Biochem. Cell. Arch. Vol. 21, No. 1, pp. 611-615, 2021	www.connectjournals.com/bca	*ISSN 0972-5075*
DocID: https://connectjournals.com/03896.2021.21.611		*eISSN 0976-1772*

EFFECT OF SOME INSECTICIDES IN CONTROLLING THE DIAMOND BACK MOTH LARVAE, *PLUTELLA XYLOSTELLA* L. (LEPIDOPTERA: PLUTELLIDAE) OF CABBAGE

Dawood Salman Hamid* and Jinan Malik Kalaf

Department of Plant Protection, College of Agriculture, University of Basra, Basra, Iraq.
*e-mail: dh3098726@gmail.com

(Recived 18 July 2020, Revised 30 September 2020, Accepted 12 October 2020)

ABSTRACT : The research was conducted on the diamond back moth *Plutella xylostella* L. as a first time in Basra Governorate, the study aim was to evaluate the efficiency of the Lufenuron, Dimethoate, Devimethrin and Emamectin insecticides on larva mortality of above insect. The laboratory experiments were conducted in the laboratories of the plant protection Department, College of Agriculture and field experiments were done in the agricultural research station in Garmat Ali of the University of Basra for the period 2\11\2019- 17\4\2020. The results of the study showed that the highest density of moth larvae was at 17\2\2020 and 2\3\2020 periods which reached to 6.90 larvae\ leaf, compared with no larvae during period. The laboratory results showed that the best insecticide effect was Emamectin, as it reached the percentage rate of mortality 84.44%. Compared 4.44% in Dimethoate insecticide. The larvae mortality increased by increasing the hours of exposure to insecticides the rates were 26.66, 49.99, 68.33% after 24, 48, 72 hours, respectively. The results of the field also showed that the best insecticide on moth larvae was Emamectin, as the maximum effect in the percentage of mortality reached 67.30%, the least of which was Dimethoate and reached 47.65% .The study showed that the efficacy of Emamectin reached 83.73% followed by Lufenuron, and it reached 70.69% after 96 hours of treatment.

Key words : Insecticides, larvae, *Plutella xylostella*.

How to cite : Dawood Salman Hamid and Jinan Malik Kalaf (2021) Effect of some insecticides in controlling the diamond back moth larvae, *Plutella xylostella* L. (Lepidoptera: Plutellidae) of cabbage. *Biochem. Cell. Arch.* **21**, 611-615. DocID: https://connectjournals.com/03896.2021.21.611

INTRODUCTION

The diamond back moth, *Plutella xylostella* L. belongs to the family Plutellidae and the order Lepidoptera, which is a destructive pest all over the world and causes great problems in many countries and has great economic importance and its control costs approximately one billion dollars annually (Mahmoud *et al*, 2009), while the total cost of combating it has been estimated. 4-5 billion dollars annually (Zalucki *et al*, 2012), which is one of the most destructive pests of vegetables. The cabbage and cauliflower of the Crusader family are among the most important winter vegetables grown mainly in tropical and temperate regions of the world and sensitive to this pest throughout the year, so they are considered one of the main pests in Iran. India, Pakistan, and in all areas of cultivation of cabbage all over the world and cause great damage (Uthamasamy *et al*, 2011). Cabbage and cauliflower are an important source and rich in nutrients such as fat, protein, vitamin A and C and minerals *Plutella xylostella* on the underside of the leaves of the host Plant, which results in irregular spots and makes them unfit for no Depreciation (Grzywacz *et al*, 2010). Although, chemical control is the best way to control this moth *Plutella xylostella*, it was classified among the most pests that were able to develop resistance to insecticides (Shelton *et al*, 2000). The insect has developed resistance against 82 pesticides belonging to different chemical groups in 17 countries (Furlong *et al*, 2013). IGRS was used that affect different roles of the insect, including the Benzoyl phenyl urea (BPU) group, which is very specialized, has low toxicity to mammals, rapidly degrades in the environment, and is effective for immature stages of insects (Hofemann and Lorenz, 1998). Mohammad *et al* (2011) used Hexaflumuronat three concentrations of 50, 100 and 200 ml / liter on *Plutella xylostella* eggs with the highest mortality rate of 85%.

Uthamasamy *et al* (2011) emphasized that the strong use of pesticides by farmers increased the risks of the insect and led to the destruction of natural enemies and the development of resistance to the pest. Therefore, a program to monitor and monitor the development of resistance and prepare future programs and strategies to manage and combat this pest was started In addition, a study was conducted to evaluate the toxicity of the pesticide Lumnuron 5.4 EC and to know the sensitivity and resistance of the moths to the pesticide. It was found that 100% of the moth resistance rangedbetween 50, 62 and 73 ppm (Sengultuvan *et al*, 2014). The efficacy of the insecticides Emamectin benzoate, Lufenuron and Profenofos against the moth *Plutella xylostella* and *Spodoptera lituralis* was compared, as the two insects are among the main pests that afflict cabbage and cauliflower in Pakistan. The study proved that the pesticide Emamectin benzoate is more effective and toxic, followed by profenofos and then Lufenuron after 24 and 72 hours of treatment (Muhmmad *et al*, 2019).

The modern insecticides Emamectin benzoate, ChlorantraniliproleFlubendiamide, Fipronil and Chlorfenaoyr were also evaluated to determine their toxicity and persistence against moths on the basis of LC50 for laboratory third-stage larvae control (Teja *et al*, 2019).

In another study, five insecticides Emamectin benzoate, SpinosadIndoxacarb, Thiodicarb, and Flubendiamide were evaluated against *Plutella xylostella* second stage larvae and all of them were effective after 7 days of treatment (Gudivada *et al*, 2019).

The study aimed to know the effect of insecticides on the percentage of mortality of the larvae of the diamond back moth, being one of the most important and most destructive pests of the cabbage plant and its resistance to various pesticides and due to its wide spread recently in Basra Governorate and its causing great economic damage and the lack ofa prior study of it in the region.

MATERIALS AND METHODS

Calculation of the density of *plutella xylostella* larvae in the Field experiments were conducted at the Agricultural Research Station College of Agriculture, University of Basra, Garmat Ali, in the area planted at cabbage a variety RAIN BALL F1 in the slabs and the 2019 and the infection/distance between a plant and another 30 cm on 11/2 appeared on 11/17/2019, the population density of the diamond back moth on the cabbage plant was calculated after 15 days of planting, three plants were taken randomly and from each plant three leaves were takenand the rate of larvae on one leaf was calculated twice per month.

Insecticides preparation

The following insecticides, Lufenuron, Dimethoate, Devimethrin and Emamectin were used in the control of *Plutella xylostella* larvae due to different chemical groups and concentrations recommended in laboratoryand field experiments.

Effect of insecticides on larvae of *Plutella xylostella in vitro*

The leaves of the softening plant were collected from the field before the watering, washed with water, dried and immersed in the insecticide solution for a second at the recommended concentration for each pesticide separately and by three repetitions. Then the treated leaves were dried at room temperature for two hours after drying. The leaves were placed in sterile Petri dishes in the form Tablets containing filter paper moistened, with water and due to the presence of larvae of different larval ages therefore 10 larvae were added randomly to each dish and kept at a temperature of 25 ± 2°C and 60-65% relative humidity, the number of dead larvae was calculated to extract the percentage of mortality after 24, 48 and 72 hours of treatment.

Effect of insecticides in field decimation of *Plutella xylostella* larvae

When the infestation reaches 6 larva / plant leaf, the plants are sprayed with insecticides at a rate of three replications (each one represents a whole plant) and at the recommended concentration and each pesticide separately using a 1 liter hand held sprinkler, while the control treatment sprayed the plants with water. The distillate only calculated the number of larvae present in three replicates and each duplicated three vegetable leaves a day before spraying. Then the number of live larvae was calculated after 24, 48 and 72 hours of treatment. The Orell and Schneider equation contained in Shaban and Al-Mallah (1993) was used according to the following equation:

$$\text{Relative efficiency \%} = 1 - \frac{\text{Number of pest individuals after treatment} \times \text{Number of pest individuals in comparison before treatment}}{\text{Number of pest individuals before treatment} \times \text{number of pest individuals in comparison after treatment}} \times 100$$

Statistical analysis

The laboratory experiments were carried out

according to the complete randomization design as two-factor experiments. As for the field experiments, they were carried out according to the random sector design as factor experiments. The averages were compared according to the RLSD method and under the probability level 0.01 and 0.05 using the SPSS program.

RESULTS AND DISCUSSION

The results as in shown in Fig. 1 showed that the highest density of *Plutella xylostella* larvae was6.90 larvae / leaf at the periods 17/2/2020 and 2/3/2020, while the lowest was 0/leaf at the period 11/17/2019. The difference in the number of larvae may be due to the influence of environmental factors or due to the presence of natural enemies of the pest, which makes the number of the pest oscillate between increase and decrease.

Effect of isecticides on *Plutella xylostella* larvae *in vitro*

The results shown in Fig. 2 that the insecticides had a significant effect on the percentage of larvae mortality, and that the best insecticide effect was Emamectin, as the percentage rate of death was 84.44% and the least affected was Dimethoate and reached 24.44%. The percentage rate increased by increasing the hours of exposure to pesticides and reached 26.66, 49.99 after 24, 84 and 72 hours, respectively. The results showed that all 68.33% pesticides it was significantly differentiated from the control treatment, as shown in Fig. 2. The variation in the effect of insecticides in the percentage of mortality of moth larvae is due to the difference in the chemical groups to which the pesticides refer, to the difference in the methods and the toxic effect of the pesticides on insects and to the difference in the mechanism of their entry into the body of the larvae. It affects through feeding and contact which leads to a gradual death within 48 hours of starting the treatment, in addition to direct and rapid killing, and has a decomposition effect, so that it penetrates the plant tissues and affects through feeding. Dimethoate is a systemic organic phosphorous insecticide that works by contact and by the, infectious agent and is used to control a group of insects that affect crops vegetables and fruit trees. As for the pesticide Emamectin, a non-systemic insecticide that works by contact has the ability to penetrate into plant tissues and store inside cells and tissues and kill pests that feed on the contents of the outer and inner paper. It has unique characteristics that give the insecticide the ability to eliminate a wide range of worms in vegetable crops, it works to cut off nerve signals. That gives orders to move the muscles of the treated larvae so they lose their ability to move and feed and die quickly. It is effective in controlling larvae that have acquired a resistant character, such as the diamond

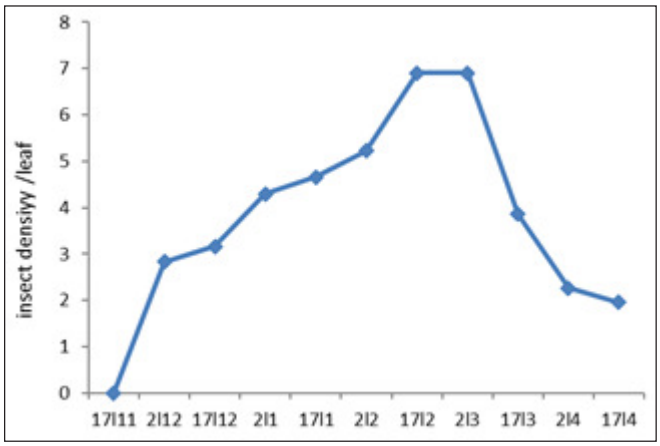

Fig. 1 : Average of population density of *Plutella xylostella* larvae / leaf. RLSD 0.05 = for the effect of days on the density of *plutella xylostella* lavae = 0.84

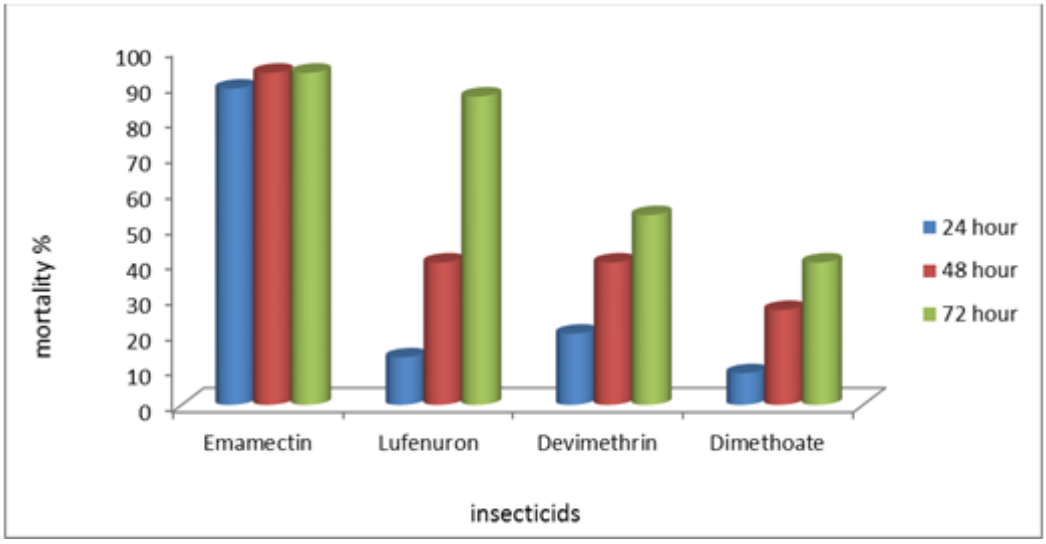

Fig. 2 : Effect of insecticides on the percentage of mortality of larvae of the diamond back moth *Plutella xylostella in vitro*. RLSD 0.05 for effect of days = 4.50, for effect of insecticides = 4.50, for effect of overlap = 9.01

Table 1 : The percentage of mortality of the *Plutella xylostella* larvae in the field.

Insecticides	Mortality %/hour				Effect average of insecticides
	24	48	72	96	
Dimethoate	27.03	42.44	55.15	66.01	47.65
Devimethrin	39.52	48.61	57.64	73.83	54.90
Lufenuron	35.55	61.50	68.25	70.69	58.99
Emamectin	52.22	63.74	69.52	83.73	67.30
Effect average of hours	38.58	54.07	62.64	73.56	

RLSD 0.05 for effect of hours = 9.17, for effect of insecticides= 9.17, for effect of overlap = 18.34

back moth. Devimethrin is a pyrethroid insecticide that is effective against a wide variety of insects. It works by touching, infectious and feeding inhibitors. It affects nerve receptors by contact. It inhibits the internal immunity of insects, leading to paralysis and then death. It is used successfully against pests that have acquired resistance to many insecticides, so it can be used successfully against the diamond back moth (AL-Baridi *et al*, 2011).

Effect of insecticideon the decimation of the *Plutella xylostella* larvae in field

The results of the field study showed that the best chemical pesticides affected the larvae of the diamond back moth is the pesticide Emamectin, as the rate of effect of the pesticide in the percentage of mortality was 67.30% and the least effect was Dimethoate and it reached 47.65%. The results of the statistical analysis showed that there is a significant difference between chemical pesticides in their effect on the percentage of mortality. The percentage, as shown in Table 1. The results showed a positive relationship between the percentage of mortality and the period of exposure to chemical pesticides, as the average effect of the period of exposure was 38.58, 54.07, 62.64, 73.56% after 24, 46, 72 and 96 hours, respectively. While the study showed that the effectiveness of Emamectin reached 83.73% followed by Lufenuron, 70.69% after 96 hours of treatment. The difference and variation in the effect and toxicity of chemical pesticides for moth larvae is due to the different chemical groups to which the insecticides refer to and to the difference in the relative efficiency and effectiveness of the insecticides in the field in insects and the difference in the mechanism of their entry into the body of the larvae. Its high toxicity to the diamond back moth. In another study between Akbar *et al* (2014), the pesticide Emamectin gave excellent results in controlling larvae and reducing the numerical density of diamond-back moth larvae to 3 / leaf, followed by the effect of Lufenuron as the density was reduced to 5.2 / sheets. The results of the study agreed with the findings of Muhammad *et al* (2019) that the pesticide Emamectin proved its effectiveness at a higher level than Lufenuron after 72 hours of treatment.

REFERENCES

Akbar I, Sttar S, Khurshid I and Akbar A (2014) Comparative efficacy of synthetic isecticides and botanical extracts against diamondback moth (*Plutella xylostella*) (Lepidoptera : Plutellidae) in Cauliflower. *European Acad. Res.* **2**(5), 6051-6066.

AL-Baridi M M, AL-Fuhaid M S, AL-Hassoun E A and AL-Tubaishi A A (2011) Directory of agricultural pesticides in the Kingdom of Saudi Arabia, Ministry of Agriculture.78-79pp (in Arabic).

Furlong M J, Wright D J and Dosdall L M (2013) Diamond back moth ecology and management: problems. Progress and prospects. *Annu. Rev. Entomol*. **58**, 517-541.

Grzywacz D, Rossbach A, Rauf A, Russel D A, Srinivasan R and Shelton A M (2010) Current control method s for diamond back moth and other brassica insect pests and the prospects for improved management with lepidoptera –resistant Bt vegtable brassicas in Asia and Africa. *Crop Prot*. **29**, 68-79.

Gudivada H, Dhurua S, Suresh M and Sreesandhya N (2019) Evaluation of certain insecticides against Diamond back moth (DBM) *Plutella xylostella* on cauliflower. *Int. J. Bio- resource and Stress Management* **10**(1), 70 -76.

Hoffmann K H and Lorenz M W (1998) Recent advances in hormones in insect pest control. *Phytoparasitica* **26**, 1-8.

Mahmoud V, Sheikhi G and Abbasipour H (2009) Toxicity of neurotoxin insecticides on the diamond back moth, (Leoidoptera:Plutellidae). *Proceeding of the 6Th Asia-pacific Congress*. pp. 68-69. Beijing, China.

Mohammad M, Habib A, Aziz S G and Ali R B (2011) Sublethal effects hexaflumu on development and reproduction of the diamond back moth, *Plutella xylostella* (Lepidoptera : Ypeunomutidae). *Insect Science* **18**, 689-696.

Muhammad R, Ghulam M, Muhammad J, Nadeem I, Taqi R, Abullah A and Muhammad A (2019) Comparative efficacy of newer insecticides against *Plutella xylostella* and *Spodoptera litura* on Cauliflower under Laboratory Conditions. *Ind. J. Pure. App. Biosci.* **7**(5), 1-7.

Senguttuvan K, Kuttalam S and Gunasekaran K (2014) Base line toxicity of Lufenuron 5.4 EC against diamond back moth, *Plutella xylostella* L.for Resistance Monitoring. *Trends in Biosciences* **7**(13), 1440-1443.

Shaban A and AL-Mallah N M (1993) *The pesticides*. Ministry of Higher Education and Scientific Research. University of AL Mosul 520pp (in Arabic).

Shelton A M, Sances F V, Hawley J and Tang J D (2000) Assessment of insecticide Resistance after the outbreak of diamondback moth (Lepidoptera : Plutellidae) in California in 1997. *J. Econ. Ent*.

93, 931-936.

Teja N, Sunitha V, RameshBabu V and Satyanarayana J (2019) Evaluation of novel insecticides and their persistency against diamond back moth, *Plutella xylostella* Linn. *J. Entomol. Zool. Studies* **7**(3), 338-341.

Uthamasamy S, Kannan M, Senguttuvan K and Jayaprakash S A (2011) Status damage potential and management of diamond back moth, *Plutella xylostella* L. in Tamilnadu, India. In : *Proceeding of the sixth International Workshop on Management of the diamond back moth and other crucifer insect pests*, AVRDC-The World vegetable center, Taiwan, March 21-25, pp. 270-279.

Zalucki M P, Shabbir A, Silva R, Adamson D, Shu-Sheng L andFurlong M J (2012) Estimating the economic cost of one of the words major insect pest, *Plutella xylostella* (Lepidoptera : Plutellidae). *J. Econ. Entomol.* **105**, 1115-1129.