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Bio-efficacy of newer insecticide molecules against whitefly (*Bemisia tabaci*)

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Abstract
Bio-efficacy of newer insecticides molecules against whitefly (*Bemisia tabaci*) were carried out during *Rabi* season of 2021-22 at the research cum instructional farm of department of Entomology, Indira Gandhi Krishi Viswavidyalaya, Raipur (C.G.). Efficacy of different treatments *viz*., Sulfoxaflor 3.7% + Bifenthrin 11.2% SC at three different doses of 22+67, 30+90, and 37+114 g. a.i. /ha along with single dose of Sulfoxaflor 24% Sc (37 g. a.i. /ha), Bifenthrin 10% SC (114 g. a.i/ha), Fenvalerate 20.0% EC (100 g. a.i. /ha), and Cypermethrin 25.0% EC (50) g. a.i. /ha reveled that all the treatment were found significantly effective in reducing the population of whitefly. The most effective treatment in reducing the population of whitefly was Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ha followed by Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha. The Cypermethrin 25.0% EC (50) g. a.i. /ha was found less effective but it was significantly superior over control.

Keywords: Bio-efficacy, insecticides, whitefly, brinjal

Introduction
Brinjal (*Solanum melongena* L.) belongs to the family of Solanaceae which is a very important vegetable crop grown in all seasons. Brinjal is considered to be the king of vegetables. Brinjal is also known as eggplant and it's the second most important solanaceous crop after tomato in the genus Solanum. It is also called aubergine (French word) in Europe. Eggplant is a member of the "Solanaceae" family, which includes over 2450 species divided into 95 genera (Mabberley, 2008) [4].
It is one of the very important vegetable crops grown in India and other parts of the world (Singhal, 2003) [8]. The worldwide production of brinjal is 54,077,210 Mt. (FAOSTAT 2019) [2]. China is the largest producer of brinjal and contributes about 68.7 percent of the world's brinjal production while India occupies second in production with a share of 23.3 percent. India has the second rank in both area and production in all brinjal growing country. The brinjal is of much importance in the warm areas of the far East, being grown extensively in India, Bangladesh, Pakistan, China, and the Philippines. It is also popular in Egypt, France, Italy and the United States. The largest brinjal producing states in India are Andhra Pradesh, Karnataka, Tamil Nadu, Odisha, West Bengal, Madhya Pradesh, Bihar, Jharkhand, Uttar Pradesh and others (Anonymous, 2008) [1].
The top five brinjal producer countries in the world are China (34.10 million tons), India (12.82 million tons), Egypt (1.40 million tons), Turkey (0.83 million tons), and Iran (0.7 million tons). In the Mediterranian and Asia, brinjal ranks among the top 5 most important vegetable crops (Frary *et al.*, 2007) [3]. Brinjal is grown on 37.94 thousand hectares in Chhattisgarh, with an annual production of 691.25 thousand metric tonnes (NHB Database 2019-20). This important crop is attacked by various insect pests right from nursery stage till harvesting *viz.*, shoot and fruit borer, *Leucinodes orbonalis Guenee*, jassid, *Amrasca biguttula biguttula* Ishida, aphid, *Aphis gossypii* (Glov.), white fly, *Bemisia tabaci* (Genn.), hadda beetle, *Epilachna* spp. (Fab.) and egg plant mealy bug, *Centrococcus insolitus* (Ferris.) (Regupathy *et al.*, 1997) [7]. The loss caused by sucking pests varies from 10-15 per cent depending on the intensity of infestation (Munde *et al*., 2011) [6]
Keeping in view of the seriousness of the pest and economic importance of this crop, the present investigation was planned to evaluate the efficacy of various newer insecticides against jassid under field condition.

Materials and Methods

The experiment was conducted at the research cum instructional farm of department of Entomology, Indira Gandhi Krishi Viswavidyalaya, Raipur (C.G.). Raipur is located in Chhattisgarh's mid-eastern region, with latitude of 21.160 North and 81.360 East, at a height of 289 meters above mean sea level. The total area of 20×24 m2 was laid out in uniformly sized plots measuring 5 m x 4 m (20 m2) with 24 plots for experiments. The brinjal variety "VNR-212" was used for the experiment. The treatments of different insecticides *viz.*, Sulfoxaflor 3.% + Bifenthrin 11.2% SC at three different doses of 22+67, 30+90, and 37+114 g. a.i. /ha along with single dose of Sulfoxaflor 24% Sc (37 g. a.i. /ha), Bifenthrin 10% SC (114 g. a.i/ha), Fenvalerate 20.0% EC (100 g. a.i. /ha), and Cypermethrin 25.0% EC (50) g. a.i. /ha were applied on appearance of sucking pests and subsequent spray were given at 15 days interval using manually operated knapsack sprayer. The observations on total number of whiteflies was recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before treatment and 1, 3, 7, 10 and 14 days after first, and second application of insecticides.

Results and Discussion

It is indicative from the data presented in the Table 1 and depicted in fig. 1 that mean whitefly population before application of treatment was consistent among different treatments as the data are statistically non-significant whereas, all the insecticides were found to be significantly superior over untreated control in reducing the population of whitefly at 1, 3, 7, 10 and 14 days after application of insecticides as well as overall pooled data.

After two sprays of newer insecticides the treatment for the management of whitefly revealed that Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ha (1.59 whiteflies/plant) was most effective followed by Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha (2.21 whiteflies/plant), and Sulfoxaflor 24% Sc (37) g. a.i. /ha (3.30 whiteflies/plant). The treatment Cypermethrin 25.0% EC (50) g. a.i. /ha (7.11 whiteflies/plant) proved least effective.

The maximum reduction of whiteflies population was recorded in the Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ha (1.59 whiteflies/plant) treatment followed by Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha (2.21 whiteflies/plant), Sulfoxaflor 24% Sc (37) g. a.i. /ha (3.30 whiteflies/plant), and Fenvalerate 20.0% EC (100) g. a.i. /ha (4.25 whiteflies/plant) treated plots. The minimum reduction was found in the plots treated with Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (22+67) g. a.i./ha (5.12 whiteflies/plant), Bifenthrin 10% SC (114) g. a.i/ha (6.34 whiteflies/plant), and Cypermethrin 25.0% EC (50) g. a.i./ ha (7.11 whiteflies/plant). Reported that Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ ha. was highly effective followed by Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha.

The descending order of effectiveness of treatments on the basis of mean pest population reduction was: Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ha > Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha > Sulfoxaflor 24% Sc (37) g. a.i. /ha > Fenvalerate 20.0% EC (100) g. a.i. /ha > Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (22+67) g. a.i./ha > Bifenthrin 10% SC (114) g. a.i/ha > Cypermethrin 25.0% EC (50) g. a.i. /ha

Table 1: Bio-efficacy of newer insecticide molecules against whitefly (*Bemisia tabaci*) Conclusion

S. No.	Treatments	Dose g a.i./ha	Average no. of Whitefly/ 5 leaves/ 5 plant											
			First spray						Second spray					
			PTO	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	Over all Mean
T_1	Sulfoxaflor 3.7% + Bifenthrin 11.2% SC	22+67	11.25 (3.49)	3.89 (2.21)	3.54 (2.12)	4.12 (2.25)	5.06 (2.46)	6.26 (2.69)	3.92 (2.21)	4.77 (2.40)	5.56 (2.56)	6.89 (2.80)	7.21 (2.86)	5.12
T_2	Sulfoxaflor 3.7% + Bifenthrin 11.2% SC	30+90	10.44 (3.38)	2.91 (1.97)	1.98 (1.72)	1.53 (1.59)	1.73 (1.64)	2.16 (1.77)	1.99 (1.72)	2.17 (1.77)	2.36 (1.83)	2.49 (1.86)	2.76 (1.92)	2.21
T_3	Sulfoxaflor 3.7% + Bifenthrin 11.2% SC	37+114	10.02 (3.31)	2.71 (1.92)	2.11 (1.76)	1.46 (1.56)	1.63 (1.62)	1.91 (1.70)	1.63 (1.61)	1.45 (1.56)	1.31 (1.51)	1.08 (1.44)	0.63 (1.27)	1.59
T_4	Sulfoxaflor 24% SC	37	10.95 (3.45)	3.82 (2.19)	3.51 (2.11)	2.81 (1.94)	3.19 (2.04)	3.91 (2.21)	2.49 (1.86)	2.33 (1.82)	2.98 (1.99)	3.61 (2.13)	4.36 (2.30)	3.30
T_5	Bifenthrin 10% SC	114	12.25 (3.63)	4.56 (2.35)	4.21 (2.27)	5.06 (2.46)	6.12 (2.66)	7.21 (2.86)	5.45 (2.53)	6.12 (2.66)	7.03 (2.83)	8.24 (3.03)	9.41 (3.22)	6.34
T_6	Fenvalerate 20.0%EC	100	11.12 (3.47)	4.12 (2.25)	3.81 (2.18)	3.49 (2.11)	4.11 (2.25)	5.23 (2.49)	3.58 (2.13)	3.23 (2.05)	4.28 (2.29)	5.12 (2.47)	5.52 (2.53)	4.25
T_7	Cypermethrin 25.0% EC	50	12.65 (3.69)	4.12 (2.25)	5.21 (2.48)	6.36 (2.70)	7.79 (2.96)	8.99 (3.16)	5.89 (2.62)	6.41 (2.71)	7.83 (2.96)	8.67 (3.10)	9.81 (3.28)	7.11
T_8	Untreated control	-	11.29 (3.50)	12.22 (3.63)	12.87 (3.72)	12.65 (3.69)	13.13 (3.75)	14.24 (3.90)	15.02 (4.00)	14.45 (3.92)	15.34 (4.03)	16.11 (4.13)	16.92 (4.23)	14.30
SE(m)			-	0.33	0.44	0.45	0.33	0.36	0.46	0.51	0.46	0.46	0.60	0.88
CD at 5%			NS	1.02	1.36	1.39	1.03	1.11	1.41	1.56	1.42	1.40	1.84	2.51

Note: Figure in parantheses are square root transformed values, NS = Non significant, PTO = Pretreatment observation, DAS = Days after spray

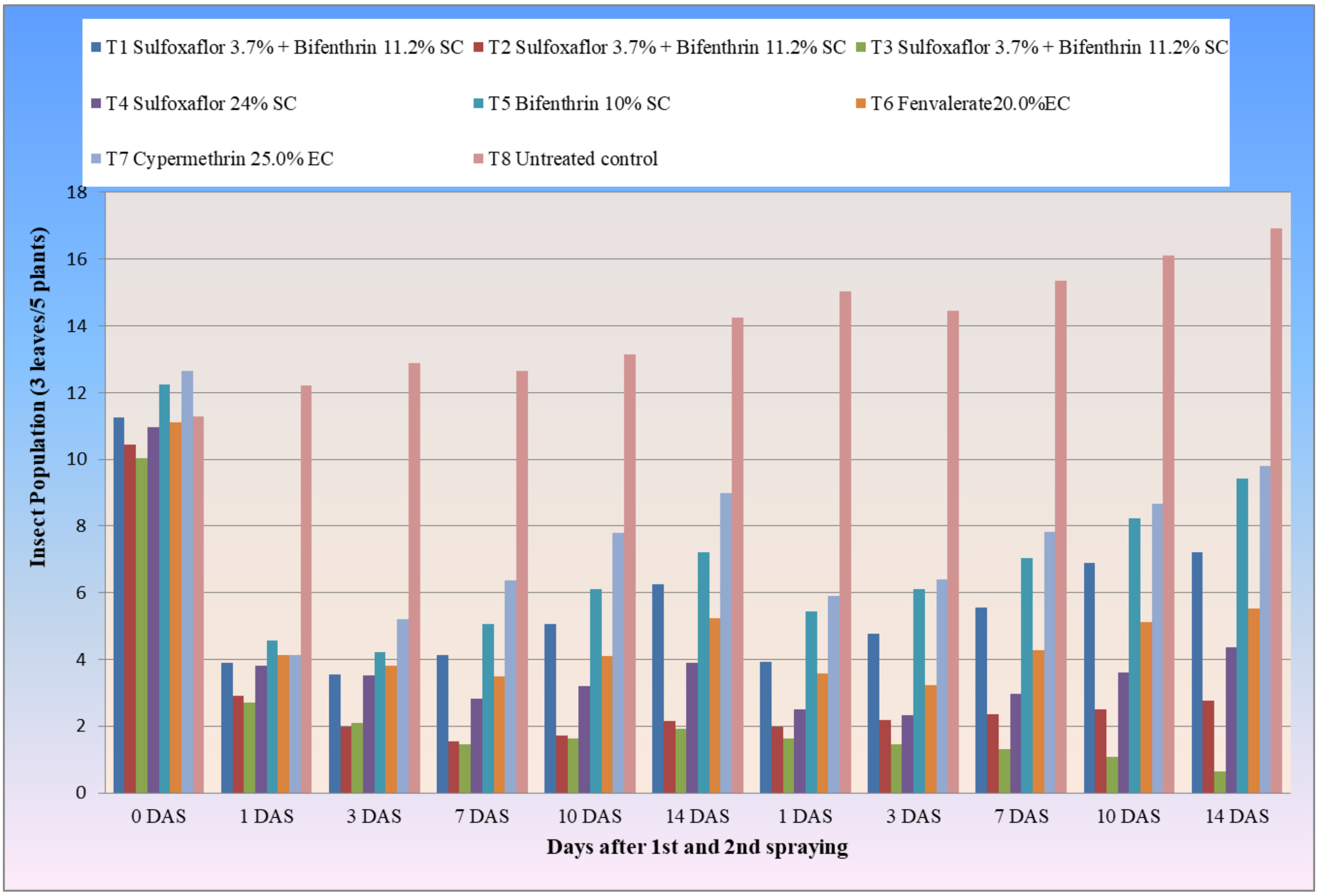

Fig: Bio-efficacy of newer insecticide molecules against white fly (*Bemisia tabaci*)

Conclusion

The present study concluded that among the seven treatments, all the insecticide treatments were more effective than control in reducing the whitefly, treatments (T3) Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (37+114) g. a.i./ha was found to be the best treatment against whitefly of brinjal followed by (T2) Sulfoxaflor 3.7% + Bifenthrin 11.2% SC (30+90) g. a.i./ha. The maximum population of whitefly was observed in untreated control (T8).

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