



EVALUATION OF IPM AGAINST PEST COMPLEX OF OKRA

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ABSTRACT

With the major pests such as shoot and fruit borer, *Earias vittella* (Lepidoptera: Noctuoidea), whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) are causing qualitative and quantitative loss to okra. In this study along with this two other important pests like leafhopper, *Amrasca bigutulla bigutulla* and aphids, *Aphis gossypii* were also studied. For controlling pests sustainable approach is required which causes less environmental hazard and economically affordable to farmers. The Integrated Pest Management (IPM) module based upon integration of resistant cultivars, cultural, mechanical and physical methods, natural enemies, biopesticides and pesticides to suppress pest population is the best solution.

Key words: IPM, shoot and fruit borer (*Earias vittella*), resistant variety, predator, natural enemies, border crop, pesticides, marketable yield, yield loss, ICBR

Okra (*Abelmoschus esculentus* L.) commonly known as 'Lady's finger' is an important vegetable crop in the Malvaceae family. India is the world's largest producer of okra. Okra is grown on a total of 5.14 lakh ha in India with an annual production of 6.12 million tonnes and productivity of 12 MT per ha. It is grown on 1.44 lakh ha in Maharashtra with an annual production of 14.80 lakh tonnes and productivity is 10.26 MT per ha (Anonymous, 2018). Leaf hopper (*Amrasca bigutulla bigutulla* Ishida 1912), whitefly (*Bemisia tabaci* Gennadius 1889), aphids (*Aphis gossypii* Glover 1877) and shoot and fruit borer (*Earias vittella* Rogenhofer 1870) are the major pests of okra. Among these pests, okra shoot and fruit borer (*Earias* sp.) is recognized as the most important one which causes both quantitative and qualitative losses of the okra crop (Mane and Kumar, 2019). To minimize the losses caused by insect pests in okra several insecticides have been recommended by many workers (Berwa et al., 2017; More, 2018).

Chemical control is the most promising strategy for insect pest management since it has the ability to control insect pests very quickly and chemicals are readily available in the market compared to other conventional methods of pest control. Excessive pesticide use leads to the development of resistance in target pests as well as killing of beneficial organisms such as pollinators (particularly bees) and natural enemies (insect parasitoids and predators) (Pedigo and Rice, 2006) with environmental pollution. To overcome

the problem of pest infestation without jeopardizing ecology and environment, it is necessary to adopt IPM strategies for insect pest management. Several IPM trials have been conducted all over the world and found that integration of all control measures like use of resistant varieties, growing border crops, trap crops, sticky traps, pheromone traps, botanical insecticides, bio-pesticides along with the application of chemical pesticides reduces the pest problem to a great extent.

MATERIALS AND METHODS

A field experiment was carried out during Kharif season 2020 at the Research Farm of All India Coordinated Research Project on Vegetable Crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra with three management modules for controlling major pests of okra including untreated control. The module are: T₁: Integrated Pest Management Module (IPM) includes sowing of maize crop as border crop, installation of yellow sticky traps @ 30/ ha at 30 days after sowing, installation of pheromone traps @ 12/ ha, spraying of *Azadirachtin* (10,000 ppm) @ 3 ml/ l of water after appearance of pest, spraying of flupyradifurone 200 SL @ 2 ml/ l of water at 10 days after first spray, spraying of chlorantraniliprole 18.5% SC @ 0.3 ml/ l of water at 10 days after second spray, spraying of spiromesifen 22.9% SC @ 0.6 ml/ l of water at 10 days after third spray. T₂: Bio-Intensive Pest Management module (BIPM) includes spraying

of pongamia oil @ 10 ml/ l after appearance of pest, spraying of *Azadirachtin* (10,000 ppm) @ 3 ml/ l of water at 10 days after first spray, spraying of *Bacillus thuringiensis kurstaki* @ 1 g/ l of water at 10 days after second spray, spraying of *Beauveria bassiana* @ 5 g/ l of water at 10 days after third spray. T₃: Chemical Pest Management module (CPM) includes spraying of flonicamid 50% WG @ 0.4 g/ l of water after appearance of pest, spraying of difenthiuron 50 % WP @ 1 g/ l of water at 10 days after first spray, spraying of spiromensifen 22.9 % SC @ 1.25 ml/ l of water at 10 days after second spray, spraying of fenpropathrin 30% EC @ 0.3 ml/ l at 10 days after third spray. T₄ formed untreated control treatment.

The four modules were laid out in a randomized block design (RBD) with five replications. Each module was divided into five equal blocks to serve as replications. The okra var. Phule Vimukta was sown in ridges and furrows on 24th August, 2020 at the 30 x 15 cm spacing. The FYM @ 20 t/ha and NPK @ 100: 50:50 kg/ ha were applied as per recommended practices. The three pest management modules viz. IPM, BIPM, CPM were tested against okra leaf hoppers, whitefly, aphids and shoot and fruit borer under field conditions and compared with untreated control. The treatment application with spraying of pesticides and bio-pesticides were given at ten days interval starting from pest appearance. Spraying was undertaken in the morning hours using manually hand operated sprayer by using 500 litre of water per hectare. The pre count of *A. bigutulla bigutulla*, *B. tabaci*, *A. gossypii* and *E. vittella* was recorded a day before initiation of spraying and the

surviving pest population was recorded at 3rd, 7th, and 10th days after each of the four sprays. The total fruit yield of eight harvests were averaged and converted to hectare basis. The data on average survival population of pests was transformed into square root formation and % shoot as well as % fruit infestation were transformed in arcsine values. The subjected data was statistically analyzed as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The perusal of data in Table 1 reveals the effect of three pest management modules (IPM, BIPM and CPM) on *A. bigutulla bigutulla*, *B. tabaci*, *A. gossypii* and *E. vittella* applied treatments proved significantly superior to control. Amongst the pest management modules, IPM and CPM modules were found equally effective in controlling the different pests. Both the treatments were significantly superior to BIPM. The IPM and CPM modules recorded maximum pest control with minimum 5.23 *A. bigutulla bigutulla*/ 3 leaves/ plant, 2.74 *B. tabaci*/ 3 leaves/ plant, 5.24 *A. gossypii*/ 3 leaves/ plant and 3.22% shoot infestation by *E. vittella*. On the other hand, in untreated control, the *A. bigutulla bigutulla* were found maximum 18.20, *B. tabaci* 14.12, *A. gossypii* 15.34/ plant and 14.07% shoot infestation by *E. vittella*. The maximum effectiveness of IPM and CPM treatments has also been observed by Garg et al. (2018), Nevgi et al. (2018), Pawar et al. (2019) in case of leaf hopper, and Kodandaram et al. (2017), More (2018), Mane and Kumar (2019) in case of whitefly, Katesiya and Prajapati (2019) in case of aphids, *E. vittella* Chavan (2017) and Bade et al. (2017).

Table 1. Effect of IPM modules on okra

Treatments	Average of four spray				% fruit infestation (Mean of eight pickings)		
	Leaf hoppers/ 3 leaves/ plant	Whitefly/ 3 leaves/ plant	Aphids/ 3 leaves/ plant	% shoot infestation by shoot and fruit borer	Survived Coccinellid grubs/ 3 leaves/ plant	Number	Weight
Integrated Pest Management Module	5.23 (2.39)*	2.74 (1.80)**	5.24 (2.39)**	3.22 (10.34)**	3.36 (1.96)*	5.47 (13.52)**	4.87 (12.75)*
Bio-intensive Pest Management Module	7.80 (2.88)	3.90 (2.10)	6.89 (2.72)	5.66 (13.76)	3.95 (2.11)	8.58 (17.03)	8.00 (16.43)
Chemical Pest Management Module	5.45 (2.44)	2.82 (1.82)	5.05 (2.36)	3.40 (10.62)	1.10 (1.26)	5.75 (13.87)	5.17 (13.14)
Untreated Control	18.20 (4.32)	14.12 (3.82)	15.34 (3.98)	14.07 (22.03)	5.00 (2.34)	24.59 (29.73)	22.67 (28.43)
S.Em+	0.06	0.04	0.04	0.15	0.04	0.21	0.23
C.D. (p=0.05)	0.18	0.14	0.16	0.46	0.13	0.64	0.71

*Figures in parentheses $\sqrt{x+0.5}$ transformed values; **Figures in parentheses for % shoot and fruit infestation are arc sin transformed value.

The IPM module was found to be most effective in controlling *E. vittella* on okra, (5.47% on number basis and 4.87% on weight basis fruit infestation) and at par with chemical module (5.75 % on number basis and 5.17% on weight basis fruit infestation). The BIPM module was next better treatment to control of *E. vittella* (8.58% on number basis and 8.00% on weight basis fruit infestation). The untreated control recorded highest fruit infestation (24.59% on number basis and 22.67% on weight basis fruit infestation). The IPM module comprised chemical components like treatment with chlorantraniliprole 18.5% SC which was found effective in reducing the shoot and fruit borer population on okra. The present findings are in close agreement with More (2018), Kodandaram et al. (2017), Mane and Kumar (2019) and Pawar et al. (2019).

It is evident from the mean surviving population of coccinellid grubs that the BIPM module recorded significantly higher 3.95 grubs/ plant, followed by IPM module (3.36 grubs/ plant). Whereas, the chemical module recorded the least population of grubs 1.10/ plant. The untreated control treatment recorded 5.00 grubs/ plant. The BIPM module was found safe to the grubs of coccinellids. The chemical module was found toxic to the Coccinellids recording least population of the grubs. The present investigations are in agreement with the findings of Patil et al. (2019) and Patil et al. (2020). Similarly, Ingale (2016), Boraste (2019), Naik et al. (2019) also observed that the pongamia oil was not toxic to adult coccinellid predators. The effect of different modules on the fruit yield of okra as presented indicate that the IPM module recorded maximum (193.79 q/ ha) yield of okra as against 132.20 q/ ha under untreated control. Whereas, the chemical module which was found at par with IPM module and recorded 180.46 q/ ha yield of okra. The BIPM module recorded relatively less yield (165.54 q/ ha) than IPM module and chemical module. The highest incremental cost: benefit ratio (ICBR) was recorded in the chemical module (1:10.07). The next best module in order of ICBR is IPM module recorded 1:9.47 ICBR. The BIPM module recorded comparatively less ICBR (1:8.39). Considerable yield advantage due to effective control of pests of okra particularly by using of IPM module was observed which is in close agreement with those of Birah et al. (2015), Ingale (2016) and Boraste (2019). These workers reported IPM to be effective in controlling pest in various crops with highest yield. Thus, the observations of earlier worker in respect of strategies used in IPM could support the present findings of present investigation.

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AUTHOR CONTRIBUTION STATEMENT

RP and SP conceived and designed research. RP and SP conducted experiments. CP contributed analytical tool. RP, SP and YS analysed data. RP wrote manuscript. All authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

- Anonymous. 2018. Area and production of horticulture crops. www.indiastatagri.com.
- Bade B A, Nimbalkar N A, Kharbade S B and Patil A S. 2017. Seasonal incidence and bioefficacy of newer insecticides and biopesticide against aphids on okra and their effect on natural enemies. *International Journal of Pure and Applied Bioscience* 5: 1035-1043.
- Berwa R, Sharma A K, Pachori R, Shukla A, Aarwe R and Piyali B. 2017. Efficacy of chemical and botanical insecticides against sucking insect pest complex on okra (*Abelmoschus esculentus* L. Monech). *Journal of Entomology and Zoology Studies* 5: 693-1697.
- Birah A, Singh S, Singh P K and Roy S D. 2015. Evaluation and efficacy of pest management modules for cucurbits against fruitfly, *Bactrocera cucurbitae* (Coquillett) in Andaman. *International Journal of Plant Ressearch* 28: 62-66.
- Boraste A A. 2019. Evaluation of different modules against major pests of cucumber (*Cucumis sativus* L.). M Sc (Agri.) Thesis, M.P.K.V. Rahuri, Maharashtra.
- Chavan T. 2017. Bioefficacy and use of eco-friendly plant and animal origin formulations for the management of pest complex of chilli (*Capsicum annum* L.). Ph D (Agri) thesis, G B Pant University of Agriculture and Technology Pantnagar, Uttarakhand.
- Garg V K, Patel Y, Raghuvanshi M S and Jamliya G S. 2018. Bio-efficacy of flupyradifurone 200SL against sucking pest and their natural enemies on brinjal. *Annals of Plant and Soil Research* 20: 73-76.
- Ingale A G. 2016. Evaluation of pest management strategies against pests of chilli (*Capsicum annum* Linn.). M Sc (Agri) Thesis submitted to M.P.K.V. Rahuri, Maharashtra.
- Katesiya M K and Prajapati B G. 2019. Bio-efficacy of different insecticides against aphid, *Aphis gossypii* Glover infesting isabgul. *International Journal of Pharmacognosy and Phytochemistry* 8: 1458-1460.
- Kodandaram M H, Halder J, Singh N and Rai A B. 2017. Pesticide Research Journal 29: 153-157.
- Mane P D and Kumar R. 2019. Evaluation of bio-intensive IPM module

- in okra. International Journal of Environmental Science and Technology 8: 1215-1219.
- More T. 2018. Management of shoot and fruit borer, *Earias vittella* fabricius on okra. M.Sc. (Agri.) Thesis, M.P.K.V. Rahuri, Maharashtra.
- Naik O, Kannan G S and Chakravarthy A K. 2019. Impact of integrated pest management modules on natural enemies of whiteflies, *Bemisia tabaci* (Genn.) in bitter gourd ecosystem. Journal of Biological Control 33: 63-69.
- Narke C G and Suryawanshi D S. 1987. Chemical control of major pests of okra. Pesticides 21: 37-42.
- Nevgi S A, Pawar S A, Datkhile R V and Bhalekar M N. 2018. Bio-efficacy of insecticidal mixtures against sucking pests of Brinjal (*Solanum melongena* L.). Annals of Plant Protection Science 26: 240-243.
- Panse V G and Sukhatme P V. 1985. Statistical Methods for Agricultural Workers. 3rd edition, ICAR, New Delhi. pp. 347.
- Patil S, Arunkumar B, Renuka H, Poornima H, Shridhar D and Padanad L A. 2020. Evaluation of IPM modules against shoot and fruit borer in Okra. International Journal of Chemical Studies 8: 188-190.
- Patil S, Sumedha J, Kakad M N and Lande G K. 2019. Effect of *Azadirachtin* with chemical insecticides and *Verticillium lecanii* against shoot infestation due to *Leucinodes orbonalis* (Guenee) of brinjal. Journal of Entomology and Zoology Studies 7: 850-854.
- Pawar S A, Bhalekar M N and Datkhile R V. 2019. Evaluation of newer insecticides against sucking pests of okra (*Abelmoschus esculentus* L.). Annals of Plant Protection Science 27: 335-337.
- Pedigo L P and Rice M E. 2006. Entomology and Pest Management. 5th edition, PHI Learning Private Limited, New Delhi.

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