EVALUATION OF BIOPESTICIDES ON Helicoverpa armigera (Hubner) INFESTING CHICKPEA

Key words: Bacillus thuringiensis (Berliner), Beauveria bassiana (Balsamo) Vuillemin, Biopesticides, chickpea, HaNPV, Helicoverpa armigera (Hubner)

The present investigations were framed with an aim to evaluate the biopesticides against H. armigera in chickpea and was planned to assess the compatibility of B. bassiana with different insecticides, evaluation of biopesticidal spray schedules, effectiveness of different doses of biopesticides, their time of application, persistence and cumulative effect on different developmental stages of H. armigera. The field investigations were carried out at Instructional Farm, Department of Agronomy, while laboratory experiments were taken at Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Junagadh during the year 2015-16 and 2016-17.

Compatibility of B. bassiana was studied in the laboratory condition with thirteen commonly used insecticides with their three doses (Lower, recommended and higher) by poisoned food technique. The results showed that the insecticides, indoxacarb 14.5 EC, fipronil 5 SC, novaluran 10 EC and chlorantraniliprole 18.5 SC were found most compatible at all doses as they were categorized as harmless (Grade 1) to the fungus. However, lambda cyhalothrin 5 EC 0.0015%, emamectin benzoate 5 SG 0.002%, bifenthrin 10 EC 0.002%, spinosad 45 SC 0.007% and profenophos 40 + cypermethrin 4 EC 0.022% were relatively harmless (Grade 1) at lower dose. At recommended dose, bifentrin 10 EC 0.003% and spinosad 45 SC 0.014% were more compatible with tested fungus. Among all the insecticides, profenophos 50 EC was found to inhibit the highest growth of the B. bassiana and distinguished as a harmful (Grade 4) in all the doses.

Among the different biopesticidal spray schedules tested for their efficacy against H. armigera showed that schedule 1 contained four sprays of B. bassiana 1.15% WP 0.007% was found significantly most effective schedule at all growth stages (vegetative, 50% flowering, post flowering and full seed stage) of chickpea. However, four sprays of schedule 3 (HaNPV 350 LE/ha) and schedule 2 (B.
*thuringiensis* 0.5% WP 0.003%) were found next in order for effective management of this pest at different growth stages of chickpea.

The highest yield increase over control and avoidable loss in yield of chickpea grains due to *H. armigera* was estimated 82.00 and 44.45%, respectively in schedule 1. The economics of different biopesticidal schedules showed that maximum grain yield of 1708 kg/ha with 82.00% increase yield over control along with the highest net return of 34167 ₹/ha and ICBR 1:11.21 was obtained from spray schedule 1. The grain yield (1567 kg/ha) and yield increase over control (62.50%) were obtained from the next better schedule 3, which noted, net return of 27813 ₹/ha with ICBR of 1:6.88.

*B. bassiana* 1.15% WP @ 5.0 g HaNPV 750 LE @ 1.50 ml and *B. thuringiensis* 0.5% WP @ 5.0 g per litre of water proved to be the most effective dose among four doses tested against all the developmental stages (egg, larvae, pupa and adult) of *H. armigera*.

Study to seek the application time of *B. bassiana*, HaNPV and *B. thuringiensis* showed that evening time (5.00 P.M.) was found the most efficient time of application to achieve better effectiveness of all the biopesticides, which was followed by application at morning (8.00 A.M.) against *H. armigera* in chickpea.

Based on the results of persistency among three biopesticides (*B. bassiana*, HaNPV and *B. thuringiensis*), HaNPV was found more effective against *H. armigera* in chickpea. Although, all the three biopesticides showed maximum effect up to 3 days and persisted up to 10 days on chickpea leaves and immature pods. The persistence for biopesticidal activity of all biopesticides against *H. armigera* became half within five days.

Susceptibility of *B. bassiana*, HaNPV and *B. thuringiensis* decreased with advance in age of the *H. armigera* larvae. Early instar larvae (first to third) were the most susceptible than the later instars (fourth to fifth). The cumulative (larva + pupa + adult) mortality due to *B. bassiana*, HaNPV and *B. thuringiensis* in all the five instars ranged from 66.24 to 91.08, 68.93 to 99.74 and 61.28 to 88.39% with an average of 81.20, 85.89 and 75.71%, respectively.

From the overall results of the present investigation, it can be concluded that when the first instar larvae of *H. armigera* appeared on chickpea, four schedule spraying of *B. bassiana* 1.15% WP 0.007% (5.0 g/litre) and HaNPV 500 LE @ 1.00 ml/litre during evening hours at vegetative, 50% flowering, post flowering and full seed stage was recommended against this pest. These biopesticides showed maximum persistence up to 10 days under field condition and indoxacarb 14.5 EC, fipronil 5 SC, novaluran 10 EC and chlorantraniliprole 18.5 SC were found the most compatible with *B. bassiana*. 