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Efficacy of different insecticides against western flower thrips *Frankliniella occidentalis* (Pergande) *(Thysanoptera: Thripidae)* on *Gladiolus* cv. white prosperity

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Abstract

In order to determine the effect of insecticides on the mortality of thrips, present studies were carried out on gladiolus at Floriculture Research Institute, Multan. For this purpose, five new chemistry insecticides viz., Confidor® 20SL (imidacloprid), Tracer® 240SC (Spinosad), Dominex® (Chlorfenapyre), Radiant® 120Sc (Spintoram) and lacenta (Imidacloprid+fipronil) were used. The population of thrips was recorded on leaves at 24 hours before spray and after 24, 72 and 168 hours of spray. Data recorded was modified to percentage mortality on the basis of population of pre-treatment and population on treated plants. Results revealed that maximum mortality (79.52%) at 24 hours after spray was due to lecenta followed by dominex (75.55%), radiant (72.47%) and tracer (66.53%) respectively. Mortality of thrips was reduced at 72 and 168 hours as compared with 24 hours after spray. However lacenta gave good results at all-time intervals against thrips than all other treatment. So it can be recommended and used against thrips in future.

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Introduction

Gladiolus known as queen of the bulbous plants due to its popularity as a cut flower and advantage in floral arrangement Bushman, 1990, is considered as the most important genus with more than 100 wild species of Gladiolus (Greving, 1987; Tombolato *et al.*, 2005; Riaz *et al.*, 2010). In addition to cut flower, blossoms may be used in flower beds such as in rebuilt Monet's garden at Giverny of France (Willery, 2010). Modern Gladiolus have been bred initially from only six species Lewis *et al*, (1972) and Safiullah and Ahmad (2001) evaluated ten hybrid cultivars of gladiolus for their performance in terms of floral characters, corm and cormels production and recommended Deciso, Trader horn, T512, Blad jackp, Rose delight, Nova lux and Mary housley for general cultivation.

Besides their aesthetic value, gladiolus can contribute to the economy by earning and saving valuable foreign exchange. Coetzee (2002) stated that the Netherlands earns more from South African flowers than South Africa earns from its gold. Various studied has been conducted to evaluate the performance of both local and exotic cultivars of gladiolus cultivars for general cultivation (Ahmad, *et al.*, 2002; Kem, *et al.*, 2003; Ram, *et al.*, 2005). Performance was based on the basis of number of corms and cormlets per plant. Rao and Janakiram (2006) studied on the performance of gladiolus cultivars and found that plant height, spike length and rachis length were maximum in Dhiraj while Maximum floret size was recorded in Kumkum whereas the maximum number of florets per spike in Dhiraj. Chopde *et al.* (2012) evaluated eight varieties of gladiolus for flower and corm production and inferred that varieties Psittacinus Hybrid and Phule Tejas were superior in respect of quantitative yield of spikes and corms, whereas for quality production of spikes and corms, the varieties Phule Ganesh, Pink Perfection, Monte Alto and Phule Neelrekha were found better than the other varieties of gladiolus.

Today, the western flower thrips (WFT), *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) is one of the most significant agricultural pests globally because of the damage it is able to inflict on a wide range of crops. Adults and nymphs feed by piercing plant tissues with their needle-shaped mandible and draining the contents of punctured cells (Kirk, 1997). Oviposition can produce a wound response in fruiting structures, which reduces the marketability of certain horticultural produce (Childers, 1997). According to Milevoj *et al.*, 2008 [16] gladiolus thrips (Thrips simplex) is a common pest of gladioli. The insect causes damage to leaves, flower stalks and buds by sucking. Use of chemical insecticides gives quick knock down effects against insect pest. Farmers also rely on use of insecticides to knock down WFT.

Chemical control method of western flower thrips is regarded as most fluently implemented method to control this invasive pest in field conditions, importantly for ornamental plants. Management of thrips basically depends on the implementation of pesticides, as mentioned in previous publications (Cloyd, 2009; Demirozer *et al.*, 2012). According to [15](Childers, 1997) all three insecticides (Acephate, Bifenthrin, and Spinosad) were effective in keeping the thrips infestation below a predetermined level, five thrips per plant, but Bifenthrin required the most number of applications to do so. New chemistry insecticides were used especially against thrips on gladiolus.

Application of broad spectrum insecticides counting organophosphates, pyrethroids, carbamates and neonicitinoids knock down native thrips species and natural enemies [17,18,19,20](Morse and Hoddle, 2006; Cloyd, 2009; Demirozer *et al.*, 2012; Funderburk *et al.*, 2016). While on the other hand Spinosad delivers reduced insecticide risk for natural insect predators and provide efficient control of WFT (Cloyd, 2009). Narrow -spectrum insecticides including lufenuron and pyridalyl also provide excellent control of WFT but the repeated applications of narrow and broad spectrum insecticides lead to the development of resistance (Jensen, 2000; Bielza, 2008;Gao *et al.*, 2012). Application of insecticides in rotation form exposed in formal publications reduces the development of resistance in WFT (Bielza, 2008; Gao *et al.*, 2012). However, insecticides should be implemented in precise and accurate form when economic damage threshold reached and conserving the insect predators.

Keeping in view significance of application of insecticides against flower thrips the aim of current study to find out most effective insecticide against flower thrips. This information could be helpful in developing the integrated pest management strategies for thrips.

Materials and method

Insecticidal Trial

Field study was carried out during 2015 and 2016 at Horticultural Research Subsation for Floriculture and Landscaping, Multan to determine the efficacy of five insecticides against thrips. These insecticides included Confidor® 20SL (imidacloprid), Tracer® 240SC (spinosad), Dominex® (chlorfenapyar), Radiant® 120Sc (spintoram) and lacenta (imidacloprid +fipronil). Calibration was done before the spray for measuring the quantity of water required for treatments' application. Crop was sprayed with power knapsack sprayer. The insecticides were sprayed at their recommended doses, whereas a check plot was also maintained for comparison. Data regarding the population of thrips were recorded before spray and 24, 48, 72 and 168 h after treatment. Performance of these insecticides was assessed on the basis of percent population reduction of thrips. Percent population reduction was calculated by the following formula:

$$\% \text{ Reduction} = \frac{\text{Population before spray- Population after spray}}{\text{Population before spray}} \times 100$$

Statistical analysis

The data regarding percent population reduction of thrips were subjected to ANOVA technique to determine the level of significance of evaluated treatment. The means of significant treatments were compared by LSD test.

Treatments

Insecticides	Common name	Trade name	Dose/120liter of water (ml/g)
1	Imidaclopid 20Sl	Confidor	120
2	Spinosad 240SC	Tracer	50
3	Spintoram 120SC	Radiant	60
4	Chlophenapyre	Dominex	1205
5	Imidacloprid+Fipronil	Lacenta	60
6	Control		

Results

Effect of different insecticides on percentage mortality of thrips on gladiolus cv. white prosperity

Mortality Effect of insecticides against thrips was determined at three different post treatments intervals. The details of results are given as under:

Mortality of thrips 24 hours post treatment

The present study results revealed the efficacy of different insecticides i.e. Confidor® 20SL (imidacloprid), Tracer® 240SC (spinosad), Dominex® (chlorfenapyar), Radiant® 120Sc (spintoram) and lacenta (imidacloprid+fipronil) against the whitefly in the field conditions. The insecticide lacenta induced maximum highly significant WFT mortality (79.52%). In the same manner dominex, radiant and tracer induced significant mortality (75.s%, 72.47% and 66.53%) respectively. While the confidor cause minimum mortality percentage rate (57.85%) when we compare the results of all used insecticides in experiment. The results further explained that all insecticides were more effective in controlling thrips population as compared with control treatment. During year 2nd year of study similar results were obtained, lacenta again proved to be highly insecticide with 82.53% mortality followed by Dominex i.e 73.3% and tracer with 62.54% mortality.

Table 2. Percentage mortality of thrips 24, 72 and 168 hours after treatment during 2017.

Trade name	Common name	Dose per acre	24h	72h	168h
Confidor	Imidaclopid 20Sl	120ml	66.53d	74.68c	62.21d
Tracer	Spinosad 240SC	50ml	75.55b	82.36b	67.94b
Radiant	Spintoram 120SC	60ml	72.47c	81.04b	66.29c
Dominex	Chlophenapyre	120ml	57.85e	62.74d	54.88e
Lacenta	Imidacloprid +Fipronil	60g	79.52a	87.33a	74.44a
Control	-	-	-4.70f	-7.23e	-12.90e
LSD VALUE@5%			2.62	4.93	1.63

Table 2. Percentage mortality of thrips 24, 72 and 168 hours after treatment during 2017.

Trade name	Common name	Dose per acre	24h	72h	168h
Confidor	Imidaclopid 20Sl	120ml	62.54d	71.03c	59.23d
Tracer	Spinosad 240SC	50ml	73.30b	80.76b	67.80b
Radiant	Spintoram 120SC	60ml	69.43c	81.13ab	64.40c
Dominex	Chlophenapyre	120ml	55.84e	61.80d	53.70e
Lacenta	Imidacloprid+Fipronil	60g	82.53a	84.63a	73.43a
Control	-	-	-4.76f	-8.60e	-13.76f
LSD VALUE@5%			3.36	3.52	3.30

Table 2. Mean population of thrips 24, 72 and 168 hours after treatment.

Trade name	Common name	Dose per acre	Pre-treatment	24 hours	72 hours	168 hours
Confidor	Imidaclopid 20Sl	120ml	7.0	7.5	8.1	9.4
Tracer	Spinosad 240SC	50ml	5.7	6.5	7.0	8.9
Radiant	Spintoram 120SC	60ml	6.2	6.8	7.8	8.6
Dominex	Chlophenapyre	120ml	5.8	6.1	6.8	7.0
Lacenta	Imidacloprid +Fipronil	60g	5.0	5.4	6.1	7.8
Control	-	-	7.5	9.1	10.5	12.3

Mortality of thrips 72 hours post treatment

After 72 hours of insecticide application lacenta (imidacloprid+fipronil) induced maximum mortality 87.33%, followed by 82.36% due to Dominex (chlorfenapyar), followed by Radiant and tracer with 81.04 and 74.68% mortality respectively. However minimum mortality was observed in the treatment where Confidor was applied with the 62.74% mortality. During 2nd year of study lacenta again showed the maximum mortality i.e. 84.63% followed by Radiant and Dominex with the 80.7 and 81.1% mortality. While confidor again showed least mortality i.e. 61.80%. However the overall all insecticides during this interval showed maximum reduction of thrips as compared to 24 hours and 168 hour after application.

Mortality of thrips 168 hours post treatment

During the 168 hours after application lacenta proved more effective with 74.44 mortality as compared to Dominex with 67.94% and 62.21% mortality. Confidor showed the least reduction in population of thrips on gladiolus. During 2nd year of study similar results were obtained lacenta proved highly effective with maximum mortality followed by 73.3% followed by Dominex and Radiant with 67 and 64% mortality respectively.

Pre and post population of thrips

Population of thrips before spray was nearly similar in all treatments. It was in the range of 5.0 to 7.5/bud. After spray there was decrease in population of thrips except in control treatment after 24, 72 and 168 hours post treatment intervals. So all the treatments proved better in controlling thrips as compared with control because in control an increase in thrips population was observed from pre to post treatment intervals.

Discussion

The results of present study demonstrated that insecticides induced different mortalities in thrips on Gladiolus buds. These mortalities also differed with respect to different time intervals. In the present study we have tested five different insecticides against thrips and compared their mortalities with control. These insecticides included Confidor® 20SL (imidacloprid), Tracer® 240SC (spinosad), Dominex® (chlorfenapyar), Radiant® 120Sc (spintoram) and lacenta (imidacloprid+fipronil).

Chemical control method of western flower thrips is regarded as most fluently implemented method to control this invasive pest in field conditions, importantly for ornamental plants. Management of thrips basically depends on the implementation of pesticides, as mentioned in previous publications (Cloyd, 2009; Demirozer *et al*., 2012). According to Childers, (1997) all three insecticides (Acephate, Bifenthrin, and Spinosad) were effective in keeping the thrips infestation below a predetermined level, five thrips per plant, but Bifenthrin required the most number of applications to do so. New chemistry insecticides were used especially against thrips on gladiolus.

The results of present studies demonstrated least effectiveness of Confidor® 20SL (imidacloprid) as compared with other tested insecticides. These findings exhibited that the due to repeated use of imidacloprid, the target insects have developed resistance against imidacloprid than other insecticides. However, combination of fipronil and imidacloprid provided very effective in controlling thrips population.

Results further revealed that maximum mortality (79.52%) at 24 hours after spray was due to lecenta followed by dominex (75.55%), radiant (72.47%) and tracer (66.53%) respectively. Mortality of thrips was reduced at 72 and 168 hours as compared with 24 hours after spray. However, lacenta gave good results at all-time intervals against thrips than all other treatment. Lacenta is mixture of fipronil and imidacloprid, while formulation of dominex is chlorfenapyre and it can be recommended against thrips in future.

Conclusion

Lacenta (imidacloprid+fepronil) yielded good results at all-time intervals against thrips than all other treatments. So it can be recommended and used against thrips in future. These findings will facilitate the selection of insecticides for effective control of thrips on gladiolus and other flowering plants.

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