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Efficacy and economics of biopesticide and insecticide combinations against okra pests

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ABSTRACT
Studies on the combinations of commercial formulation of *Bacillus thuringensis* (B.t.) @ 500 g ha^{-1} with lower concentration of insecticides viz., Cartap 50 SP @ 130 g ha^{-1}, Acephate 75 SP @ 300 g ha^{-1}, Chlorpyriphos 20 EC @ 175 g ha^{-1}, Endosulfan 35 EC @ 250 g ha^{-1}, Amrutguard 0.5% and B.t. @ 500 g ha^{-1} as well as Monocrotophos 36 EC @ 400 g ha^{-1} alone against Jassid, *Amrasca biguttula biguttula* Ishida and shoot and fruit borer *Earias vittella* Fabricius were conducted at the University Apiary, Rajendra Agricultural University, Pusa Farm during summer of 2000 and 2001. The treatment combinations of B.t. + Endosulfan and Bt + Acephate recorded minimum Jassid population (7.94 and 7.97/ 30 leaves), per cent shoot infestation (9.10 and 9.46) and per cent fruit damage based on fruit number (17.35 and 19.50) and fruit weight (16.3 and 17.13) as well as the larval population per hundred fruits (24.23 and 27.61). These treatments also maximized the crop yield 123.14 and 117.52 q ha^{-1}, respectively and proved to be most effective treatments, while B.t. alone was found to be the least effective treatment. Monocrotophos proved profitable in monetary term with the maximum cost benefit ratio (1:5.21) followed by B.t. + Endosulfan (1:2.96).

Key words : Biopesticide, Okra, Jassid, Shoot and fruit borer, Insecticide.

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is an important vegetable crop and grown widely in various parts of India throughout the year. It is considered to be native of India and is grown extensively in South-East Asian countries. One of the major constraints for low productivity and poor qualificative in India is that the crop is attacked by as many as 45 species of pests belonging to different orders on okra Nair (1981). Out of numerous pests that infest the okra crops, the Jassid, *Amrasca bigutulla biguttula* Ishida and shoot and fruit borer, *Earias vittella* Fabricius, are the most serious pests and a major limiting factor in okra cultivation. Krishnaiah (1980) estimated the loss due to Jassid and shoot and fruit borer incidence to be in the order of 40-56 and 49-79 per cent, respectively in untreated plot. After the introduction of hybrid varieties of okra with broader leaves, the pests have become a thrust to okra cultivation in India. To control the pest ravages, farmers use many insecticides during crop growth period. But frequent and enormous use of synthetic pyrethroids, organophosphate insecticides has posed the resistance problem and resurgence of pest(s) (Mehrotra, 1990). Moreover, in okra the shorter interval between pluckings of fruits poses the residue hazards to the consumers when the chemical insecticides are used. The pests were also found to develop resistance to insecticides (Kabir *et al*., 1994). Microbial insecticides particularly those derived from bacterium, *Bacillus thuringensis* Berliner (Colloquially called B.t.) offer great promise for management of various pests in vegetables. However, the biopesticides are not as effective as conventional insecticides. Delfin WG (B.t. kurstaki) was used alongwith lower concentration of insecticides in the present study and the efficacy of combinations against the pests are discussed in this paper.

MATERIALS AND METHODS

The field experiment was conducted at the University Apiary, Rajendra Agricultural Univeristy, Pusa Farm, Samastipur, Bihar during summer, 2000 and 2001 to assess the efficacy of biopesticide and insecticide combinations on the pests incidence. The experiment was laid out in a randomized block design with three replications in a plot size of 3 m x 2 m. The okra (cv. Pusa Sawani) seeds were sown on 16th February in both the years with a spacing of 30 cm x 30 cm. All the crop management practices except the insecticide applications were followed for maintaining healthy crop growth. There were 8 treatments including untreated control (Table 1).

Spraying was done late in the afternoon with high volume knapsack sprayer (ASPEE make) and a through coverage of leaf area, tender shoots and fruits was ensured. Sprays were done @ 200-500 L of water ha^{-1}, depending on the height of the crop. First foliar spray was done on 3rd April after 20 days of the crop emergence on 25th March followed by second and third foliar sprays on 15th April and 6th May after 40 and 60 days of the crop emergence, respectively in both the years (2000 and 2001).

Observation on population density of pests :

Jassid :

Observations on the pest activity were recorded in each plot of the replicates, a day preceding and 3 and 7 days following the foliar treatments in both the years. Jassid nymphs as well as adults population were observed from three leaves consisting of 2nd, 3rd and 4th each of the 10 randomly selected tagged plants in each of the replicates after Krishnaiah *et al*. (1979). Both the Jassid nymphs and adults were counted on lower surface of leaves in boarder area of plots in the early morning (7 AM to 9 AM), the time during which the Jassids were found inactive. The population of Jassids counts in all the replicates were taken together and average population per 30 leaves per 10 plants was worked out and transformed into square root, x + 0.5 value for analysis of variance.

Shoot and fruit borers :

All the plants in a plot were considered for recording shoot and fruit borer incidence. Harvesting of okra fruits was done at weekly interval. Observations on the pest incidence, viz., shoot damage (total number of shoots and damaged shoots) and fruit damage (total number and total weight of healthy and damaged fruits) were recorded on weekly basis and ultimately pooled together, separately for the respective parameters after tabulating replication wise at each observation to worked out mean value of the pest incidence calculated by unitary method by using the following formula:

$$\text{(i) Per cent shoot damage} = \frac{\text{No. of damaged shoots}}{\text{Total no. of (healthy + damaged) shoots}} \times 100$$

$$\text{(ii) Per cent fruit damage by no.} = \frac{\text{No. of damaged fruits}}{\text{Total no. of (healthy + damaged) fruits}} \times 100$$

$$\text{(iii) Per cent fruit damage by wt.} = \frac{\text{Wt. of damaged fruits}}{\text{Total wt. of (healthy + damaged) fruits}} \times 100$$

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