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EFFECTIVENESS OF SOME CHEMICAL PESTICIDES AGAINST ARTHROPOD PESTS OF ORNAMENTAL PLANT

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Abstract

The study was conducted with seven chemical pesticides to control the arthropod pests of some ornamental plants during November 2017 to May 2018 at Gazipur in Bangladesh. Pesticides were applied following company recommended dose, more than recommended dose, farmers' practicing dose and below farmers' practicing dose. The pesticides Actara 240SC (Thiamethoxam) and Abom 1.8EC (Abamectin) were applied @ 1.0, 1.25 (farmers' practice), 1.5 (recommended) and 1.75 ml/L water on rose plants to control aphid and spider mite. Effectiveness of Roxin 40 EC (Dimethoate) @ 0.5, 0.75 (farmers' practice), 1.0 (recommended) and 1.25 ml/L water was evaluated against aphid attacking tuberose. Actara 25 WG (Thiamethoxam) @ 0.1, 0.2(farmers' practice), 0.25 (recommended) and 0.3 g/L water was sprayed to control marigold aphid. Tundra 20 SP (Acetamiprid 20%) was sprayed to control rose thrips @ 0.25, 0.5 (farmers' practice), 0.75 (recommended) and 1.0 g/L water. Effectiveness of Liquor 1.8 EC (Abamectin) against gladiolus thrips was tested @ 1.75, 2.0 (farmers' practice), 2.5 (recommended) and 2.75ml/L water. Feniton 50 EC (Fenitrothion) was applied to control dahlia mealy @ 1.5, 1.75 (farmers' practice), 2.0 (recommended) and 2.5 ml/L water. Abundance of the arthropod pests was compared with control (untreated plant) at 1, 3 and 7 days after treatment. The tested pesticides significantly reduced pest population and the recommended dose of the pesticides revealed higher efficacy than that of farmers' practice.

Keywords: Effectiveness, pesticides, sucking pests, ornamental plants.

Introduction

Bangladesh has favorable climatic condition for ornamental crop production and there is ample opportunity for increasing the profit from flower production due to increased demand. Ornamental plants are being cultivated nearly 10,000 hectares of land in 23 districts of Bangladesh (Dhaka Tribune, 2020). About 5,000 resilient farmers are growing flower and foliage in the country, and 80,000-90,000 people are directly or indirectly involved in floriculture business (Chowdhury, 2010). Nowadays it is an emerging enterprise in the agriculture sector of Bangladesh.

Infestation of insect and mite is one of the main obstacles of floriculture in Bangladesh. Islam *et al*. (2019) showed that in total 51 species of insects and 4 species of mites caused infestation on 10 species of ornamental plants in different

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areas of Bangladesh. They also found that thrips (*Rhipiphorothrips cruentatus, Scirtothrips dorsalis, Teniothrips simplex*), aphid (*Aphis craccivora, Macrosiphum rosae, Neotoxoptera oliveri*), mealy bug (*Plannococcus citri*) and spider mite (*Tetranychus cinnabarinus*) are the major sucking arthropod pests of ornamental plants. A total of sixty-five insect species cause damage to different ornamental plants in Himachal Pradesh, India, and the extent of damage ranges from 10 to 80% in various cultivars of carnation (Pal and Sarkar, 2009).

The nymph and adults of the sucking arthropod pestintake sap from leaves, flower buds and petals, and their infestations cause distorted and deformed flowers (Flint and Karlik, 2008). The larvae and adults of thripsattack all the stages of rose plant and they cause 28-95% damage with a population density of 11-33 /flower (Gahukar, 2003; Murugan and Jagadish, 2004). Aphid deposits honey dew on the host plant at the time of feeding, that serves as a growth media for sooty mold, which in turn affects photosynthesis of the plant.

Farmers of Bangladesh are mostly dependent on synthetic chemical pesticides to control the sucking arthropod pests of ornamental plants. They apply pesticide frequently to suppress pest population as well as getting attractive shape, size and color of the flowers. Most of the farmers apply pesticides indiscriminately for the control of arthropod pests. They generally use lower and /or higher doses of the pesticides than the recommendation of the manufacturing company and suffering from pest problems. Sridhar and Rani (2003) reported that chemical insecticides did not suppress thrips population on rose in India because of several factors.

For sustainable pest management decision, it is utmost necessary to find out the efficacy and appropriate doses of the pesticides which are being applied by the farmers. With this point in view, the pesticides namely, Actara 240SC, Roxin 40 EC, Actara 25 WG, Tundra 20 SP, Liquor 1.8 EC, Feniton 50 EC and Abom 1.8 EC were tested on aphid of rose, tuberose and marigold, thrips of rose and gladiolous, mealy bug of dahlia, and mite of rose.

Materials and Methods

The study was conducted in the experiment field and laboratory of the Department of Entomology, and Ornamental Plant Gardens of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur during November 2017 to May 2018. The study site is located in the middle (25°25′ N and 89°5′ E) of Bangladesh. The study area has a tropical climate but seasonal, and characterized by a well-defined dry season (February to May), rainy season (June to September) and short winter (December and January). Annual average temperature, relative humidity and rainfall are 25.8ºC, 67% and 2036 mm, respectively (Amin *et al.*, 2018).

The study was done with five flowering plants namely, rose, tuberose, gladiolus, dahlia and marigold plants and the investigation was conducted on aphid, thrips

and spider mite of rose, gladiolous thrips, dahlia mealy bug, marigold aphid and tuberose aphid. The ornamental plants were collected from the Savar Nursery, Savar, Dhaka and cultivated in the experimental field following randomized complete block design with three replications. Each plant species was cultivated in 15 plots maintaining proper spacing and management practices. Rose and dahlia were cultivated in plots measured 4×4 m with a row to row and plant to plant distance of 80 cm. Plot size for tuberose, gladiolus, and marigold plants was 2.4×2.4 m with a row to row and plant to plant distance of 60 cm.

Application of pesticides

Prior to selecting pesticides and doses, consultation was done with the commercial farmers, dealers and extension workers of Jashore, Narshindi, Cox's Bazar and Satkhira. The pesticides Actara 240SC (Thiamethoxam) and Abom 1.8EC (Abamectin) were applied with doses of 1.0, 1.25 (farmers' practice), 1.5 (recommended) and 1.75 ml/L water on rose plants to control aphid and spider mite. Effectiveness of Roxin 40 EC (Dimethoate) with doses of 0.5, 0.75 (farmers' practice), 1.0 (recommended) and 1.25 ml/L water were evaluated against aphid attacking tuberose. Actara 25 WG (Thiamethoxam) with doses of 0.1, 0.2 (farmers' practice), 0.25 (recommended) and 0.3 g/L water was sprayed to control marigold aphid. Tundra 20 SP (Acetamiprid 20%) was sprayed to control rose thrips following doses of 0.25, 0.5 (farmers' practice), 0.75 (recommended) and 1.0 g/L water. Effectiveness of Liquor 1.8 EC (Abamectin) against gladiolus thrips was tested with doses of 1.75, 2.0 (farmers' practice), 2.5 (recommended) and 2.75ml/L water. Feniton 50 EC (Fenitrothion) was applied to control dahlia mealy bug with doses of 1.5, 1.75 (farmers' practice), 2.0 (recommended) and 2.5 ml/L water. All the doses of the pesticides were applied twice in three individual plots and control (untreated) observations were taken in account.

Data collection

Data were collected at 1, 3 and 7 days after treatment. To collect data of the abundances of aphid on rose and tuberose, and thrips on gladiolus, five shoots (two apical leaves) were randomly selected for each treatment and number of the insects of the shoots was counted using a hand lens. For counting data of the abundances of thrips on rose and aphid on marigold, five branches were randomly selected for each treatment and number of the insects of each branch was recorded using hand lens. For counting the rose mite and dahlia mealy bug, five top shoots (two apical leaves) were randomly selected for each treatment then cut with knife and brought to the laboratory. Number of mite and mealy bug of each shoot was counted and recorded using a microscope. Data were analyzed by one-way analysis of variance (ANOVA) and the mean values were separated using Tukey HSD posthoc statistics.

Results and Discussion

The different doses of Actara 240 SC had significant effect on the abundances of rose aphid at 1, 3 and 7 days after treatment (Table 1; ANOVA, 1day: $F_{4, 10}$ = 87.9, p< 0.001; 3 days: $F_{4, 10}$ = 143.5, p< 0.001; 7days: $F_{4, 10}$ = 122.1, p< 0.001), and the results varied from 1.4±0.2 to 7.1±0.4, 1.2±0.1 to 8.1±0.4 and 1.0±0.1 to 8.5±0.5/shoot, respectively. Roxin 40EC showed significant effect on the abundances of tuberose aphid (Table 2; ANOVA, 1day: $F_{4, 10}$ = 5.2, p<0.01; 3 days: $F_{4, 10}$ = 1.5, p=0.30; 7days: $F_{4, 10}$ = 1.8, p=0.20). The abundances of tuberose aphid at 1, 3 and 7 days after treatment varied from 0.7±0.3 to 2.1±0.2, 0.7±0.4 to 2.1±0.3 and 0.4±0.1 to 1.7±0.4/shoot, respectively. The doses of Actara 25WG showed significant effect on the abundances of marigold aphid at different days after treatment (Table 3; ANOVA, 1day: $F_{4, 10}$ = 165.5, p< 0.001; 3 days: $F_{4, 10}$ = 141.8, p< 0.001; 7 days: $F_{4, 10}$ = 522.7, p< 0.001). The abundances of marigold aphid at 1, 3 and 7 days after treatment varied from 1.5±0.2 to 6.6±0.1, 1.2±0.1 to 7.0±0.3 and 1.0±0.1 to 7.6±0.1/branch, respectively.

Table 1. Effectiveness of different doses of insecticide (Actara 240SC) against rose aphid at different days after treatment

Day after treatment	Abundance of aphid (number/shoot)				
	Control	1.0 ml/L	1.25 ml/L (Farmers' practice)	1.5 ml/L (Recommended)	1.75 ml/L
1 day	7.1±0.4a	3.7±0.2b	2.6±0.1bc	2.1±0.3cd	1.4±0.2d
3 days	8.1±0.4a	3.3±0.2b	2.4±0.1bc	1.9±0.1cd	1.2±0.1d
7 days	8.5±0.5a	2.9±0.2b	2.0±0.1bc	1.7±0.1bc	1.0±0.1c

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different by Tukey HSD posthoc test.

Table 2. Effectiveness of different doses of insecticide (Roxin 40EC) against the tuberose aphid at different days after treatment

Day after treatment	Abundance of aphid (number/shoot)				
	Control	0.5 ml/L	0.75 ml/L (Farmers' practice)	1.0 ml/L (Recommended)	1.25 ml/L
1 day	2.1±0.2a	1.9±0.1ab	1.4±0.3ab	1.1±0.3b	0.7±0.3c
3 days	2.1±0.3a	1.7±0.4a	1.7±0.1a	0.7±0.1b	0.7±0.4b
7 days	1.7±0.4a	1.3±0.1a	0.8±0.1ab	0.4±0.1b	0.4±0.1b

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

Synthetic contact insecticides penetrate into the insect body through cuticle and attack the nervous system and cause death. Feeding of phytophagous insects on the plants treated with systemic and stomach poisons kills them and reduce their

population. Halstead (2000) reported that application of the chemical insecticides Monocrotophos 0.05%, Phosphamidon 0.02% and Dimethoate 0.03% significantly reduced the population of onion aphid, *Neotoxoptera formosana*. Foliar application of Phosphamidon, Dimethoate and Malathion reduced the population of *Aphis durantii*on duranta hedge from 96.7 to 99.8% and reduced the population of *Aphis nerii*on oleander shrubs from 95.7 to 100% (Salem *et. al.*, 2009).The present study showed that the tested doses of Actara 240 SC, Roxin 40EC and Actara 25WG were found statistically effective against the incidences of aphid on rose, tuberose and marigold, respectively.

Table 3. Effectiveness of different doses of insecticide (Actara 25WG) against marigold aphid at different days after treatment

Days after treatment	Abundance of aphid (number/branch)				
	Control	0.10 g/L	0.20 g/L (Farmers' practice)	0.25 g/L (Recommended)	0.30 g/L
1 day	6.6±0.1a	3.5±0.2b	2.6±0.1c	2.1±0.2cd	1.5±0.2d
3 days	7.0±0.3a	3.1±0.2b	2.4±0.1bc	2.0±0.2cd	1.2±0.1d
7 days	7.6±0.1a	2.7±0.1b	2.1±0.1c	1.7±0.1c	1.0±0.1d

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

Table 4. Effectiveness of different doses of insecticide (Tundra 20 SP) against rose thrips at different days after treatment

Day after treatment	Abundance of thrips (number/branch)				
	Control	0.25g/L	0.50 g/L (Farmers' practice)	0.75 g/L (Recommended)	1.0 g/L
1 day	4.8±0.1a	3.4±0.1b	2.7±0.2b	1.8±0.2c	1.1±0.1c
3 days	4.5±0.3a	2.9±0.2b	2.3±0.1b	1.6±0.2c	0.9±0.1c
7 days	4.9±0.2a	2.6±0.1b	2.0±0.1c	1.3±0.1d	0.7±0.1e

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

The tested doses of Tundra 20 SP on the abundance of thrips at different days after treatment showed significant effect (Table 4;ANOVA, 1day: $F_{4, 10} = 67.2$, $p< 0.001$; 3 days: $F_{4, 10} = 44.6$, $p< 0.001$; 7days: $F_{4, 10} = 164.1$, $p< 0.001$). The abundances of thripsat 1, 3 and 7 days after treatment varied from 1.1±0.1 to 4.8±0.1, 0.9±0.1 to 4.5±0.3 and 0.7±0.1 to 4.9±0.2/branch, respectively. The abundances of gladiolus thripsin different doses of Liquor 1.8 ECat 1, 3 and 7 days after treatment varied from 2.1±0.1 to 6.3±0.3, 1.9±0.3 to 8.3±0.5 and 1.6±0.2 to 9.4±0.5, respectively and the results differed significantly (Table 5; ANOVA, 1day: $F_{4, 10} = 74.9$, $p< 0.001$; 3 days: $F_{4, 10} = 90.7$, $p< 0.001$; 7days: $F_{4, 10} = 137.2$, $p< 0.001$). Insecticides are often used to control thrips attacking different crops. Zepa *et al.* (2011) found that Actara 25 WG had the best

performance in reducing tobacco thrips with an efficiency of 97%, followed by Fastac 10 EC having an efficiency of 86%.

Table 5. Effectiveness of different doses of insecticide (Liquor 1.8 EC) against gladiolus thrips at different days after treatment

Days after treatment	Abundance of thrips (number/shoot)				
	Control	1.75 ml/L	2.0 ml/L (Farmers' practice)	2.5ml/L (Recommended)	2.75 ml/L
1 day	6.3±0.3a	4.7±0.2b	4.1±0.2b	2.6±0.1c	2.1±0.2d
3 days	8.3±0.5a	4.2±0.1b	3.8±0.1b	2.3±0.1c	1.9±0.2c
7 days	9.4±0.5a	3.8±0.1b	3.6±0.1b	2.1±0.1c	1.6±0.2c

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

Table 6. Effectiveness of different doses of insecticide (Fenitox 50EC) against dahlia mealy bug at different days after treatment

Day after treatment	Abundance of mealybug (number/shoot)				
	Control	1.5 ml/L	1.75 ml/L (Farmers' practice)	2.0 ml/L (Recommended)	2.5 ml/L
1 day	3.2±0.3a	2.7±0.1ab	1.6±0.1b	0.8±0.1bc	0.8±0.1bc
3 days	3.4±0.3a	2.2±0.1ab	1.6±0.1b	1.6±0.1b	1.2±0.1bc
7 days	3.4±0.2a	1.9±0.1b	1.7±0.1b	1.6±0.1b	1.4±0.1bc

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

Table 7. Effectiveness of different doses of acaricide (Abom 1.8 EC) against rose spider mite at different days after treatment

Day after treatment	Abundance of spider mite (number/shoot) at different treatment doses				
	Control	1.0 ml/L	1.25 ml/L (Farmers' practice)	1.5 ml/L (Recommended)	1.75 ml/L
1 day	8.2±0.2a	2.6±0.1b	2.6±0.1b	1.8±0.1bc	1.4±0.1c
3 days	8.5±0.2a	2.1±0.1b	1.9±0.1bc	1.9±0.1bc	1.7±0.1c
7 days	9.3±0.2a	1.9±0.1b	1.7±0.1b	1.6±0.1b	1.3±0.1b

Data expressed as mean ± SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistics at $p \leq 0.05$.

The tested doses of Fenitox 50 EC showed significant differences on the abundance of dahlia mealy bug at 1, 3 and 7 days after treatment (Table 6; ANOVA, 1day: $F_{4, 10} = 5.4$, $p=0.01$; 3 days: $F_{4, 10} = 15.8$, $p<0.001$; 7days: $F_{4, 10} = 49.6$, $p<0.001$). The abundance of mealy bug at 1, 3 and 7 days after treatment varied from 0.8±0.1 to 3.2±0.3, 1.2±0.1 to 3.4±0.3 and 1.4±0.1 to 3.4±0.2/shoot,

respectively. The present findings showed agreement with Ahmad *et al.* (2011) who sprayed chemical insecticides Acephate, 75SP, Malathion 50 EC and Buprofezin 25SCin cotton field and observed successful control of mealy bug.

The effect of the doses of Abom 1.8 EC on the abundances of rose mite at 1, 3 and 7 days after treatment showed significant difference (Table 7; ANOVA, 1day: $F_{4, 10} = 787.9$, $p< 0.001$; 3 days: $F_{4, 10} = 2771.0$, $p< 0.001$; 7days: $F_{4, 10} = 3364.4$, $p< 0.001$). The abundance of mite at 1, 3 and 7 days after treatment varied from 1.4±0.1 to 8.2±0.2, 1.7±0.1 to 8.5±0.2 and 1.3±0.1 to 9.3±0.2/shoot, respectively. In the present investigation, the recommended dose of Abom 1.8 EC was found very effective against rose spider mite. Patel *et al.* (2009) reported that the chemical pesticide Diafenthiuron 50 WP significantly reduced the population of aphid *Tetranychu surticae*on rose. Shah and Shukla (2014) applied Diafenthiuron 50 WP and Fenazaquin10 EC on gerbera against *T. urticae* and found very effective results.

The present findings showed that the tested doses of the insecticides revealed significantly lower incidence of pest population compared to control. The company recommended doses had better performance compared to farmers' practice. Long time and frequently practicing of lower doses may result pest resistance, so the farmers should apply the company recommended doses of the tested pesticides to control the sucking pests of ornamental plants.

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