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Relative toxicity of selected insecticides against spotted ladybird beetle, *Harmonia octomaculata* (Fabricius) under laboratory conditions

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Abstract
The insecticides effectively check the insect pests but can be troublesome to natural enemies if applied in excess or improperly. A laboratory experiment on relative toxicity of spotted ladybird beetle, *Harmonia octomaculata* (Fabricius) was conducted under laboratory conditions to find out the safer insecticides to the predator. Study on relative toxicity of different insecticides against adults of *H. octomaculata* revealed that there were no insecticides under testing found highly toxic to the adult of *H. octomaculata* while, the treatment of novaluron 10 EC was slightly harmful to the adults. Moreover, clothianidin 50 WDG, diafenthiuron 50 WP, acetamiprid 20 SP, spinosad 45 SC, imidacloprid 17.8 SL, thiamethoxam 25 WG, flonicamid 50 WG, and dinotefuran 20 SG were found to be harmless to the adults of *H. octomaculata*. The treatment of control (Water dipping) exhibited nil adult mortality during the present investigation.

Keywords: ladybird beetle, *H. octomaculata*, Insecticides, relative toxicity

1. Introduction
Insecticides are playing great role in the management of insect pests, but can be troublesome to natural enemies such as parasites and predators prevailing in natural ecosystem [1]. Coccinellids can tolerate many insecticides which are actual benefit over other predators. The extensive use of insecticides has harmful influence on biological control agents in many cropping ecosystems as these insecticides may have a direct or indirect effect on the population of parasitoids and predators. Sometime, the indiscriminate use of the insecticides dangerously affects the population of these biological control agents [4].
The use of over insecticides leads to insecticides resistance, pest resurgence and residues in/on crops. This offers a scope for biological control agents *viz*., predators and parasitoids as they would be important tools in integrated pest management. Therefore, the present study was undertaken to know the relative toxic effect of different insecticides against spotted ladybird beetle *H. octomaculata* under laboratory condition.

2. Materials and Methods
The adult of spotted ladybird beetle, *H. octomaculata* were collected from laboratory culture and relative toxicity test was carried out at PG Research Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during 2019.

A. Insecticides application: The relative toxicity of various insecticides was evaluated against adults of *H. octomaculata* by using thin dry film method suggested by Paul [6] with slight modifications. The solutions of different concentration of insecticides were prepared separately in glass jar (Table- 1). A transparent plastic vials (6 x 4 cm) with plastic lid used as a pesticide testing unit. For preparation of thin insecticidal film, plastic vials (6 x 4 cm) were treated by dipping them in respective insecticidal solution for 5 minutes. The control treatment was maintained by dipping the plastic vials in distilled water. The insecticidal film formed was dried under the ceiling fan for 15 minutes. Ten treatments were repeated thrice along with control. For this purpose, ten adults of *H. octomaculata* were released individually per treatment per repetition in each plastic vials (6 x 4 cm) and test insects were allowed to remain in contact with insecticides dry film for about 45 minutes. Thereafter, adults were transferred

to fresh plastic vials (6 x 4 cm) individually as per respective treatment along with lucerne aphid.

Table 1: Insecticides used in present investigation with the trade name and concentrations

Treat. No.	Chemical name	formulations	Conc. (%)	Trade name	Dose/ 1L of water
T_1	Clothianidin	50 WDG	0.003	Dantotsu	0.06 g
T_2	Flonicamid	50 WG	0.0075	Panama	0.15 g
T_3	Diafenthiuron	50 WP	0.04	Pegasus	0.80 g
T_4	Dinotefuran	20 SG	0.0025	Oshin	0.12 g
T_5	Imidacloprid	17.8 SL	0.005	Confidor	0.28 ml
T_6	Spinosad	45 SC	0.02	Tracer	0.44 ml
T_7	Novaluron	10 EC	0.0075	Rimon	0.75 ml
T_8	Acetamiprid	20 SP	0.004	Manik	0.2 g
T_9	Thiamethoxam	25WG	0.005	Actara	0.2 g
T_{10}	Control (Water dipping)	-	-	-	-

Observations on adults mortality of *H. octomaculata* were recorded at 12, 24, 48 and 72 hrs after release. The moribund adults were also considered as dead. The data obtained on per cent adult mortality of *H. octomaculata* were converted into Arcsine transformation values and then subjected to statistical analysis for interpretation of the results by employing completely randomized design (CRD) with 10 treatments and three repetitions. Thus, data obtained was categorized into mortality groups for laboratory trials following scale was used to categories the tested insecticides to determine the magnitude of the response of toxicant exposure on the predatory coccinellids as suggested by Paul [6].

Score	Toxicity rating for natural enemies	
	Mortality (%)	Category
1	< 50	Harmless
2	50-79	Slightly harmful
3	80-99	Moderately harmful
4	> 99	Harmful

3. Results and discussion

Perusal of the data presented in Table-2 and Figure-1 indicated that the mortality of the adults of *H. octomaculata* after 12 hrs of insecticide application revealed that the treatment novaluron 10 EC and diafenthiuron 50 WP showed maximum mortality (30.00%) which was at par with clothianidin 50 WDG (26.67%) and acetamiprid 20 SP (26.67%) while spinosad 45 SC (16.67%), imidacloprid 17.8 SL (13.33%) and thiamethoxam 25 WG (13.33%) caused intermediate mortality. However, flonicamid 50 WG (0.00%), dinotefuran 20 SG (0.00%) and control (Water spray) were found to be least toxic with zero per cent adult mortality. All insecticides and control (Water spray) were found to be harmless to the adult beetles of *H. octomaculata* at 12 hrs of the treatment.

The data obtained at 24 hrs after treatment revealed that novaluron 10 EC caused highest mortality (43.33%) followed by diafenthiuron 50 WP (40.00%) and it was at par with clothianidin 50 WDG (36.67%). Moreover, the treatment of acetamiprid 20 SP (30.00%) was at par with spinosad 45 SC (26.67%) and imidacloprid 17.8 SL (20.00%). The lowest adult mortality exhibited by thiamethoxam 25% WG (13.33%) and it was at par with flonicamid 50 % WG (13.33%) on one side and dinotefuran 20 SG (10.00%) on the other side. The treatment of control (Water spray) had no adult mortality.

After 48 hrs of the treatment, novaluron 10 EC showed consistently the highest mortality (60.00%) and remained slightly harmful insecticide followed by clothianidin 50 WDG (53.33%) and diafenthiuron 50 WP (46.67%) which was at par with the treatment of acetamiprid 20 SP (40.00%) and spinosad 45 SC (40.00%). Furthermore, imidacloprid 17.8 SL (26.67%) was at par with thiamethoxam 25 WG (20.00%) and flonicamid 50 WG (20.00%). Moreover, dinotefuran 20 SG caused minimum adult mortality (10.00%). The treatment of control had nil adult mortality.

The data recorded after 72 hrs of the treatment indicated that novaluron 10 EC showed consistently the maximum mortality (80.00%) followed by clothianidin 50 WDG (63.33%). Moreover, diafenthiuron 50 WP (53.33%) was at par with the treatment of spinosad 45 SC (50.00%). Further, acetamiprid 20 SP (40.00%) was at par with imidacloprid 17.8 SL (33.33%). The toxicity of remaining insecticides in descending order was thiamethoxam 25WG (30.00%) > flonicamid 50 WG (30.00%) > dinotefuran 20 SG (10.00%) > control (Water spray).

The pooled data obtained on the per cent adult mortality at 12, 24, 48 and 72 hrs after treatment revealed that significantly highest mortality of adults of *H. octomaculata* was recorded with the treatment of novaluron 10 EC (53.33%) followed by clothianidin 50 WDG (45.00%). Furthermore, the toxicity of remaining insecticides were diafenthiuron 50 WP (42.50%), acetamiprid 20 SP (34.17%), spinosad 45 SC (33.33%), imidacloprid 17.8 SL (23.33%), thiamethoxam 25 WG (19.17%), flonicamid 50 WG (15.83%), dinotefuran 20 SG (7.50%) and control (Water spray) (0.00%).

The present study was in accordance with the report of Tank *et al*. [9] who reported that acetamiprid 0.002 per cent (40.89%) was least toxic to the adult of *C. sexmaculata* under laboratory condition. Furthermore, the treatment of dichlorvos 0.025 per cent was found to be highly toxic (99.79%). Sohail *et al*. [8] who recorded that imidacloprid @ 80 ml per 100 liter of water, imidacloprid @100ml per 100 lit water and thiamethoxam @ 10 g per 100 liter of water were found to be safer for ladybird beetles. During the present investigations, the treatments of thiamethoxam @ 0.2 g per liter of water and imidacloprid @ 0.28 ml per liter of water were found harmless to the adults of *H. octomaculata*.

Table 2: Adult mortality of *H. octomaculata* under laboratory condition (2019)

Tr. No.	Insecticides	Mean per cent mortality at different intervals				Pooled
		12 HAT	24 HAT	48 HAT	72 HAT	
T_1	Clothianidin 50 % WDG	30.98(26.67)d	37.21(36.67)ef	46.90(53.33)ef	52.75(63.33)f	41.96(45.00)f
T_2	Flonicamid 50 % WG	0.91(0.00)a	21.14(13.33)bc	26.55(20.00)c	33.20(30.00)c	20.45(15.83)c
T_3	Diafenthiuron 50 % WP	32.99(30.00)d	39.13(40.00)fg	43.06(46.67)de	46.90(53.33)e	40.52(42.50)f
T_4	Dinotefuran 20% SG	0.91(0.00)a	18.43(10.00)b	18.43(10.00)b	18.43(10.00)b	14.05(7.50)b
T_5	Imidacloprid 17.8 % SL	21.14(13.33)b	26.55(20.00)cd	30.77(26.67)c	35.20(33.33)cd	28.42(23.33)d
T_6	Spinosad 45 % SC	23.85(16.67)bc	30.98(26.67)de	39.22(40.00)d	44.98(50.00)e	34.76(33.33)e
T_7	Novaluron 10 % EC	33.20(30.00)d	41.14(43.33)g	50.75(60.00)f	63.41(80.00)g	47.12(53.33)g
T_8	Acetamiprid 20 % SP	30.77(26.67)cd	32.99(30.00)de	39.22(40.00)d	39.22(40.00)d	35.55(34.17)e
T_9	Thiamethoxam 25% WG	21.14(13.33)b	21.14(13.33)bc	26.55(20.00)c	33.20(30.00)c	25.51(19.17)d
T_{10}	Control (Water spray)	0.91(0.00)a	0.91(0.00)a	0.91(0.00)a	0.91(0.00)a	0.91(0.00)a
S. E m. ± (T) (P x T)		2.41	2.29	1.59	1.51	1.67
		--	--	--	--	1.38
C. D. at 5% (T) (P x T)		7.11	6.74	4.68	4.45	4.95
		--	--	--	--	3.89
C. V. (%)		21.22	14.68	8.53	7.11	8.24

* Figures outside the parentheses are arcsine transformed values while those inside are original values.
HAT= Hours After Treatment

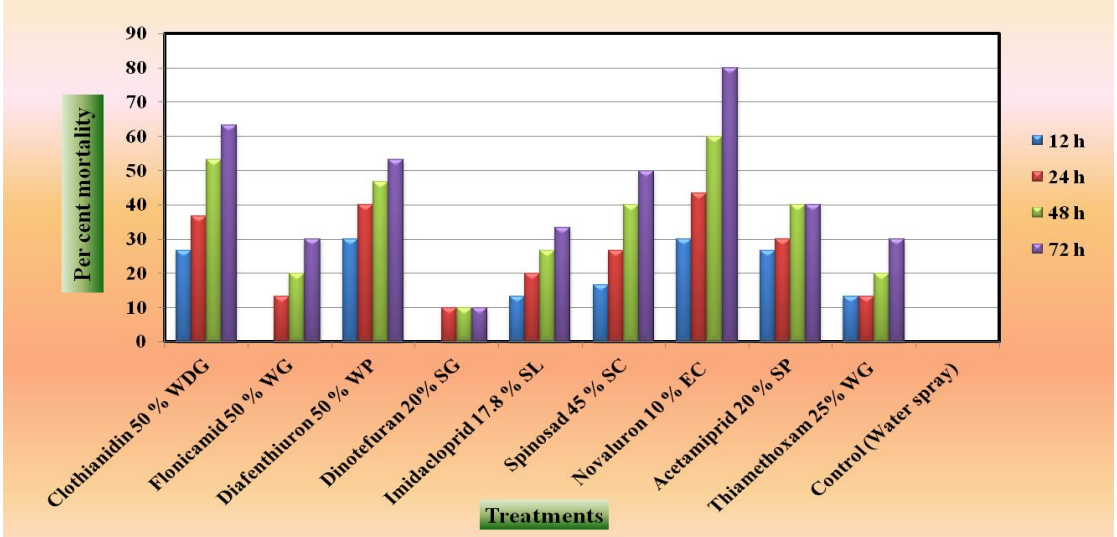

Fig 1: Relative toxicity of different insecticides against adult of *H. octomaculata*

The present investigations are agree with Yadav *et al*. [10] who reported that imidacloprid 0.005 per cent was found to be least toxic to the adult of *C. septempunctata* and dichlorvos 0.05 per cent was highly toxic in nature. The present study are in line with Khan *et al*. [3] who observed that spinosad 240SC @ 247ml/ha was found to be slightly toxic (44% mortality) to the adults of *M. sexmaculatus*. According to Kaushik *et al*. [2], thiamethoxam 30FS, imidacloprid 17.8 SL and spinosad 45 EC were relatively safer to the coccinellids while quinalphos 25 EC was recorded highly toxic to coccinellids of cowpea ecosystem. A similar observations were reported by Patel *et al*. [5] who reported that the treatment novaluron 10 EC 0.0075 per cent was slightly harmful to adults of *Propylea sp*. while, thiamethoxam 25 WG 0.005 per cent, acetamiprid 20 SP 0.004 per cent, flonicamid 50 WG 0.0075 per cent, clothianidin 50 WDG 0.003 per cent, diafenthiuron 50 WP 0.04 per cent, imidacloprid 17.8 SL 0.005 per cent, spinosad 45 SC 0.02 per cent, azadirachtin 1500 ppm 0.15 per cent were found safer to the adults under laboratory condition. The present findings are deviated from the results of Shinde and Radadia [7] who revealed that none of the insecticides were found to be absolutely harmless to the adults of *C. sexmaculata*. The treatment insecticides *viz*., imidacloprid, thiamethoxam and acetamiprid were recorded as slightly harmful with 29.33, 42.67 and 48.33 per cent adult mortality, respectively. However, spinosad and clothianidin were showed moderately harmful with 53.00 and 73.67 per cent adult mortality, respectively. The insecticides like novaluron and profenophos were found highly toxic to coccinellids with 75.00 and 90.33 per cent mortality, respectively under field conditions. The results of Shinde and Radadia [7] different from the present results and it might be due to change in test insect, tested insecticides and adopted methodology when compare to present investigations.

4. Conclusion

There was no any insecticide under testing found highly harmful to the adults of *H. octomaculata*. However, novaluron 10 % EC was slightly harmful to the adults. Moreover, clothianidin 50 WDG, flonicamid 50 WG, diafenthiuron 50 WP, dinotefuran 20 SG, imidacloprid 17.8 SL, spinosad 45 SC, acetamiprid 20 SP, thiamethoxam 25 WG and control (Water dipping) were found to be harmless to the adults. Thus, all these tested insecticides could be used in sucking pest management programme thereby *H. octomaculata* predators can be conserved in agro-ecosystem.

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6. References

1. Alexander A, Krishnamoorthy SV, Kuttalam S. Toxicity of insecticides to the coccinellid predators, *Cryptolaemus montrouzieri* Mulsant and *Scymnus coccivora* Ayyar of papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink. Journal of Biological Control. 2013; 27(1):18-23.
2. Kaushik AK, Yadav SK, Srivastava P. Impact of various insecticides on natural enemies in cowpea ecosystem. Annuals of Entomology. 2016; 34:57-64.
3. Khan S, Ullah F, Khan I, Khan MA, Khan SZ, Khan MA, Khan IA, Iqbal T *et al*. Toxicity of selected insecticides against the zig zag ladybird beetle *Menochilus sexmaculatus*. Journal of Entomology and Zoology Studies. 2015; 3(3):143-147.
4. Mughal KT, Ullah Z, Sabri AM, Ahmad S, Hussain D. *In vitro* comparative toxicity of different insecticides against adults of seven spotted beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae). Journal of Entomology and Zoology Studies. 2017; 5(6): 498-502.
5. Patel HA, Shinde CU, Patel HN. Relative toxicity of selected insecticides against ladybird beetle, *Propylea sp*. under laboratory conditions. International Journal of Current Microbiology and Applied Sciences. 2018; 7(9):640-644.
6. Paul AVN. Testing side effects of pesticides on natural enemies of crop pests. A training manual of summer school on "Current approaches in biological control of insect pests and disease" during May 26th-June 16th 1998 at Biocontrol Laboratory Division of Entomology, IARI, New Delhi- 110012, 1998; Pp1-12.
7. Shinde CU, Radadia GG. Field persistent toxicity of various insecticides against potent predator, *Cheilomenes sexmaculata* (F.). International Journal of Chemical Studies. 2018; 6(1):87-91.
8. Sohail K, Jan S, Shah SF, Ali H, Israr M, Farooq M, Jan S, Arif M, Ahmad B *et al*. Effect of different chemical pesticides on mustard aphid (*Lipaphis erysimi*) and their adverse effects on ladybird leetle. Sarhad Journal Agriculture, 2011; 27(4):611-615.
9. Tank BD, Korat DM, Borad PK. Relative toxicity of some insecticides against *Cheilomenes sexmaculata* (Fab) in laboratory. Karnataka Journal Agriculture Science. 2007; 20(3):639-641.
10. Yadav MK, Patel JI, Wazire NS. Testing of insecticides for its tolerance to ladybird beetle, *Coccinella septempunctata* (Linn.). AGRES – An International e-Journal. 2014; 3(2):193-198.