EMAMECTIN BENZOATE 1.9 EC AND 5 SG: A SAFER INSECTICIDE TO PREDATORY SPIDERS OF BHENDI (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH).

Abstract

Bhendi is a vital vegetable crop in India is heavily infested by a variety of insect pests causing considerable damage and yield loss. Borers are major pests of economical importance. The indiscriminate use of insecticides has affected the population of bio control agents. Emamectin benzoate is an avermectin effective against several pests in number of crops. Two field experiments were conducted to study the impact of emamectin benzoate on spiders of bhendi ecosystem. Emamectin benzoate 5 SG and 1.9 EC @ 7,11 15 and 20 g a.i. ha^{-1} was tested in comparison with Emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} with different trader, chlorpyrifos 20 EC @ 200 g a.i. ha^{-1} and untreated check. Observations on the population of spiders were made prior to spraying and on 3, 7, 10 and 14 days after spraying from 10 randomly tagged plants per plot and the mean was worked out. Results clearly showed that emamectin benzoate 5 SG and 1.9 EC was found to be relatively safer to spiders at all concentrations tested. However,among the insecticidal treatments, highest population was recorded in plots treated with Emamectin benzoate @ 7 g a.i. ha^{-1} followed by emamectin benzoate @ 11 g a.i. ha^{-1}, respectively.

Key words: Emamectin benzoate 5 SG, Emamectin benzoate 1.9 EC, safety, spiderbhendi .

Introduction

Okra, *Abelmoschus esculentus* (L.) Moench (Malvaceae) is one of the vital vegetable crops grown throughout the tropical and warm temperate regions of the world. Okra is ravaged by many insect pests right from germination to harvest (Sharma *et al*., 1997; Jagtab *et al.,* 2007). Sucking pests in the early stage and the fruit borers, *Earias vittella* Fabricius, *Earias insulana* Boisdual and *Helicoverpa armigera* (Hübner) in the later stage causes extensive damage to fruits and results in 69 per cent yield loss (Atwal and Singh, 1990; Mani *et al*., 2005). The avoidable losses from chemically protected plots were 23.39%, 20.00% and 24.88% and organically managed plots were 22.73%, 16.98% and 24.39% in 3 seasons, respectively.(Bikash et al., 2023)Chemical insecticides are used as the vanguard defense sources against pests, in spite of their drawbacks *viz.* pesticide resistance, resurgence and contamination of different components of the environment in India. In addition, the misuse and over use of insecticides has affected the population of

bio control agents as all the recommended insecticides are highly toxic to predators and parasitoids (Dhawan *et al*., 1992, 1994; Singh 1994). Plots treated with the chemical module found decreased populations of natural enemies. (Swapnalisha *et al*., 2024)

To a large extent, problems of environmental and human risk have been overcome through the development of newer compounds that can be handled safely and that do not persist as environmental contaminants. Emamectin benzoate is one of the broad spectrum microbial insecticides derived from the soil actinomycetes *Streptomyces avermitilis* has been reported to possess excellent performance against the pests of cotton and vegetables (Sinha *et al.*, 2007; Harish and Patil, 2008, Sharma and Kausik, 2010) alternate to existing formulation and also ecologically sound for the effective management of Okra borers. Keeping in view, the present study was taken up to study the impact of emamectin benzoate to spiders.

Materials and Methods

Two field experiments were conducted one each at Allapalayam, Annur and Maampalli, Kinathukadavu to study the impact of emamectin benzoate 5 SG and 1.9 EC against spiders on bhendi eco system. The experiments were carried out in a randomized block design with eleven treatments, each replicated three times. The texture of the soil was red sandy loam. It had a low to medium level of organic carbon (0.33-0.61%).Soil pH is 6.5 to 8. For all interventions, the typical nutrient management schedule of 20:50:30 Kg NPK per hectare was adhered. The treatments applied were emamectin benzoate 5 SG and 1.9 EC @ 7,11 15 and 20 g a.i. ha^{-1}, Emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} with different trader , chlorpyrifos 20 EC @ 200 g a.i. ha^{-1} and untreated Check. The treatments were applied three times at 14 days interval commencing from 30^{th} day after sowing with pneumatic Knapsack sprayer using 750 litres of spray fluid per hectare. Observations on the population of spider, a day before each spraying and on 3, 7, 10 and 14 days after each spraying from 10 randomly tagged plants out of 1200 plants per plot were made and the mean was worked out. The statistical analysis was carried out using IRRISTAT ver 3.1. ANOVA. The data were transformed into $\sqrt{x+0.5}$. The mean values of treatments were separated using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1994).

Results and Discussion

The population of spiders ranged from 6.7 to 7.7 per 10 plants before imposing the treatments in the first field experiment (Table 1). Emamectin benzoate 5 SG at the lowest dose recorded the higher mean spider population of 8.10 per 10 plants next to untreated check (8.83 / 10 plants) which was on par with emamectin benzoate 1.9 EC at 7 g a.i.ha^{-1} (8.00 /10 plants). Emamectin benzoate 5 SG at 11 g a.i.ha^{-1} recorded 7.73 spiders per 10 plants which was on par with standard check Emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} with different trader Proclaim® at 11 g a.i.ha^{-1} and emamectin benzoate 1.9 EC at 11 g a.i.ha^{-1} (7.65 / 10 plants). Emamectin benzoate 5 SG @ 20 g a.i.ha^{-1} recorded a mean of 7.35 spiders per 10 plants, followed by emamectin 1.9 EC @ 20 g a.i.ha^{-1} (7.28 / 10 plants) which was on par with each other. Chlorpyrifos 20 EC recorded 6.08 spiders per 10 plants (Table 1). It was interesting to note that the population increased significantly three days after each spraying in all the treatments. After the second round of spray, emamectin benzoate 5 SG @ 7 g a.i.ha^{-1} -1 recorded a mean of 10.25 spiders per 10 plants and emamectin benzoate 5 SG at 11 g a.i.ha-1 (9.83 per 10 plants). All the emamectin benzoate treatments were recorded more spiders significantly when compared to standard check, chlorpyrifos 20 EC (6.75 / 10 plants) throughout the investigation period (Table 2). At the end of third spray, emamectin benzoate 5 SG @ 7 g a.i.ha^{-1} -1 recorded a mean of 12.18 spiders per 10 plants, followed by emamectin 1.9 EC @ 7 g a.i.ha-1 (12.00 / 10 plants) which was on par with each other. Emamectin benzoate 5 SG @ 15 g a.i.ha^{-1} -1 recorded a mean of 10.90 spiders per 10 plants, followed by emamectin 1.9 EC @ 15 g a.i.ha-1 (10.75 / 10 plants) which was on par with each other. (Table 3)

In the second field experiment, the pretreatment population of spiders ranged from 6.7 to 8.0 per ten plants in various treatments. After the first round of spraying, the mean population of spider was the highest in the untreated check (9.00 / 10 plants), followed by emamectin benzoate 5 SG at 7 g .a.i. ha^{-1} (8.33 / 10 plants) which was on par with emamectin benzoate 1.9 EC at 7 g a.i.ha^{-1} . (8.25 /10 plants). Emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} harboured 8.08 spiders per 10 plants followed by emamectin benzoate 1.9 EC at 11 g .a.i. ha^{-1} (8.00 / 10 plants) which was on par with Proclaim® at 11 g a.i.ha^{-}

[1]. Emamectin benzoate 5 SG at the highest dose recorded a mean of 7.35 spiders per 10 plants, followed by emamectin 1.9 EC @ 20 g a.i.ha^{-1} (7.25 spiders /10 plants) which was on par with each other. While the standard check chlorpyrifos recorded 6.60 spiders per 10 plants. (Table 4). It was interesting to note that the population increased significantly three days after each spraying in all the treatments. A similar trend was recorded after the second round of spraying also. Emamectin benzoate 5 SG and 1.9 EC at the lowest dose recorded a higher mean spider population of 9.43and 9.35 per 10 plants, respectively, next to untreated check (11.58 / 10 plants) (Table 5). All the emamectin treatments showed little effect on the spiders when compared the chlorpyrifos (standard check). The same trend was observed throughout the experimental period. Emamectin benzoate 5 SG and 1.9 EC at 7 g a.i. ha^{-1} recorded a higher mean spider population of 9.43 and 9.35 per 10 plants, respectively, next to untreated check (13.73 / 10 plants) at the end of third spray. Proclaim® at 11 g a.i. ha^{-1} recorded a mean spider population of 10.03 per 10 plants which was on par with emamectin benzoate 5 SG @ 11 g a.i. ha^{-1} (10.00 / 10 plants), followed by emamectin 1.9 EC @ 11 g a.i. ha^{-1} (9.85 spiders / 10 plants) (Table 6).

The effect of emamectin benzoate 5 SG and 1.9 EC on spiders revealed that after first spray, emamectin benzoate at all doses reduced the spider population significantly on 3 DAT in the first field experiment. Among them, emamectin benzoate at 15 and 20 g a.i. ha^{-1} recorded minimum number of spiders per 10 plants. The observations on 7, 10 and 14 showed the recolonization of spiders in all the treatments irrespective of concentrations. The same trend was observed in the second field experiment also. The findings are in conformity with the earlier report of Amalin *et al*. (2000) who stated that abamectin applied as spray had moderate toxicity to predatory spider *Hibana velox* Becker of citrus leaf miner under laboratory conditions. This is supported by Reis *et al.* (1999) that abamectin was slightly harmful to spider in laboratory conditions and Giribabu *et al*. (2002) concluded that abamectin at 15 g a.i. ha^{-1} was found to be relatively safer to predatory spiders.The present finding is in accordance with the observations of Sechser *et al.* (2003) who reported that emamectin benzoate at the rate of 13.5 g ai/ha applied twice 1 week apart proved to be very safe to all predator groups and stages (adults and immature stages of spiders, *Orius* and *Campylomma* adults and

nymphs adults of *Scymnus*, *Coccinella*, *Chrysoperla* larvae, and *Paederus* This is supported by Chizhov *et al.* (2000) who stated that avermectins were safe to non target organisms viz., *Dolycoris bauarum* (L.), *Pentatoma rufipes* (L.), *Adalia bipunctata* (L.) and *Coccinella septempunctata* (L.) Sansone and Minzenmayer (2000) reported that spinosad had the least impact on spiders and *Scymnus* sp as compared to indoxacarb (Steward®) and emamectin benzoate (Denim®). In contrast to the above, Jyoti and Goud (2008) reported that emamectin benzoate 5 SG was safer to the natural enemies *viz*., coccinellids, chrysopids & spiders in brinjal ecosystem. Emamectin benzoate degrades rapidly on the surface of foliage, thereby limiting the contact activity to beneficial arthropods and safe to most predator groups (Dunbar *et al.* 1998).

Conclusion

Emamectin benzoate had minimum negative impact on the predator population and may be considered as ideal chemical for use in Integrated Pest Management programmes. Although emamectin reservoir with the mesophyll layer of leaf tissues is accessible to phytophagous insects, the parasitic and predatory arthropods continue to proliferate because of the short lived surface residues. Therefore, the application of emamectin benzoate is less harmful to the important natural enemies in bhendi fields.

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Table 1. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Allapalayam)
First application

Treatments	PTC	Number of spiders / 10 plants				
		Days after first treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	6.7	6.3^{bc} (2.6)	7.3^{b} (2.8)	8.7^{ab} (3.0)	9.7^{ab} (3.2)	8.00
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	7.0	6.0^{cd} (2.6)	7.3^{b} (2.8)	8.3^{abc} (3.0)	9.0^{b} (3.1)	7.65
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	6.7	5.7^{d} (2.5)	7.0^{bc} (2.7)	8.0^{bc} (2.9)	9.0^{b} (3.1)	7.43
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	7.0	5.7^{d} (2.5)	6.7^{c} (2.7)	7.7^{cd} (2.9)	9.0^{b} (3.1)	7.28
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	7.3	6.7^{b} (2.7)	7.3^{b} (2.8)	8.7^{ab} (3.0)	9.7^{ab} (3.2)	8.10
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	6.7	6.0^{cd} (2.6)	7.3^{b} (2.8)	8.3^{abc} (3.0)	9.3^{ab} (3.1)	7.73
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	7.3	6.0^{cd} (2.6)	7.0^{bc} (2.7)	8.0^{bc} (2.9)	9.3^{ab} (3.1)	7.58
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	7.7	6.0^{cd} (2.6)	6.7^{c} (2.7)	7.7^{cd} (2.9)	9.0^{b} (3.1)	7.35
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1}	7.0	5.0^{d} (2.4)	5.7^{d} (2.5)	6.3^{d} (2.6)	7.3^{c} (2.8)	6.08
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	7.3	6.0^{cd} (2.6)	7.3^{b} (2.8)	8.3^{abc} (3.0)	9.3^{ab} (3.1)	7.73
Untreated check	7.3	7.7^{a} (2.9)	8.3^{a} (3.0)	9.0^{a} (3.1)	10.3^{a} (3.3)	8.83

Mean of three observations ; PTC- Pre treatment count
Values in parentheses are $\sqrt{x+0.5}$ transformed values
In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 2. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Allapalayam)
Second application

Treatments	PTC	Number of spiders / 10 plants				
		Days after second treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	9.7	9.0^{b} (3.1)	9.7^{b} (3.2)	10.3^{b} (3.3)	11.7^{b} (3.5)	10.18
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	9.0	8.7^{b} (3.0)	9.3^{b} (3.1)	10.0^{b} (3.2)	11.0^{bc} (3.4)	9.75
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	9.0	8.0^{cd} (2.9)	9.0^{bc} (3.1)	9.7^{b} (3.19)	10.7^{bc} (3.4)	9.35
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	9.0	7.3^{d} (2.8)	8.7^{c} (3.0)	9.7^{b} (3.2)	10.7^{bc} (3.4)	9.10
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	9.7	9.0^{b} (3.1)	9.7^{b} (3.2)	10.3^{b} (3.3)	12.0^{b} (3.54)	10.25
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	9.3	8.7^{b} (3.0)	9.3^{b} (3.1)	10.0^{b} (3.2)	11.3^{bc} (3.4)	9.83
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	9.3	8.3^{bc} (3.0)	9.0^{bc} (3.1)	10.0^{b} (3.2)	10.7^{bc} (3.4)	9.50
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	9.0	7.7^{cd} (2.9)	9.0^{bc} (3.1)	9.7^{b} (3.2)	10.7^{bc} (3.4)	9.28
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1}	7.3	5.7^{e} (2.5)	6.3^{d} (2.6)	7.0^{c} (2.7)	8.0^{d} (2.9)	6.75
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	9.3	8.7^{b} (3.0)	9.3^{b} (3.1)	10.0^{b} (3.2)	11.0^{bc} (3.4)	9.75
Untreated check	10.3	10.7^{a} (3.4)	11.3^{a} (3.4)	12.0^{a} (3.5)	14.0^{a} (3.8)	12.00

Mean of three observations; PTC- Pre treatment count
Values in parentheses are $\sqrt{x+0.5}$ transformed values
In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 3. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Allapalayam) Third application

Treatments	PTC	Number of spiders / 10 plants				
		Days after third treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	11.7	10.7 ^{bc} (3.3)	11.3 ^{bc} (3.4)	12.3 ^{b} (3.6)	13.7 ^{b} (3.8)	12.00
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	11.0	10.0 ^{bc} (3.2)	11.0 ^{bc} (3.4)	11.7 ^{bc} (3.5)	13.3 ^{b} (3.7)	11.50
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	10.7	9.3 ^{bc} (3.1)	10.7 ^{bc} (3.3)	11.3 ^{c} (3.4)	13.0 ^{bc} (3.7)	11.08
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	10.7	9.0 ^{c} (3.1)	10.3 ^{c} (3.3)	11.0 ^{c} (3.4)	12.7 ^{c} (3.6)	10.75
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	12.0	11.0 ^{b} (3.4)	11.7 ^{b} (3.5)	12.3 ^{b} (3.6)	13.7 ^{b} (3.8)	12.18
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	11.3	10.3 ^{bc} (3.3)	11.0 ^{bc} (3.4)	11.7 ^{bc} (3.5)	13.3 ^{b} (3.7)	11.58
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	10.7	9.3 ^{bc} (3.1)	10.7 ^{bc} (3.3)	11.3 ^{c} (3.4)	13.3 ^{b} (3.7)	11.15
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	10.7	9.3 ^{c} (3.1)	10.3^{c} (3.3)	11.3 ^{c} (3.4)	12.7 ^{c} (3.6)	10.90
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1}	8.0	6.0^{d} (2.6)	6.7 ^{d} (2.7)	7.7 ^{d} (2.9)	8.7 ^{d} (3.0)	7.28
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	11.0	10.0 ^{bc} (3.2)	11.0 ^{bc} (3.4)	11.7 ^{bc} (3.5)	13.3 ^{b} (3.7)	11.50
Untreated check	14.0	14.0 ^{a} (3.8)	14.3 ^{a} (3.9)	15.0 ^{a} (4.0)	15.3 ^{a} (4.0)	14.65

Mean of three observations; PTC- Pre treatment count

Values in parentheses are $\sqrt{x+0.5}$ transformed values

In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 4. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Maampalli)
First application

Treatments	PTC	Number of spiders / 10 plants				
		Days after first treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	7.3	7.0^{ab} (2.7)	8.0^{b} (2.9)	8.7^{b} (3.0)	9.3^{b} (3.1)	8.25
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	7.0	6.7^{abc} (2.7)	7.7^{bc} (2.9)	8.3^{bc} (3.0)	9.3^{b} (3.1)	8.00
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	6.7	6.3^{bc} (2.6)	6.7^{e} (2.7)	7.7^{d} (2.9)	8.7^{c} (3.0)	7.35
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	7.7	6.3^{bc} (2.6)	6.7^{e} (2.7)	7.3^{de} (2.8)	8.7^{c} (3.0)	7.25
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	7.3	7.3^{a} (2.8)	8.0^{b} (2.9)	8.7^{b} (3.0)	9.3^{b} (3.1)	8.33
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	7.3	7.0^{ab} (2.7)	7.7^{bc} (2.9)	8.3^{bc} (3.0)	9.3^{b} (3.1)	8.08
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	7.0	6.7^{abc} (2.7)	7.0^{d} (2.7)	7.7^{d} (2.9)	8.7^{c} (3.0)	7.53
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	7.3	6.3^{bc} (2.6)	6.7^{e} (2.7)	7.7^{d} (2.9)	8.7^{c} (3.0)	7.35
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1}	8.0	5.7^{d} (2.5)	6.0^{f} (2.5)	6.7^{f} (2.7)	8.0^{d} (2.9)	6.60
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	7.7	7.0^{ab} (2.7)	7.3^{cd} (2.8)	8.3^{bc} (3.0)	9.3^{b} (3.1)	7.98
Untreated check	7.0	7.7^{a} (2.9)	8.7^{a} (3.0)	9.3^{a} (3.1)	10.3^{a} (3.3)	9.00

Mean of three observations ; PTC- Pre treatment count
Values in parentheses are $\sqrt{x+0.5}$ transformed values
In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 5. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Maampalli)
Second application

Treatments	PTC	Number of spiders / 10 plants				
		Days after second treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	9.3	8.7^{b} (3.0)	8.7^{b} (3.0)	9.3^{b} (3.1)	10.7^{b} (3.3)	9.35
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	9.3	8.3^{bc} (3.0)	8.3^{bc} (3.0)	9.0^{c} (3.1)	10.3^{bc} (3.3)	8.98
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	8.7	7.3^{cd} (2.8)	7.7^{d} (2.9)	8.3^{d} (3.0)	9.7^{d} (3.2)	8.25
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	8.7	7.0^{cd} (2.8)	7.3^{de} (2.7)	7.7^{e} (2.8)	9.0^{f} (3.1)	7.75
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	9.3	8.7^{b} (3.0)	9.0^{b} (3.1)	9.3^{b} (3.1)	10.7^{b} (3.3)	9.43
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	9.3	8.3^{bc} (3.0)	8.7^{b} (3.0)	9.0^{c} (3.1)	10.3^{bc} (3.3)	9.08
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	8.7	7.7^{c} (2.9)	7.7^{d} (2.9)	8.3^{d} (3.0)	9.7^{d} (3.2)	8.35
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	8.7	7.3^{cd} (2.8)	7.3^{de} (2.8)	7.7^{e} (2.8)	9.3^{e} (3.1)	7.90
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1}	8.0	5.7^{e} (2.5)	6.0^{f} (2.6)	7.3^{f} (2.8)	8.7^{g} (3.0)	6.93
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	9.3	8.3^{bc} (3.0)	8.3^{bc} (3.0)	9.0^{c} (3.0)	10.3^{bc} (3.3)	8.98
Untreated check	10.3	10.7^{a} (3.3)	11.3^{a} (3.4)	12.0^{a} (3.5)	12.3^{a} (3.6)	11.58

Mean of three observations; PTC- Pre treatment count
Values in parentheses are $\sqrt{x+0.5}$ transformed values
In a column means followed by a common letter are not significantly different by DMRT (P=0.05)

Table 6. Effect of emamectin benzoate 5 SG and 1.9 EC on spiders on bhendi eco system (Location-Maampalli) Third application

Treatments	PTC	Number of spiders / 10 plants				
		Days after third treatment				
		3	7	10	14	Mean
Emamectin benzoate 1.9 EC 7.0 g a.i.ha^{-1}	10.7	10.0 ^{b} (3.2)	10.3 ^{b} (3.3)	10.7 ^{c} (3.3)	11.7^{b} (3.5)	10.68
Emamectin benzoate 1.9 EC 11.0 g a.i.ha^{-1}	10.3	9.0 ^{c} (3.1)	9.7 ^{cd} (3.2)	10.0 ^{de} (3.2)	10.7^{c} (3.3)	9.85
Emamectin benzoate 1.9 EC 15.0 g a.i.ha^{-1}	9.7	7.7 ^{d} (2.9)	7.7 ^{f} (2.9)	9.7 ^{ef} (3.2)	10.7 ^{c} (3.3)	8.95
Emamectin benzoate 1.9 EC 20.0 g a.i.ha^{-1}	9.0	7.0 ^{ef} (2.7)	7.3 ^{fg} (2.8)	9.0 ^{gh} (3.1)	10.0 ^{d} (3.2)	8.33
Emamectin benzoate 5 SG 7.0 g a.i.ha^{-1}	10.7	10.0 ^{b} (3.2)	10.3 ^{b} (3.3)	11.3 ^{b} (3.4)	12.0^{b} (3.5)	10.90
Emamectin benzoate 5 SG 11.0 g a.i.ha^{-1}	10.3	9.0 ^{c} (3.1)	10.0 ^{bc} (3.2)	10.3 ^{cd} (3.3)	10.7^{c} (3.3)	10.00
Emamectin benzoate 5 SG 15.0 g a.i.ha^{-1}	9.7	7.3 ^{de} (2.8)	8.3 ^{e} (3.0)	9.7 ^{ef} (3.2)	10.7^{c} (3.3)	9.00
Emamectin benzoate 5 SG 20.0 g a.i.ha^{-1}	9.3	7.3 ^{de} (2.8)	7.7 ^{f} (2.9)	9.3 ^{fg} (3.1)	10.0 ^{d} (3.2)	8.58
Chlorpyrifos 20 EC 200.0 g a.i.ha^{-1-1}	8.7	5.7^{g} (2.5)	6.0 ^{h} (2.6)	7.7 ^{i} (2.9)	8.7^{e} (3.0)	7.03
Emamectin (Proclaim®) 5 SG 11.0 g a.i.ha^{-1}	10.3	9.0 ^{c} (3.1)	9.7 ^{cd} (3.2)	10.7 ^{c} (3.3)	10.7^{c} (3.3)	10.03
Untreated check	12.3	13.3 ^{a} (3.7)	13.3 ^{a} (3.7)	14.0 ^{a} (3.8)	14.3 ^{a} (3.9)	13.73

Mean of three observations; PTC- Pre treatment count

Values in parentheses are $\sqrt{x+0.5}$ transformed values

In a column means followed by a common letter are not significantly different by DMRT (P=0.05)