CHAPTER 5
SUMMARY AND CONCLUSION

The investigations were undertaken on “Seasonal incidence, residual toxicity and bio-efficacy of different insecticides on sucking pests of summer cowpea” at Junagadh Agricultural University, Junagadh.

4.1 Seasonal incidence of sucking pests in cowpea and its relation with weather parameters

4.1.1 Jassid, *E. kerri* (Pruthi)

The jassid population initiated from the 1st WAS i.e the second week of March with 0.48 nymphs/3 leaves/plant. The population of the pest increased eventually from the 1st to 9th WAS and reached the peak population (4.91 nymphs/3 leaves/plant) in the 9th WAS coinciding with the first week of May. However the second peak of population (4.78 nymphs/3 leaves/plant) was observed in the 8th WAS (5th week of April). Jassid population was observed throughout the crop period. Then population declined gradually towards the end of the crop period.

The population of jassids exhibited significant positive correlation with maximum temperature ($r = 0.689$) and positive correlation with minimum temperature ($r = 0.152$), mean temperature ($r = 0.564$) and mean bright sunshine hours ($r = 0.196$). While, negative correlation with morning relative humidity ($r = -0.511$), evening relative humidity ($r = -0.344$), mean relative humidity ($r = -0.424$) and wind speed ($r = -0.272$) was observed during the summer season of 2016.

4.1.2 Whitefly, *B. tabaci* (Genn)

The population of whitefly (1.86 whiteflies/3 leaves/plant) appeared from the 1st WAS i.e the second week of March and remained active throughout the crop period. Whitefly population increased gradually and reached the first peak level of 4.99 whiteflies/3 leaves/plant during the 8th WAS coinciding with the fifth week of April. Later on, it was found to decline drastically and reached 1.54 whiteflies/3 leaves/plant at the time of harvest.

The correlation matrix indicated that the population of whitefly exhibited significant positive correlation with maximum temperature ($r = 0.613$) and positive correlation with minimum temperature ($r = 0.265$), mean temperature ($r = 0.412$) and mean bright sunshine hours ($r = 0.303$). Whereas, highly significant negative
correlation with morning relative humidity (r = -0.769), evening relative humidity (r = -0.708), mean relative humidity (r = -0.753) and negative correlation with wind speed (r = -0.054) was observed during the summer season of 2016.

4.1.3 Aphids, A. craccivora (Koch)

The population of aphids (0.48 aphids index / 3 leaves/plant) appeared from the 1st WAS i.e. the 2nd week of March and remained active throughout the flowering period. The pest population increased gradually and reached a peak level of 3.82 aphids index / 3 leaves/plant during the 8th WAS coinciding with the fifth week of April. The population declined gradually during the successive weeks and reached 1.86 aphids index/plant at the time of harvest.

The results of indicated that the population of aphids exhibited significant positive correlation with maximum temperature (r= 0.632). While, positive non-significant correlation exhibited between pest population, sunshine hours (r=0.292), mean temperature (r = 0.313), morning relative humidity (r = 0.019), evening relative humidity (r = 0.040) and mean relative humidity (r = 0.013). Whereas, correlation between aphids population, minimum temperature (r= -0.336) and wind speed (r= -0.500) was negatively non-significant.

4.2 Bio-efficacy of insecticides against sucking pests in cowpea

4.2.1 Jassid, E. kerri (Pruthi)

Dinotefuran 0.006 per cent, acetamiprid 0.004 per cent and dimethoate 0.03 per cent were the most effective treatments against jassid. Whereas, flonicamid 0.02 per cent, cyantraniliprole 0.02 per cent, clothianidin 0.003 per cent and chlofenapyr 0.0075 per cent were moderate in their suppressive action against the leaf hopper population.

4.2.2 Whitefly, B. tabaci (Genn.)

Acetamiprid 0.004 per cent maintains its supremacy in being the most efficient insecticide against whiteflies. The treatments dimethoate 0.03 per cent and spiromesifen 0.08 per cent were found statistically at par with acetamiprid 0.004 per cent. The insecticides, dinotefuran 0.006 per cent, flonicamid 0.02 per cent and clothianidin 0.003 per cent were the next best in order of their efficacy. The treatments, cyantraniliprole 0.02 per cent, chlorfenapyr 0.0075 per cent and spinosad 0.009 per cent were found poor in their suppressive action against the white fly population.
4.2.3 Aphid, *A. craccivora* (Koch)

Dinotefuran 0.006 per cent, acetamiprid 0.004 per cent and dimethoate 0.03 per cent were similar in their effectiveness against aphids although the former has recorded a higher mortality percentage. They are immediately followed by clothianidin 0.003 per cent and chlorfenapyr 0.0075 per cent were the next best in order of their efficacy. The insecticides, flonicamid 0.02 per cent, cyantraniliprole 0.02 per cent, spiromesifen 0.08 per cent and spinosad 0.009 per cent gave less than average results against aphids.

4.3 Residual toxicity

The results presented on per cent mortality in population of *A. craccivora* revealed that dinotefuran 0.006 per cent (98.00 per cent) was found superior over rest of the insecticide and it was at par with the treatments acetamiprid 0.004 per cent, spiromesifen 0.08 per cent and dimethoate 0.03 per cent as they had registered 96.00, 92.55 and 90.23 per cent mortality of aphids, respectively. The treatments flonicamid 0.02 per cent and clothianidin 0.003 per cent registered 87.33 and 85.66 per cent mortality, respectively. The rest of treatments chlorfenapyr 0.0075 per cent, cyantraniliprole 0.02 per cent and spinosad 0.009 per cent gave 79.25, 75.56 and 46.69 per cent mortality value, respectively.

After four days of spraying dinotefuran 0.006 per cent gave significantly the highest mortality of 95.23 per cent and it was statistically at par with acetamiprid 0.004 per cent (90.43 per cent). The treatments dimethoate 0.03 per cent, clothianidin 0.003 per cent, chlorfenapyr 0.0075 per cent, flonicamid 0.02 per cent, cyantraniliprole 0.02 per cent and spiromesifen 0.08 per cent registered 78.22, 77.32, 72.36, 66.44, 60.59 and 56.38 per cent mortality values, respectively and the lowest mortality was observed in treatment of spinosad 0.009 per cent which registered 38.25 per cent.

The treatment of dinotefuran 0.006 per cent gave the highest mortality of 81.15 per cent mortality after six days after spraying and it was found to be statistically at par with acetamiprid 0.004 per cent as it registered 74.36 per cent mortality. However, treatments of dimethoate 0.03 per cent, clothianidin 0.003 per cent, chlorfenapyr 0.0075 per cent and cyantraniliprole 0.02 per cent which had registered 69.66, 60.87, 45.25 and 42.25 per cent mortality proved that next best treatments, respectively.
Summary and Conclusion

The acetamiprid 0.004 per cent was significantly found to be the most effective treatment and gave 61.89 per cent mortality after eight days after spraying. The next best effective treatments dinotefuran 0.006 per cent and dimethoate 0.03 per cent recorded 52.25 and 44.29 per cent mortality, respectively. The insecticides clothianidin 0.003 per cent, spiromesifen 0.08 per cent and chlorfenapyr 0.0075 per cent registered 28.63, 22.55 and 21.56 per cent mortality, respectively. The mortality data also revealed that spinosad was the least persistent as it did not show mortality of the pest at eight days after application.

Among all the treatments mortality was drastically reduced after ten days of spraying. Acetamiprid, dinotefuran and dimethoate were found significantly superior to rest of the insecticides and show mortality, 55.23, 29.25 and 18.25 per cent respectively. Acetamiprid, dinotefuran and dimethoate were persisted for sixteen days and exhibited 9.95, 4.54 and 2.89 per cent mortality values, respectively.

The aphid mortality recorded at different intervals after the application, clearly indicated that there was continuous decline in effectiveness of various insecticides as the exposure of the insecticides was prolonged. Considering the RPT values, it can be observed that acetamiprid 0.004 per cent, dinotefuran 0.006 per cent and dimethoate 0.03 per cent were comparatively more effective in controlling the adults of aphids than others insecticides under test, both in respect of mortality as well as their prolonged persistances. Taking the RPT values into consideration, they can be arranged in descending order as follows: Acetamiprid > Dinotefuran > Dimethoate > Clothianidin > Chlorfenapyr > Flonicamid > Cyantraniliprole > Spiromesifen > Spinosad.

4.4 Yield and Economics

So far as yield of cowpea in various insecticides in concerned, the highest grain yield of 853 kg/ha was obtained from the treatment of dinotefuran 0.006 per cent, followed by acetamiprid 0.004 per cent, spiromesifen 0.08 per cent, dimethoate 0.03 per cent and flonicamid 0.02 per cent in which 816, 795, 790 and 752 kg/ha yield was recorded, respectively. While, chlorfenapyr 0.0075 per cent (700 kg/ha), cyantraniliprole 0.02 per cent (652 kg/ha), clothianidin 0.003 per cent (624 kg/ha) and spinosad 0.009 per cent (614 kg/ha) recorded moderate yield.
Summary and Conclusion

Among the different insecticides, the highest cost benefit ratio (1: 21.8) was obtained from the treatment of acetamiprid 0.004 per cent followed by dimethoate 0.03 per cent (1:21.2), spiromesifen 0.08 per cent (1:9.8), dinetofuran 0.006 per cent (1:9.4), chlorfenapyr 0.0075 per cent (1:5.8), clothianidin 0.003 per cent (1:5.5) and flonicamid 0.02 per cent (1:4.8). The remaining treatments, spinosad 0.009 per cent (1:1.9) and cyantraniliprole 0.02 per cent (1:0.4) registered low cost benefit ratios.

Considering the effectiveness yield and economics of insecticides, acetamiprid 0.004 per cent and dimethoate 0.03 per cent were found most effective and economical treatments for the control of sucking pests in cowpea. The treatments of dinetofuran 0.006 per cent and spiromesifen 0.08 per cent were found comparatively less economical against the sucking pests of cowpea ecosystem.