FIELD EFFICACY OF BIOPESTICIDES AND PESTICIDE COMBINATIONS AGAINST WHITEFLY INFESTING GERBERA

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ABSTRACT: Whiteflies (Trialeurodes vaporariorum) are one of the most intricate pests to control in gerbera grown under polyhouse conditions. Whiteflies have shown an ability to develop resistance to many pesticides so an attempt was made to test various pesticide biopesticides combinations. To test the efficacy of some pesticide, biopesticides, their combinations and cow urine extract against whitefly in gerbera an experiment was designed at Badamawala polyhouse, Vikasnagar Dehradun during 2011. An experiment was conducted in polyhouse conditions to evaluate and compare the effectiveness of synthetic pesticides (Imidacloprid-T_1 and T_2, Acetamiprid-T_3 and T_4), biopesticides (NeemAzal-T_5), their combinations (T_6-T_1+T_5, T_7-T_3+T_5) and extract containing cow urine and garlic paste (T_8). Whitefly population was assessed by randomly selecting 5 flowers along with stem and leaves for each replicate just before the spray (pre count) and 1st, 5th, 7th and 10th day after spray (post count). Monitoring the population during the test period revealed that all the treatments were found superior over the control as per mean whitefly population count. In addition the spray of cow urine extract also showed results parallel with the treatment T_5. Besides the extract of cow urine fermented with garlic extract showed good efficacy against white fly suggesting a prospect for organic production of gerberas in India.

KEY WORDS: Gerbera, white fly, efficacy, biopesticides.

Polyhouse cultivation of flowers in India is of latest origin and is being gradually practiced for production of quality produce for export. Gerbera L. is a genus of ornamental plants from the sunflower family. In polyhouses gerbera is highly susceptible to various pests and diseases. Among them whiteflies, spider mites, cut worm and leaf miners takes the major share in reducing the flower yield. White flies are the major pests of greenhouse crops. They attack more than 500 species of food, fiber and ornamental plants such as gerbera and cause crop losses which amounts to hundreds of millions of dollars as informed by (Gerling & Mayer, 1996*)*. When there infestation becomes excessive, the most noticeable symptom is a yellow tinge on the daisy's leaves. They attach themselves as pupa to the underside of a gerbera daisies leaves. When they mature, they inhibit the daisy's bloom growth by draining it of its sap and other vital nutrients. They reproduce quickly, like to hide on parts of the plant which makes it hard to reach when spraying and have certain stages which are not susceptible to chemicals.

A wide range of pesticides are used in the cultivation of gerbera (Cresswell et al., 1994; George et al., 1994). But pesticides cause toxicity to humans and warm-blooded animals and may also kill the beneficial insects. Therefore, there is a need to use biopesticides and various pesticide biopesticides combinations which are effective, biodegradable and do not leave any harmful effect on the environment. Few studies have been cited in the literature where biopesticides were used for the control of white flies. The effective use of biopesticide for the control of white flies was shown by a group of researchers. (George et al., 2007; Menke & Gerhard, 2010).

Imidacloprid and Acetamiprid are the commonly used pesticides in the control of whitefly in gerbera but they have shown reduced flower production and

residual problems when used at recommended and double the recommended dose. Currently most of the works about pesticides in gerbera is focused on the study of fate of these pesticides in gerbera. The studies related to the pesticide fate were shown by various groups of researchers. (Oliver & Meyhofer, 2008; Hatzilazarou et al., 2004; Romero et al., 2011; Benson & Parker, 2011). But the information regarding bioefficacy of various pesticides and biopesticides combinations are limited. Various pesticide and biopesticide combinations for the control of pests were tried by different research groups (Khanapara & Kapadia, 2011; Meena & Khan, 2006, Olaitan & Abiodun, 2011). Due to incomplete literature found on the study of pesticides biopesticides combination in gerbera plantation a study was initiated to study the field efficacy of various pesticide and biopesticides combinations against whitefly in gerbera grown in poly house conditions.

MATERIALS AND METHODS

Working solutions

For the field studies, Acetamiprid (Prime 20 SP) and Imidacloprid (Confidor 200 SC) and the biopesticide Neem Azal (T/S 1%) were procured from the local market.

Cow urine garlic extracts preparation

25 g of garlic paste is added to 5 litres of cow urine and 5 litres of water. The mixture is mixed well and kept for fermentation for 5 days. The mixture is filtered and mixed with 10 litres of water containing 2 tablespoons of liquid detergent.

Trials

A field trial was conducted to study the bioefficacy of the biopesticides alone and in combination with pesticides in polyhouse conditions at Paachamiwala farm, Vikasnagar, Dehradun, Uttarakhand, India during 2011 with eight different treatments replicated thrice. The treatments were laid in complete randomized block design with three replicates. For these experiments flower beds of yellow flowers were selected. The spacing between the rows should be 30-40 cm and 25-30 cm within the row accommodating 8-10 plants/m^2.The experiment was carried out with 8 different treatments (T_1-Imidacloprid, recommended dose T_2-double the recommended dose,T_3-Acetamiprid, recommended dose T_4-double the recommended dose, T_5-NeemAzal, T_6=T_1+T_5 and T_7=T_3+T_5) and T_8=Cow urine and garlic paste. The treatments were imposed using Knapsack sprayer. The selected plants were heavily infested with whiteflies. Spray was done during day time with temperature averaging 30-35°C. Whitefly population was assessed by randomly selecting 5 flowers along with stem and leaves for each replicate. Unsprayed plots were included as control.

The white fly on the leaf were recorded with the help of 10 X hand lens. The growth parameters like total number of good flowers, diameter of opened flower and quality of flowers like unopened, discolored and malformed flowers were observed. The mean populations of whitefly were worked out and the data were arc sine transformed and tabulated to deduce the results.

RESULTS

The efficacy ratings presented here are based on the results of field studies. The bioefficacy of biopesticides alone and in combination with insecticides against whitefly was tested under polyhouse conditions. The experimental data tabulated in Table 1 showed significant reduction in white fly population in all the

treatments over the control. All the treatments were found significantly superior showing high mortality of whitefly with respect to the control. Among the treatments T_7 and T_6 showed superior efficacy on bringing down whitefly population followed by treatment T_2, T_1, T_4, T_3, T_5 and T_6. A single spray with treatment T_6 killed all the nymphs in 10 days without apparent damage to the plants. The results revealed that there was a significant difference in percentage reduction at each observation days. After 1st day, the treatment T_4 showed highest percentage reduction (81.34% reduction) followed by T_2, T_6 and T_7.Data recorded after 5 days have shown T_6 (84.34% reduction) to be superior followed by T_2 and T_4. After 7th and 10th day treatments T_7 and T_6 produced better results (90.86 and 88.71% reduction respectively). The compiled results thus show that the biopesticide and pesticide combinations have shown better results in percentage reduction of whitefly as compared to the pesticide taken alone. The efficacy study with treatment T_8 is at par with the treatment T_5 which suggest that treatment T_8 can be developed as an effective biopesticide after selecting a suitable ratio and preparing an emulsified solution.

Growth parameters were also recorded to see the overall effects of the combination products of pesticides and biopesticides. Results of various growth parameters like flower yield, diameter, stalk length and vase life are tabulated in Table 2. The data presented in Table 2 revealed that Treatment T_7 and T_6 showed comparative better results as far as flower yield, diameter, stalk length and vase life is concerned. The results tabulated in table 2 have shown that there were 245flowers/sq mt in case of treatment T_6 and 244 flowers/sq mt for treatment T_7 as compared to 95 flowers/ sq mt in case of control. When the diameters and stalk length of the flowers were compared the pesticide biopesticide combinations have shown a healthy flower (diameter 11cm both for treatment T_6 and T_7 and stalk length 46 and 48 cm for T_6 and T_7) respectively as compared to the control which was infested with whitefly. Even the vase life of the flower in plot treated with T_6 and T_7 was 9.5 and 10.5 days respectively.

DISCUSSION

The promising effect of pesticide biopesticide combinations against whitefly which have increased the yield in the present investigation agreed with the finding of one of the research group (Khanapara & Kapadia, 2011). According to their findings the combinations of pesticide biopesticide were effective against Helicoverpa armigera on pigeonpea. Meena & Khan (2006) has also shown positive results when pesticide biopesticide combinations were taken against Spilaretia oblique on Soyabean.

Similar study using pesticide biopesticide combinations were done by Boricha et al. (2010) where various combinations were effectively used against whitefly infesting cotton. Results shown by treatment T_8 were also at par with treatment T_5 which indicates that mixture of cow urine and garlic paste at various ratios can prove to be an effective biopesticide. Whitefly population can be controlled and managed effectively and economically by applying well emulsified solution of cow urine and garlic paste. The quantitative data indicates that the biopesticides if used in combinations with synthetic pesticide showed best result in controlling the whitefly population without apparent damage to plants. These treatments also maximized the marketable flower yield.

CONCLUSION

On the basis of results obtained from field trials among the pesticide/biopesticides applied, Treatment T_6 and T_7 significantly reduced the whitefly population. Treatments T_8 were also found to be effective compared to untreated control. Half dose of chemicals along with half dose of botanicals reduces the pesticide load on the crop and also cost of the treatment which in turn safeguards the natural enemies. The combinations if used will lower the cost of production incurred by farmers, allow increase of whitefly natural enemy and reduce resistance developed by pest to the synthetic pesticides. Hence, the mixture of the new molecules with botanicals and mycopathogens can be included in the IPM strategy in gerbera cultivation.

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Table 1. Effect of pesticides and biopesticides and their combinations on the population of white flies in Gerbera at Paachamiwala farm Vikasnagar, Dehradun Uttarakhand.

Treatments	Dosage	% Reduction in Whitefly population			
		1st DAS	5th DAS	7th DAS	10th DAS
T_1	0.5 ml/l	70.52(57.11)	75.54(60.35)	82.06(64.94)	84.7(66.97)
T_2	1 ml/l	76.54(61.029)	82.06(64.94)	84.32(66.67)	85.97(68.97)
T_3	0.4 g/l	74.16(59.44)	79.71(63.22)	79.32(62.95)	80.63(63.47)
T_4	0.8 g/l	81.34(64.40)	81.56(64.56)	84.08(66.48)	84.86(67.10)
T_5	3ml/l	68.37(55.57)	71.23(57.56)	74.84(59.59)	76.81(61.21)
T_6	1:3 v/v	75.65(60.4)	84.34(66.68)	85.16(67.34)	88.71(70.36)
T_7	1:3 v/v	74.26(59.51)	75.18(60.11)	85.56(67.66)	90.86(72.40)
T_8		64.32(53.32)	73.32(58.90)	74.36(59.57)	75.96(60.63)
Control		8.32(16.76)	8.36(16.80)	8.4(16.84)	8.42(16.86)

DAS-Days after spray

Figure in paranthesis are arc sin√p values

Table 2. Growth Parameters of flowers with different treatments.

Growth parameters of Flowers	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	Untreated Control
Flowers/sq.mt	240	242	232	236	156	245	244	152	95
Diameter cm	8.5	8.0	9	7.5	9	11	11.6	9	7
Stalk length cm	32	36	40	38	36	46	44	30	29
Vase life days	8.5	9.0	8.0	8.2	8.0	9.5	10.5	7.5	6.5