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Natural Enemies of Cotton Whitefly, *Bemisia tabaci* Gennadius in Relation to Host Population and Weather Factors*

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ABSTRACT

The nymphal parasitism of whitefly, *Bemisia tabaci* Gennadius due to *Eretmocerus serius*, *Eretmocerus* sp. and an aphelinid reached 27.4 and 40.2 per cent while the predators *Brumoides suturalis* (F), *Verania vincta*, *Menochilus sexmaculatus*, *Chrysoperla carnea* (Steph.), *Amblyseiuss* pp. were at a level of 10.8 and 17.1 numbers per 10 leaves during January and November respectively. The incidence of fungal pathogens viz., *Aspergillus* sp., Paecilomyces sp. and *Fusarium* sp., of whitefly was high during November month by suppressing adults, nymphs and eggs to the extent of 86.6, 19.0 and 39.8 per cent respectively. In line with pest population, the parasites were also influenced by the rainfall which showed significant negative correlations (r=0.4275 and - 0.3971 respectively). The temperatures also showed a significant correlation with the parasitism, predatory population and mortality due to fungal pathogens.

KEY WORDS : *Bemisia tabaci*, Phytoseiids, fungal pathogens, abiotic factors

Cotton whitefly, *Bemisia tabaci* Gennadius snowballed as a big threat to cotton as well as to other field crops in Andhra Pradesh by 1984-85 season. In the process of identifying the factors responsible for the flare up of this pest in subsequent seasons, extensive studies were initiated. As a part of this approach, surveys were made in cotton fields of Nagarjun Sagar Project area during 1985-87 crop seasons and three parasitoids ie.,*Eretmocerus Serius* sil. *Eretmocerus* sp. and an unidentified aphelinid; seven species of predators *viz.*,Coccinellids *Brumoides suturalis* (F), *Verania vincta*, *Menochilus sexmaculatus*, lace wings, *Chrysoperla carnea* (Steph), predatory mites *Amblyseius* spp., unidentified species of spiders and three fungal pathogens *Aspergillus* sp.,*Paecilomyces* sp. and *Fusarium* sp. were recorded (Venugopal, 1987). With a view to understand the importance of these biotic factors in relation to whitefly populations as well as the weather parameters of 1985-87 seasons, observations were recorded.

MATERIALS AND METHODS

Counts on whitefly in terms of adults/leaf, nymphs/cm^2 and egg/cm^2 from three leaves of top and middle order of 10 plants in 100 m^2 plot of commonly grown cotton variety (MCU-5) were recorded. The observations were initiated in first week of August (23rd week) and continued upto end of January (5th std., week) during 1985-86 and 1986-87 crop seasons. Observations were also made simultaneously on the endoparasite activity in terms of nymphal parasitism of whitefly in cm^2 area of sampled leaves and predator population levels on all the sampled leaves. Similarly, the incidence of whitefly pathogens on adults, nymphs and eggs were observed, realising that the mortality and discolouration was due to pathogenicity of fungal organisms. The causal organisms (fungus) were got identified upto genus level. These were isolated and multiplied using agar slants and tested for pathogenicity by reinoculation. The nymphal parasitism, predatory population as well as level of mortality due to pathogens were correlated with the level of the pest as well as weather factors prevailing in the area during those crop seasons.

RESULTS AND DISCUSSION

Seasonal occurrence of different natural enemies

The parasitism of whitefly nymphs due to *Eretmocerus serius* Sil, Eretomocerus sp., and unidentified aphelinid was observed from the beginning of September and extended upto third week of January (Fig.1). The natural parasitism was found gradually increasing at the rate of 0.1 per cent in the first week of September and reached a peak level of 40.2 per cent by third week of January synchronising with 3.2 and 0.7 nymphal popula-

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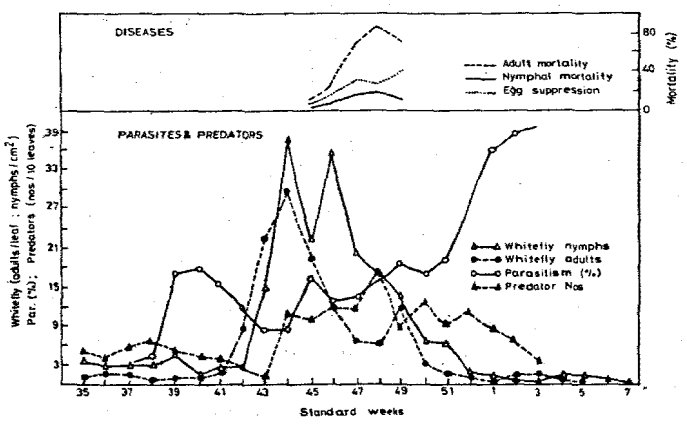

Fig. 1 Occurrence of parasites, predators and pathogens on cotton whitefly

tion of whitefly per cm^2 area, respectively.

The natural predatory population *viz.*, Coccinellids in the early stage of crop growth and phytoseiid mites and spiders in the subsequent growth stages, besides lace wings throughout the season, were almost at low ebb upto October. The initial predatory mite (*Amblyseius* spp.) population was only 0.4/140 leaves in November and it reached a peak level of 17.1/10 leaves in the last week of December. Though several workers (Greathead, 1976; Gerling, 1986; Abdel Rahman, 1986) reported the role of parasites and predators in regulating whitefly population on cotton, the seasonal fluctuations were not studied in detail. However, the work of Sharaf (1982) revealed that the parasitism of whitefly was common throughout the year and it was to an extent of 26.0 to 50.0 per cent during December and January months respectively, which is in line with the present finding.

Occurrence of fungal diseases on different stages of the whitefly was noticed from the third week of November upto the second week of December. The level of disease incidence on adult populations ranged from 26.8 to 86.6 per cent and that of eggs ranged from 16.6 to 39.8 per cent. On the nymphal population, the incidence varied from 6.8 to 19.0 per cent. The mean disease incidence was more than eight per cent on adults during both the seasons. The highest incidence of fungal pathogens (86.6 per cent) synchronised with the heavy whitefly infestations. These observations indicated that the disease occurrence was most common among whitefly adults, while the nymphs were least prone to disease.

Influence of pest population on the natural enemies

The levels of nymphal parasites (aphelinids) and predators (phytoseiids) were found to have direct bearing on all the stages of whitefly (Fig.1). The level of parasitization and predator numbers had significant positive correlation with whitefly nymphal (r = 0.664 and 0.579 respectively), adult (r = 0.0207 and 0.2930 respectively) and egg (r = 0.0374 and 0.2390 respectively) population (Table 1). Mortality due to fungal pathogens was also found to have direct relation on the host population levels. The present finding is in agreement with the conclusion of Sharaf (1982) that parasitic activity synchronised with the availability of whitefly puparia. With the suppression of the whitefly population during rainy period, the number of parasites and predators also declined in the absence of their host. With the revival of the whitefly population after cessation of rains, the parasites and predators also increased, thus exhibiting a close association between population of the pest and that of its natural enemies. However, late in the season, the whitefly population was reduced considerably with the increased activity of the parasites and predators which took an upperhand (Fig.1).

Influence of weather factors on the natural enemies

The populations of parasites and predators besides fungal pathogens responded identically to different weather factors. Both mean maximum (with a range of 29.0 to 42.1°C) and mean minimum (with a range of 16.4 to 31.3°C) temperatures exhibited negative correlations with the activity of parasite (r = -0.6136 and -0.8686) and fungal pathogens in terms of egg (r = -0.235 and -0.4068), nymphal (r = -0.2480 and -0.4055) and adult (r = 0.2365 and - 0.3993) mortality (Table 1). Similarly, there was significant negative influence of precipitation on the build up of nymphal parasites (-0.4275) and predators (-0.3971). The relation between rainfall or rainy days and fungal pathogens was not perceptible. However, the rainfall received during 44th and 45th std.

TABLE 1. ***Correlation coefficients of natural enemies of whitefly in relation to pest and weather factors***

Factor	Parasitism (%)	Predators (nos)	Fungal Pathogens (%)		
			Eggs	Nymphs	Adults
Whitefly eggs	0.0374	0.2390	0.2533	-	-
Whitefly nymphs	0.6642*	0.5790*	-	0.4536*	-
Whitefly adults	0.0207	0.2930	-	-	0.2134
Maximum temperature (°C)	-0.6316*	-0.6170*	-0.2350	-0.2480	-0.2365
Minimum temperature(°C	-0.8985*	-0.8686*	-0.4068*	-0.4055*	-0.3993*
Relative humidity (%) 7 AM	0.0594	-0.2863	0.1665	0.1732	0.1572
Relative humidity (%) 2 PM	0.1429	0.1021	0.2381	0.2590	0.2327
Rainfall (mm)	-0.4275*	-0.3910*	-0.1828	-0.2090	-0.1889
Rainy days (nos.)	-0.3790*	-0.3721	-0.1922	-0.2211	-0.1992

* Significant at 5% level

weeks contributed for the flare up of the pathogens during both the seasons under study.

In Jordan valley, Sharaf (1982) found that the level of parasitism by *Eretmocerus* sp. was high at 29°C and low at 14.5°C. The role of fungal pathogens like *Paecilomyces* in regulating whiteflies was highlighted by Nene (1973) and Bennett (1981). However, the relation between the pathogens and host as well as the other abiotic factors were not recorded in their studies.

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