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TOXICITY OF SOME COMMONLY USED INSECTICIDES AGAINST *SPILARCTIA OBLIQUA* (WALKER)

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ABSTRACT

Deltamethrin was found to be most toxic against the larvae of *Spilarctia obliqua* followed by triazophos, spinosad, chlorpyrifos and fipronil in leaf dip. LC_{50} of deltamethrin at 12, 24 and 48 hours after treatment (HAT) was 0.008, 0.0001 and 0.00002 per cent respectively through larval dip method. With leaf dip method the LC_{50} was 0.007, 0.0002 and 0.00002 at 12, 24 and 48 HAT respectively. Being the novel mode of action and safety point of view spinosad was the most promising insecticide which gave the satisfactory control with safety measures, application and environment.

Key words: Toxicity, Chlorpyrifos, Deltamethrin, Triazophos, Spinosad, Fipronil, *Spilarctia obliqua*

Introduction

Spilarctia obliqua (Walker) is a sporadic polyphagous pest of numerous species of forest shrubs and trees (Yadav *et al.*, 2001) and various agricultural crops *viz.* crucifers, oilseed, pulse, bean, jute, sweet potato and vegetables (Bakethia and Sindhu, 1970); Although *S. obliqua* is a known pest of many agricultural and forestry crops but owing to its foliage damaging potential, it was considered as one of the major pest of *Paulownia fortunei* (Kumar and Ahmad, 2004).

The avoidable yield loss has been estimated as 75.12 per cent in grain number and 77.08 per cent in grain weight of soybean (Singh *et al.*, 1985). In the recent era of agriculture intensification, pest control problems rely only on the chemical pesticides which have led to an energy driven escalation in the pest control technology. Cole *et al.* (1993) studied the mode of action of fipronil and found that GABA gated chloride channel is the target for phenyl pyrazole. Spinosad have a new mode of action because it belongs to a new family of compounds, *spionosoids*, containing substances derived from the bacteria *Sachropolispora spinosa* (Tascari *et al.*, 1998). The changing perception of pest management demanded newer environmentally sound molecules with new mode of actions. In the past couple of decades the pest management has gone through the spectacular changes with regard to the development of safer bioactive molecules. With this background present study has been carried out to study the LC_{50} of Spinosad 45 SC, Fipronil 5 SC and deltamethrin 2.8 EC, Triazophos 40 EC and Chlorpyrifos 20 EC against the larvae of *S. obliqua*.

Material and Methods

The nucleus culture of *S. obliqua* was collected from teak plant in the field of Entomology experiment block, Institute of Forest Productivity, Ranchi. The larvae were reared in the laboratory on caster leaves for one generation. Healthy pupae were procured from the culture and newly emerged adults were shifted to other jar lined with filter paper for egg laying. To avoid the escape of moths the jar was covered with muslin cloth. The adults were fed on 10 % sucrose solution on a cotton swab. The efficacy of insecticides was tested on freshly hatched second instar larvae of insect.

The preliminary test was carried out with the objective to decide the final concentrations of the insecticide. Following concentrations were used in the preliminary screening test *viz.* spinosad: 0.01, 0.001and 0.0001%, fipronil: 0.02, 0.002 and 0.0002 %; deltamethrin 0.0002, 0.00005, 0.00001%, triazophos 0.01, 0.005, 0.001% and chlorpyrifos: 0.05, 0.001 and 0.0005. On the basis of mortality obtained from the screening test at 24 HAT seven concentrations were prepared expansively for the final determination of the LC_{50} values as spinosad: 0.05, 0.02, 0.005, 0.002, 0.005, 0.002 and 0.0005 %, fipronil: 0.04, 0.02, 0.01, 0.005, 0.002, 0.001and 0.0005%; deltamethrin: 0.0002, 0.0001, 0.00005, 0.00002, 0.00001, 0.000005 and 0.000002 %; triazophos: 0.02, 0.01, 0.005, 0.002, 0.001, 0.0005 and 0.0002 and chlorpyrifos: 0.02, 0.01, 0.005, 0.002, 0.001,

Among 4 insecticides Deltamethrin was found most toxic against *S. obliqua* with LC_{50} value 0.0002 per cent in leaf dip method after 24 hrs. of treatment.

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Table1 : Relative toxicity of insecticides against *S. obliqua* larvae by larval dip method

Insecticides	HAT	Chi square	Regression equation	LC_{50}	Fiducial Limit
Spinosad	12	5.45	Y = 6.17 + 0.89x	0.045	0.0013-0.158
	24	4.520	Y = 6.03 + 0.562x	0.014	0.0042-0.048
	48	14.22	Y = 6.88 + 0.70x	0.002	0.0008-0.004
Fipronil	12	1.57	Y = 6.25 + 1.25x	0.120	0.035-0.296
	24	2.273	Y = 6.054 + 0.747x	0.038	0.014-0.01
	48	2.66	Y = 6.97 + 0.955x	0.008	0.005-0.013
Deltamethrin	12	0.18	Y=5.5+0.30X	0.008	0.00002-0.2
	24	0.62	Y=6.5+0.40X	0.0001	0.00002-0.0004
	48	0.40	Y=7.7+0.60X	0.00002	0.00001-0.00003
Triazophos	12	0.60	Y=5.5+0.4X	0.03	0.005-0.20
	24	0.23	Y=5.8+0.4X	0.0014	0.002-0.03
	48	1.09	Y=7.0+0.7X	0.001	0.0006-0.002
Chlorpyrifos	12	1.17	Y = 5.72 + 0.57x	0.052	0.009-0.29
	24	1.359	Y = 6.638 + 0.725x	0.005	0.0028-0.01
	48	5.39	Y = 8.16 + 1.16 x	0.001	0.001-0.021

0.0005 and 0.0002%.

The insecticidal toxicity was tested with two methods: larval dip method and leaf dip method. The Larval dip method described by Piyarat *et al.* (2000) was followed for treating larvae of *S. obliqua*. The insects were delicately holded with the help of brush and provided a dip for 10 seconds in the insecticide concentrations. The larvae thus retained on a tissue paper to dry. Thereafter larvae were transferred to separate jars (10 cm dia) containing fresh untreated castor leaves. The leaf dip method was followed as described by Tabashink and Cushing (1987), leaf dishes were dipped in required concentrations of insecticides for 15 seconds and after air drying these leaves were provided to feed to the larvae in jars. The experiment was replicated three times and in each replication ten second instar larvae were released. The observations on mortality were recorded at 12, 24, and 48 hrs after treatment.

The moribund larvae were considered as dead. Recorded data was subjected to median lethal dose and LC_{50} values were calculated by computer programme Mondal *et al.* (2001) and corrected mortality calculated as given by Abbott (1925).

Results and Discussion

The Table1 revealed that the LC_{50} values with larval dip method at 12 hours after treatment (HAT) deltamethrin was found most toxic followed by triaziphos, spinosad, chlorpyrifos and fipronil against the larvae of *S. obliqua* with its lowest concentration *viz.* 0.008, 0.032, 0.045, 0.052 and 0.120 per cent respectively and at 24 HAT 0.0001, 0.0014, 0.005, 0.014, and 0.008 per cent respectively while at 48 HAT 0.00002, 0.001, 0.001, 0.002 and 0.008 respectively. Thus, the deltamethrin was appeared most toxic insecticides among all tested insecticides.

With leaf dip bio-assay deltamethrin, chlorpyrifos, triazophos fipronil and spinosad gave LC_{50} of 0.0007,

Table 2 : Relative toxicity of insecticides against *S. obliqua* larvae by leaf dip method

Insecticides	HAT	Chi square	Regression equation	LC_{50}	Fiducial Limit
Spinosad	12	1.76	Y = 5.299 + 0.47x	0.21	0.01-3.71
	24	6.51	Y = 6.75 + 0.88x	0.018	0.0054-0.019
	48	19.62	Y = 6.76 + 0.79x	0.0061	0.0033-0.011
Fipronil	12	2.68	Y = 6.55 + 0.86x	0.082	0.012-0.188
	24	2.83	Y = 5.85 + 0.54x	0.014	0.014-0.064
	48	3.26	Y = 6.23 + 0.72x	0.011	0.005-0.120
Deltamethrin	12	2.83	Y=8.30+1.1X	0.0007	0.0001-0.003
	24	3.18	Y=8.8+1.0X	0.0002	0.0001-0.0005
	48	3.45	Y=11.8+1.4X	0.00002	0.00001-0.00002
Triazophos	12	2.60	Y=6.43+1.3X	0.072	0.01-0.3
	24	5.43	Y=6.1+0.9X	0.010	0.011-0.18
	48	9.85	Y=7.4+1.1X	0.005	0.003-0.008
Chlorpyrifos	12	4.03	Y = 6.55 + 01.16x	0.043	0.015-0.176
	24	1.13	Y = 6.50 + 0.51x	0.0027	0.0009-0.0044
	48	39.35	Y = 5.82 + 0.322x	0.0021	0.00062-0.061

0.043, 0.072, 0.082 and 0.21 per cent at 12 HAT respectively and 0.0002, 0.0027, 0.010, 0.014 and 0.018 per cent at 24 HAT respectively, while at 48 HAT 0.00002, 0.0021, 0.005, 0.011 and 0.061 per cent, respectively (Table 2) Vostrel (1997), Saljoqi *et al.*, (2002) and Obstrink and Lak (2002) also studied the bio-efficacy of spinosad and fipronil and were found more or less similar result.

Thus it can be concluded from the data obtained that chlorpyrifos was always be more toxic insecticides in decreasing order tested in the experiments followed by chlorpyrifos, triazophos, spinosad and fipronil. However, on the basis of the novel mode of action and safety to the environment the Spinosad can be recommended for suppression of *S. obliqua*.

Relative toxicity value showed that deltamethrin was highly toxic. Naveed, *et al.*, (2002) reported lowest LC_{50} of deltamethrin followed by triazophos against larvae of *Spodoptera exigua* in Pakistan.

In leaf dip method same results were observed. Deltamethrin was found to be most effective. Here LC_{50} values of deltamethrin were 0.0007 at 12 HAE, 0.0002 at 24 HAE, 0.00002 at 48 HAE. Prasad and Sachan (1985) observed that deltamethrin was the most toxic of the insecticides when applied by various methods. Topical method was most effective and sandwich method was least effective in producing a toxic response in larvae. Dhingra (1998) reported that on the basis of LC_{50} value deltamethrin was 51.4 times more toxic than endosulfan when tested against larvae of castor semilooper.

स्पिलेरक्टिया ऑब्लिका (वाकर) के विरूद्ध कुछ सामान्यत: प्रयुक्त कीटनाशकों की विषाक्तता

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सारांश

स्पिलेरक्टिया ऑब्लिका के लार्वा के विरूद्ध डेल्टामीथ्रिन सबसे विषाक्त पाया गया। इसके बाद पत्ती डुबाव में ट्राइजोफोज़, स्पिनोसेड, क्लोरपाइरिफोज़ और फिप्रोनिल पाया गया। उपचार के बाद 12, 24 और 48 घण्टे पर डेल्टामीथ्रिन की LC_{50} लार्वल डुबाव विधि द्वारा क्रमश: 008, 0.0001 और 0.00002 प्रतिशत थी। पत्ती डुबाव विधि के साथ LC_{50} क्रमश: 12, 24 और 48 एच ए टी पर 0.007, 0.0002 और 0.00002 [illegible] की नवीन प्रणाली होने के नाते और सुरक्षा की दृष्टि से स्पिनोसेड सबसे आशाजनक कीटनाशक था, जिसने सुरक्षा उपाय, उपयोग और पर्यावरण के साथ सन्तोषजनक नियंत्रण दिया।

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