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RESEARCH NOTE

Sole and combined effect of some microbial and chemical insecticides against *Spilarctia obliqua* under laboratory conditions

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ABSTRACT

Spilarctia obliqua as polyphagous pest has tendency to develop resistance against frequently used conventional insecticides. So, microbial insecticides and their combination with modern chemical insecticides could be alternative option in IPM of *Spilarctia obliqua*. The significant susceptibility of *Spilarctia obliqua* was noticed by use of *Bacillus thuringiensis* var. *kurstaki (B.t.k)*, flufenoxuron, cartap either sole or separate combination of *B.t.k* with other two chemical insecticides at half of their recommendation.

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Bihar hairy caterpillar, *Spilarctia obliqua* is an important polyphagous pest of tropical and subtropical crops and causes extensive damage particularly in early stages. In West Bengal, it is considered as a serious pest of jute, vegetables, various pulses and oilseeds (Dutta, 1952; Senapati and Ghosh, 1990). This pest is also reported as serious one in terms of economic losses of some crops in Bihar, Madhya Pradesh, Uttar Pradesh and Punjab (Atwal and Dhaliwal, 2002). Synthetic chemical insecticides like endosulfan, quinalphos, monocrotophos, and chlorpyriphos etc. are usually employed to combat this pest (Tripathi, 1967; Bakhetia and Sidhu, 1972; Tewari and Singh, 1979; Samyal and Sharma, 1984). However, it has a tendency to develop quick resistance against most of the synthetic pesticides if used frequently (Mehrotra, 1989 and Sharma, 2012). In this regard, microbial bio-pesticides either sole or their combination with chemical insecticide may have the opportunity as alternative component of IPM for management of *Spilarctia obliqua*. So, the present study was untaken in laboratory condition to find out the comparative efficacy of some commercially available microbial and chemical insecticides either sole or their mixtures against *Spilarctia obliqua*.

Among microbial bio-insecticide, *Bacillus thuringiensis* var. *kurstaki* 5 per cent WP (halt) and *Beauveria bassiana* 2 $\times 10^9$ spores/g (daman) were selected and collected from market. Similarly, chemical insecticides namely, flufenoxuron 10 DC (cascade), cartap hydrochloride 50 SP (Kaldane) and imidacloprid 17.8 SL (confidor) were also taken for this study. This experiment was conducted in IPM laboratory of Directorate of Research, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, W.B. at 25-32^0 C and 75 ± 80 per cent relative humidity. Larvae of *Spilarctia obliqua* were mass reared in laboratory on cabbage leaves. The disease free cultured was maintained by following proper sanitary conditions. In all bioassays, leaf discs of equal size from cabbage were used against *Spilarctia obliqua*. The food materials (leaf discs) were dipped in the pesticide solution with proper particular concentration for 30 seconds and the excess fluid was removed after uniform jerking before shade drying. They were then placed separately inside Petri dishes over moist blotting paper and were allowed to feed by 8 hr. starved third instar larva of *Spilarctia obliqua* for 24 hours. Three replications were maintained for each treatment with 10 larvae for each replication. Mortality counts were taken at 24 hour interval. The data on per cent mortality were corrected by using Abbott's (1925) formula. The data in percentage were transformed into correspondence angles (angular transformation) before analysis. Analysis of variance was done

and means were separated by DMRT.

The data on the efficacy of microbial and chemical insecticides after their single or combined application against 3rd instar larvae of *Spilarctia obliqua* are presented in Table 1. The results revealed that after first day of exposure, the mortality of *Spilarctia obliqua* varied from 3.33 to 83.33 per cent in all the treatments compared to 0.00 per cent in control. All the treatments showed significant difference over control except imidacloprid @ 0.02 per cent. On the first day of observation microbial pesticides, *Beauveria bassiana* @ 0.5 per cent and *B.t.k* @ 0.1 per cent provided 13.33 and 63.33 per cent larval mortality, respectively and significantly differed with each other. Larval mortality of *S. obliqua* after first day exposure was found 13.33, 30.00 and 3.33 per cent in insecticidal treatments of flufenoxuron @ 0.1 per cent, cartap hydrochloride 50 SP @ 0.1 per cent and imidacloprid @ 0.02 per cent, respectively. However, in joint action of microbial and chemical pesticides, it varied from 10.00 to 83.33 per cent with maximum mortality in the combination of *B.t.k.* @ 0.05 per cent + flufenoxuron @ 0.05 per cent and minimum mortality in *B. bassiana* @ 0.25 per cent + imidacloprid @ 0.01 per cent. No significant difference in mortality was recorded in combination of *B.t.k* @ 0.05 per cent + imidacloprid @ 0.01 per cent (30.00%) and *B.t.k* @ 0.05 per cent + cartap hydrochloride 50 SP @ 0.05 per cent (36.67%). So, after first day exposure some additive effect of microbial pesticides with chemical pesticides was recorded. After second days of exposure, *B.t.k* alone and its joint action with flufenoxuron with half of their recommended doses caused 100 per cent mortality and was significantly superior than all other treatments. The second highest (93.33 %) larval mortality was noticed in combination of *B.t.k.* @ 0.05 per cent + cartap hydrochloride 50 SP @ 0.05 per cent. On the third days of observation, total mortality (100%) was recorded in flufenoxuron alone and also in combination of *B.t.k.* + flufenoxuron and *B.t.k.* + cartap hydrochloride 50 SP and significantly at par with that of cartap hydrochloride 50 SP alone (96.67%). No difference in mortality among imidacloprid (43.33%), *B. bassiana* (50.00%) and their mixture (46.67%) were observed. But *B.t.k.* combined with imidacloprid caused 86.67 per cent mortality *i.e.* significantly different from other treatments. More or less similar trend in ranking of the treatments were recorded in fourth days of observation.

Table 1 unfolded that either solo application of *B.t.k.* @ 0.1 per cent or *B.t.k.* @ 0.05 per cent in combination with flufenoxuron @ 0.05 per cent was highly effective against the 3rd instar larvae of *S. obliqua* from the 1st day of observation as evident from the higher mortality *i.e.* 63.33 and 83.33, respectively and the total (100 %) mortality was recorded on 2 days after treatment. On the other hand *B. bassiana* @ 0.5 per cent alone or in combination with imidacloprid @ 0.01 per cent did not show appreciable efficacy throughout the observation period that exhibited 13.33 to 53.33 per cent and 10.00 to 60.00 per cent mortality, respectively. The efficacy of *Bacillus thuringiensis* was increased by the addition of sublethal doses of synthetic pesticides against important lepidopteran pests (Benz, 1971; Hamilton and Attia, 1977; Salama *et al*., 1984; Dabi *et al*., 1988) and the synergistic action with many other insecticides has also been reported (Creighton and Mc Fadden, 1974; Dabi *et al*., 1988; Pramanik and Somchoudhury, 2001).

The result of this present study was also strongly agreed

Table 1 : Efficacy of microbial and chemical pesticides against *Spilarctia obliqua*

Treatments	% Mortality at different days after treatment			
	1	2	3	4
Flufenoxuron 10% DC @ 0.1%	13.33 (21.14)^{d}	90.00(74.73)^{b}	100.00(89.19)^{a}	100.00(89.19)^{a}
Cartap hydrochloride 50 SP @ 0.1%	30.00 (33.00)^{c}	70.00(57.00)^{c}	96.67(83.32)^{ab}	100.00(89.19)^{a}
Imidacloprid 17.8% SL @ 0.02%	3.33 (6.80)^{ef}	23.33(28.78)^{e}	43.33(41.15)^{d}	46.67(43.08)^{c}
Beauveria bassiana ($2x10^{9}$ spores/g)	13.33 (21.14)^{d}	40.00(39.15)^{d}	50.00(45.00)^{d}	53.33(46.92)^{c}
B.t.k. 5% WP @ 0.1%	63.33 (52.78)^{b}	100.00(89.19)^{a}	100.00(89.19)^{a}	100.00(89.19)^{a}
B.t.k. 5% WP @ 0.05% + Flufenoxuron @ 0.05%	83.33 (66.14)^{a}	100.00(89.19)^{a}	100.00(89.19)^{a}	100.00(89.19)^{a}
B.t.k. 5% WP @ 0.05% + Cartap hydrochloride 50 SP @ 0.05%	36.67 (37.22)^{c}	93.33(77.44)^{b}	100.00(89.19)^{a}	100.00(89.19)^{a}
B.t.k. 5% WP @ 0.05% + Imidacloprid @ 0.01%	30.00 (33.00)^{c}	73.33(59.00)^{c}	86.67(68.86)^{c}	90.00(74.73)^{b}
B. bassiana @ 0.25% + Imidacloprid @ 0.01%	10.00 (15.33)^{de}	26.67(31.00)^{e}	46.67(43.08)^{d}	60.00(50.77)^{c}
Control	0.00 (0.99)^{f}	0.00(0.99)^{f}	0.00(0.99)^{e}	0.00(0.99)^{d}
C.D. (P=0.05)	11.10	7.99	9.55	12.11
S.E. ±	3.74	2.689	3.21	4.08

– Figures without parenthesis indicate original value * Figures in parenthesis indicate angular transformed value.
– In a column means followed by a common letter(s) are not significantly different by DMRT (p = 0.05).

with Bhattacharya and Pramanik (2003) who reported *Bacillus subtilis* in combination with each of endosulfan and acetamiprid provided total mortality of *S. obliqua* and 91.11 per cent mortality as found in *B. subtilis* + imidacloprid. Pramanik and Somchoudhury (2002) also stated that *B.t.k* (Delfin) @ 0.2 per cent and 0.1 per cent yielded 100 per cent mortality of 1st instar larvae of *S. obliqua* and the values in 0.2 per cent *B.t.k* were 96.67, 90 and 76.7 per cent against 2nd, 3rd and 4th instar, respectively.

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