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Population of predators associated with leafhopper in sunflower

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ABSTRACT: **Studies on the population dynamics of arthropod predators were carried out at the Directorate of Oilseeds Research, Rajendranagar, Hyderabad with an objective of understanding their association with leafhoppers in sunflower. Among these predators, coccinellids (*Cheilomenes sexmaculata* and *Illeis cincta*), bugs (*Cyrtorhinus* spp. and *Geocoris* spp.), chrysopid (*Chrysoperla carnea*) and spiders (green lynx spider, jumping spider and crab spiders) were found to be predating on leafhopper nymphs. The maximum population of *C. sexmaculata* was during September and January whereas *I. cincta*, *Cyrtorhinus* spp. and *Geocoris* spp. populations were maximum during January. *C. carnea* and spiders were maximum during September and January, respectively. Population of all the predators except *C. carnea* had positive correlation with leafhopper population. There was negative correlation between the populations of all the predators except *C. carnea* and minimum temperature.**

KEY WORDS: Leafhopper, population dynamics, predator, sunflower

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is one of the fastest growing oilseeds in India with an area of 2.0 million hectares and a production of 0.99 million tonnes (CMIE, 2005). Sunflower is grown under different agro-ecological situations and cropping systems due to its wide adaptability, day neutral nature and responsiveness to better management practices. Several species of both beneficial and harmful insects are associated with sunflower crop. Among harmful insects, insect pests of major economic importance are leaf hoppers, *Amrasca biguttula biguttula* Ishida; cutworm, *Agrotis* spp.; capitulum borer, *Helicoverpa armigera* (Hübner); tobacco caterpillar, *Spodoptera litura* (Fabricius); Bihar hairy caterpillar, *Spilarctia obliqua* (Walker); green semilooper, *Thysanoplusia orichalcea* (Fabricius) and cabbage semilooper, *Trichoplusia ni* (Hübner). In recent years, thrips (*Frankliniella schultzei* (Trybom), *Scirtothrips dorsalis* Hood and *Megalurothrips usitatus* (Bagnall) are receiving importance as they are associated with sunflower necrosis disease (Basappa and Santha Lakshmi Prasad, 2005). Among sucking pests, leafhopper (*A. biguttula biguttula*) appears on the crop round the year but it will be serious during certain months at different places. The pest is distributed in almost all sunflower growing regions of the country, but economically important in Maharashtra, Tamil Nadu and Karnataka. Summer crops are likely to suffer more with this pest than *kharif* crop. The incidence starts from seedling stage and prevails right through the entire crop growth period. Both nymphs and adults suck the cell sap from the under surface of leaves and cause stunted growth of plant. Yellowing, cupped and crinkled leaves, burnt appearance of leaf margins or entire leaf called "hopper burn" are the symptoms of damage. Cotton, sunflower, castor, brinjal, potato, *Hibiscus* spp. and cucurbits are the alternate hosts of this pest (Basappa and Santha Lakshmi Prasad, 2005). From Maharashtra, there are reports of this pest causing crop loss up to 46 per cent in sunflower (AICRP, 1979).

In sunflower crop system, several species of coccinellids, *viz.*, *Cheilomenes sexmaculata* (Fabricius), *Brumoides suturalis* (Fabricius), *Chilocorus nigrita* (Fabricius), *Coccinella septempunctata* L. and *Scymnus*

nubilus Muls. keep a good check on leaf hopper nymphs. In addition, predatory lygaeid *Geocoris tricolor* Fabricius and *Anthocoris* sp., mantids such as *Eumantissa giglio* Tos., *Cariagrion coromandeliarum* Fabricius, *Ichneura* sp., *Dolichopus* sp. and *Therevia* sp. play a vital role in suppression of sucking and other pests (Basappa *et al.*, 2005). Hence investigations were initiated to study the population dynamics of natural enemies associated with leafhoppers in sunflower ecosystem.

MATERIALS AND METHODS

Studies on the population dynamics of natural enemies associated with leafhoppers in sunflower were carried out at the Directorate of Oilseeds Research, Rajendranagar, Hyderabad during 2003-04 and 2004-05 on popular sunflower variety Morden in an area of 150 m^2 by following the recommended package of practices (DOR, 2005) except plant protection. A total of 12 dates of sowings were taken at two months interval starting from June, 2003.

Observations on number of natural enemies like coccinellid beetles (*C. sexmaculata* and *Illeis cincta*), predatory mirid bug (*Cyrtorhinus* spp.), lygaeid bugs (*Geocoris* spp.), green lace wings (*Chrysoperla carnea*) and spiders per ten plants were recorded at weekly interval along with their prey like eggs and neonate larvae of lepidopteran pests per plant and leafhopper nymphs / 6 leaves per plant. Average population of above natural enemies along with prey in each month is based on mean values of two years' data (2003-04 and 2004-05). The data related to predators and prey were subjected to correlation by using mean values of weather parameters of both years.

RESULTS AND DISCUSSION

In both years the mean population of leafhopper was at its peak during January but its activity was low during June – October, whereas the activity of lepidopteran insects was maximum during September and low during December - June. There was negative correlation between leafhopper population and minimum temperature (r = - 0.6606), evening relative humidity (r = - 0.74583) and rainfall (r = - 0.74583), and positive correlation (r = + 0.754187) with sunshine hours. Eggs and early stage larvae of epidopteran insect pests had positive correlation with morning and evening RH (Fig.1).

In sunflow the major natural enemies associated with leafhopp n both years included coccinellid predators like *C. sexmaculata*, *I. cincta*, mirid bug *Cyrtorhinus* spp., lygaeid bug *Geocoris* spp., green lacewing *C. carnea* and spiders (Fig. 2). *C. sexmaculata* population had negative correlation with minimum temperature (r = - 0.53707) and positive correlation with morning relative humidity (r = + 0.596659). There was negative correlation between *I. cincta* population and minimum temperature (r = - 0.80193), evening relative humidity (r = - 0.46714) and rainfall (r = - 0.50029) and positive correlation (r = + 0.53899) with sunshine hours. Similar trend was observed in the case of *Geocoris* spp. *Cyrtorhinus* spp. population had negative correlation with minimum temperature and positive correlation with morning relative humidity. *C. carnea* population had positive correlation with morning and evening relative humidity. Spider population predating on leafhopper was dominated by green lynx spider, jumping spiders and crab spiders. There was negative correlation between spider population and minimum temperature (r = - 0.50025) and positive correlation with morning relative humidity (r = + 0.471726). Population of all the predators except *C. carnea* had positive correlation with leafhopper population. *C. septempunctata*, *B. suturalis* and *S. nubilus* were also found predating on leafhopper nymphs but their population was 2 per plant during peak activity (January) of leafhopper, but negligible during other periods. Apart from leafhopper nymphs, *C. sexmaculata*, *C. carnea* grubs and spiders were found predating on eggs and early stage larvae of *H. armigera*, *T. orichalcea* and *S. litura* during July - October.

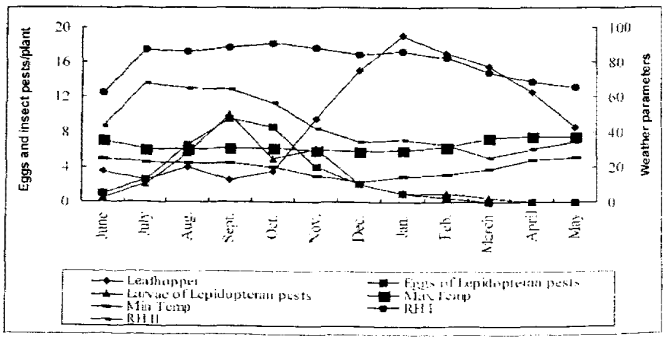

Fig. 1. Population of leafhopper nymphs, eggs and early stage larvae of lepidopteran pests in relation to weather parameters in sunflower

Activity of *C. sexmaculata* was observed throughout the year in sunflower ecosystem with population ranging from 2.5 to17.5 per 10 plants and its population was maximum during September and January coinciding with the peak population of lepidopteran insect

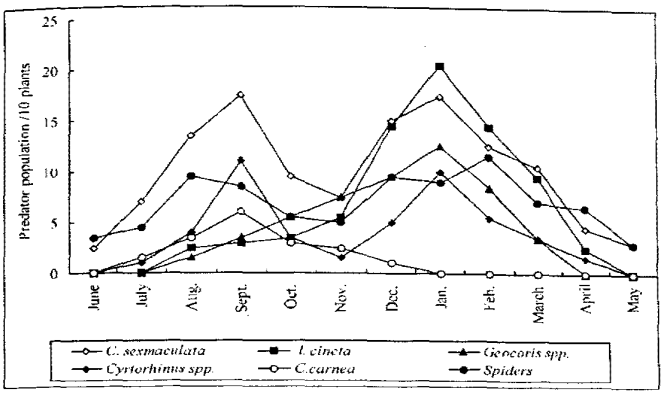

Fig. 2. Population of predators associated with leafhopper in sunflower

pests and leafhopper, respectively. Maximum activity of another coccinellid, *I. cincta* was noticed during December - February with a peak population of 20.5 per 10 plants during January coinciding with the peak activity of leafhopper. *I. cincta* was found feeding on fungal growth of powdery mildew disease during December - February. Lygaeid bug (*Geocoris* spp.) activity was observed from August to March with highest population of 12.5 bugs per 10 plants during January. *Cyrtorhinus* spp. activity was observed from July to April with two peak activities during September (11 bugs per 10 plants) and January (10 bugs per 10 plants) coinciding with the peak activity of lepidopteran insect pests and leafhopper, respectively. *C. carnea* population was more during September when leafhopper activity was moderate and it also predates on eggs and early stage larvae of lepidopteran insect pests. Though spider population was observed throughout the year, it was maximum during January. Similar observations were made by Sandhu *et al.* (1973), Goel and Kumar (1990) and Basappa *et al.*(2005) as these biological control agents play a vital role in the suppression of not only leafhopper population, but also other sucking and lepidopteran insect pests.

The activity of general predatory ants, *Camponotus sericius* Fabricius, *C. rufoglaucus* Jerdon and *Monomorium indicum* Forel, was found throughout the year in sunflower ecosystem and they were found carrying leafhopper nymphs.

Among the six major predators associated with leafhopper in both years based on mean population across seasons, *C. sexmaculata* activity was maximum in sunflower followed by spiders (green lynx spider, jumping spider and crab spiders), *I. cincta*, lygaeid bug, *Geocoris* spp., mirid bug, *Cyrtorhinus* spp. and the least active was green lacewing, *C. carnea*. Development of new and improved bio-intensive IPM strategies for the management of leafhopper in the sunflower crop system needs enhancing our understanding of natural biological control agents and their relationship with prey and weather parameters. Hence, the knowledge on the activity of natural enemy and leafhopper population in sunflower cropping system will not only help to develop eco-friendly pest management modules but also to keep the leafhopper population below economic threshold level for sustainable production of the crop.

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