IMPACT OF SEASONAL VARIATIONS ON INSECT POPULATION

Hemalatha[1*], Pai. I. K[2] and Shree M. P[3]
1* - Department of Sericulture, Sri Siddartha I Grade College,
Tumkur (Karnataka) – 572103 (Corresponding author)
2 - Department of Zoology, Goa University, Goa-403 206
3 - Department of Sericulture, Bangalore University, Bangalore-560 056

Abstract

A periodical survey of incidence (%) and intensity (%) on popular insects was carried out for two consecutive years to study the impact of environmental changes on them in 17 villages of Tumkur district in Karnataka. The total sample size surveyed was 68 plots / month. The host crop selected was mulberry. Meteorological data was gathered periodically & the survey was done by "Fixed plot" method. Percentage of Insect Incidence (PII) with corresponding insect population (PPI) was recorded and their association with weather parameters was correlated. The insects selected for the study were *Spilosoma obliqua* (Bihar hairy caterpillar), *Diaphania pulverulentalis* (Leaf roller) and *Neorthacris acuticeps nilgriensis* (Common wingless grasshopper). The PII and PPI of *S. obliqua* was maximum in September (15.23% and 1.56 Caterpillar / plant), moderate in winter (1.72% & 0.72 caterpillars/plant). In summer both were meager (PII = 0.17% and PPI = 0.01/plant). *D. pulverulentalis* exhibited maximum PII (22.21%) and PPI (5.46 larvae/plant) in November. It decreased in September (PII = 9.91% & PPI = 1.62 larvae/plant). In April – May, both parameters were negligible (PII = 0.16% & 0.13 larvae/plant). Maximum PII (13.75%) of wingless grasshoppers was noticed in August, it decreased to 11.87% in November and negligible insect population was observed in summer (0.42 grasshoppers / microplot). Correlation and regression studies indicated a significant negative association of temperature with PII and PPI of these three insects (*S. obliqua* r = -0.82, *D. pulverulenatlis* r = -0.89, *N. acuticeps* r = -0.75). The study inferred that, the population density of these insects was temperature dependant. The threat to multiplication & spread of them under the changing climatic conditions with higher temperature (global warming) is significant and working out a suitable measure to protect them from declining in their population density appears to be very much necessary.

Key words : Environment, Insect population, PII, PPI, threat.

Introduction

India - a mega biodiversity country, during the path of development, has been sensitive to the needs of conservation. India's strategies for conservation and sustainable utilization of biodiversity in the past have comprised of providing special status and protection to biodiversity rich areas by declaring them as national parks, wildlife sanctuaries, biosphere reserves and ecological fragile and sensitive area. Ecological degradation and its out come – biodiversity loss – cause a serious threat to the development. The habitats, in which organisms live, for example, area spatially structured at a number of scales and these patterns interact with organism perception and behavior to drive the higher-level processes of population dynamics and community structure. Field observations are the only input in the distribution analysis of species. The present survey was concentrated to record the impact of weather parameters on insect population dynamics. It is well known that insects affect human interest both in the good and evil. They play vital role in any ecosystem / habitat and a major role in any food chain / web. Economic importance of class Insecta is well known to every human being from all disciplines / profession. Lepidoptera - the second largest order of class Insecta contains butterflies and moths. Lepidopterans and Orthopterans are well known pollinators and bio-control agents. The grasshopper (*Neorthacris acuticeps nilgriensis*), Bihar hairy caterpillar (*Spilosoma obliqua*) and leaf roller (*Diaphania pulverulentalis*) are of frequent occurrence in almost all agro climatic conditions with wide range of alternate host plants. They were selected for the present field investigation to study the influence of meteorological factors viz., temperature, rainfall and relative humidity. The perennial all season crop-mulberry was considered for host crop. The study aimed at analyzing the impact of season variation on incidence and population density of these insects.

Considering the lack of such investigations under the agro climatic conditions of Tumkur district (Karnataka), an extensive survey was conducted from September 2002 - August 2004.

Materials and Methods

Survey was carried out by "fixed plot method" (Govindaiah and Gunashekar, 1992). 17 villages representing all the ten taluks of Tumkur district. In each village, four mulberry gardens with similar crop pattern were selected, making a sample size of 68 plots. In every selected garden, five microplots of equal size were fixed (one each in the four corners, 10 meters away from the border and one in the centre of the garden). Ten mulberry plants were randomly chosen in each microplot for recording the percentage of insect incidence. Thus, the total sample size studied was 200 plants / village (4 gardens x 50 plants). Observations were recorded systematically at monthly intervals. The intensity of insect incidence was calculated using the following formula (Manjunatha, 1998):

$$\text{Percentage of Insect Incidence (PII)} = \frac{\text{Total number of plants with insects}}{\text{Total number of plants observed}} \times 100$$

To study the population of Bihar hairy caterpillar, ten plants were chosen randomly from all five microplots of each garden. The number of caterpillars on each plant were counted & compiled for assessing the percentage of insect population. To estimate the population of leaf roller the same method was applied. The average population of wingless grasshopper was assessed by 'sweep net' technique (Biradar, 1989). The insect count was recorded in cooler hours of the day, when the comparative density of insect population was more. Weather factors viz., temperature, rainfall & relative humidity during the study period were simultaneously recorded to asses their influence on the population density of the insects studied. The data were statistically analyzed using the standard 'F test'.

Results and Discussions

The findings of the present study are indicated in Table 1 & 2. The studied insects exhibited a well marked seasonal behavior in their incidence & population density. Though monthly variations were apparent, statistically high significant differences were noticed among the three seasons (Rainy, winter & summer). PII values of all the three insects monitored indicated almost similar trend of occurrence. Bihar hairy caterpillar (*Spilosoma Obliqua*) had peak PII (15.23%) and maximum population (1.56 caterpillars/plant) in September month. Population density was minimum (0.17 caterpillar/plant) with decreased PII (1.72%) in March. In April – May months the PII was negligible (0.01%). The correlations between weather factors and PII confirmed the significant negative association of temperature (Table 1). Maximum PII & PPI of leaf roller (*Diaphania pulverulentalis*) was observed in November (22.21% & 5.46 larvae/plant respectively). They decreased to 9.91% & 1.06 larvae/plant during July. In April – May months, they were negligible (PII = 0.16% - 0.31% and 0.76 larvae /plant – 1.73 larvae/plant respectively). The correlation analysis indicated a strong negative influence of temperature on density of insect population (Table 2). High relative humidity with low temperature was found to be congenial for the incidence & multiplication of the insect. Maximum level of PII of wingless grasshopper (*Neorthacris acuticeps nilgriensis*) was notice in August (13.75%). It was moderate in November (11.87%). Negligible insect population was prevalent in June (0.42 grasshopper/microplot). Low temperature with high relative humidity & rainfall favored the outbreak & spread of insect. The present observations are supported by the earlier reports Kotaikal (1982); noticed frequent incidence of *S. obliqua* in rainy & winter months. Reddy & Narayanswamy (2003); observed a strong positive association between relative humidity & population density of *S. obliqua*. Siddegowda *et.al.*, (1995) reported that the incidence of leaf roller was severe from October to February. Rajadurai *et.al.*, (2000) noticed that leaf rollers disappeared from March to May. Srinivasagowda *et.al.*, (2001) reported that the insect was not traced during March to June. Pradip Kumar *et.al.*, (1989) observed the incidence of wingless grasshopper to be maximum in rainy months on mulberry crop. Manujnatha and Shree (1998) reported that least grasshopper population was observed in the month of May. The present field investigation inferred the peak population density of the studied insects in the cooler months of the year (winter/rainy seasons). Their occurrence was almost nil in hot months of summer. Based on this finding a suitable measure can be worked out for conservation of the studied insect population in high temperature of present climatic changes.

Acknowledgement

The authors are extremely thankful to the sericulturists of the surveyed villages for their kind co-operation.

Table-I : Correlation coefficients between PII of Studied insects and weather factors

Insects	Maximum Temperature	Minimum Temperature	Rainfall	Relative humidity
Bihar hairy caterpillar	-0.82**	-0.09	0.28	0.48
Leaf roller	-0.88**	-0.32	0.10	0.39
Wingless grasshopper	-0.76**	0.34	0.54	0.75**

** Significant correlation at P<0.01 level

Table-II : Correlation coefficients between insect population and weather factors

Insects	Maximum Temperature	Minimum Temperature	Rainfall	Relative humidity
Bihar hairy caterpillar	-0.77**	0.06	0.44	0.56
Leaf roller	-0.69*	-0.30	0.19	0.36
Wingless grasshopper	-0.78**	0.08	0.46	0.64*

** Significant correlation at P<0.01 level

References

Biradar, N. 1989. Faunistic study of Arthropods infesting Mulberry (*Morus spp.*) and Biology of *Euproctis fraterna* moore (Lepidoptera: Lymantriidae), M.Sc., (Seri) *thesis,* University of Agricultural Sciences, Bangalore, PP.81.

Govindaiah and Gunashekara, V. 1992. The need for effective pest and disease surveillance in mulberry, Indian Silk, 31 (2);39-40.

Kotikal, Y. K. 1982. Studies on the pests of mulberry Morus alba L. with special reference to the black headed hairy caterpillar, Spilosoma obliqua Walker (Lepidoptera: Arctiidae). M.Sc., (Agri) thesis, UAS, Bangalore, pp.170.

Manjunatha, S. 1998. Survey of mulberry pests and diseases in Kanakapura Taluk, Ph.D. Thesis, Bangalore University, Bangalore.

Manjunatha, S. and Shree, M. P. 1998. Intensity of wingless grasshopper infesting mulberry in Kanakapura taluk (Bangalore rural district, Karnataka state). National symposium on faunistic Bio-diversity, Environment monitoring and Biotechnolgy. Feb.6-9 1998 at Gurukul Kangri Viswavidyalaya, Haridwar (Abst.60):pp.38.

Pradip Kumar., Govindaiah and Sengupta, K. 1989. Use of pesticides in mulberry crop protection. Workshop on Sericulture Extension and Management, CSR&TI, Mysore, 30-31 August, 1989, P.7-8.

Reddy, D. N. R. and Narayanaswamy, K. C. 2003. Pests of mulberry, Zen publishers, Bangalore. PP.48-49.

Rajadurai, S., Sen, A. K., Manjunath, D. and Datta, R. K. 2000. Natural enemy fauna of mulberry leaf roller, *Diaphania pulverulentalis* (Hampson) (Lepidoptera: Pyralidae) and its potential. National Conference on strategies for sericulture Research and Development, Central Sericulture Research and Training Institute, Mysore, India, 16-18 November, 2000, P.50.

Siddegowda, D. K., Vinodkumar., Gupta., Sen, A. K., Benchamin, K. V., Manjunath, D., Satyaprasad. K., Magdum, S. B. nad Dutta, R. K. 1995. *Diaphania sp.* Infests mulberry in South India. *Indian Silk*, 34(8):6-8.

Srinivasgowda, R., Narayanswamy, T. K. and Sreeramulu, K. R. 2001. Management of mulberry leaf roller, *Diaphania pulverulentalis* (Hampson). (Lepidoptera : Pyralidae). Abstracts of Natl Sem. On Mulber. Seri. Res. In India, KSSR & DI, Bangalore, India, 26-28 November, 2001, P.206.