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Original Research Article

Effect of Newer Neonicotinoids on Red Spider Mites

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A B S T R A C T

The study on effect of newer neonicotinoids on red spider mites carried out under field condition in Department of Agricultural Entomology, VNMKV, Parbhani during the year 2015-16 and 2016-17. Pooled data on 1, 3, and 7 DAS showed that dimethoate was the most superior treatment for controlling red spider mites infesting brinjal. Whereas, the significantly highest population of mites *i.e.* more than untreated control was recorded in imidacloprid 17.8 SL, acetamiprid 20 SP, flonicamid 50 WG, clothianidin 50 WDG, thiamethoxam 25 WG, and dinotefuran 20 SG. Pooled data on 14 days indicated that the treatment dimethoate 30 EC recorded minimum red spider mite population (5.92 mites/4 cm^2 leaf area) while imidacloprid 17.8 SL showed highest mite population (13.25 mites/4cm^2 leaf area) than untreated control (10.38 mites/4 cm^2 leaf area). Next to that the highest population mites was observed in the treatment acetamiprid 20 SP, flonicamid 50 WG, clothianidin 50 WDG, thiamethoxam 25 WG, and dinotefuran 20 SG, respectively (12.82, 12.07, 11.50, 11.43 and 11.23 mites/4cm^2 leaf area), which was also more than untreated control plot.

Keywords

Brinjal, Red spider mites, Neonicotinoids, Efficacy

Introduction

Brinjal or eggplant (*Solanum melongena* L.) is an important Solanaceous crop of subtropics and tropics. Brinjal has been cultivated in India for the last 4,000 years and is often thought of as a Mediterranean or Mid-Eastern vegetable. The brinjal is of much importance in the warm areas of Far East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. It is also popular in Egypt, France,

Italy and United States. It is known as a "King of vegetables" originated from India where a wide range of wild types and land races occurs (Thompson and Kelly, 1957).

It is the third most important vegetable crop grown throughout the year in all parts of India and contributes 17.8 per cent of the total production of vegetables in the country. Further, it is a popular vegetable in China, Turkey, Syria, Egypt, Indonesia, Philippines, Thailand, France, Taiwan, Italy and USA. In India, brinjal is cultivated on an area of 664 thousand ha with an annual production of 12552 thousand million tonnes with productivity of 18.9 tonnes ha^{-1} during 2015-16. The total area under brinjal cultivation is 26.7 thousand ha in Maharashtra producing 543.9 thousand million tonnes annually with productivity of 20.4 tonnes fruits ha^{-1}. The west Bengal is a

leading state in brinjal production (2,985.4 thousand MT) and area (161.9 thousand ha) in India. The major brinjal producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Karnataka and Uttar Pradesh (Anon., 2017).

In India, brinjal is widely cultivated in 8 states, practically on all soils from light sand to heavy clay and in almost all eight vegetable growing zones including Maharashtra- Madhya Pradesh. Although several varieties of brinjal are cultivated, the expected yield of the crop is not achieved so far because of the crop damage caused by the insect pests. Insect pests are most limiting factor for accelerating crop yield. Brinjal is attacked by more than 70 insect pests (Subbaratnam and Butani, 1982), of which the major important ones are the shoot and fruit borer (*Leucinodes orbonalis* Guen: pyralidae), stem borer (*Euzophera perticella* Ragonot: Phycitidae), leaf hopper (*Amrasca biguttula biguttula* Ishida: Cicadellidae), aphid (*Aphis gossypii* Glover: Aphididae), Leaf roller (*Antoba olivacea* Walker: Noctuidae), leaf beetle (*Henosepilachna vigintiopunctata* Fab: Coccinellidae), whitefly (*Bemisia tabaci* Gennadius: Aleyrodidae), lace wing bugs (*Urentius echinus* Distant and *U. sentis* Distant: Tingidae), mealy bug (*Coccidohystrix insolitus* Green: Pseudococcidae) and non-insect pest, red spider mite (*Tetranychus macfurlanei* Baker and Pritchard) which cause about 70-92 per cent loss in the fruit yields (Vevai, 1970).

Mites produce injury primarily by removing cell contents by penetrating stylet into leaf tissues resulting into appearance of yellowish spots. The dense web produced by spider mite often covers the plants where dust particles adhere which in turn affect the physiological activity of the plants, making it stunted. The entire plant becomes yellowish giving poor unhealthy look. Infested leaves wither and eventually fall off (Gupta, 1985; Channabasavanna, 1985). The yield losses due to mite infestation were 13.64 to 31.09 per cent at Bangalore and Varanasi (Anon., 1996). For controlling these pests more neonicotinoids are used in brinjal ecosystem.

Pest management is an important aspect of brinjal production. Several chemical insecticides have been experimented, recommended and are being used extensively by farmers to control pests. However, considering economics and efficacy of pesticidal treatments, satisfactory control could not be obtained in many instances due to misuse of insecticides, resistance developed by pests and faulty application techniques. With this view the present experiment was conducted for studying the effect of newer neonicotinoids on red spider mites.

Materials and Methods

In the same plot which was grown for studying the efficacy of neonicotinoids against sucking pests 3rd and 4th spraying was taken for studying the effect of neonicotinoids on the red spider mite activity in brinjal ecosystem. From each treatment plot, 5 plants were randomly selected and were separately labeled with identifying tags. The number of red spider mites was recorded at 1 day before and at 1, 3, 7 and 14 days after insecticidal spray on three leaves per 4cm^2 leaf area selected from top, middle and bottom canopy of the plant.

The data obtained in number was subjected to transformation using Poisson formula $\sqrt{x + 0.5}$ and per cent data was transformed using arc sine transformation before further statistical analysis. The mean data on efficacy and yield were statistically analyzed

and subjected to the analysis of variance by adopting the appropriate methods as outlined by Panse and Sukhatme (1978) and Gomez and Gomez (1984) by adopting "Fishers analysis of variance technique".

Results and Discussion

Overall effect of newer neonicotinoids against red spider mites infesting brinjal based on pooled data (*Kharif* 2015-16 and 2016-17)

Pooled data in respect of effect of newer neonicotinoids against brinjal red spider mites (average number /4cm^2/three leaves) of two seasons *viz.*, *Kharif* 2015-16 and 2016-17 are presented in Table 1 and Figure 1.

The pre-treatment count of red spider mites before initiation of the spray treatments was in the range of 6.83 to 8.40 mites/4 cm^2 /three leaves. Based on the mean of two sprays of both the years, the post-treatment counts of red spider mites population on untreated control plants were 8.45, 8.83, 9.47 and 10.38 mites /4 cm^2 /three leaves on 1, 3, 7, and 14 days after spray (DAS), respectively. The red spider mite incidence in all insecticidal treatments except dimethoate 30 EC was significantly high indicating that all the insecticides were not at all effective against red spider mites. Pooled data on 1, 3, and 7 DAS showed that dimethoate was the most superior treatment for controlling red spider mites infesting brinjal. Whereas, the significantly highest population of mites *i.e.* more than untreated control was recorded in imidacloprid 17.8 SL, acetamiprid 20 SP, flonicamid 50 WG, clothianidin 50 WDG, thiamethoxam 25 WG, and dinotefuran 20 SG.

Pooled data on 14 days indicated that the treatment dimethoate 30 EC recorded minimum red spider mite population (5.92 mites/4 cm^2 leaf area) while imidacloprid 17.8 SL showed highest mite population (13.25 mites/4cm^2 leaf area) than untreated control (10.38 mites/4 cm^2 leaf area). Next to that the highest population mites was observed in the treatment acetamiprid 20 SP, flonicamid 50 WG, clothianidin 50 WDG, thiamethoxam 25 WG, and dinotefuran 20 SG, respectively (12.82, 12.07, 11.50, 11.43 and 11.23 mites/4cm^2 leaf area), which was also more than untreated control plot.

The reports of earlier researchers on effect of newer neonicotinoids on red spider mite activity are discussed here. Atwal *et al.*, (1969) found that dimethoate and phosphamidon were effective against red spider mites of vegetables. Singh *et al.*, (1975) observed that monocrotophos and dimethoate were found effective in controlling mites both at 3 and 7 days after spraying and hence anyone of these might be used to control this pest. Nemoto (1993) reported resurgence in spider mite, *Tetranychus kanzawai* Kishida following the application of imidacloprid and benfuracarb for controlling *Thrips palmi* on eggplant. Garima Gupta (2015) conducted toxicity bioassays and revealed that imidacloprid drench treatments showed significant increases in mite numbers at 7, 9, and 11 DAT when compared with the untreated control.

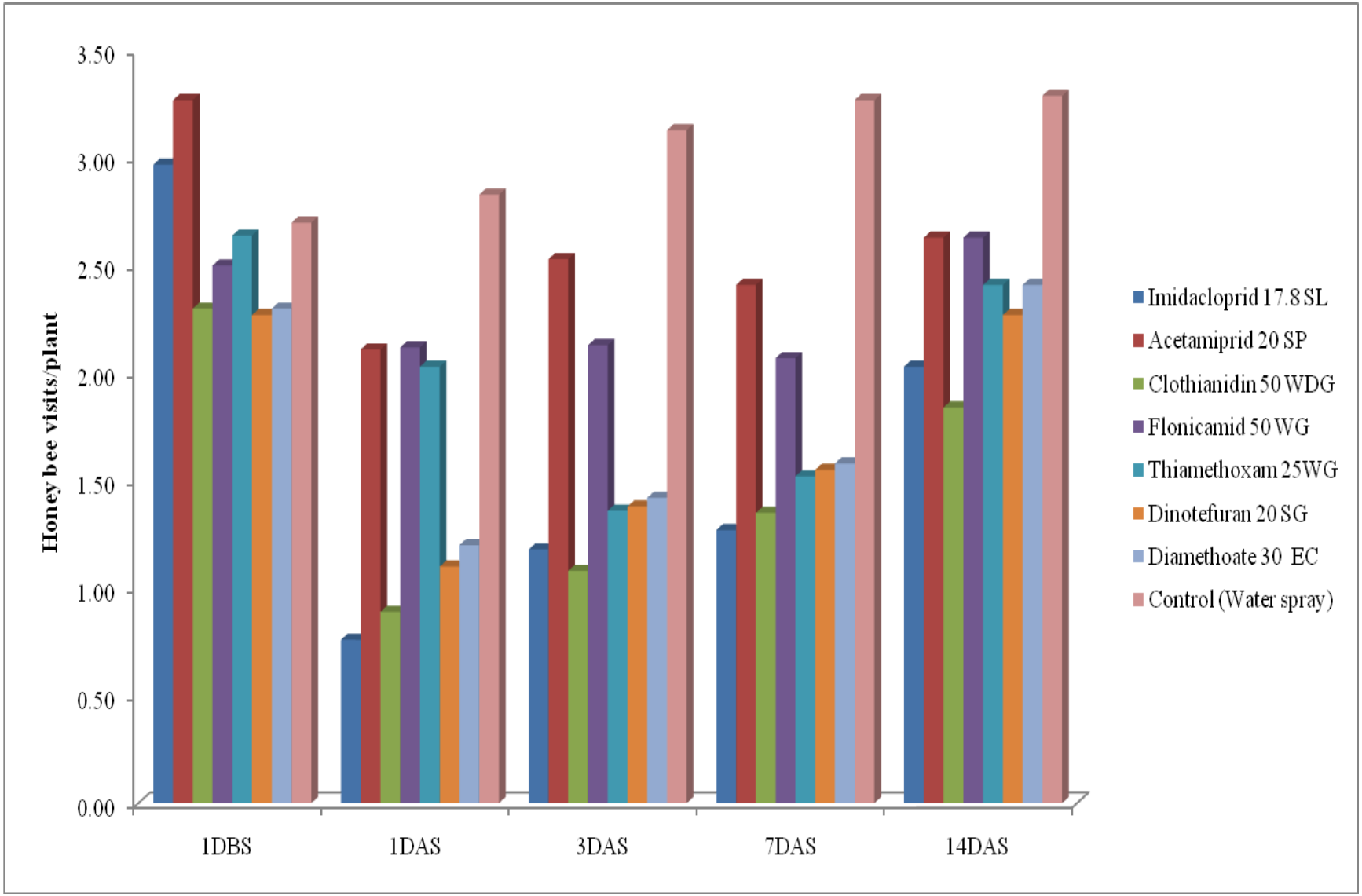
In the present investigation the traditional organophosphate (dimethoate) were found effective against mites but the newer neonicotinoids including imidacloprid, thiamethoxam, acetamiprid, clothianidin, flonicamid, dinotefuran treatments increased mite population even more than untreated plots. This clearly indicated that these products had no effects on mites even it has added to brinjal physiology making cell sap more nutritive to mites justifying the concept of harmoligosis.

Table.1 Overall efficacy of newer neonicotinoids against red spider mites infesting brinjal based on pooled data (*Kharif* 2015-16 and 2016-17)

Sr.No	Treatments	Dose g.a.i/ha	Average number of mites per 4cm^2/3 leaves				
			1DBS	1DAS	3DAS	7DAS	14DAS
1	Imidacloprid 17.8 SL	20	8.40 (2.98)	9.88 (3.22)	9.75 (3.20)	11.47 (3.46)	13.25 (3.71)
2	Acetamiprid 20 SP	10	7.43 (2.81)	9.18 (3.11)	9.07 (3.09)	11.03 (3.40)	12.82 (3.65)
3	Clothianidin 50 WDG	20	7.60 (2.84)	8.37 (2.98)	8.17 (2.94)	9.97 (3.23)	11.50 (3.46)
4	Flonicamid 50 WG	75	7.20 (2.77)	8.70 (3.03)	8.45 (2.99)	10.38 (3.30)	12.07 (3.54)
5	Thiamethoxam 25 WG	50	7.47 (2.82)	7.95 (2.90)	7.62 (2.85)	10.10 (3.22)	11.43 (3.45)
6	Dinotefuran 20 SG	30	7.30 (2.79)	7.63 (2.85)	7.20 (2.77)	10.12 (3.26)	11.23 (3.42)
7	Diamethoate 30 EC	200	6.83 (2.71)	3.03 (1.88)	3.38 (1.97)	4.78 (2.30)	5.92 (2.53)
8	Control (Water spray)	-	7.17 (2.77)	8.45 (2.98)	8.83 (3.02)	9.47 (3.15)	10.38 (3.30)
	S.E ±	**-**	**0.10**	**0.10**	**0.13**	**0.14**	**0.10**
	CD at 5 %	**-**	**NS**	**0.30**	**0.41**	**0.42**	**0.30**

DAS-Days after spray DBS- Day before spray Figures in parenthesis are $\sqrt{x + 0.5}$ transformed values

Fig.1 Overall effect of newer neonicotinoids on honey bee visits in brinjal ecosystem (*Kharif* 2015-16 and 2016-17)



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