparent yellow for old eggs to dark brown after 24 hours of treatment. Treatment The egg shell became soft and creased and shrank over time. As for the differences in the effect of the pesticide in the normal and nanoparticles and in different concentrations during the mentioned periods on the pest stages, it can be explained that the pesticide Fenpyroximate affects the pests by contact (Eleawa, 2016). After its conversion to the nanoparticles, it is subjected to fracture in its molecules into small particles, which led to its homogenization in a larger spray solution. Thus, it was widely spread over the sprayed area in addition to the speed and ease of access to the body of the lesion and egg shell. Because it is carried out within the plant tissue and at relatively large concentrations of small particles, its decay and fading are slower and continue to affect the pest for a longer period, whereas Fenpyroximate is normally twice as large Thus, the amount of pesticide applied to plant parts is less and more than it remains on the surface of plant parts, thus exposing it to environmental factors that tend to fade more. For example, their efficacy was similar to the stages of the pest despite the different concentration used (Motoba *et al.*, 2000; Ellis, 2009). Studies have shown that nanopesticides are characterized by the fact that their active compounds are more soluble, making them more ready to spread in the solution, which increases their ability to penetrate the barriers and resistance to the defenses of the pest or pathogen. They are more effective against target pests than conventional conventional pesticides and these features allow the use of less pesticide without the need for re-application while reducing costs and reducing plant poisoning, as well as not harming the environment and other non-target organisms. Many nanopesticides have been manufactured as fungicides and insecticides and compared with commercial preparations of traditional pesticides. For example, Nano-Hexaconazole was found to have a fivefold higher control efficiency against pathogens than conventional commercial preparations. Nano-Sulfur is ten times more efficient than a standard product in mite control (Gopal *et al.*, 2011; Margulis and Magdassi, 2012; Rouhani *et al.*, 2012). In another study on the effectiveness of the pesticide Fenpyroxmate in the individuals of the two-spotted mite on the zucchini plant, where the results showed the superiority of Fenpyroxmate pesticide on the rest of the used pesticides, where the death rate for adult pests achieved by the use

Table 2: Percentage of corrected mortality of *O. afrasiaticus* Immature moving stages in Orchard.

The average	Corrected percentage of death after treatment							Conc. ml/L	The treatment
	28 D.	21 D.	14 D.	7 D.	5 D.	3 D.	1 D.		
63.8	6.7	42.6	60.6	67.2	82.0	92.4	95.3	1.5	Normal Fenpyroximate
69.6	16.1	50.9	67.1	74.8	88.6	92.4	97.1	0.75	Nano Fenpyroximate
66.7	11.4	46.8	63.9	71.0	85.3	92.4	96.2	The average	
LSD = 1.6									

Table 3: Percentage of corrected mortality of *O. afrasiaticus* eggs in Orchard.

The average	Corrected percentage of death after treatment							Conc. ml/L	The treatment
	28 D.	21 D.	14 D.	7 D.	5 D.	3 D.	1 D.		
60.5	4.8	32.0	56.3	68.8	79.6	88.7	93.4	1.5	Normal Fenpyroximate
69.3	14.8	48.2	63.1	77.6	88.7	94.3	98.1	0.75	Nano Fenpyroximate
64.9	9.8	40.1	59.7	73.2	84.2	91.5	95.8	The average	
LSD = 2.2									

of this pesticide 76.9%, while it reached 79.6% in the moving stages. For eggs, the corrected death rate was 74.5% after four weeks of treatment (Al-Saady, 2017).

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