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EVALUATION OF SOME NOVEL INSECTICIDES AGAINST *MYZUS PERSICAE* (SULZER)

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ABSTRACT
Realtive toxicity of some insecticides *viz*., acetamiprid, fipronil, imidacloprid, lambda cyhalothrin, malathion and thiamethoxam to apterous adults of the green peach aphid, *Myzus persicae* (Sulzer) was evaluated in the laboratory using leaf dip method of bioassay. The LC_{50} values of these insecticides were calculated to be 17, 16.5, 4.5, 15.4, 362.2 and 4.1 ppm, respectively. On the basis of LC_{50} values, thiamethoxam was found to be the most toxic insecticide with LC_{50} value of 4.1ppm, closely followed by imidacloprid with LC_{50} value as 4.5ppm. Malathion was found to be the least toxic with LC_{50} value of 362.2ppm.

INTRODUCTION

The green peach aphid, *Myzus persicae* (Sulzer) (Aphididae: Hemiptera) is an extremely polyphagous species of aphids which has been reported to feed on more than five hundred species of host plants from at least forty different families including several important agricultural crops (Van Emden and Harrington, 2007). The aphid is also one of the most important insect-pests of greenhouse crops (Sanchez *et al*., 2010; Mehta, 2012). In addition to direct losses caused by sucking the vital cell sap from the plant-parts by both nymphs and adults, the aphid is capable of transmitting more than one hundred and fifty viral diseases in different hosts particularly in Solanaceous vegetables (Cloyd and Sadof, 1998). In view of its economic importance, efficacy of a large number of insecticides belonging to different groups including some novel compounds has been reported against the aphid under laboratory, field and greenhouse conditions (Dewar 2007, Wali *et al*., 2007, Jandial and Malik, 2008). However, most of these insecticides have been withdrawn because of their high toxicity to non-target organisms, high persistence and other harmful effects on the environment. The aphid is also known to have developed resistance to many groups of insecticides throughout the world (Foster *et al.,* 2000). Consequently, there is a need for the evaluation of toxicity of different insecticides to the aphid in order to find less persistent, safer and effective alternatives for its management. The present studies were, therefore, undertaken to evaluate toxicity of some novel compounds along with two commonly recommended insecticides to *M. persicae*.

MATERIALS AND METHODS

Toxicity of six commercial formulations of insecticides viz. acetamiprid (Wapkil 20SP), thiamethoxam (Suckgan 25 WG), imidacloprid (Confidor 17.8 SL), fipronil (Mahaveer 5 SC), lambda cyhalothrin (Bravo 5000 5 EC) and malathion (Emithion 50 EC) to apterous adults of *M. persicae* was studied in the PG laboratory of the Department of Entomology, CSKHPKV, Palampur, Himachal Pradesh, India by using leaf dip method of bioassay (FAO, 1979). For this purpose, adult aphids were used for bioassay from the stock culture maintained in the laboratory on the potted plants of capsicum under caged conditions. Desired concentrations of each insecticide were prepared by diluting the commercial formulations with distilled water. Initial trails were run in order to adjust the range of insecticidal concentrations which could give mortality between 10 to 90 per cent. The desired concentration of test insecticide was taken in 100 ml capacity beaker and fresh excised leaves of capsicum along with their petioles were dipped in the insecticidal solution for 30 seconds. The excess of insecticide was allowed to drain off and the leaves were dried in shade. The leaf stalks were also wrapped with moist cotton wool to keep the leaves turgid.

Ten apterous adults of *M. persicae* of equal age and size, pre-starved for 4 hours were picked up from the stock culture with the help of a soft camel hair brush and released on the treated leaves. Complete test for each insecticide finally comprised of three replications of five concentrations and one control. All the sets were maintained at 25 $\pm$ 10 in BOD incubator and mortality was recorded after 24 hours of aphid release on

treated leaves. Aphids that failed to move when touched with camel hair brush were considered as dead.

Data obtained from the experiment were subjected to probit analysis (Finney, 1971) to find out the LC_{50} values of different insecticides. Before applying probit analysis, the per cent mortality data were corrected by Abbott's correction (Abbott, 1925) wherever necessary.

RESULTS AND DISCUSSION

The data on concentration - mortality response of the *M. persicae* to different insecticides have been summarized in Table 1 and represented graphically in the form of regression lines in Fig. 1. The LC_{50} values of acetamiprid, fipronil, imidacloprid, lambda cyhalothrin, malathion and thiamethoxam were calculated to be 17, 16.5, 4.5, 15.4, 362.2 and 4.1 ppm, respectively. Based on LC_{50} values, thiamethoxam was observed to be the most toxic insecticide to the aphid with LC_{50} of 4.1ppm followed by imidacloprid (4.5ppm), lambda cyhalothrin (15.4ppm), fipronil (16.5ppm), acetamiprid (17ppm) and malathion (362.2ppm). However, perusal of data revealed that the toxicity of thiamethoxam and imidacloprid was statistically same because of their overlapping fiducial limits. Similarly, the fiducial limits of acetamiprid and fipronil were found to be overlapping indicating thereby that the toxicity of these insecticides to the aphid was statistically same. Malathion was the least toxic insecticide to the aphid as it had significantly highest LC_{50} value. The relative toxicity of thiamethoxam, imidacloprid, lambda cyhalothrin, fipronil and acetamiprid to *M. persicae* was worked out to be 88.34, 80.49, 23.52, 21.95 and 21.31 times more as compared to malathion.

Thus, it can be inferred from these results that among the six insecticides, the neonicotinoids (thiamethoxam and imidacloprid) were significantly more toxic to the aphid as compared to other insecticides. Earlier workers have also found neonicotenoids viz. imidacloprid, acetamiprid and thiomethoxam quite effective against *M. persicae* in different crops (Wali *et al.,* 2007, Jandial and Malik, 2008). Khan *et al.* (2011) studied effectiveness ofimidacloprid and thiamethoxam against *M. persicae* and reported that both these insecticides significantly reduced the aphid infestation. Malathion, the most commonly used insecticide belonging to organophosphates, was found to be the least toxic insecticide to *M. persicae* in the present study. Perusal of toxicity data reveals that the value of slope (b) in case of malathion was the lowest (0.71) among all the insecticides which showed that with the increase in concentration of the insecticide the mortality of the aphid increased at a slow rate. This may be an indication of development of resistance in the aphid population. Low

Table 1: Relative toxicity of insecticides against apterous adults of *M. persicae*

S. No.	Insecticide	Formulation used	LC_{50}(ppm)	Fiducial limits (%)	Slope (b)	Heterogeneity*(χ^2)	Relativetoxicity
1.	Acetamiprid	Wapkil 20 SP	17	16-19	1.70 ± 0.28	0.84	21.31
2.	Fipronil	Mahaveer 5 SC	16.5	16.4-16.7	1.74 ± 0.29	2.12	21.95
3.	Imidacloprid	Confidor 17.8 SL	4.5	4.3-4.6	1.57 ± 0.28	0.26	80.49
4	Lambdacyhalothrin	Bravo 5000 5 SC	15.4	15.2-15.5	1.37 ± 0.26	1.38	23.52
5.	Malathion	Emithion 50 EC	362.2	361.9 -362.4	0.71 ± 0.25	1.18	1
6.	Thiamethoxam	Suckgun 25 WP	4.1	4-4.3	1.38 ± 0.27	0.59	88.34

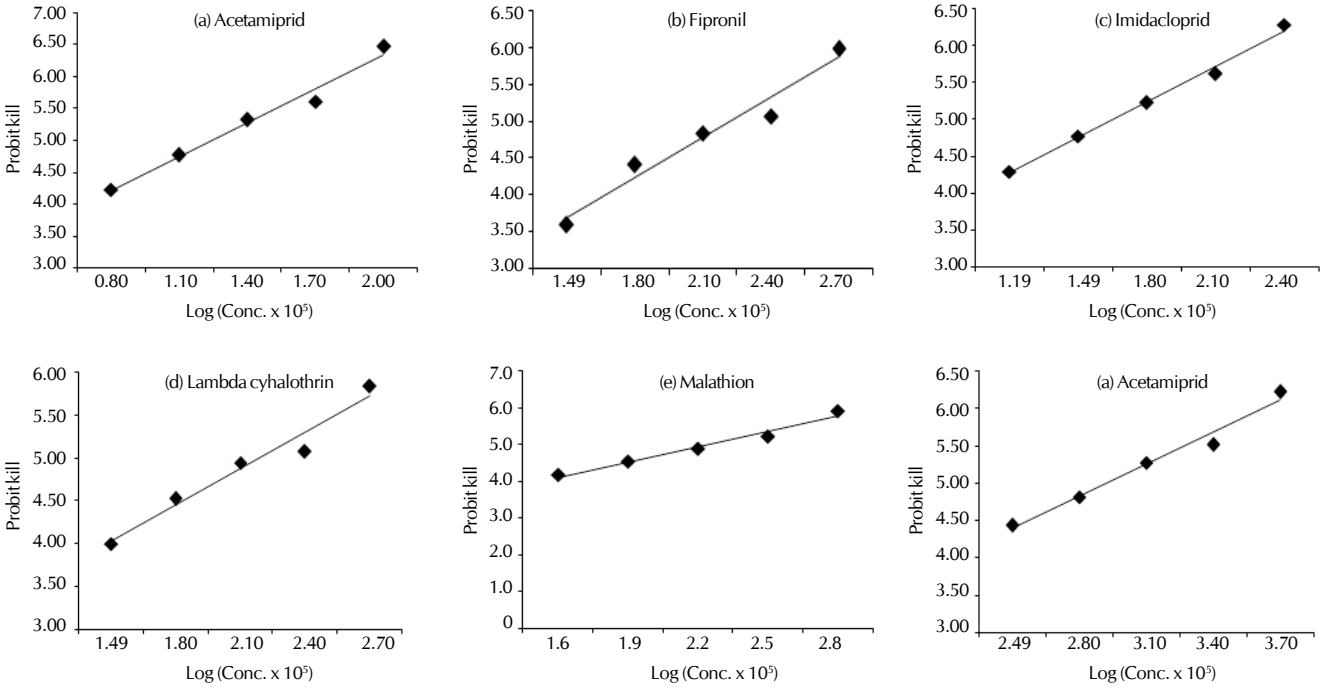

Figure 1: The log (concentration) - probit mortality regression lines for different insecticides to apterous adults of *M. persicae*

toxicity of malathion to the aphid has also been reported by Khalequzzaman and Jesmun (2008) who tested five insecticides viz. malathion, carbosulfan, cypermethrin, imidacloprid and azadirachtin against the aphid and found that malathion was the least toxic having LC_{50} of 305.26ppm.

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