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EFFECTS OF THREE HOST PLANTS ON SUSCEPTIBILITY OF *SPODOPTERA LITURA* (LEPIDOPTERA : NOCTUIDAE) LARVAE TO SOME INSECTICIDES

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Abstract

Spodoptera litura is known as tobacco cutworm or cotton leafworm. It is located in Asia, Oceania and India and caused damage to many agricultural crops. The possible impact on the many different cultivated crops has led to extreme efforts to control on this pests. Therefore, new chemical compounds of pesticides (Tracer, Match and Proclaim) were evaluated for their toxicity against leafworm *Spodoptera litura*. One of the main objectives in this paper is to study the effect of the food host on the sensitivity of the leafworm against these Pesticides. The results of the present study were showed a significant inhibitory effect with the percentage of 3rd in star larvae mortality, which has varied according to the type of pesticide, type of food host and exposure period. The results were showed that the larvae of *Spodoptera litura* fed on the MAIZE plant (*Zea mays*) are the most sensitive to the pesticides (Proclaim, Tracer and Match) comparison with CABBAGE (*Brassica oleracea*) and CHARD (*Beta vulgaris*) plants and the death rates reached to 72.7, 60, 28 and 60, 17%, respectively, after twenty four hours of treatment. Otherwise, the feeding larvae on the CHARD were less sensitive to pesticides (Proclaim, Tracer and Match) and the death rates were reached to 66, 46, 28, 32, 32%, respectively, after 24 hours of treatment. Furthermore, the highest death rate was reached to 80% that recorded to the CABBAGE when treated with Proclaim, also after 24 hours after treatment.

Key words: insect growth regulators, spinosad , Tobacco leaf worm

Introduction

Tobacco leafworm *Spodoptera litura* is one of the most fatal insect pests on green vegetables and field crops (Lightfield, 1996; Ogden and Podleckis, 2000). This pest has huge host variety with more than a hundred and twenty host plants, and it is commonly known as tobacco caterpillar, a most devastating pest of cotton, groundnut, chillies, tobacco, castor, bhendi, pulses (Bhatti *et al.,* 2013, Xue M *et al.,* 2010, Qin *et al.,* 2004). Larvae feed on vegetable leaves and stems, causing holes in leaves and a loan in small stems and buds. The economic loss of crops by larvae in different plants were estimated at 25.8-100% , depending on the type of crop, stage of growth and level of infection (Dhir, B.C *et al.,* 1992). Resistance to pesticides is a major trouble connecting with the chemical power of insect pests. The development trouble of resistance to insecticides is greater acute in this pest due to its polyphagous nature and rapid multiplication (Ramakrishnan *et al.,* 1984). The process of controlling this pest took a lot of time, effort and money from farmers to control it. The extensive use of pesticides led to the emergence of strains resistant to most pesticide groups (Shad *et al.,* 2010). Therefore, it required the use of alternative and sustainable strategies. Finally, the aim of this study is to investigate and study the effect of plant hosts on insect sensitivity to some pesticides (Spinosad, Lufenuron and Emamectin Benzoate).

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Materials and Methods

Insects

The key materials and methods that used in this paper will be described. Many of these methods were conducted in the labs of Agriculture college/university of Mosul in 2013. Late ages of Leafworm tobacco larvae were collected from the fields of Agriculture College. The larvae were raised for two generations on the three plant families: chard (*Beta vulgaris*), cabbage (*Brassica oleracea*) and maize (*Zea mays*), to make three insect cultures.

Insecticides

The recommended insecticides against *Spodoptera litura* on the three plant families were selected and obtained in the form of their commercial formulations to use for the experimentation. Ninety larvae of a third in star were taken from each culture and divided into three groups (thirty larvae for each pesticides, Proclaim, Tracer, and Match).

Bioassay

First fifteen larva placed individually after starving for two hours in Plastic container underneath filter papers and fed on plant leaves which treated with spinosad concentration 5 ml/L Immersion method for ten seconds ,containers were Covered with a muslin and a rubber band to prevent the larva from leaving .The second group of fifteen larvae were fed on plant leaves treated with distilled water as a comparative treatment. Containers placed in incubation at 27°C and 50% humidity, numbers of dead and live larvae was taken after 24 and 48 hours. The same experiment was repeated on the Match pesticides and Emamectin Benzoate on three host plant. The total replicates were 270. The experiment was analyzed using a complete randomized design and the averages were compared with the Duncan test at a 5% probability level.

Results and Discussion

Effect of food type on larvae sensitivity to pesticides

The results of the experiment showed high sensitivity of larvae that fed on Maize leaves treated with pesticides, when compared to larvae fed on Cabbage and Chard leaves, table 2. Larvae Mortality rate reached 64.2, 48.6 and 48.3%, respectively, Duncan test showed significant differences between the averages at a probability level of 0.05. The reason may be due to the variation in the different food supplies and their biochemical reactions inside the insect's body, which are reflected in their toxins tolerance and pesticides.

Table 1: Names of pesticides used and application rate.

Name of commercial pesticide	active ingredient	Usage ratios/ 100 liters
Emamectin benzoate	Proclaim	300 ml
Spinosad	Tracer	500 ml
Lufenuron	Match	700 ml

The result was consistent with (Xue, *et al.,* 2010), who was found that tobacco leafworm larvae fed on tobacco, cabbage, cowpea and sweet potatoes, treated with Emamectin benzoate, phoxim, chlorfenapyr and methomyl, were more sensitive to all pesticides, whereas those fed on potatoes were the most resistant to pesticides when they raised for three generations. The reason may be due to the difference of food components ,therefore, the best food Which provides nutritional needs larva make resistance and tolerance to the pesticide better.

Effect of pesticide type on larvae sensitivity

The results showed that Emamectin benzoate was more effective than Spinosad and Match on third instar larvae, where the mortality percentage 73.4, 50.6 and 37.6, respectively, table 3.

The result was identical to (Rashad *et al.,* 2011) where he found that all pesticides be insecticidal under laboratory conditions and the mortality percentage increased positively with exposure time. Mortality percentage reached 100% when treated with an Emamectin Benzoate at a concentration of 110 ml/acre, followed by chlorpyrifos with a killing rate of 69.56% at

Table 2: The effect of interaction between the food host, pesticide and Exposure period on larval mortality percentage.

Host food plant	pesticides	Mortality Percentage % after treatment				Rate of host food effect	Pesticide effect rate
		24 Hours	Average	48hours	Average		
Chard	Spinosad	46.2 ±1.7 e	48.3	33 ± 2.3 g	26.3	37.3 b	36.3 b
	Match	32.5 ± 1.7 g		33 ± 1.1 g			34.3 c
	Emamectin Benzoate	66.3 ± 1.7 c		13 ± 3.4 i			41.8 a
Maize	Spinosad	60 ± 2.8 d	64.2	13 ± 1.7 i	15.3	39.7 a	
	Match	60 ± 1.7 d		20 ± 2.8 h			
	Emamectin Benzoate	72.7± 1.4 b		13 ± 2.3 i			
Cabbage	Spinosad	45.6 ± 2.2 e	48.6	20 ± 1.4 h	22	35.3 c	
	Match	20.3 ± 1.2 h		40 ± 2.3 f			
	Emamectin Benzoate	80 ± 2.3 a		6 ± 1.1 j			
		53.7 a		21.2 b		Effect of exposure time	

The averages that share similar letters do not differ significantly from each other according to the Dunkin test at a probability level of 0.05.

Table 3: The effect of interaction between the food host , pesticide on larval mortality percentage.

Mortality Percentage %after treatment	Pesticide	Host plant	24 hour	Average	48 hour	Average	General Average
	Imamectin	Chard	66.3 ± 1.7 c	73.4 a	13 ± 3.4 i	10.6 c	41.8 a
		Maize	72.7± 1.4 b		13 ± 2.3 i		
		Cabbage	80 ± 2.3 a		6 ± 1.1 j		
	Match	Chard	32.5 ± 1.7 g	37.6 c	33 ± 1.1 g	31 a	34.3 c
		Maize	60 ± 1.7 d		20 ± 2.8 h		
		Cabbage	20.3 ± 1.2 h		40 ± 2.3 f		
	Spinosad	Chard	46.2 ±1.7 e	50.6 b	33 ± 2.3 g	22 b	36.3 b
		Maize	60 ± 2.8 d		13 ± 1.7 i		
		Cabbage	45.6 ± 2.2 e		20 ± 1.4 h		

The averages that share similar letters do not differ significantly from each other according to the Dunkin test at a probability level of 0.05.

a concentration of 1100 ml/acre and a match of 86.67% at a concentration of 55 ml/acre. The results are similar to (Gadhiya *et al.,* 2014) in India, an experiment conducted to study the evaluation of insecticides Emamectin Benzoate, Spinosad, Chlorantranipiolre and Mach against tobacco leafworm that infested peanuts. They observed that Chiorantranipiolre, Spinosad and Emamectin Benzoate were the best protecting bean plants from infection. While Match was weak in its effect on larvae. Other study from (Bhatti *et al.,* 2013) found, Pyrethroids were less effective on second instar larvae compared with Imamectin, which was more toxic.

Effect of exposure period of treatment

The results indicated in table 2 that most larvae treated with pesticides died after 24 hours of treatment and some of them died later (after 48 hours) of treatment , this is a natural result of most types of pesticides, where the strength of the pesticide appears during the 24 hours of treatment except some types of pesticides known as growth regulators, which may be delayed until after 24 hours. This is what happened to the pesticide match. The results showed the presence of significant differences between the average at a level of probability of 5%.

Effect of interaction between pesticide and host type on larval mortality after 24 hours

Mortality percentage ranged between (20.3–80)%, table 2. The highest percentage recorded when larvae feded on cabbage treated with Emamectin Benzoate, averaging 80%. While, lowest percentage recorded when larvae feded on the cabbage leaves treated with Match pesticide, reached 20.3% and showed significant differences between the averages at a probability level of 0.05. The results showed that the Imamectin benzoate was the most effective on larvae that fed on all host plants, Followed by Spinosad, then Match.

Effect of interaction between pesticide and Exposure period on larval mortality

The larval mortality rate varied according to the type of pesticide and Exposure period . The highest recorded when larvae treated with Emamectin Benzoate after 24 hours of treatment, Average 73.4%. While the lowest mortality rate of larvae treated with Emamectin Benzoate after 48 hours was an average 10.6%. It is noteworthy that the killing rates after 48 hours for pesticides Emamectin Benzoate and Spinosad was lower than the mortality rate for Match after 48 hours, which averaged 31.1%. This may be due to the fact that Match pesticide may be delayed a little and that it works as a growth regulator unlike the pesticides Spinosad and Emamectin Benzoate, which work on the nervous system and areas of synapses where the effect is faster.

Effect of interaction between pesticide, host plant and Exposure period on larval mortality

The results of the experiment in table 2 showed that the larval mortality percentage varied significantly, Ranged between (6-80)%, The highest mortality of larvae fed on cabbabe treated with Emamectin Benzoate after 24 hours of treatment reached (80)%. Followed by the same pesticide on larvae fed on Maize after 24 hours with an average of 72.7% and then the same pesticide on larvae fed on Chard after 24 hours with an average of 66.3%.

Relative effectiveness of pesticides

The results showed in Fig. 1 the relative effectiveness of the three pesticides by mortality ratios. Imamectin benzoate was the most effective relative with an average of 74.9%, while Match pesticide recorded the lowest effectiveness among the three pesticides with an average of 21.2%. Significant differences were found between the three averages according to the Duncan test.

References

Abbas, N., S.A. Samiullah Shad, M. Razaq, A. Waheed and M.

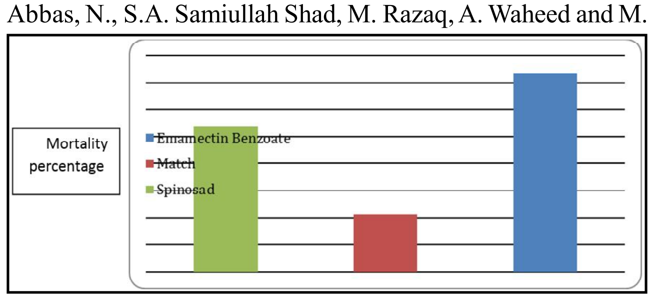

Fig. 1: Relative Effectiveness of Pesticides.

Aslam (2014). Resistance of *Spodoptera litura* (Lepidoptera: Noctuidae) to profenofos: Relative fitness and cross resistance. *Journal of Crop Protection,* **58:** 49-54.

Armes, N.J., J.A. Wightman, D.R. Jadhav and G.V. Ranga (1997). Status of insecticide resistance in *Spodoptera litura* in Andhra Pradesh, India. *Pesticide Science,* **50:** 240-248.

Bhatti, Sufiann Saif, Munir Ahmad, Kamran Yousaf and Muhammad Naeem (2013). Pyrethroids and New Chemistry Insecticides mixtures against *Spodoptera litura* (Noctuidae : Lepidoptera) under Laboratory Conditions, Department of Entomology, Agriculture University Rawalpindi, Pakistan, *Asian J. Agri. Biol.,* **1(2):** 45-50.

Dhir, B.C., H.K. Mohapatra and B. Senapati (1992). Assessment of crop loss in groundnut due to tobacco caterpillar, *Spodoptera litura* (F.). *Indian J. Plant Protect.,* **20(7-10):** 215-217.

Gadhiya, H.A., P.K. Borad and J.B. Bhut (2014). Effectiveness OF Synthetic Insecticides against the *Helicoverpa armigera* (Hubner) Hardwick and *Spodoptera litura* (Fabricius) Infesting Groundnut, Department of Entomology, College of Agriculture, *An and Agricultural University, India,* **9(1):** 23-26.

Kranthi, K.R., D.R. Jadhav, S. Kranthi, R.R. Wanjari, S.S. Ali and Russell (2002). Insecticide resistance in five major insect pests of cotton in India. *Crop Protection,* **21:** 449-460.

Lightfield, J. (1996). Importation into the United States from Japan of fresh *Zingiber mioga* flowers leaves and stems for consumption: qualitative, pathway-initiated pest risk assessment. Animal and Plant Health Inspection Service, US Department of Agriculture, Riverdale, MD.

Ogden, S. and E.V. Podleckis (2000). Importation of Pepper (*Capsicum* spp.) fruits from New Zealand into United States. Animal and Plant Health Inspection Service, US Department of Agriculture, Riverdale, MD.

Pests not known to occur in the United States or of limited distribution: Rice cutworm, USDA-APHIS-PPQ, 1982.

Qin, H., Z. Ye, S. Huangs, J. Ding and R. Luo (2004). The correlations of the different host plants with preference level, life duration and survival rate of *Spodoptera litura* Fabricius, *Chin. J. Eco-Agric.,* **12:** 40-42.

Rashad Rasool Khan and Sohail Ahmed and Shahid Nisar (2011). Mortality Responses of *Spodoptera litura* (FAB.) (Lepidoptera: Noctuidae) against some Conventional and new Chemistry Insecticides under Laboratory Conditions, Department of Agri. Entomology, University of Agriculture, Faisalabad.

Shad, Sarfraz Ali, Ali H. Sayyed and Mushtaq A. Saleem (2010). Cross-resistance, mode of inheritance and stability of resistance to emamectin in *Spodoptera litura* (Lepidoptera: Noctuidae), *Article first published online:* 12 APR 2010DOI: 10.1002/ps.1950 **66(8):** pages 839-846.

Xue, M., Y.H. Pang, H.T. Wang, Q.L. Li and T.X. Liu (2010). Effects of four host plants on biology and food utilization of the cutworm, *Spodoptera litura* 14pp. *Journal of Insect Science,* **10:** 22, available online : insect sicence.org/10.22.