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Relative Toxicity of Different Insecticides Against *Macrosiphoniella sanborni* Gillette on *Chrysanthemum*

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Abstract

An experiment was laid out to evaluate the bio-efficacy of insecticides viz., thiamethoxam, monocrotophos, dimethoate, oxydemeton-methyl and triazophos through different bioassay methods to the adult of *Macrosiphoniella sanborni* Gillette. The relative toxicity and LC_{50} values of five insecticides were determined by treated food-untreated insects and untreated food-treated insects method of bio-assay for 24 and 6 hours of exposure. The order of relative toxicity of different insecticides for the treated food-untreated insects after 24 hours of exposure to aphids was found as follows : Thiamethoxam > monocrotophos > oxydemeton-methyl > dimethoate > triazophos. In untreated food-treated insects method the order was found as follows : Thiamethoxam > monocrotophos > oxydemeton-methyl > dimethoate > triazophos. In untreated food – treated insects method it was found as follows – Thiamethoxam > monocrotophos > oxydemeton-methyl > triazophos > dimethoate. The LC_{50} values of these insecticides upto 24 and 6 hour exposure were also determined and found that thiamethoxam recorded the lowest LC_{50} values.
Key words : Bioassay, Insecticides, *Macrosiphoniella sanborni* Gillette, *Chrysanthemum* plant.

Among all the flowers, *Chrysanthemum* occupies a place of pride both as commercial crop and as a popular exhibition flower. With the advancement of the society the use of flowers is increasing and now it becomes one of the most important commercially viable enterprise in India. It ranks second to rose among top ten cut flowers in the world trade of flower crops (Brahma 2002). Its wide popularity is due to its large number of cultivars in respect of growth habit, size, color and shape of bloom. The ultimate goal of any commercial grower is the production of quality flowers to fetch maximum market value. Several constraints affect the production of this flower and among these, the damage by insect pests is common. So, importers should be cautions about the insect pests that cause a heavy loss in flower production. Among all the insects, aphids are considered to be important. Of some aphid species recorded *Macrosiphoniella sanborni* Gillete is most important and now represents a major threat to *Chrysanthemum* importers as it acts as a vector for vein mottle virus and *Chrysanthemum* virus B (Jeskiezicz et al. 2001). In the present investigation five systemic insecticides were used to evaluate the bio-efficacy through various bioassay methods in laboratory to make a comparative study and among them the most potent can be recommended to the farmers for their use in the field with least expenditure to get a good return.

Methods

The laboratory experiments were carried out in the Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, WB during January to March 2005 and 2006.

The toxicity evaluation of chemicals namely, oxydemeton-methyl, dimethoate, triazophos, thiamethoxam and monocrotophos were done by taking *Macrosiphoniella sanborni* Gillette as test species. The test insects were collected from untreated plants.

The treatments involved the method of treated insect-untreated food and treated food-untreated insect with the help of hand atomizer. In first case the insects were treated with insecticidal spray and after 1 hour fed with untreated fresh leaves of *Chrysanthemum.* In second case, the untreated insects were taken in petriplates and 1 hour later fed with treated leaves of *Chrysanthemum.* The lids of the petriplates

Table 1. Relative toxicity and LC_{50} values of different chemicals against *Macrosiphoniella sanborni* Gillette through treated food- untreated insects at 24 hours exposure. Y = Probit kill ; LC_{50} = Concentration calculated to give 50% mortality. X = Log concentration. Relative toxicity of the above insecticides have been calculated by taking LC_{50} value of triazophos as unity.

	Insecticides	df	Heterogeneity	Regression equation	LC_{50} (ppm)	Fiducial limit	Relative toxicity (RT)	Order of RT
1.	Oxydemeton-methyl	2	0.239	5.6783 + 2.1849x	0.00252	0.00328 0.00181	1.087	3
2.	Dimethoate	2	0.105	6.4240 + 2.4788x	0.00256	0.00325 0.00193	1.070	4
3.	Monocrotophos	2	0.780	5.4524 + 2.0715x	0.00233	0.00328 0.00161	1.176	2
4.	Triazophos	2	0.071	5.6002 + 2.1859x	0.00274	0.00356 0.00200	1.000	5
5.	Thiamethoxam	2	0.484	5.6022 + 2.1859x	0.00218	0.00290 0.00146	1.257	1

were loosely secured and kept in cool dry place. Observations on mortality were taken in both the cases after 6 and 24 hours to find out the acute toxicity. For each insecticide several concentrations were taken and each concentration of treatment was replicated thrice. For control only water was sprayed.

The mortality rate of test species recorded after 6 and 24 hours. The moribund insects were considered as dead. The data were subjected to probit analysis after correcting the mortality in the untreated check by Abbott's formula (Abbott 1925).

The probit analysis done by a method modified by Finney (1971) for the mathematical estimation of the median lethal concentration (LC_{50}) and probit regression line (Finney, 1964). The order of relative toxicity of different insecticides was then determined by comparison of LC_{50} values by taking the insecticide possessing the highest LC_{50} value as unit.

Results and Discussion

The relative toxicity and LC_{50} values of different chemicals against the aphid through treated food-untreated insects at 24 hours exposure are presented in Table 1 and that at 6 hours exposure are presented in Table 2. The Tables 3 and 4 show the relative toxicity and LC_{50} values of different chemicals through treated insects-untreated food at 24 and 6 hours exposure. In all cases the heterogeneity values with 2 degrees of freedom (df), regression equations and

Table 2. Relative toxicity and LC_{50} values of different chemicals against *Macrosiphoniella sanborni* Gillette through treated food-untreated insects at 6 hours exposure. Y = Probit kill ; LC_{50} = Concentration calculated to give 50% mortality. X = Log concentration. Relative toxicity of the above insecticides have been calculated by taking LC_{50} value of triazophos as unity.

	Insecticides	df	Heterogeneity	Regression equation	LC_{50} (ppm)	Fiducial limit	Relative toxicity (RT)	Order of RT
1.	Oxydemeton-methyl	2	0.422	4.7343 + 1.8683x	0.00292	0.00397 0.00205	1.134	3
2.	Dimethoate	2	0.165	4.5866 + 1.8201x	0.00302	0.00414 0.00210	1.096	4
3.	Triazophos	2	0.089	4.2089 + 1.6969x	0.00331	0.00468 0.00228	1.000	5
4.	Thiamethoxam	2	0.133	5.1025 + 1.9761x	0.00262	0.00349 0.00182	1.263	1
5.	Monocrotophos	2	0.105	4.8196 + 1.8828x	0.00276	0.00372 0.00190	1.199	2

Table 3. Relative toxicity and LC_{50} values of different chemicals against *Macrosiphoniella sanborni* Gillette through treated insects-untreated insects at 24 hours exposure. Y = Probit kill ; LC_{50} = Concentration calculated to give 50% mortality. X = Log concentration. Relative toxicity of the above insecticides have been calculated by taking LC_{50} value of triazophos as unity.

Insecticides	df	Heterogeneity	Regression equation	LC_{50} (ppm)	Fiducial limit	Relative toxicity (RT)	Order of RT
1. Oxydemeton-methyl	2	0.293	5.2606 + 2.0169x	0.00246	0.00327 0.00171	1.211	3
2. Dimethoate	2	0.860	5.7492 + 2.2760x	0.00298	0.00386 0.00224	1.000	5
3. Triazophos	2	0.184	5.0046 + 1.9569x	0.00277	0.00370 0.00195	1.076	4
4. Thiamethoxam	2	0.987	6.0986 + 2.2576x	0.00199	0.00259 0.00136	1.497	1
5. Monocrotophos	2	0.511	5.6096 + 2.1115x	0.00220	0.00290 0.00151	1.355	2

fiducial limits are also presented.

In treated food-untreated insects at 24 hours exposure (Table 1), thiamethoxam having the lowest LC_{50} value of 21.8 ppm proved to be the highly toxic and triazophos having the highest LC_{50} value of 27.4 ppm proved to be the least toxic insecticide. On the basis of their LC_{50} values the insecticides could be arranged in descending order of toxicity as — thiamethoxam (21.8 ppm) > monocrotophos (23.3 ppm) > oxydemeton > oxydemeton-methyl (25.2 ppm) > dimethoate (25.6 ppm) >triazophos (27.4 ppm) and these are 1.257, 1.176, 1.087 and 1.070 times toxic with respect to triazophos.

In treated insects-untreated food at 24 hours exposure (Table 3), thiomethoxam having the lowest LC_{50} value of 19.9 ppm proved to be highly toxic and dimethoate having the highest LC_{50}values of 29.8 ppm proved to the least toxic insecticide. Thus on the basis of their LC_{50} values the insecticides could be arranged in descending order of toxicity as thiamethoxam (19.9 ppm) > monocrotophos (22.0 ppm) > oxydemeton-methyl (24.6 ppm) > triazophos (27.7 ppm) > dimethoate (29.8 ppm) and these are 1.497, 1.355, 1.211 and 1.076 times toxic with respect to dimethoate.

In treated food-untreated insects at 6 hours exposure (Table 2), thiamethoxam having the lowest LC_{50} value of 27.5 ppm proved to be highly toxic and triazophos having the highest LC_{50} value of 33.1 ppm proved to be highly toxic and oxydemeton-methyl having the highest LC_{50} value of 31.2 ppm proved to be the least toxic insecticide. Thus on the basis of

Table 4. Relative toxicity and LC_{50} values of different chemicals against *Macrosiphoniella sanborni* Gillette through treated insects-untreated food at 6 hours exposure. Y = Probit kill ; LC_{50} = Concentration calculated to give 50% mortality. X = Log concentration. Relative toxicity of the above insecticides have been calculated by taking LC_{50}value of triazophos as unity.

Insecticides	df	Heterogeneity	Regression equation	LC_{50} (ppm)	Fiducial limit	Relative toxicity (RT)	Order of RT
1. Oxydemeton-methyl	2	1.633	5.0184 + 2.0026x	0.00312	0.00418 0.00227	1.000	5
2. Dimethoate	2	1.043	4.0791 + 1.6238x	0.00308	0.00433 0.00205	1.013	4
3. Triazophos	2	0.619	4.2202 + 1.6707x	0.00298	0.00419 0.00199	1.047	2
4. Thiamethoxam	2	0.885	4.8113 + 1.8786x	0.00275	0.00371 0.00190	1.135	1
5. Monocrotophos	2	0.317	4.5748 + 1.8145x	0.00301	0.00413 0.00210	1.037	3

their LC_{50} values, the insecticides could be arranged in descending order of toxicity as thiamethoxam (26.2 ppm) > monocrotophos (27.6 ppm), > oxydemeton-methyl (29.2 ppm) > dimethoate (30.2 ppm) > triazophos (33.1 ppm) and these were 1.263, 1.199, 1.134 and 1.096 times toxic with respect to triazophos.

In treated insects-untreated food at 6 hours exposure (Table 4), thiamethoxam having the lowest LC_{50} value of 31.2 ppm proved to be least toxic insecticide. Thus on the basis of their LC_{50} values, the insecticides could be arranged in descending order of toxicity as—thiamethoxam (27.5 ppm) > triazophos (29.8 ppm) > monocrotophos (30.1 ppm) > dimethoate (30.8 ppm) > oxydemeton-methyl (31.2 ppm) and these were 1.135, 1.047, 1.037 and 1.013 times toxic with respect to oxydemeton-methyl.

Thus among the insecticides thiamethoxam was relatively more toxic to *Macrosiphoniella sanborni* Gillette and its LC_{50} ranges between 19.9 to 27.5 ppm.

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