BIO-ECOLOGY AND MANAGEMENT OF DIAMOND BACK MOTH, *Plutella xylostella* INFESTING CABBAGE

SUMMARY

SUBMITTED TO THE UNIVERSITY OF ALLAHABAD FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN SCIENCE 2015

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SUMMARY AND CONCLUSION

Studies on bio-ecology and management of Diamondback moth, Plutella xylostella infesting cabbage were conducted during 2010-2011, 2011-2012 cropping season in Allahabad. Cabbage is important cruciferous vegetables infested by a number of pests contributing major losses both quantitative and qualitative, during different stages of its growth. Continuous and indiscriminate use of synthetic chemicals has resulted not only in the problems of resurgence, resistance and population but also caused adverse effects on beneficial insect. In view of this, management of the test insect pest, studies by using different botanical products, chemicals and their combination under laboratory conditions and fields conditions.

In nursery pests viz., Athalia lugens proxima, Liphahis erysimi (K.), Breyicoryne brassicae (L.) and grasshopper were recorded. Under field condition aphids, Breyicoryne brassicae (L.), Diamondback moth, Plutella xylostella were recorded as major pests. Cabbage aphid, Breyicoryne brassicae were recorded to infest the cabbage crop in second week of January and touched the peak in the first fortnight of March and last fortnight of February in both the years i.e., 2010-2011 and 2011-2012, respectively. The aphid population was positive correlated with maximum and minimum temperature, relative humidity, rainfall, sunshine hours and wind velocity in 2010-2011, while in 2011-2012, it was positively correlated with maximum and minimum temperature, maximum relative humidity, rainfall, wind velocity and sunshine hours. The studies on the correlation of cabbage aphid with weather parameters indicated that the aphid population increased with increasing maximum and minimum temperature, relative humidity, rainfall and sunshine hours.

Among the natural enemies of cabbage aphid, it was found that C. septempunctata, C. transversalis and Syrphids spp. were predating the aphids during this study. They appeared more or less along with the commencement of aphid population. The Coccinellids population was maximum in the first and 3rd fortnight of February in both the years i.e., 2010-2011 and 2011-2012.
The aphidophagopus predator syrphids appeared more or less with appearance of aphid in the last week of January and remained active till last week of March. The correlation analysis between the aphid and syrphid showed significant positive correlation.

*Plutella xylostella* appeared in the beginning of September and its population steadily touched the peaks by the end of November followed a decline phase from 1st week of December to first week of February onwards and peaked in April. Population of *Plutella xylostella* showed positive correlation with maximum temperature and minimum temperature and negative correlation with relative humidity, rainfall, wind velocity and sunshine hours. Overall survey revealed temperature as a key abiotic factor in regulating the field population; hot conditions favoured its multiplication, while cold ones in November – February limited it.

The studies on the biology of *P. xylostella* revealed that on emergence female took on average of 1.5 ± 0.8 days for laying eggs. Each female deposited an average of 173.6 ± 26.51 eggs over a period of 3.6 ± 0.6 days. The egg larval and pupal period lasted for about 2.4 ± 0.6, 5.9 ± 0.6 and 4.6 ± 0.65 days respectively. The average male and female adult’s longevity were about 21.2 ± 0.67 and 21.1 ± 1.32 days respectively. In general males lived longer than females.

In studies on the biology and feeding potential of *C. septempunctata* female deposited an average of 312.4 ± 62.43 eggs during its life time. The average egg, larvae, pupae period and adult longevity were 7.0, 6.0, 6.3 and 32.5 ± 2.18 days respectively. It was observed that each *C. septempunctata* adult devoured on an average of 62.5 ± 5.45 aphids/day. Each *C. transversalis* female deposited on an average 302.6 ± 56.30 eggs during its life time. The average egg, grub, pupal period and adult longevity were 5.9, 5.0, 5.1 and 32.5 ± 2.53 days respectively. It was observed that *C. transversalis* on an average devoured 36.8 ± 12.18 aphids/day. Among the two Coccinellids, the feeding potential *C. septempunctata* was higher than *C. transaversalis* in both grub and adult stage.

In the present study considering all the aspects i.e. different time periods, different treatments, different instars and different method, it was noted that all three methods are significantly different from each other to cause the mortality of the larvae. Among the
chemical insecticides Quinalphos (0.05%) recorded highest net mortality on all the larval instar over control.

The data revealed that mortality rate increased with the increased in hours. The percent net mortality in 1st instar larvae and 3rd larvae were significantly more as compared to 4th instar larvae. It was observed that the 1st instar larvae showed higher mean value followed by 3rd instar than 4th instar respectively. It was also found that the percent net mortality rate significantly increased with the increase in the time periods, being maximum at 72 hours with highest mean value, followed by 48 hours and then 24 hours, respectively.

Among the botanical products the extracts of NSKE 5% was found to cause maximum net mortality on the 1st instar larvae for the time period of 72 hours and minimum net mortality caused by *Curcuma logna* extract 3% on the 4th instar larvae for the time period of 24 hours.

The field efficacy of these treatments were also worked out on the basis of percent reduction in pest population, indicated that all the treatments proved better than untreated control in reducing the infestation and enhancing the marketable yield of cabbage. Highest yield was obtained from Quinalphos 0.05% during the cropping season of 2010-2011 and 2011-2012 respectively. The highest net profit over untreated control was recorded in Quintalphos in the first and second cropping season respectively. On the basis of benefit cost ratio the maximum ratio was observed in Quinalphos in both the cropping season.

The comparative efficacy of various treatment combination (Modules) was tested against the larvae of *P. xylostella* under field condition during 2010-2011 and 2011-2012 and the most effective module was $M_2$ (Quinalphos 0.05% + Neem leaf extract 5% + Garlic extract 5%) followed by $M_4$ (DDVP 0.05% + Chilli extract 3% + NSKE 5%).

Many authors studied on the incidence and biology of insect pests of cabbage and their natural enemies at different places and different times. Yet no information has been generated from this region on pest constraints of this important vegetable crop. Therefore, the information's obtained from this study can effectively utilized in formulating pest management programme for the insect pests of cabbage in this region.
CONCLUSION

In view of the faces given in the foregoing discussion, the following inferences have been drawn out from the present study.

1. It may be conducted among all the chemical insecticides, as Quinalphos 0.05% proved to be best followed by DDVP (Dichlorvos) 0.05% concentration in controlling test insect. On other hand, certain botanical products were also very effective against the test insect.

2. Above all it was also inferred that in all the three bioassay methods, the effect of treatments obtained by combination were much closer to the effects obtained by chemical insecticides along with the least effective indigenous products gave complete management of the test insect pest, further, conclusion was also drawn that none of the indigenous products could be compared with that of the chemical insecticides.

Therefore, these indigenous products can be effectively exploited in the pest management programs, due to their significant and deleterious impact on the life of the insect population.

3. It can be thus concluded that botanical products significantly controlling the pest population in lab as well as in field condition. But the chemical insecticides are very hazardous to our flora and fauna. Indigenous products are non-pollutants and eco-friendly. Apart from being eco-friendly this approach will reduce the pest population.

4. This alarming situation has warranted to identify such alternative methods that are comparatively safer and do not upset agro-ecosystem. Among alternatives the future of indigenous products in modern concepts of IPM system appears to be promising as they are bio-control agent and bio-degradable in nature and safer to higher animals including humans because of their low mammalian toxicity. But it still needs more investigation to be conducted in this regard for proper recommendation.
RECOMMENDATIONS

1. The above management strategies are purely eco-friendly and non-pollutants.
2. The treatment is low cost effective, home made and easy for applied with no health hazards.
3. The materials (botanical products) are also within reach of farm families.
4. They fit into farmer’s routine work.
5. Raw materials can be easily available with no risk of adulteration.

FUTURE LINE OF WORK

1. Farmers can be made aware of alternative methods of pest management.
2. An attempt needs to be made in the direction of indigenous products to develop eco-friendly package to manage crucifers’ pest management.
3. Conducting a series of skill oriented training for furthers with new scientific and indigenous local knowledge practices shall be economical and replicable.
4. Awareness programs on health hazards by pesticides need to be launched through ratio talks, T.V. channels and seminars.
5. There is scope for researchers to extend the studies of growth and development parameters to pest of other economically important crops.