International Journal of Farm Sciences **8(1):** 45-49, 2018; doi: 10.5958/2250-0499.2018.00012.5

Efficacy of various insecticides against castor hairy caterpillar (*Euproctis lunata* Walker) on castor

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 Received: 7.10.2017/Accepted: 28.10.2017

ABSTRACT

The present study was undertaken to find out certain effective insecticides against castor hairy caterpillar. All the insecticides proved better than the control at all the intervals of observations. The effectiveness of the insecticides increased with time interval after spraying. The results after seven days of treatment revealed that larval mortality ranged from 63.41 to 82.92 per cent. Maximum population was recorded (8.2 larvae per plant) in control. The best results were recorded in novaluron 10 EC (0.01%)-treated plot (1.4 larvae/plant) with 82.92 per cent mortality in the larval population followed by novaluron 10 EC (0.007%) (1.6 larvae/plant) with 80.48 per cent mortality and cypermethrin 25 EC (0.018%) (2.0 larvae/plant) with 75.60 per cent mortality over control. The highest yield 2660 kg/ha was recorded under treatment novaluron 10 EC (0.01%) which was 510 kg more than the control. Other treatments gave additional yield varying from 220 to 450 kg. However highest monetary return in the present study was obtained under the treatment of cypermethrin 25 EC (0.018%) (B-C ratio 21.93:1) followed by cypermethrin 25 EC (0.0125) (B-C ratio 21.10:1) and quinalphos 25 EC (0.075%) (B-C ratio 10.6:1).

Keywords: Castor hairy caterpillar; insecticides; population; mortality; yield

INTRODUCTION

India being a producer of substantial quantities of oilseeds occupies a prominent place in the oilseed map of the world. The major oilseed crops of India are mustard, castor, sunflower, sesame etc and castor is an important crop among these oilseeds. The castor (*Ricinus communis* L) is an important non-edible oilseed crop of drylands which is becoming popular as a commercial oilseed crop owing to its high export potential and industrial uses. The castor seed is one of the commodities where India enjoys supremacy as far as production and export are concerned. Its seed is the source of castor oil which has a wide variety of uses and contains 40.0 to 60.0 per cent oil that is rich in triglyceride mainly ricinolein. The seed also contains ricin, a toxin which is present in lower concentrations throughout the plant. The major castor growing countries are India, China, Brazil, Africa, USA and many other Asian countries (Watt 1892) out of which India, China and Brazil account for 90.0 per cent of world production. India ranks first among the major castor producing countries in the world which occupies 11.05 lakh hectares, holds the production of 17.33 lakh tons and productivity of 1568.0 kg per hectare (Anon 2016).

Though castor productivity in India is more than world average but there are several production constraints. Out of a number of production constraints, biotic stresses steal the lion share of castor productivity by affecting the quantity and quality. More than 60 species of insects and mites have been reported to cause damage to castor crop (Rai 1976). The most important pests are castor hairy caterpillar (*Euproctis lunata* Wlk), castor semilooper (*Achaea janata* L), castor shoot and capsule borer (*Dichocrocis punctiferalis* Guen), tabacco caterpillar (*Spodoptera litura* Fab), castor leaf hopper (*Empoasca flavescens* Fab), castor whitefly (*Trialeurodes ricini* N), gram pod borer (*Helicoverpa armigera* Hub) and leaf minor (*Liriomyza trifolii* Burgess) (Vora et al 1984). The

losses in castor yield of about 40 per cent have been estimated due to insect pest attack (Koltey 1995). Gaur (2014) also reported that castor hairy caterpillar was a new threat to the castor production in southwest Haryana and observed that in human beings it develops uticarial on touching the larvae of *E lunata* or even the infested plant material. At some places the labourers denied harvesting of castor crop due to terror of castor hairy caterpillar. Hence the present study was undertaken to find out certain effective insecticides against castor hairy caterpillar.

MATERIAL and METHODS

The present investigations were carried out at Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Bawal, Haryana located in the low rainfall zone of southwestern Haryana (28.1° N, 76.5° E and 266 m amsl). Studies on the bio-efficacy of different insecticides against castor hairy caterpillar were carried out under the field as well as under laboratory conditions.

The seed of castor (DCH 177) was soaked in water for 24 h before sowing. The crop was sown on 20 July 2014 by hand-dibbling method and two seeds in each dibble were placed at a distance of 120 cm between row to row. Thinning was done at ten days after crop germination and maintaining plant to plant distance of 60 cm. All standard crop production practices were followed except plant protection measures. The treatments comprised T_1 [Rimon10 EC (novaluron) @ 375 ml/ha (0.007%)], T2 [Rimon10 EC (novaluron) 500 ml/ha (0.01%)], T_3 [Shera 25 EC (cypermethrin) 250 ml/ha (0.012%)], T_4 [Shera 25 EC (cypermethrin) 375 ml/ha (0.018%)], T_5 [Tarzen 40 EC (trizophos) 1000 ml/ha (0.08%)], T_6 [Tarzen 40 EC (trizophos) 1250 ml/ha (0.1%)], T_7 [Hydin 25 EC (quinalphos) 1000 ml/ha (0.05%), T_8 [Hydin 25 EC (quinalphos) 1500 ml/ha (0.075%)] and T_9 (Control). The experiment was laid out in RBD with three replications. The size of each plot was 5 x 4 m^2 with two meter inter-plot distance. Only one foliar application of different insecticides was applied with knapsack sprayer on 30 September 2014 where an average population of eight larvae per plant was observed. Larval population was recorded from ten plants in each treatment before the foliar application. Similarly the larval population of the pest was recorded on first, third and seventh day of spray. The data thus collected in the experiment were statistical analyzed.

E lunata was reared in the laboratory on castor leaves. In the field a plot size of 5 x 4 m^2 was kept for releasing and exposing the larvae to sprays of different insecticides. Thirty five larvae were released in the middle two rows of each plot with a camel brush for each treatment. The plots were sprayed with the requisite concentration of different insecticides. These larvae and treated leaves were collected after spray and kept separately @ 10 larvae per jar to maintain three replications of each treatment in the laboratory. The leaves as food were provided from the respective treatments as per requirement. The larval mortality was observed after 24, 48 and 72 h of exposure. The transformation of the data was done before the statistical analysis.

RESULTS and DISCUSSION

It is evident from the data presented in Table 1 that all the insecticides proved better than the control at all the intervals of observations. The effectiveness of the insecticides increased with the time interval after spraying. One day after treatment the mean population of larvae ranged from 4.2 to 8.1 larvae per plant. Minimum larval population (4.2 larvae/plant) was recorded in cypermethrin 25 EC (0.018%) treatment with maximum mortality (48.14%) which was significantly superior to triazophos 40 EC (0.08%) and novaluron 10 EC (0.0075%). Maximum larvae per plant (8.1) were recorded in control. Novaluron 10 EC (0.007%) proved least effective with 5.3 larvae per plant causing 34.56 per cent larval mortality. Sukhija et al (1977) stated that two days after spray quinalphos (0.075 and 0.1%) proved significantly better than endosulfan (0.05%) and trichlorophon (0.05 and 0.075%) against first and second instar larvae of *E lunata*. Similarly Grewal and Singh (1979) reported that quinalphos 0.03 per cent and chlopyriphos 0.05 per cent were effective against *E lunata* and resulted in more than 90 per cent mortality of the fourth and fifth instar larvae two days after the treatment.

The results after three days of treatment revealed that larval mortality ranged from 55.0 to 75.0 per cent. Maximum population was recorded (8.0 larvae/plant) in control. The best results were recorded in novaluron 10 EC (0.01%)-treated plot (2.0 larvae/ plant) with 75.0 per cent mortality in larval population followed by novaluron 10 EC (0.007%) (2.3 larvae/ plant) with 71.25 per cent mortality and cypermethrin 25 EC (0.018%) (2.8 larvae/ plant) with 65.0 per cent

mortality over control. Triazophos 40 EC (0.08%) (3.4 larvae/plant) proved least effective with 55.0 per cent mean mortality. However all the treatments were significantly superior over control (Table 1).

In the present investigations novaluron 10 EC (0.01%) after seven days of spray gave the best results (82.925 mortality in larval population) among all the treatments followed by novaluron 10 EC (0.007%) (80.48% larval mortality) under field condition. Narayanamma et al (2010) reported that novaluron 0.01 per cent gave 48.3, 83.3 and 100 per cent mortality of castor defoliator at first, third and seventh day after first spray respectively. Gupta and Shukla (2013) reported that on increasing the concentrations of novaluron increased the rate of mortality of fifth instar larvae of *E icilia*. In descending order of efficacy the next treatments were cypermethrin 25 EC (0.018%) and quinalphos 25 EC (0.075%) which resulted in 75.60 per cent mortality after seven days of treatment. Patil et al (2014) reported that insecticidal treatment with 0.006 per cent cypermethrin + profenophos was found to be most effective for the control of *E icilia.* Singh et al (1987) found that cypermethrin followed by fenvalerate was most toxic to the larvae of *E lunata*. Triazophos 40 EC (0.08%) (3.0 larvae/plant) proved least effective with 63.41 per cent mean larval mortality. No report on the efficacy of triazophos against *E lunata* is available. The larval population in control was recorded 8.2 larvae per plant (Table 1).

The data in Table 2 show that all the insecticides proved better than the control at all intervals of observations under laboratory conditions. The effectiveness of the insecticides increased with the time interval after treatment. After 24 h of exposure both cypermethrin 25 EC (0.018%) and quinalphos 25 EC (0.075%) were the most effective insecticides with 60 per cent larval mortality. Novaluron 10 EC (0.007%) and triazophos 40 EC (0.08%) were least effective as these resulted in 46.67 per cent larval mortality. No mortality was recorded in control. After 48 hours of exposure maximum mortality was recorded in novaluron 10 EC (0.01%)-treated larvae (86.67% larval mortality) which was significantly superior to all other treatments except novaluron 10 EC (0.007%) (83.33% larval mortality) while lowest was recorded in triazophos 40 EC (0.08%) (66.67% larval mortality).

After 72 h exposure highest larval mortality (100%) was recorded under novaluron 10 EC (0.01%) which was significantly superior to all other insecticidal treatments. The least effective treatment was triazophos 40 EC (0.08%) resulting in 76.67 per cent larval reduction. Mean per cent mortality varied from 76.67 to 100.00 per cent in different insecticidal treatments as against nil in control. However all the treatments were significantly superior over control.

Grain yield was higher in all the treatments as compared to control (Table 3). Yield ranged from 2370 to 2660 kg/ha in different treatments. The highest yield (2660 kg/ha) was recorded under novaluron 10 EC (0.01%) which was 510 kg more than control. Other treatments gave additional yield varying from 220 to 450 kg. However yield was minimum in control (2150 kg).

Economics and benefit-cost ratio of insecticidal treatments

The data presented in Table 3 show that all the treatments gave profit over control. The maximum yield (2660 kg/ha) of castor seed was recorded under novaluron 10 EC @ 500 ml/ha which resulted in net profit of Rs 13300/ ha with benefit-cost ratio of 6.65:1. However benefit-cost ratio was maximum (21.93:1) where cypermethrin 25 EC (375 ml/ha) was applied followed by cypermethrin 25 EC (250 ml/ha) (B-C ratio 21.10:1) and quinalphos 25 EC (1000 ml/ha) (B-C ratio 10.6:1).

CONCLUSION

It is concluded that spraying of cypermethrin 25 EC (375 ml/ha) was economical and most remunerative recording 21.93:1 B-C ratio followed by cypermethrin 25 EC (250 ml/ha) (B-C ratio 21.10:1) and quinalphos 25 EC (1000 ml/ha) (B-C ratio 10.6:1) against castor hairy caterpillar.

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Table 1. Bio-efficacy of different insecticides against *E lunata* infesting castor under field conditions

Treatment	Dose (ml or g/ha)	Mean number of larvae before spray	Population of larvae after 1st day	Per cent mortality over control	Population of larvae after 3rd day	Per cent mortality over control	Population of larvae after 7th day	Per cent mortality over control
Novaluron 10 EC (0.007%)	375	7.7	5.3 (2.50)	34.56	2.3 (1.8)	71.25	1.6 (1.61)	80.48
Novaluron 10 EC (0.01%)	500	7.8	4.9 (2.42)	39.50	2.0 (1.74)	75.0	1.4 (1.54)	82.92
Cypermethrin 25 EC (0.012%)	250	8.1	4.5 (2.37)	44.44	3.0 (1.99)	62.50	2.2 (1.77)	73.17
Cypermethrin 25 EC (0.018%)	375	7.9	4.2 (2.28)	48.14	2.8 (1.94)	65.0	2.0 (1.72)	75.60
Triazophos 40 EC (0.08%)	1000	7.8	5.0 (2.44)	38.30	3.6 (2.14)	55.0	3.0 (2.00)	63.41
Triazophos 40 EC (0.1%)	1250	7.9	4.7 (2.38)	41.97	3.4 (2.08)	57.50	2.8 (1.96)	65.85
Quinalphos 25 EC (0.05%)	1000	7.9	4.6 (2.36)	43.20	3.4 (2.09)	57.50	2.3 (1.80)	71.95
Quinalphos 25 EC (0.075%)	1500	7.9	4.3 (2.30)	46.91	3.1 (2.01)	61.25	2.0 (1.74)	75.60
Control	-	7.7	8.1 (3.02)	-	8.0 (2.99)	-	8.2 (3.04)	-
$CD_{0.05}$	-	NS	(0.14)	-	(0.19)	-	(0.23)	-

Figures in parentheses are square root transformed values

Table 2. Bio-efficacy of different insecticides against *E lunata* infesting castor under laboratory conditions

Treatment	Larval population (hours after spray)			Mean per cent larval mortality (hours after spray)		
	24	48	72	24	48	72
Novaluron 10 EC (0.007%)	5.3	1.7	0.7	46.67 (43.06)	83.33 (66.11)	93.33 (74.65)
Novaluron 10 EC (0.01%)	4.3	1.3	0.0	56.67 (48.82)	86.67 (68.82)	100.00 (80.37)
Cypermethrin 25 EC (0.012%)	4.3	2.6	1.3	56.67 (48.82)	73.33 (58.98)	86.67 (68.82)
Cypermethrin 25 EC (0.018%)	4.0	2.3	1.0	60.00 (50.74)	76.67 (61.19)	90.00 (71.53)
Triazophos 40 EC (0.08%)	5.3	3.3	2.3	46.67 (43.06)	66.67 (54.76)	76.67 (61.19)
Triazophos 40 EC (0.1%)	4.3	3.0	2.0	56.67 (48.82)	70.00 (56.76)	80.00 (63.41)
Quinalphos 25 EC (0.05%)	4.7	3.0	2.0	53.33 (46.90)	70.00 (56.76)	80.00 (63.41)
Quinalphos 25 EC (0.075%)	4.0	2.7	1.3	60.00 (50.74)	73.33 (58.98)	86.67 (68.82)
Control	10.0	10.0	10.0	0.00 (3.14)	0.00 (3.14)	0.00 (3.14)
$CD_{0.05}$	0.81	0.81	0.66	(4.69)	(5.77)	(5.30)

Figures in parentheses are angular transformed values

Table 3. Economics of insecticide treatments against *E lunata* infesting castor

Treatment	Dose (ml or g/ha)	Cost of insecticide spray including labour charges/ha	Mean yield (kg/ha)	Increase in yield over control (kg/ha)	Value of increased yield (Rs/ha)	Net profit (Rs/ha)	B:C
	1	2	3	4	5	6 (5-2)	7 (6÷2)
Novaluron 10 EC (0.007%)	375	1575	2600	450	13500	11925	7.57
Novaluron 10 EC (0.01%)	500	2000	2660	510	15300	13300	6.65
Cypermethrin 25 EC (0.012%)	250	475	2500	350	10500	10025	21.10
Cypermethrin 25 EC (0.018%)	375	562.5	2580	430	12900	12337.5	21.93
Triazophos 40 EC (0.08%)	1000	750	2370	220	6600	5850	7.80
Triazophos 40 EC (0.1%)	1250	862.50	2420	270	8100	7237.50	8.40
Quinalphos 25 EC (0.075%)	1000	750	2440	290	8700	7950	10.6
Quinalphos 25 EC (0.05%)	1500	975	2485	335	10050	9075	9.30
Control	-	-	2150	-	-	-	-

Calculations made on the basis of:
Cost of insecticides: Novaluron= Rs 3400/l, Cypermethrin= Rs 700/l, Triazophos= Rs 450/l, Quinalphos= Rs 450/l, Labour charges: Rs 300/ha,
Market rate of castor: Rs 3000/q

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