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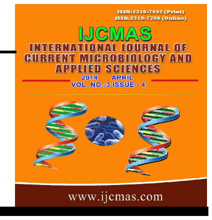

Original Research Article

Study the Effects of Pyridalyl on Larvae of *Spodoptera exigua* (Hubner) at First, Second and Third Ages During 72 Hours in Laboratory Conditions

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A B S T R A C T

Keywords

Pyridalyl; Larvae; Sugar beet; Caradrina

Spodoptera exigua H. is one of the major pests of vegetables, farm plants and greenhouse plants and has a wide range of hosts. Regarding to reports indicating the resistance of this pest against common pesticides in different countries, thus, utilizing mildew pesticides of different mechanisms and of possibility to cancel resistance to these pesticides is of special manner in pest control programs. In this study the effects of Pyridalyl was investigated on larvae of 1^{st}, 2^{nd} and 3^{rd} ages of *Spdoptera exigua* through biometric experiments. *Spodoptera exigua* larvae were grown under controlled lab conditions of 26±2^{0}C, relative humidity of 57±3% and cycles of 16h light and 8h dark. Natural food was used to feed larvae. The sugar beet plants used for feeding larvae and biometric tests were grown in pots. The LC_{50} amounts for Pyridalyl of the 1^{st}, 2^{nd} and 3^{rd} ages of larvae cared for 72h were estimated 485, 791 and 1280 ppm, respectively. The percentages of larvae losses for 1^{st}, 2^{nd} and 3^{rd} ages cared for 72h in 1500 ppm Pyridalyl were 95%, 92.5% and 80%, respectively. The result of present study suggested that application of Pyridalyl to control *Spodoptera exigua* in primary ages will be recommendable.

Introduction

Sugar beet (*Beta vulgaris* L.) is a plant of species Chenopodiaceae which its history of planting as a farming and industrial plant returns to about 200 years ago. Before sugar beet and identifying its characteristics and the methods of extracting Sugar from its cane, the needs for sugar were met through cane. For the first time, this plant war grown in the Middle East and about the fifth and sixth centuries was become common in Greece and Romania (khanjani, 2008). Several pests harm this product including *Spodoptera exigua* H., *Agrotis segetum*, *Plusia gamma*, *Phthorimaea ocellatella*, *Chaetonema tibialis* and *Conorrhynchus* spp. Among sugar beet pest larvae, *Spodoptera exigua* H. is one of the most harmful ones that causes severe damages in all steps of growth. In Iran Afshar (1938) collected this pest for the first time and reported it (khanjani, 2008). This pest is polyphage and can be found on the most of farm plants around Iran.

The larvae of *Spodoptera exigua* is accounted for as the number one pest of sugar beet which gets out bursting state in some years and under this conditions doesn't leave any leaves of hosts. On the continue to feed it attacks the middle parts of stem as well as the head of root that causes sugar beet plant to dead (behdad, 1992). *Spodoptera exigua* H. is one of the major insects of a wide range of host including cotton, sugar beet, tobacco, soy bean and many other vegetables in African and Mediterranean countries (Mushtaq *et al*., 2008). In Iran, this pest distributes over sugar beet in the provinces Khozestan, Fars and Golestan and its damage is significant especially in the initial and vulnerable stages of the host (Kheyri, 1991). Although this insect has several natural enemies, but, one of the control methods yet is insecticides. Considering the existing facts related to fight against plant pests we must acknowledge that it is necessary to use chemical pesticides in many cases. For example, in the cases of out breaking population of this pest, the only effective method is to use chemical poisons. Therefore, we must try to apply correct, in-time, and scientific use of chemical poisons in the framework of a mass pest control program to regulate the pest population. Today, the pesticides recommended until now don't offer effective fighting and in outbreak years, the farmers suffer heavy damages. Nowadays, the impacts of uncontrolled uses of these poisons are evident; therefore, selecting efficient, low-risk and low-dose pesticides is of high importance.
Pyridalyl is a new and unstable insecticide which prevents cell growth, obviously (Saito *et al*., 2005). Pyridalyl function through practical new mechanisms is completely different from of the existing agents including organophosphates, carbamates, synthetic pyrethroids, and IGRs. Also, Pyridalyl is so risk free for arthropoda like parasitoides, predators, hunter ticks and hence is a so suitable tool for compositional management of pests as well as management of pest resistance. Due to its short currence period and low impacts on environment, human and other mammals and beneficial insects, this pesticide may be used as a selective poison against most of pests (Sakamoto *et al*., 2005).

Spodoptera exigua H. is highly polyphage which its larvae damage 60 species of 31 families of farm plants and weeds (Dewhurst, 1975; Talhouk, 2003). Among target products we can point to: corn, cotton, sugar beet, soya, tomato, pea, potato, egg-plant, spinach, lettuce, cabbage and alfalfa (Dingha *et al*., 2004; Rizwan- ul- Haq *et al*., 2009).

Materials and Methods

Sugar beet was used as preferential host for breeding insect on the natural food. A few months before beginning of lab operations, disinfected seeds of sugar beet were planted in 200 plastic pots of 12 cm high and 16 cm diameter, and were grown in research greenhouse of West Azerbaijan center for agriculture and natural resources studies.

When sugar beet bushes were grown sufficiently and had 6-8 leaves, the pots were transferred to cages of dimensions 120×60×50 cm made of thin and flexible wires and covered with a fine mesh fabric (Figure 1).

The tests were completed to determine

Spodoptera axigua larvae losses due to ingestion effects of Pyridalyl. After primary tests, concentration ranges of Pyridalyl suitable for larvae of 1^{st}, 2^{nd} and 3^{rd} ages were determined 250, 500, 1000 and 1500 ppm, respectively. These concentrations were prepared by diluting the pesticide with distilled water. First, the leaves needed to feed 1^{st} aged larvae were immersed in pesticide solution for 5 second, then removed out of solution. The leaves then were dried in lab conditions (Griskova *et al*., 2006).

Special traps were prepared by transparent single-use plastic vessels, Parafilm and cotton: a small slot was created on the edge of plastic vessel and a little cotton was placed in the slot. Then, some big and fresh leaves of each pot was selected and placed in plastic vessels so the petiole located in slot was covered with cotton and Parafilm. In each repetition 20 larvae of 1^{st} age separated with measuring head capsules and morphology, were released in traps. Top of the vessels were covered with a fine mesh cloth and tightened by elastic band so exiting was impossible. This procedure was done for 2^{nd} and 3^{rd} aged larvae, too. The caring conditions of test larvae were similar to growth conditions.

Above tests were completed in full randomized, with 4 different concentrations of pesticide plus one reference group and in 4 repetitions, followed by counting losses of larvae after 72 h for each test. In each counting the lost larvae were removed from vessels and the vessels were covered again.

Results and Discussion

Results of this study show that the maximum loss in 1500 ppm were observed in 1^{st}, 2^{nd} and 3^{rd} aged larvae was 95%, 93%, and 80% respectively, and after 72 h. Researchers show that emulsion of Pyridalyl had a good control on cotton worms (*Earias insulana*) and tomato worms (*Helicoverpa armigera*) after 10-15 day of poisoning (Nair *et al*., 2008). Suganthi *et al*. (2007) investigated the effects of insecticides including Pyridalyl, Endosulfan and Indoxacarb for controlling cabbage moth (*Plutella xylostella*). Their results suggested that the population of larvae decreased significantly by using Pyridalyl relative to Endosulfan and Indoxacarb (Suganthi *et al*., 2007). Rahimi *et al*. (2010) stated that Pyridalyl has the highest efficiency on *Spodoptera exigua* larvae after 20 days of applying pesticide. The above figure shows that losses of first age is more than 2^{nd} and 3^{rd}.

Calculation of LC_{50} and LC_{95} amounts of Pyridalyl for different ages of *Spodoptera exigua* larvae

The Chi-squared test shows that there is a significant difference between different times in the level of 5%. Regarding LC_{50} it must mentioned that from the point of view of application and control on the farms the calculated amount must be used in 5 times more in farm, because several factors diminishes the efficiency of pesticides.

It should be noted that calculation of LC_{95} is very important practically; because application of this compound in this concentration can be expected to have economic control, and retaining sugar beet market acceptability, the low aged larvae must be controlled before growing more and attacking plant.

Fig.1 Breeding *Spodoptera exigua* larvae on original food

Table.1 Variance analysis of data relating to losses of first aged larvae of *Spodoptera exigua* resulted from Pyridalyl of concentrations 250, 500, 1000 and 1500 ppm

S.O.V	df	SS	MS	F	probability
Treatment	4	733.300	183.325	423.058**	0.0001
Error	15	6.500	0.433		
Total	19	739.800			

** Significant at the 1% levels of probability CV = 6/64%

Table.2 Variance analysis of data related to second aged larvae of *Spodoptera exigua* against Pyridalyl of concentrations 250, 500, 1000 and 1500 ppm

S.O.V	df	SS	MS	F	probability
Treatment	4	686.000	171.500	214.375**	0.0001
Error	15	12.000	0.800		
Total	19	698.000			

** Significant at the 1% levels of probability CV = 9.93%

Table.3 Variance analysis of data related to third aged larvae of *Spodoptera exigua* against Pyridalyl of concentrations 250, 500, 1000 and 1500 ppm

S.O.V	df	SS	MS	F	probability
Treatment	4	532.300	133.075	362.932**	0.0001
Error	15	5.500	0.367		
Total	19	537.800			

** Significant at the 1% levels of probability CV = 7.66%

Table.4 Comparison of average losses of 1st age larvae of *Spodoptera exigua* against different concentrations of after 72 h caring

Treatment	1500	1000	500	250	control
SE±M	0.40±19	0.40±13	0.28±9.50	0.25±7.25	0.25±0.75
Group	a	b	c	d	e

Dissimilar letters indicate significant difference at the 5% probability level by Tukey test

Table.5 Comparison of average losses of 2nd age larvae of *Spodoptera exigua* against different concentrations of after 72 h caring.

Treatment	1500	1000	500	250	control
SE±M	0.64±18.50	0.62±11.25	0.25±8.25	0.25±6.25	0.25±0.75
Group	a	b	c	d	e

Dissimilar letters indicate significant difference at the 5% probability level by Tukey test

Table.6 Comparison of average losses of 3rd age larvae of *Spodoptera exigua* against different concentrations of after 72 h caring

Treatment	1500	1000	500	250	control
SE±M	0.40±16	0.25±10.25	0.28±7.50	0.25±5.25	0.28±0.50
Group	a	b	c	d	e

Dissimilar letters indicate significant difference at the 5% probability level by Tukey test

Fig.1 Comparison of average ± standard deviation of losses of all aged larvae of *Spodoptera exigua* in different concentrations of pyridalyl after 72 h

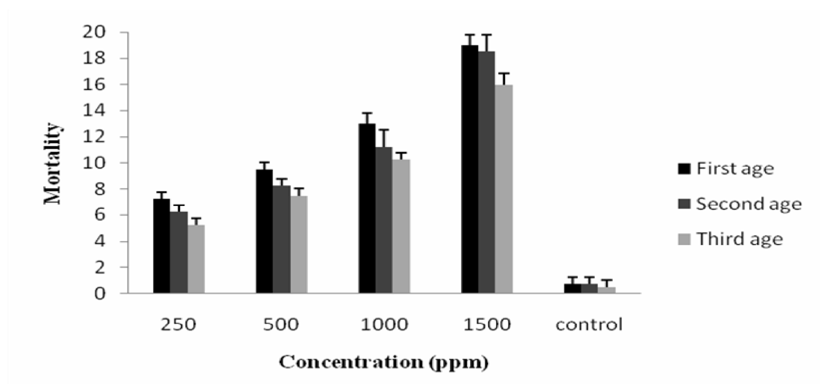

Table.7 Probit analysis for determining LC_{50} and LC_{95} in ppm and regression line equation of 1st, 2nd and 3rd ages larvae of *Spodoptera exigua* under Pyridalyl effect after 72 h.

Age	LC_{50}	LC_{95}	x^2	Slop (b)	Intercept (a)
First	485	9518	397.180	- 0.262	0.313
Second	791	5672	361.421	- 0.255	0.309
Third	1280	6599	315.367	- 0.407	0.335

The highest levels of LC_{50} were seen in 3rd, 2nd and 1st ages, respectively. The reason for the difference is that at the older ages defense and detoxifying systems of body becomes more complete, resulting to more resistant larvae and its tolerance. Also, growing in age and weight, larvae receives less poison per body weight.

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