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Relative safety of some new insecticides to *Microvelia douglasi atrolineata* Bergroth, an aquatic predator of hoppers in the rice ecosystem

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ABSTRACT: **In a greenhouse experiment, the relative safety of thiamethoxam at 50, 25 and 12 ppm, imidacloprid at 50 ppm, fipronil at 100 ppm, acephate at 1200 ppm along with untreated control was assessed to the aquatic veliid predator, *Microvelia douglasi atrolineata* Bergroth, which feeds on nymphs of brown planthopper, *Nilaparvata lugens* (Stål). The results revealed that fipronil 100 ppm was the safest treatment followed by acephate at 1200 ppm and thiamethoxam at 12 ppm.**

KEY WORDS: Insecticides, *Microvelia douglasi atrolineata*, *Nilaparvata lugens*, relative safety, rice

Microvelia douglasi atrolineata Bergroth are small, black coloured, fast moving ripple bugs found on water surface in flooded rice fields. Both nymphs and adults of *Microvelia* congregate at the base of the rice plant and feed on planthopper nymphs falling onto the water. These are very active predators and can consume 4 -7 hoppers per day (Shephard *et al.*, 1987).

Although cultural practices and varietal resistance are employed to check the damage by brown planthopper, use of insecticides is one of the major tactics practiced to check the damage by this insect pest. Insecticides applied to the rice crop canopy as sprays or broadcast as granules in standing water invariably contaminate water, which provides ecological niches for these predators.

Thiamethoxam (Actara 25 WG) and imidacloprid (Confidor 200 SL) are nitroguanidine compounds recently identified to be very effective at 25g a. i. per ha against brown planthopper (DRR, 1998, 2000). Fipronil (Regent 5 SC) belonging to phenyl pyrazole group has also been identified to be effective against brown planthopper at 50g a. i. per ha (DRR, 1996). Acephate at 600g a. i./ha is an organophosphorous insecticide, which was previously identified to be effective against brown planthopper and also safe to its natural enemies (DRR, 1991). However, the information on the safety of these new compounds to *Microvelia* is lacking in literature. Hence, the studies have been undertaken to assess the initial and residual safety of thiamethoxam, imidacloprid and fipronil to *Microvelia douglasi atrolineata* in comparison with standard insecticide acephate

under controlled greenhouse conditions.

MATERIALS AND METHODS

Rice plants of TN1 Variety were raised in the greenhouse and were maintained according to their age. Brown planthopper was reared on 40-day-old rice plants in the wooden cages. *Microvelia douglasi atrolineata*, which is an aquatic bug and feeds on brown planthopper nymphs, was collected from the water in the trays used for rearing planthoppers. Rice plants and all the insects were maintained in the greenhouse at 30±5° C and 60±10 per cent relative humidity. Thiamethoxam (Actara 25 WG) and imidacloprid (Confidor 200 SL) are recommended @ 25g a. i. per ha while fipronil (Regent 5 SC) and acephate (Starthene 75 WP) are recommended @ 50 and 600g a. i. per ha, respectively. Keeping the spray volume @ 500 litres per ha, the concentration of these insecticides works out to be 50 ppm for thiamethoxam and imidacloprid while for fipronil and acephate the concentrations are 100 ppm and 1200 ppm, respectively. However, to work out in detail in case of thiamethoxam two additional concentrations *viz*, 25 and 12 ppm were also included in addition to untreated control. Thus there were seven treatments in the experiment which were replicated four times.

Ten ml of the spray fluid was added to 1 litre of water contained in a 2 litre capacity plastic pot. Ten *Microvelia* adults were released on the water surface and covered with muslin to prevent escape of bugs and also to prevent contamination from outside. Brown planthopper nymphs were provided as prey. Mortality was recorded 24, 48 and 72 hours after release of *Microvelia* 1, 7, 14, 21 and 28 days after treating with insecticide as per the method standardized by Jhansi Lakshmi *et al.* (1997).

Persistent toxicity (PT) values were calculated for each exposure period, *viz.*, 24, 48 and 72 hours separately according to Pradhan (1967). PT value is the product of average per cent mortality and the period in days up to which the insecticide persisted. The mortality figures were converted into percentages and transformed into angular values for analysis. PT values were subjected to square root transformation. All data were subjected to analysis of variance and means were separated by least significant difference (l. s. d.) method (Cochran and Cox, 1957).

RESULTS AND DISCUSSION

Safety of insecticide treatments to adults of *Microvelia douglasi atrolineata*

Initially, one day after spraying thiamethoxam at 50, 25 and 12 ppm recorded 100 per cent mortality within 72 hours of exposure and was on par with imidacloprid 50ppm (100 % mortality) while fipronil 100 ppm (72 % mortality) and acephate 1200 ppm (37 % mortality) were safer treatments. However, after 14 days of spraying thiamethoxam at 50 and 25 ppm exhibited 100 and 90 per cent mortality of *M. douglasi* within 72 hours of exposure and was on par with imidacloprid 50 ppm (100 % mortality) and the check insecticide acephate at 1200 ppm (75 % mortality) but less safer than fipronil 100 ppm (52.5 % mortality) and untreated control (0 % mortality). When the mortality data 21 days after spraying was considered, thiamethoxam at 50 and 25 ppm showed 55 and 65 per cent mortality of aquatic veliid bug at 72 hours of exposure and was safer than imidacloprid 50 ppm (100 % mortality). However, at the same time thiamethoxam at 12 ppm revealed 25 per cent mortality and was on par with fipronil 100 ppm (27.5 % mortality) and the standard check acephate (17.5 % mortality). After 28 days of spraying thiamethoxam at 50, 25 and 12 ppm recorded 32.5, 25 and 15 per cent mortality of *M. douglasi* at 72 hours exposure and were on par with fipronil 100 ppm (27.5 % mortality) and acephate 1200 ppm (12.5 % mortality) but better than imidacloprid 50 ppm (60 % mortality). When persistent toxicity values at 48 hours of exposure were taken into consideration, thiamethoxam at 50 (PT value of 2100) and 25 ppm (PT value of 1919) were better than imidacloprid at 50 ppm (PT value of 2576) with regard to their safety to *M. douglasi*. However, thiamethoxam at 12 ppm (PT value of 840) was better than the above treatments, but was on par

Table 1. Mortality of aquatic veliid bug, *M. douglasi atrolineata* at different intervals after spraying and exposure

Treatment	Per cent mortality (after days)								
	1			7			14		
	24h	48h	72h	24h	48h	72h	24h	48h	72h
Thiamethoxam 50 ppm	100a	100a	100a	100a	100a	100a	100a	100a	100a
Thiamethoxam 25 ppm	100a	100a	100a	100a	100a	100a	100a	90ab	90a
Thiamethoxam 12 ppm	90a	100a	100a	100a	100a	100a	0a	5c	12.5c
Imidacloprid 50ppm	97a	100a	100a	100a	100a	100a	0a	100a	100a
Fipronil 100ppm	65b	72b	72b	5b	5b	30b	0a	5c	52.5b
Acephate 1200ppm	27.5c	100a	100a	100a	100a	100a	12.5c	87.5b	87.5b
Control (untreated)	0d	0d	0d	0c	0c	0c	0a	0c	0c

The values in each column followed by the same letter are not significantly different (P=0.05).

Table 2. Mortality and persistent toxicity of insecticides to *M. douglasi atrolineata* at different intervals after spraying and exposure periods

Treatment	Per cent mortality (after days)						Persistent toxicity		
	21			28					
	24h	48h	72h	24h	48h	72h	24h	48h	72h
Thiamethoxam 50 ppm	0b	42.5b	55b	32.5b	32.5b	32.5b	700a	2100b	2170a
Thiamethoxam 25 ppm	7.5b	37.5bc	65b	20bc	20bc	25bc	1848bc	2758a	2800a
Thiamethoxam 12 ppm	7.5b	20cd	25c	7.5cd	7.5cd	15bc	100a	1751c	2436ba
Imidacloprid 50ppm	100a	100a	100a	60a	60a	60a	100a	1793c	2534ab
Fipronil 100ppm	0b	20bcd	27.5c	27.5b	27.5b	27.5b	100a	2016b	2660ab
Acephate 1200ppm	0b	12.5d	17.5cd	5cd	5cd	12.5cd	446b	1034c	1259b
Control (untreated)	0b	0e	7.5d	0d	0d	2.5cd	0.0d	0.0e	56c

The values in each column followed by the same letter are not significantly different (P=0.05)

with the check insecticide acephate (PT value of 1034) although inferior to fipronil 100 ppm (PT value of 146).

When the overall results on the safety of thiamethoxam to predatory aquatic veliid bug are considered, it can be said that thiamethoxam at 50 and 25 ppm was safer than imidacloprid 50 ppm, but inferior to check insecticide acephate 1200 ppm and fipronil 100 ppm. However, thiamethoxam at 12 ppm was on par with standard check acephate 1200 ppm, but inferior to fipronil 100 ppm with regard to the safety to *M. douglasi*. Thus in the present studies, acephate as a check insecticide was observed to be safer to *Microvelia* under greenhouse conditions. Several workers reported that acephate spray was safe to *Microvelia* under glasshouse conditions (Heinrichs *et al.*, 1980; Mochida *et al.*, 1982; Fabellar and Heinrichs, 1984), which confirm the results of the present studies.

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