Chapter 6

SUMMARY
Studies on the population dynamics of *H. armigera* and determination of efficacy of bio-pesticides and combination with insecticides were concluded in chickpea. Two field trials were conducted during year 2007-08 and 2008-09 at crop Sardar vallabh Bhai Patel University of Agriculture and Technology, Modipuram Meerut (U.P.) The trials were laid out randomized block design and sown in week of November and harvested in the month of April.

The larvae of *H. armigera*, the damaging stage, generally appeared on chickpea crop in the 50\(^{th}\) and 51\(^{st}\) standard week. Its population gradually increased during successive weeks and attained the first peak with low larval population in the 52\(^{nd}\) week. Thereafter, the larval population declined sharply and again increased very fast reached its highest second with population in the 9\(^{th}\) standard week. However, during 10\(^{th}\) standard week the larval population started declining. The pest completed two overlapping generations during second fortnight of December to March (50\(^{th}\) to 9\(^{th}\) standard week).

The larval parasitization was started in the 3\(^{rd}\) standard week during 2007-08 and one week earlier i.e. n the 2\(^{nd}\) standard week during 2008-09 low till 4\(^{th}\) standard week. Thereafter, it increased and reached to highest in the 6\(^{th}\) standard week. The parasitization become nil in the 11\(^{th}\) standard week in the first year and in the 12\(^{th}\) standard week in the second year.

The range of atmospheric temperature ranging from 22.75 to 25.37\(^{\circ}\)C maximum and 9.75\(^{\circ}\)C minimum to 87.75% morning and 43.75 to 50.75% in the evening were found ideal weather factors for its appearance. The most conducive weather factors for larval development of highest peak were recorded as 21.87 to 27.25\(^{\circ}\)C maximum and 7.38 to
11.75°C minimum temperature and 82.12 to 89.62% morning and 34.50 to 46.75% evening relative humidity. Further rise in maximum temperature (above 29.87°C) and minimum temperature above 12.87°C and decrease in relative humidity did not favor the buildup of larval population. It was observed that maximum and minimum temperature and evening relative humidity were negatively correlated with larval population.

Results on the efficacy of bio-pesticides in the field revealed that treatment of Ha NPV @ 125 LE/ha + endosulfan @ 0.05% was found superior over the other treatments. It was followed by treatment endosulfan and Ha NPV @ 250 LE/ha alone. Among the fungal pathogen the Nomuraea rileyi was the better than Beauveria bassiana and Metarhizium anisopliae in controlling the larval population. Treatments lower and higher dose with neem oil and Bt. were not found as effective as fungal pathogen against larvae of H. armigera. Neem Products i.e. NSKE (5.0%) and neem oil (3.0%) were least effective against this pest. The cost benefit ratio showed that the highest per rupee return of Rs. 9.82 was recorded in the treatment receiving three sprays of Ha NPV @ 250 LE/ha + endosulfan @ 0.05% followed by endosulfan alone (9.02). The lowest per rupee return Rs. 2.65 and 3.94 were recorded in the treatment receiving three sprays of NSKE and neem oil, respectively. The per rupee return Rs. 6.35, 6.05 and 5.71 were registered in treatment with N. rileyi, B. bassiana and M. anisopliae, respectively.

Second and third instar larvae were tested with their respective bio-pesticides and neem based formulation showed significant variations in percent mortality after 3rd and 6th day of the application. Treatment with Ha NPV (1.4×10 POBs/ml) was found superior over the rest of the treatments. It was observed that among the fungal pathogens tested, N. rileyi was proved better over B. bassiana and M. anisopliae in killing the larvae of H. armigera.
Treatment with lower and higher concentration of Ha NPV in combination with neem oil were found less effective against larvae of *H. armigera* compared to Ha NPV (1.4×10^6 POBs/ml), endosulfan, and *B.thurengiensis* (1.4×10^6 POBs/ml). Neem formulations were found least effective.