*International Journal of Theoretical & Applied Sciences,* 13(2): 42-45(2021)

**ISSN No. (Print): 0975-1718**
**ISSN No. (Online): 2249-3247**

# Relative Safety of Newer Insecticides to Spiders in Okra Ecosystem

***Bhupender Singh[1*], Ram Karan Gaur[2] and Anil Jakhar[1]***
*[1]Department of Entomology, CCS Haryana Agricultural University, Hisar, (Haryana), India.*
*[2]KVK, Rohtak, CCS Haryana Agricultural University, Hisar (Haryana), India.*

*(Corresponding author: Bhupender Singh*)*
*(Received 18 August, 2021, accepted 22 October, 2021)*
*(Published by Research Trend, Website: www.researchtrend.net)*

**ABSTRACT: The indiscriminate use of pesticides has resulted into various consequences most importantly the destruction of natural enemies. So prior to inclusion of any insecticide in pest management programme, its insecticidal properties, mammalian toxicity and safety to natural enemies must be evaluated. In this context, a study was conducted in Hisar (Haryana) to assess the relative safety of newer insecticides to natural enemies when used against okra shoot and fruit borers during *kharif* 2019 and 2020. Experiment was laid out in randomized block design in plot size of 5 ✖ 4 m with three replications for each treatment. Insecticides *viz.* chlorantaniliprole 18.5 SC, emamectin benzoate 5 SG, Pyridalyl 10 EC, lambda-cyhalothrin 5 EC, cypermethrin 25 EC quinalphos 25 EC were applied thrice at 25, 6.75, 15, 50, 37 and 200 g a.i. per ha, respectively. Results revealed that among various insecticides, application of chlorantaniliprole 18.5 SC and emamectin benzoate 5 SG did not cause any significant reduction in spider population and hence were safe to theses natural enemies. Pyridalyl 10 EC was next relatively safer insecticide whereas cypermethrin 25 EC, lambda-cyhalothrin 5 EC and quinalphos 25 EC suppressed spiders population significantly. Hence, chlorantraniliprole, emamectin benzoate and pyridalyl may be employed as a component of IPM in okra.**

**Keywords**: Spiders, newer insecticides, okra, relative safety, natural enemies.

## I. INTRODUCTION

Okra *Abelmoschus esculentus* L. (Moench) belongs to family Malvaceae, is an economically important vegetable crop grown in tropical and subtropical parts of the world. In India, okra is grown throughout the year over an area of 5.09 lakhs ha with annual production of 60.95 lakh metric tons and productivity of 12 metric tons per ha. After China, India ranks second in total vegetables production in the world and first in okra production, contributing about 62 per cent of the total global production of okra [1]. Major limiting factor in okra productivity is its susceptibility to a large number of insect-pests. As many as 72 species of insect-pests have been recorded on okra (Rao and Rajendran, 2002) [15] of which leafhopper, *Amrasca biguttula biguttula* (Ishida), whitefly, *Bemisia tabaci* (Gennadius), aphid, *Aphis gossypii* Glover, mite, *Tetranychus cinnabarinus* (Boisduval) and borers including shoot and fruit borers, *Earias insulana* (Boisduval) and *E. vittella* (Fabricious) and American bollworm, *Helicoverpa armigera* (Hubner) are the major pests causing enormous losses to the crop. For the management of these pests, farmers use several insecticides repeatedly and too at higher than recommended doses. The indiscriminately use of insecticides has resulted in numerous environmental and health problems [7]. Most importantly, the non selective use of pesticides causes destruction of natural enemy fauna which may invite serious consequences for the pest population dynamics like resurgence and eruption of secondary pests [5]. It is important to adopt or use some newer insecticide molecule with high toxicity even at lower doses and safer to the natural enemies present in the agro eco-system [2]. Hence, the present study was undertaken to evaluate relative safety of some newer insecticides to the spiders in okra ecosystem.

## II. MATERIAL AND METHODS

The present study was conducted at Research Farm, CCS Haryana Agricultural University, Hisar during *i.e*. *kharif* 2019 and 2020. The experiment was laid out in randomized block design in plot size of 5 × 4 m with three replications for each treatment. Okra variety "*Hisar Naveen*" was sown with row to row and plant to plant spacing of 60 and 30 cm, respectively. For the management of okra shoot and fruit borers, *Earias* spp., foliar application of chlorantraniliprole 18.5 SC, emamectin benzoate 5 SG, lambda-cyhalothrin 5 EC, pyridalyl 10 EC, cypermethrin 25 EC and quinalphos

25 EC was done at 25, 6.75, 15, 50, 37 and 200 g a.i. per ha, respectively. Total of three applications of each insecticide were done at 15 days interval. To assess the effect of insecticides on natural enemies, spider population was recorded before and at 1, 3, 7 and 14 days after each spray from five randomly selected and tagged plants in each treatment. For this, each of the five plants was thoroughly examined to detect the presence of spiders. The statistical software OPSTAT (http:// 14.139.232.166/opstat/index.asp), developed by CCS, Haryana Agricultural University, Hisar (Haryana), India was used for statistical analysis of the data [16].

## III. RESULTS AND DISCUSSION

***Kharif* 2019:** Population of spiders recorded before spray did not differ significantly among the treatments including untreated check. Mean population after first spray showed that chlorantraniliprole 18.5 SC, emamectin benzoate 5 G and pyridalyl 10 EC applied at 25, 6.75 and 50 g a.i. per ha resulted in spider population of 0.82, 0.78 and 0.70 spider per plant, respectively, significantly higher than other treatments and *on a par* with untreated check (0.87 spider/plant). Contrarily, cypermethrin 25 EC, lambda-cyhalothrin 5 EC and quinalphos 25 EC applied at 37, 15 and 200 g a.i. per ha, respectively resulted in spider population in the range of 0.32 to 0.38 spider per plant and significantly lower than untreated check. Almost similar trend was observed after second spray whereas mean population of spiders after third spray indicated that application of chlorantraniliprole was safe to the spiders as resulted in spider population of 0.77 spider per plant, *on a par* with untreated check (0.87 spider/plant). However, emamectin benzoate and pyridalyl resulted in mean population of 0.70 and 0.63 spider per plant, respectively, significantly lower than untreated check but higher than other treatments and *on a par* with chlorantraniliprole. Further, application of lambda-cyhalothrin resulted in mean population of 0.30 spider per plant, significantly higher than cypermethrin and quinalphos having 0.13 and 0.15 spider per plant, respectively.

Data on overall mean population of spiders during *kharif* 2019 indicated that application of chlorantraniliprole and emamectin benzoate registering 0.85 and 0.82 spider per plant and *on a par* with untreated check (0.93 spider/plant) proved equally safe to these arthropod fauna. Application of pyridalyl however resulted in spider population (0.71 spider/plant) significantly lower than untreated check but *on a par* with chlorantraniliprole and emamectin benzoate. On the other hand, cypermethrin, lambda-cyhalothrin and quinalphos were harmful as resulted in mean population of 0.28, 0.41, and 0.36 spider per plant, respectively, significantly lower than untreated check.

***Kharif* 2020:** It is apparent from the data recorded before spray that spider population did not differ significantly among the treatments including untreated check. However, after first spray chlorantraniliprole, emamectin benzoate and pyridalyl resulting in mean population of 0.83, 0.87 and 0.75 spider per plant, respectively and *on a par* with untreated check (0.92 spider/plant) were found relatively safer insecticides to the spiders. Rest of the treatments *i.e.* cypermethrin, lambda-cyhalothrin and quinalphos having mean population in the range of 0.38 to 0.48 spider per plant, *on a par* with each other and significantly lower than untreated check appeared to be toxic to these natural enemies. Similar trend was observed after second spray as well.

**Table 1: Effect of insecticides on population of spiders in okra.**

| Treatment | Dose (g a.i. per ha) | *Mean population of spiders/plant (pooled data) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Kharif* 2019 | | | | | *Kharif* 2020 | | | | | Pooled Mean |
| | | BS | 1st spray | 2nd spray | 3rd spray | Overall Mean | BS | 1st spray | 2nd spray | 3rd spray | Overall Mean | |
| Chlorantraniliprole 18.5 SC | 25 | 0.80 (1.34) | 0.82 (1.35) | 0.97 (1.40) | 0.77 (1.33) | 0.85 (1.36)$^{ab**}$ | 1.00 (1.41) | 0.83 (1.35) | 0.73 (1.32) | 0.73 (1.32) | 0.77 (1.33)$^{ab}$ | 0.81 (1.35)$^{ab}$ |
| Emamectin benzoate 5 SG | 6.75 | 0.60 (1.26) | 0.78 (1.34) | 0.98 (1.41) | 0.70 (1.30) | 0.82 (1.35)$^{ab}$ | 0.87 (1.37) | 0.87 (1.37) | 0.75 (1.32) | 0.78 (1.34) | 0.80 (1.34)$^{ab}$ | 0.81 (1.35)$^{ab}$ |
| Lambda- cyhalothrin 5 EC | 15 | 0.53 (1.24) | 0.37 (1.17) | 0.57 (1.25) | 0.30 (1.14) | 0.41 (1.19)$^{c}$ | 0.87 (1.37) | 0.48 (1.22) | 0.47 (1.21) | 0.35 (1.16) | 0.43 (1.20)$^{c}$ | 0.42 (1.19)$^{c}$ |
| Pyridalyl 10 EC | 50 | 0.73 (1.31) | 0.70 (1.30) | 0.80 (1.34) | 0.63 (1.28) | 0.71 (1.31)$^{b}$ | 1.00 (1.41) | 0.75 (1.32) | 0.72 (1.31) | 0.57 (1.25) | 0.68 (1.30)$^{b}$ | 0.69 (1.30)$^{b}$ |
| Cypermethrin 25 EC | 37 | 0.80 (1.34) | 0.32 (1.15) | 0.40 (1.18) | 0.13 (1.06) | 0.28 (1.13)$^{c}$ | 0.93 (1.39) | 0.38 (1.18) | 0.35 (1.16) | 0.23 (1.11) | 0.32 (1.15)$^{c}$ | 0.30 (1.14)$^{c}$ |
| Quinalphos 25 EC | 200 | 0.67 (1.29) | 0.38 (1.18) | 0.55 (1.25) | 0.15 (1.07) | 0.36 (1.17)$^{c}$ | 0.87 (1.37) | 0.47 (1.21) | 0.43 (1.20) | 0.35 (1.16) | 0.42 (1.19)$^{c}$ | 0.39 (1.18)$^{c}$ |
| Untreated check | | 0.67 (1.29) | 0.87 (1.37) | 1.07 (1.44) | 0.87 (1.37) | 0.93 (1.39)$^{a}$ | 1.00 (1.41) | 0.92 (1.38) | 0.87 (1.37) | 0.87 (1.37) | 0.88 (1.37)$^{a}$ | 0.91 (1.38)$^{a}$ |
| **SE(m)±** | | **0.04** | **0.02** | **0.03** | **0.02** | **0.02** | **0.03** | **0.02** | **0.02** | **0.02** | **0.02** | **0.01** |
| **C.D. (p=0.05)** | | **NS** | **0.07** | **0.10** | **0.07** | **0.05** | **NS** | **0.06** | **0.07** | **0.07** | **0.05** | **0.04** |

*Mean of all the observations
BS= Before spray
**DMRT (Duncan's multiple range test): Figures with the same letter(s) do not differ significantly
Values in parentheses are square root transformed figures

However, mean population recorded after third spray clearly showed that application of chlorantraniliprole and emamectin benzoate did not cause any significant reduction in population as resulted in 0.73 and 0.78 spider per plant, respectively, *on a par* with untreated check (0.87 spider/plant). Next to these, pyridalyl resulted in mean population of 0.57 spider per plant whereas rest of treatments having mean population in the range of 0.23 to 0.35 spider per plant, *on a par* with each other but significantly lower than untreated check.

Overall mean of spider population during *kharif* 2020 also indicated that application of chlorantraniliprole and emamectin benzoate did not cause any significant reduction in spider population and resulted in 0.77 and 0.80 spider per plant *i.e. on a par* with untreated check (0.88 spider/plant). Likewise, pyridalyl however registered mean population of 0.68 spider per plant, significantly lower than control but *on a par* with former treatments in terms of relative safety to spiders. Conversely, application of cypermethrin, lambda-cyhalothrin and quinalphos registered 0.32, 0.43 and 0.42 spider per plant, respectively and significant lower than control plots.

**Pooled data of two years.** Pooled mean of spider population recoded during both the seasons (*kharif* 2019 and 2020) also showed that application of chlorantraniliprole and emamectin benzoate was safe to the spiders as each resulted in mean population of 0.81 spider per plant, *on a par* with untreated check (0.91 spider/plant). Pyridalyl resulting in mean population of 0.69 spider per plant and *on a par* with former insecticdes was next safe molecule. However, cypermethrin, lambda-cyhalothrin and quinalphos with mean population of 0.30, 0.42 and 0.39 spider per plant and significantly lower than untreated check were detrimental to the spiders.

The present findings are in line with those reported by Rajavel *et al.,* (2011) that application of chlorantraniliprole 18.5 SC against shoot and fruit borer in brinjal did not cause any significant reduction in the predatory fauna present in the egg plant ecosystem [14]. Patel *et al*., (2016) also reported that chlorantraniliprole 18.5 SC applied at 30 g a.i. per was safe to the spider population [13]. Wagh *et al.,* (2017) reported that chlorantraniliprole 18.5 SC (30 g a.i./ha) was safe while cypermethrin 25 EC (62.50 g a.i./ha) was detrimental to the natural enemies in tomato crop [19]. Present results were further in agreement with Narayan *et al*., (2019) [11] who found chlorantraniliprole 18.5 SC (0.0074%) comparatively safer to natural enemies followed by cyantraniliprole 10 OD (0.0143%) and emamectin benzoate 5 SG (0.002%) while lambda-cyhalothrin 5 EC (0.003%) as slightly toxic. Matcha *et al*., (2021) also reported that chlorantraniliprole 18.5 SC was safer to natural enemies when compared to spinetoram 11.7 SC, spinosad 45 SC and thiodicarb 75 WP [9].

The current findings are also supported by Sontakke *et al*., (2007) who suggested that emamectin benzoate 5 SG applied at 8.5 g a.i. per ha against shoot and fruit borer, *E. vittella* in okra was safe to the natural enemies [17]. Likewise, [4] also observed that emamectin benzoate 5 SG applied at 0.2 g per litre of water did not cause any harmful effect on natural enemies. Similarly, Venkateswarlu *et al*., (2011) proved emamectin benzoate and chlorantraniliprole as safer insecticides to natural enemies in cabbage [18]. Govindan *et al*., (2013) also reported that emamectin benzoate did not cause any significant reduction in coccinellids population in cotton [6]. Similarly, Pandey *et al*., (2021) reported that application of emamectin benzoate did not cause any significant reduction in coccinellids population in brinjal [12]. Cruces *et al*., (2021) also suggested that emamectin benzoate was safer to the natural enemies as compared to cypermethrin [3]. The results obtained were also in accordance with those of other workers who reported that pyridalyl was very safe to natural enemies when used against lepidopteran insect pests [8, 10].

## IV. CONCLUSION AND FUTURE SCOPE

It can be inferred that chlorantaniliprole 18.5 SC and emamectin benzoate 5 SG when applied at 25 and 6.75 g a.i. per ha, respectively did not cause any significant harmful effect on spider population. Pyridalyl 10 EC applied at 50 g a.i. per ha was next relatively safer chemical while cypermethrin, lambda-cyhalothrin and quinalphos applied at 37, 15 and 200 g a.i. per ha, respectively were detrimental to the spiders. Hence, chlorantaniliprole 18.5 SC, emamectin benzoate 5 SG and pyridalyl 10 EC can be better fit in integrated pest management in okra. In future also, similar study may be conducted so that effective and safer molecules can be indentified for eco-friendly management of insect pests in various crop ecosystems.

**Acknowledgment:** The author is thankful to Head of the Department of Entomology, CCS Haryana Agricultural University for providing me the necessary facilities to conduct this study.

**Conflict of Interest:** None.

## REFERENCES

[1]. Anonymous (2018). Indian Horticulture Data Base, National Horticulture Board, Agricultural Research Data Book, ICAR, New Delhi.

[2]. Chaudhary, H.R. and Dadeech, L.N. (1989). Incidence of insect attacking okra and losses caused by them. *Annuals of Arid Zone*, **2**(3/4): 305-307.

[3]. Cruces, L., de la Peña, E., De Clercq, P. (2021). Field evaluation of cypermethrin, imidacloprid, teflubenzuron and emamectin benzoate against pests of quinoa (*Chenopodium quinoa* Willd.) and their side effects on non-target species. *Plants,* **10**, *1788. https://doi.org/10.3390/plants10091788.*

[4]. Dhanalakshmi, D.N. and Mallapur, C. P. (2008). Evaluation of promising molecules against sucking

pests of okra. *Annals of Plant Protection Science,* **16**(1): 29-32.
[5]. Gallo, D., Nakano, O., Silveira-Neto, S., Carvalho, R.P.L., Baptista, G.C., Berti-Filho, E., Parra, J.R.P., Alves, S. B., Vendramin, J.D., Marchini, L.C., Lopes, J.R.S. and Omoto, C. (2002). *Manual de Entomologia Agrrcola. Piracicaba, Fealq*, p. 649.
[6]. Govindan, K., Gunasekaran, K. and Kuttalam, S. (2013). Emamectin Benzoate 5 SG: A safer insecticide to coccinellids predators in cotton ecosystem. *African Journal of Agricultural Research*, **8**(21): 2455-2460.
[7]. Ignacimuthu, S. 2007. Insect Pest Management. Meeting Report. *Current Science*, **92**: 1336-1337.
[8]. Isayama, S., Saito, S., Kuroda, K., Umeda, K. and Kasamatsu, K. (2005). Pyridalyl, a novel insecticide: potency and insecticidal selectivity. *Archives Insect Biocheistry and Physiology*, **58**(4): 226-233.
[9]. Matcha, N., Duraimurugan, P. and Bhowmick, A. K. (2021). Effect of spinetoram 11.7 SC and some newer chemicals against *Spodoptera litura* (F.) on soybean. *Biological Forum – An International Journal*, 13(2): 720-724.
[10]. Nair, N., Sekh, K., Somchoudhury, A. K. and Dhar, P.P. (2008). Bioefficacy of pyridalyl 10 EC against the bollworms of cotton and its effect on natural enemies in West Bengal condition. *Journal of Entomological Research*, **32**(4): 313-315.
[11]. Narayan, H.A., Zanwar, P.R. and Shubhash, A.S. 2019. Bioefficacy of newer insecticides against natural enemies of insect-pest on brinjal (*Solanum melongena* L.). *Journal of Pharmacognosy and Phytochemistry,* **8**(5): 1144-1147.
[12]. Pandey, S., Sundria, M.M. and Ameta, H.K. (2021). Bio-efficacy of some insecticides against fruit and shoot borer, *Leucinodes orbonalis* Guenee of brinjal and their effect on natural enemies. *Journal of Entomological Research,* **45**(1) : 95-97.
[13]. Patel, R.D., Parmar, V.R., and Patel, N.B. (2016). Bioefficacy of chlorantraniliprole 35 WG against *Helicoverpa armigera* (Hubner) Hardwick in tomato. *Trends in Bioscience Journal*, **9**(15): 793-798.
[14]. Rajavel, D.S., Mohanraj, A. and Bharathi, K. (2011). Efficacy of chlorantraniliprole (Coragen 20 SC) against brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guen.). *Pest Management in Horticultural Ecosystems*, **17**(1): 28-31.
[15]. Rao, N.S. and Rajendran, R. (2002). Joint action potential of neem with other plant extracts against the leaf hopper *Amrasca devastan* (Distant) on okra. *Pest Management and Economic Zoology*, **10**:131-136.
[16]. Sheoran, O.P. (2010). Online statistical analysis (OPSTAT) software developed by Chaudhary Charan Singh Haryana Agricultural University, Hisar, India. http://www.hau.ernet.in/opstat.html.
[17]. Sontakke, B.K., Das, N., Panda, P.K. and Swain, L.K. (2007). Bioefficacy of emamectin benzoate 5 SG against fruit and shoot borer in okra. *Journal of Plant Protection and Environment,* **4**(2): 30-33.
[18]. Venkateswarlu, V., Sharma, R.K. and Sharma, K. (2011). Evaluation of eco-friendly insecticides against major insect pests of cabbage. *Pesticide Research Journal*, **23**(2): 172-180.
[19]. Wagh, B.M., Pagire, K.S., Thakare, D.P. and Birangal, A.B. (2017). Management of sucking pests by using newer insecticides and their effect on natural enemies in tomato (*Lycopersicon esculentum* Mill.). *International Journal of Current Microbiology and Applied Science,* **6**(4): 615-622.