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Assessment of LC_{50} value of deltamethrin 2.8 EC, cypermethrin 25 EC, endosulfan 35 EC against *Spilosoma obliqua* Walker

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Abstract
The toxicity of some insecticides *viz*., deltamethrin, cypermethrin and endosulfan were determined against same age larvae (7 day old) of *Spilosoma obliqua* by leaf dip method at different concentrations 0.2, 0.02, and 0.002 percent for deltamethrin 2.8 EC, 0.4 0.04 and 0.004 for cypermethrin 25 EC and 08, .04 and .01 for endosulfan 35 EC. Deltamethrin proved to be the most toxic and quick acting insecticide amongst all the insecticide followed by cypermethrin and endosulfan during observation at12, 24, 48 and 72h after feeding . On the basis of LC50 values at different time intervals the order of toxicity was, deltamethrin > cypermethrin > endosulfan. These findings can be helpful for the selection of suitable insecticides for effective pest management under field condition.

Keywords: *Spilosoma obliqua*, pyrethroids, $LC_{50,}$ toxicity etc

Introduction
The Bihar hairy caterpillar, Spilosoma (=*Diacrisia) obliqua* (Walker) (Arctiidae: Lepidoptera), is an intermittent pest widely distributed in India, China, Bangladesh, Myanmar, Nepal and Pakistan (CPC, 2004) [2]. It is a serious pest in Bihar, Madhya Pradesh, Uttar Pradesh, Punjab, Manipur and other states. Due to its highly polyphagous nature, it attacks soybean, pulses, oilseeds, cereals, certain vegetables, mulberry, medicinal, aromatic and other economic plants and causes severe economic damage (Gupta and Bhattacharya, 2008) [5]. It has been reported feeding on 96 host plants belonging to 34 families. The larvae feed gregariously and voraciously on a variety of crops. Having destroyed one field, they move in swarms to another field. As the pest passes the first generation mostly on weeds, it should be destroyed in the weed itself before the pest multiplies and migrates to the cultivated crops (Yadav *et al*., 2001) [16]. Use of chemicals for pest control indeed has been proved as boon for agriculture and chemical insecticides are often recommended to combat the infestation of these pests (Murugesan and Dhingra, 1995) [9]. Synthetic pyrethroids representing the major invention in insecticide chemistry in recent years contribute 25 percent to the total pesticides marketed in the country (Verma and Singh. 2000) [13]. In fact, they were introduced to replace the resistance- prone and environmentally unstable organochlorines, carbamates and cyclodienes. Deltamethrin and cypermethrin is synthetic compound primarily used as an insecticides. They act as a stomach and contact insecticides. Keeping in mind the importance of the pest, some pyrethroid and non-pyrethroid insecticides were evaluated by Singh *et al.* (2000) [15]. Baseline data on the susceptibility of the target insect pest to the insecticide is the most important factor for monitoring the development of resistance. By keeping these points in mind, the present study was conducted to determine the toxicity (LC50) of some insecticides against the larvae of *S. obliqua* by leaf-dip methods of application. The obtained LC50 values would serve as for the selection of insecticide for further use in field study and this base line data could be used as critical inputs in the deployment of new insecticides and insecticide resistance management programmes (Kaur and Kang, 2014) [7].

Materials and Methods
The laboratory bioassay experiments were conducted during 2019, College of Agriculture,

Rani Lakshmi Bai Central Agricultural University, Jhansi during 2019. The Concentration 0.2, 0.02, and 0.002 percent for deltamethrin 2.8 EC, 0.4 0.04 and 0.004 for cypermethrin 25 EC and 08, .04 and .01 for endosulfan 35 EC were used for testing their LC_{50} against *S. obliqua.* Each concentration was replicated thrice and each replication consists of 10 larvae of same age group. Control leaf discs were dipped in water only. Leaf dip method will be followed according to (Kodandaram and Dhingra, 2007) [8]. The full grown matured Castor (*Ricinus communis*) leaves was plucked and brought to the laboratory. After proper washing, leaves were dipped in the required concentration of insecticide for one minute. Excess liquid were shaken from the foliage. This was then allowed to dry at room temperature. The treated leaves were transferred to clean plastic boxes (10x5cm). In each box, ten larvae were placed and each treatment was replicated three times. In control, the leaves were dipped in distilled water. The observations were recorded on mortality at 12, 24, 48 and 72h after feeding. Moribund larvae will be counted as dead. The average per cent mortality in each treatment was corrected by Abbott's formula (Abbott, 1925) and LC_{50} values was calculated by using probit analysis according to Finney (1971) [4].

Results and Discussion

It observed that the Deltamethrin proved to be the most toxic and quick acting insecticide amongst all the insecticide followed by cypermethrin and endosulfan. At 12 HAE LC_{50} of deltamethrin 0 .0474% was recorded. At 24 HAE LC_{50} of deltamethrin, was .03785115.Whereas LC_{50} cypermethrin and endosulfan at 12 HAE and 24 HAE could not be calculated because of less mortality. At 48 HAE the LC_{50} of deltamethrin, cypermethrin and endosulfan were .0000908, .000922, .080% respectively. At 72 HAE the LC_{50} of deltamethrin, cypermethrin and endosulfan were 1.059591, .0130, .034% respectively (Table 1-4). The order of toxicity was: deltamethrin > cypermethrin > endosulfan. Dhingra, (1998) [3] 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. The LC_{50} values of deltamethrin and endosulfan were found 0.00098 and 0.08759 respectively. Singh and Singh (1997) [14] studied relative susceptibility of six synthetic pyrethroids and four non pyrethroids against second instar larvae of *S. obliqua*. The LC_{50} values of deltamethrin and endosulfan was found 0.000613 and 0.037150 respectively. Goel and Kumar (1991) [12] were made field studies to control *S. obliqua* and *Acherontia styx* on sesamum using synthetic pyrethroids, *viz*., cypermethrin, deltamethrin, fenpropathrin, fenvalerate and fluvalinate and compared with quinalphos. Deltamethrin was found to be the most potent insecticide followed by cypermethrin against both the insect species, and were effective for 15 days of spray. (Nagia *et al.*, 1990 [11] and Muthusamy *et al.*, 2011) [10] reported that Cypermethrin was most toxic chemical among all tested insecticides against *S. obliqua.* Gupta and Yadav (2011) [6] evaluated that the relative contact toxicity of 17 conventional and new insecticides against *S. obliqua* larva. They reported the descending order of relative toxicity for 3-4- day-old larvae was: Lambda-cyhalothrin > deltamethrin > alphamethrin> chlorpyriphos > cypermethrin > fenvalerate > quinalphos > Prokill > prophenophos >dichlorvos > monocrotophos > methomyl > triazophos > phenthoate > endosulphan > C-505 > dimethoate.

Table 1: LC50 of insecticides against larvae of *S.obliqua* at 12 HAE by larval dip method

Insecticides	Heterogeneity X^2	Regression equation	LC_{50}	Fiducial limit
Deltamethrin	2.089	Y=9.74+3.58X	0.0474634	03024304-.07448902
*Cypermethrin	_	-	-	-
*Endosulfan	-	-	-	-

*LC50 could not be calculated due to less mortality.

Table 2: LC50 of insecticides against larvae of *S.obliqua* at 24 HAE by larval dip method

Insecticides	Heterogeneity X^2	Regression equation	LC_{50}	Fiducial limit
Deltamethrin	0.352	Y=10.62+3.93X	.03785115	.0272-.171
*Cypermethrin	_	-	-	-
*Endosulfan	-	-	-	-

*LC50 could not be calculated due to less mortality.

Table 3: LC50 of insecticides against larvae of *S.obliqua* at 48 HAE by larval dip method

Insecticides	Heterogeneity X^2	Regression equation	LC_{50}	Fiducial limit
Deltamethrin	.0000908	Y=6.86+.530X	.0000908	.000014-.00655
Cypermethrin	.000922	Y=10.05+2.33X	.000922	.00453-.00996
Endosulfan	0.33	Y=6.53+1.404X	.080	.051-.25

Table 4: LC50 of insecticides against larvae of *S.obliqua* at 72 HAE by larval dip method

Insecticides	Heterogeneity X^2	Regression equation	LC_{50}	Fiducial limit
Deltamethrin	.0000708	Y=5.16+.433X	.0000018	.000014-.0000055
Cypermethrin	9.7035	Y=2.85-1.14X	.0130	.0772-.00592
Endosulfan	.786	Y=7.0+1.439X	.034	.014-.058

Conclusion

It can be concluded that the Deltamethrin proved to be the most toxic and quick acting insecticide amongst all the insecticide followed by cypermethrin and endosulfan. and can be a good control measure for the management of S. obliqua. The study would also be helpful to develop management strategies to overcome the resistance problems and to manage S. obliqua under field conditions in the future.

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