EFFECT OF DIFFERENT RISTRIOTORS ON THE TOXICITY OF SOME INSECTSIDES AGAINST THE DESERT LOCUST IN ABO RAMAD, EASTERN DESERT, EGYPT

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Abstract

The effects of four insecticide formulations were tested under field conditions of Abo Ramed in the region Valley El Doeib Eastern desert, Egypt by using four different nozzles with micron ulva sprayer (ULV+) against 4^{th} and 5^{th} nymphal instars of desert locust, *Schistocerca gregaria*. The insecticide engeo proved superior compared with karate, regent and dursban through all the periods post treatment. The toxicity of insecticides were arranged descending as follow: engeo> regent> karate> dursban after 48 and 72 hours. There were significant differences between the insecticides of all the periods post treatment. There were no significant differences between the black and orange nozzles in the all periods post treatment to all tested insecticides. Also, no significant differences between the red and yellow nozzles but they arranged as: black> orange> red>yellow. As a general trend, the effectiveness of four insecticides against the nymphal instars (4^{th}, 5^{th}) of desert locust differed according to different type of nozzles and the carrier (water or oil).

INTRODUCTION

The desert locust, *Schistocerca grgaria* Forsk is a serious agricultural pest. Both adults and hoppers devastate wild vegetations and crops-inflicting immense losses (Singh, 1974). It has caused considerable losses to African crops in both modern and traditional agricultural systems. Existing control strategies rely on chemical insecticides proved necessary to prevent damage to vegetation. The desert locust is considered the most economic important pest in eastern desert of Egypt. Until recently, chlorinated hydrocarbon insecticides were extensively used for locusts and grasshoppers control, particularly, in developing countries. Because these chemicals are hazardous to man and the environment (Hunter 1968), there has been a continuous search for effective and more safer insecticides as new alternatives for controlling these pests (MacCuaig, 1977; Amisi and MacCuaig, 1977; MacCuaig, 1979).

The ULV spray can be used for the control of migrant pests with ULV formulations e.g. locusts, grasshoppers and armyworm. The sprayer produces relatively small spray droplets which are distributed and deposited by wind and gravity, allowing several rows/meters to be treated during each spray pass.

Development of centrifugal energy nozzles has led to the concept of controlled droplet application (CDA), so that sprays are applied in a narrow range of droplet sizes; selected according to the target at which the pesticide is aimed.

The present study aimed to study the effect of different nozzles ULVA sprayer (ULVA+) on the toxicity of some insecticides against the desert locust in the field conditions in Abo Ramad in the region valley El Doeib, eastern desert, Egypt.

MATERIALS AND METHODS

During the season (2004), many ecological surveys were carried out in summer to evaluate the major insect pest of Acrididae prevailing in Eastern desert of Egypt. As a result of rainfall in last November and the beginning of December 2004 in the region valley El-Doeib about 100 kms^2 area, it was found that the desert locust, *Schistocerca gregaria* (Forsk.) was the most dominant insect pest in this area. Thus the desert locust was chosen to evaluate the most potent integrated action of the proposed chemicals during the winter season of 2005. Suitable infested sites with the locust were selected at valley El-Doeib about 70 kms of Abo Ramad. These sites were characterized by a high population density of locust (more than 500 insect/m^2). The studied nymphs were 4th and 5th instars only.

The insecticides used:

1- karate (lambdacyhalothrin) U.L.V.20 % (rate of application 20 g.a.i / ha = 1000 ml /ha used3/4 the dose of the karate

2- dursban (chlorpyrifos) E.C. 48 % (rate of application 225 g.a.i / ha = 468.8 ml/ha)

3- regent (Fipronil) W.G.80 % (rate of application 5 g.a.i / ha = 6.25g/ha.

4- engeo (Thiamethoxam + Lambdacyhalothrin) S.C. 247 (rate of application 24.7g.a.i/ha = 100 ml/ha).

Experimental design:

Field application of the tested insecticides was conducted in experimental plots of grass and pushes heavily infested with the 4^{th} and 5^{th} instar nymphs of *schistocerca gregarai* (more than 500nymph/m). Each plot was about, 25 m x 25 m = (625 m^2). The plots were isolated by a wide belt of lox 25 m = 250 m to prevent immigration of treated nymphs to the other plots and the control and avoid the drift spray. Plots laying up wind of treatments were used as a control. The untreated check plot was sprayed with water only in the case of E.C or W.G or S.C. but in the case of U.L.V. formulations the untreated check plot was sprayed with sunflower oil only as a carrier.

For each compound four nozzles (Red, Black, Orange and Yellow) and each nozzle were used in one treatment only and each treatment represented five replicate cages 0.5m x 0.5m x 0.5mx.

The insects were collected randomly from the same treatment after application directly by using sweep–net and placed in the cages. The cages were left and kept on the area of treatment under the trees. Twenty five nymphs were kept per cage and fed with treated desert plants. Mortality counts were taken after different period of treatment, i.e., 3, 24, 48 and 72 hrs post treatment. The insects were considered dead when they were unable to right themselves after being turned upside down (MacCuaig and Yeates, 1961).

Application equipment:

Sprayer: The ULVA+

Nozzle: Red, Black, Orange and Yellow nozzles were used in treating each compound.

Spraying height: 0.5 m above the plants.

Walking speed: 40 m/min =2.4 km/h.

Swath width : 3 m according to wind velocity.

Weather Conditions at applications

Wind: 3-5 m/sec

Temperature: 29 – 33ºC maxim and 18 - 20ºC minim.

Humidity: 30-40%.

The sun rose clearly.

The spraying was done between 08 and 11 am early in the morning.

The spinning disk sprayer or ULVA sprayer:

It is used for ultra –low –volume application of pesticides. The sprayer has one liter plastic bottle for the concentrate liquid, which was fed by gravity to reach the rotáry circular spinning disc. The sprayer attached with back tank 10 liters to increase its performance. This disc is driven by a constant speed motor, powered by four, 1.5 v batteries.

Field calibration and estimation of performance of tested nozzles:-

The program of calibration for ground machines suggested by Gabir et al. (1982) was followed. The following parameters were defined to fulfill the technical needs of required field tests:

$$Q=(T.R_W v_O)/252$$

Where: Q = flow rate L/min ; T = spraying volume L/fed

Rw = effective run width (ml) and vo = working speed (km/h)

Flow rate (L/m)

It was determined as an average of five replicates with the use of water or oil. The mean flow rate is the result of dividing total delivery by time in minutes. The influence of the physical properties of the tested pesticides on the rate of flow was taken into account.

Swath width (m):

The patter nation test was done for single nozzle over sensitive cards.

The sensitive cards technique was found to be less accurate but more easy and quicker technique than the former one. Therefore, this technique was selected to determine the swath width, spray heights and two walking speeds. Calculated technical data of the tested nozzles are presented in (Table 1).

Droplet size and distribution:

A water and oil sensitive papers of C I B A GEIGY with dimension of 52 x 76 mm. were used to collect droplets. Number of droplets per cm at 0.5 m spray height was counted to determine the swath width and the average droplet distribution under local metrological conditions. Droplets were determined to obtain VMD values by using a microscope eyepiece reticule described Maksymiuk (1978).

Assessments:

Routine work was daily done includes removing the uneaten food, faces and dead nymphs and counting the living insects before introducing the fresh food. Data were analyzed using General Linear Model Procedures (SAS, 1995).

RESULTS AND DISCUSSION

The effects of four insecticide formulations were tested under field conditions of Abo Ramad in the region valley El Doeib by using four different nozzles with micron ulva sprayer (AULV+) against 4th and 5th nymphal instar of desert locust, *S. gregaria* during the winter season of 2005. The efficacy of tested insecticides was calculated by using Schneider and Oriel equation as follow:

$$\text{Efficacy}\,\% = \frac{\text{Dead treatment}\,\% - \text{Dead check}\,\%}{100 - \mathit{Dead\ Check}\,\%}$$

Mortality percentages were calculated after 3, 24, 48 and 72 hr post treatment.

Date in Table 2 show the toxicity of four insecticides formulation against the late nymphal instars (4^{th} an 5^{th}) of the desert locust, *S. grgaria* by using four different nozzles with micron ulva sprayer (AULVA+). Generally, the engeo was superior compared to karate, regent and dursban through all the periods post treatment, respectively. The toxicity of insecticides was arranged descending as follow: engeo >karate > dursban >regent after 3 and 24 hours and arranged as engeo> regent> karate> dursban after 48 and 72 hours post treatment. Significant differences between the insecticides of all the periods post treatment were proved Harb et al. (1988) came to the same conclusion. The obtained results are in consistent with El-Garhy et al. (1988) and Metaweh and Ibrahim (1994). Statistical analysis show no significant differences between the potency of tested nozzles at the periods post treatment. But in the case of karate there were significant differences between the nozzles of all the periods post treatment. The nozzles were arranged descending as follow: black> orange> yellow> red at all the periods post treatment. In the case of regent, there were significant differences between the nozzles of all the periods post treatment except after 3 hours post treatment. The nozzles were arranged descending as follow: orange> black> red = yellow after 3 hour and black> yellow> orange> red after 24 hour and yellow> black> orange = red after 48 and 72 hours. In the case of dursban the arrangement was black > orange = red = yellow after 3 hours, but after 24 and 48 hours the nozzles were arranged descending as follow: black> orange> red> yellow. After 72 hours the arrangement was black> orange = red> yellow. Finally after 3 hours the nozzles were arranged descending as follow: black> orange> red> yellow, but after 24 hour the arrangement was black> orange> yellow> red.

After 48 hrs the nozzles were arranged descending as follows: orange> Black> yellow> red. Post 72 hours treatment the arrangement was black> orange> yellow red. It is worth to note that, there were no significant differences between the black and orange nozzles in the all periods post treatment with all tested insecticides. Also, there were no significant differences between red and yellow nozzles.

Data presented in Table 3 show the effect of four different nozzles with Micron ulva sprayer and four tested insecticides against desert locust *S. gregaria.* The obtained results show that, there was a positive relationship between flow rate and the distribution of droplets, Therefore, the lowest number of droplets/ Cm^2 and droplets size (Owens and Bennett, 1978). The number of droplets/ Cm^2 of cotton seed oil was less than droplets size of water and diesel oil by about 13.3, 17.8 %, respectively (Hindy et al., 1991). In this study differences between VMD to four different nozzles with micron Ulva + sprayer and four insecticides were proved. Also, number of droplets / Cm^2 increased or decreased according to different nozzles as to flow rate and different carrier (water or oil). So that the effectiveness of four insecticides against the nymphal instars (4^{th} and 5^{th}) of the desert locust differed according to different nozzles and the carrier (water or oil). In this respect, Ammar (2003) tested Ulva sprayer on white fly and aphid infesting tomato plants at rates 13L/Fed. The Ulva sprayer gave droplet size ranged 47 - 91 um and number/ Cm^2 of droplets ranged 80 - 294. Data showed that no significant difference was detected due to the reduction caused by using low volume spraying. The use of low volume spray could be recommended since the use of such sprayer reduces times and save effort, money and losses of spray solution. In addition the low volume spraying gave better coverage of the spray solution on plant leaves. Also reduction of spraying volume minimizes spray loss on ground between plants.

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Items	Micron ulvA sprayer			
Nozzles	Red	Black	Orange	Yellow
Rate of (a)water	0.780	1.296	0.540	0.360
Application L (b)oil	0.204	0.390	0.132	0.72
Mean working speed (km / h)	2.4	All treatment		
Swath width (m)	.3.0	3.0	3.0	3.0
Mean spray height (m)	0.50	0.50	0.50	0.50
Flow rate L/min (a) water (b)Oil	0.130	0.216	0.090	0.060
	0.034	0.065	0.022	0.012

Table 1. Technical data of micron ulva sprayer with different Nozzles.

Table 2. Mortality percentage of four insecticides formulation by using four different nozzles with micron ulva sprayer (AULVA+) under the field conditions of Abo Ramad against the desert locust, *Schistocerca gergaria* (Forsk.) after 3, 24, 48, and 72 hr post treatment.

Insecticides	nozzle type	Hrs. post treatment			
		3hrs	24hrs	48hrs	72hrs
karate	Red	60.8 ^{i}	43.2 ^{i}	44.8 ^{i}	48.0 ^{i}
	Black	78.4 ^{h}	73.6 ^{h}	80.8 ^{h}	88.0 ^{h}
	Orange	72.0 ^{h}	72.8 ^{h}	75.2 ^{h}	77.6 ^{h}
	Yellow	69.6 ^{hi}	53.6 ^{i}	56.8 i	58.4 ^{i}
dursban	Red	12.8 ^{f}	56.0 ^{e}	56.0 ^{f}	65.6 ^{f}
	Black	36.8 ^{e}	76.0 ^{e}	80.0 ^{e}	82.4 ^{e}
	Orange	17.6 ^{f}	58.4 ^{e}	64.8 ^{ef}	64.8 ^{f}
	Yellow	4.0 ^{f}	26.4 ^{f}	36.8 ^{g}	37.6 ^{g}
regent	Red	0.0 ^{b}	5.6 ^{c}	63.2 ^{c}	84.8 ^{c}
	Black	5.6 ^{b}	54.4 ^{b}	80.0 ^{bc}	92.8 ^{bc}
	Orange	6.4 ^{b}	32.8 ^{b}	79.2 ^{bc}	89.6 ^{bc}
	Yellow	0.0 ^{b}	47.2 ^{b}	92.8 ^{b}	96.0 ^{b}
engeo	Red	100.0 ^{a}	88.8 ^{a}	93.6 ^{a}	95.2 ^{a}
	Black	100.0 ^{a}	92.8 ^{a}	99.2 ^{a}	99.2 ^{a}
	Orange	96.8 ^{a}	87.2 ^{a}	91.2 ^{a}	93.6 ^{a}
	Yellow	96.8 ^{a}	85.6 ^{a}	91.2 ^{a}	92.0 ^{a}

Means with different superscripts within each classification, differ significantly ($P<0.05$).* $P<0.05$.

Table 3. Spray coverage on sensitive cards, and weeds as produced by four different nozzles with micron ulva sprayer and four insecticides against desert locust, *Schistocerca gregaria* (Forsk.).

	Micron ulvA sprayer + water carier							
	Nozzles							
	Red		Black	Orange			Yellow	
spray volume (L/h)	12.48		20.74	8.64			5.76	
	Droplet spectrum							
Insecticides used	VMD	N/cm²	VMD	N/cm²	VMD	N/cm²	VMD	N/cm²
engeo	109	159	123	163	85	166	82	177
regent	105	172	134	171	87	167	82	177
dursban	98	178	111	175	82	192	80	168
Oil Carrier								
spray volume (L/h)	3.26		6.24	2.11			1.15	
karate	119	186	147	187	107	180	105	173

VMD: Volume mean diameter.

N/cm^2 : Number of droplet per cm^2 .

دراسة تأثيرانواع بشبورى مختلفة على سمية بعض المبيدات ضد الجراد الصحراوى فى ابو رماد الصحراء الشرقية - مصر

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**قسم بحوث الجراد والنطاط ** قسم بحوث تكنولوجيا الرش*

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