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Population Dynamics of the Mealybug, *Maconellicoccus hirsutus* (Green), and its Natural Enemies in the Grapevine Ecosystem

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ABSTRACT

The population of the mealybug, *Maconellicoccus hirsutus* (Green) was found to be high from January to May and low from June to December in vineyards in South India. Maximum temperature showed a positive significant correlation with the mealybug population, while the relative humidity showed a negative correlation. In general, the activity of the natural enemies coincided with that of the mealybugs. A positive and significant relationship between the dominant parasite *Anagyrus dactylopii* (How.) and *M. hirsutus* was observed.

Key words : ***Maconellicoccus hirsutus,*** natural enemies, ***Anagyrus dactylopii***

The pink mealybug, ***Maconellicoccus hirsutus*** (Green) (Homoptera, Pseudococcidae) is widely distributed. Recently Manjunath (1985) gave an account of its outbreak on grapevine in South India, its seasonal history and natural enemies. The present studies were undertaken to obtain some quantitative data on ***M. hirsutus*** and its natural enemies in grapevine ecosystems.

MATERIALS AND METHODS

The study was conducted on the grapevine variety Anab-e-Shahi at Murudeshwara farm (Bangalore South) and on Black Champa at I. I. H. R. farm (Bangalore North). The crop was pruned in October and April every year, and all other recommended cultural practices were followed. The crop was kept free from insecticidal applications during the period of study. Observations were made at 15 days interval for a period of two years from April 1984 to March 1986. Ten plants were selected at random in each vineyard and observations were made on 10 randomly selected shoots during the vegetative phase and 10 randomly selected bunches during the fruiting phase in each plant. From each bunch, one secondary rachis with berries was sampled from the middle of the grape bunch. At each observation, the infested shoots/berries from each sampled vine were collected and brought to the laboratory for counting the mealybugs. After counting, the infested shoots/berries were placed over pumpkins in wooden cages for emergence of the parasites and predators.

Data on weather parameters *viz.*, maximum and minimum temperatures, relative humidity and rainfall, were collected during the period of study to

work out the relationship between the mealybug population and weather factors.

RESULTS

The results revealed the presence of the mealybug, *M. hirsutus* on grapevine throughout the year. About two months after pruning, the mealybug population started increasing from January onwards. During January, the mealybugs migrated from bark and shoots to flowers, panicles and berries. Its population was considerably high from January to May, and attained its peak before harvesting of bunches during March-April. At Murudeshwara farm, a maximum population of 522.9 per vine was seen on 16th March, 1984 and it was 493.8 on 16th March, 1985. At I. I. H. R. farm, the highest population of *M. hirsutus* observed on 15th April in 1984 and 1985 was 448.7 and 386.8, respectively. The peak population was followed by a steep decline. After the harvest of bunches, the mealybug population was very low on the vines.

In the monsoon and cold weather seasons (June to December), the population was low. At Murudeshwara farm, the number of mealybugs per plant ranged from 14.1 on 2nd June to 2.0 on 16th November in 1984 and 15.0 to 3.8 in the same period in 1985. Similar trend was observed in 1984 and 1985 at I. I. H. R. farm.

The relationship of the population of the mealybug and its principal parasite, *Anagyrus dactylopii* (How.) (Hymenoptera, Encyrtidae), with weather parameters was studied using correlation coefficient (Table 1-2). Maximum temperature showed a positive correlation with the mealybug population, while the relative humidity showed negative correlation. *M. hirsutus* population was not significantly affected by minimum temperature and rainfall. The partial regression coefficients of the parasite *A. dactylopii* and maximum temperature was found to be highly significant. However, the partial regression coefficients of other weather factors were not significant. The multiple regression equations fitted with *A. dactylopii* and weather parameters to predict the mealybug population (Y) were :

Table 1. Correlations of the grape mealybug population, *Maconellicoccus hirsutus* with the parasite *Anagyrus dactylopii* and weather factors at Murudeshwara farm, Bangalore.

	X_1	X_2	X_3	X_4	X_5	Y (Mealybug)
X_1 (Parasite)		0.143	0.429 **	-0.458 **	-0.238	0.917 **
X_2 (Minimum temperature)			0 543 **	-0.219	0.246	0.057
X_3 (Maximum temperature)				-0.839	-0.238	0.551 **
X_4 (Relative humidity)					0.436 *	-0.517 **
X_5 (Rainfall)						-0.239

* Significant (P = 0.05) ** Significant (P = 0.01)

$Y = -523.366 + 1.973\ X_1 - 10.492\ X_2 + 18.822\ X_3 + 2.814\ X_4 + 0.050\ X_5$ with R^2 value of 0.886 at Murudeshwara farm, and

$Y = -163.903 - 2.248\ X_1 - 7.010\ X_2 + 10.261\ X_3 + 0.206\ X_4 + 0.040\ X_5$ with R^2 value of 0.908 at I. I. H. R. farm.

Table 2. Correlation of the grape mealybug population, *Maconellicoccus hirsutus* with the parasite, *Anagyrus dactylopii* and weather factors at I. I. H. R. farm, Bangalore.

	X_1	X_2	X_3	X_4	X_5	Y (mealybug
X_1 (Parasite)	0.209	0.46 **	-0.607*	-0.226	0.940 **	
X_2 (Minimum temperature)		0.659 **	-0.144	0.150	0.195	
X_3 (Maximum temperature)			-0.657 **	-0.179	0.536 **	
X_4 (Relative humidity)				0.305*	-0.648 **	
X_5 (Rainfall)					-0.271	

* Significant (P = 0.05) ** Significant (P = 0.01)

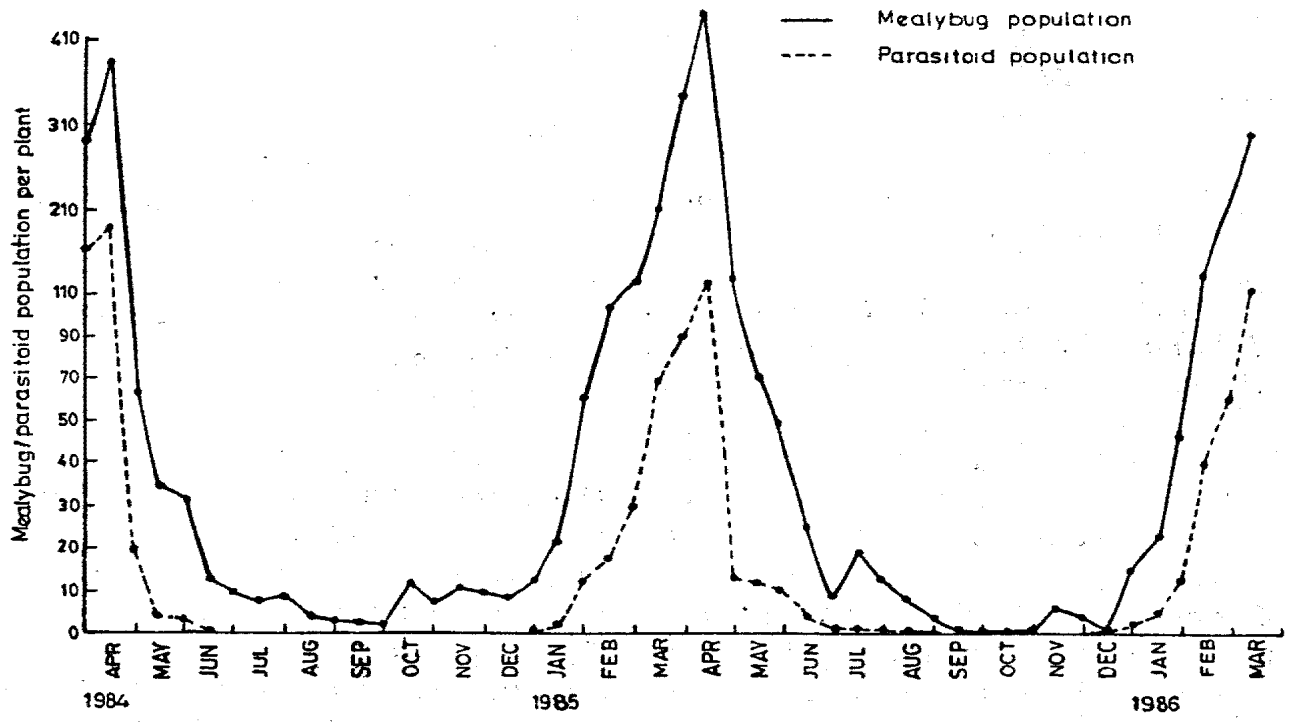

Fig. 1 Seasonal fluctuation in the population of *Maconellicoccus hirsutus*(Green) in relation to the parasitoid, *Anagyrus dactylopii* (How.) at I.I.H.R farm.

where X_1, X_2, X_3, X_4 and X_5 denote parasite, minimum temperature, maximum temperature, relative humidity and rainfall, respectively.

Two species of parasites and six predators were observed during January-May when the mealybug population was high. *A. dactylopii* was the dominant parasite of *M. hirsutus*. The activity of the parasite was highest during the first week of March with 152.4 and 210.2 parasites per plant in 1985 and 1986 respectively, at Murudeshwara farm. At I. I. H. R., the highest parasite population of 115.2 per plant was observed on 15th April, 1985 (Fig. 1). A positive and significant relationship between the parasite (*A. dactylopii*) and the mealybug populations was observed in both the locations. The parasite had exhibited a highly density dependent relationship (*i.e.*, its activity reached a peak when *M. hirsutus* population was high). The activity of *A. dactylopii* was positively correlated with maximum temperature and negatively with relative humidity.

The parasite *Allotropa* sp. nr. *japonica* Ashm. (Platygasteridae : Hymenoptera) was of minor importance. The maximum incidence was 4.2 per plant in the first fortnight of March, 1986 at Murudeshwara farm and 4.6 per plant in April, 1984 at I. I. H. R. farm. The coccinellid predators, *Scymnus coccivora* Ayyar and *Cryptolaemus montrouzieri* Muls. were noticed in both the localities. They were active mostly during February-May when the mealybug population was comparatively high. The other two predators *Mallada boninensis* (Okomato) (Chrysopidae : Neuroptera) and *Spalgius epius* Westwood (Lycaenidae : Lepidoptera) were observed in negligible numbers. Larvae of the above four predators were commonly observed feeding on *M. hirsutus*. The activity of the cecidomyiid, *Triommata coccidivora* (Felt) was recorded in cooler months (January - February) whereas that of another predatory drosophilid, *Cocoxenus pearpicax* (Knab) was found active during summer months (March-May).

DISCUSSION

The presence of *M. hirsutus* throughout the year on the vines and its population trend are in agreement with the findings of Manjunath (1985). In general, the mealybug population was considerably high from January to May. This is due to high temperature prevailing in this period which probably helped in faster multiplication of the mealybug. In the present study, more mealybugs were recorded from berry formation to harvesting of grape bunches. Similar observations were reported by Berlinger (1977) for *Planococcus vitis* (Nied) on grapevine in Israel and by Charles (1982) for *Pseudococcus longispinus* (Targioni-Tozzetti) in New Zealand.

The low mealybug population in the rainy season and the following winter season (January to December) may be due to low rate of reproduction of the mealybugs during these periods. This agrees with the reports of Misra (1919) from India and Hall (1921) from Egypt that the developmental time of mealybugs was extended in cooler months. Berlinger (1977) and Charles (1982) reported that the popu-

lation of *P. vitis* and *P. longispinus* remained low during winter in the vineyards of Israel and New Zealand, respectively. Hibernation was not observed in the present study which agrees with the report of Ghose (1972) who found *M. hirsutus* reproducing throughout the year in West Bengal.

In general, the seasonal activity of the natural enemies coincided with the activity of the mealybugs. The parasite *A. dactylopii* was abundant from January to May. Manjunath (1985) also reported 60-70% parasitisation of *M. hirsutus* by this species during March-April, even in insecticide sprayed fields.

Results of the present investigations revealed the incidence of the cecidomyiid, *T. coccidivora* in January-February when the temperature was low and the predator emerged mostly from infested bunches. This is in conformity with the observations of Charles (1982) who found the larvae of another cecidomyiid, *Diplosis* to be common in the fruit bunches infested with *P. longispinus*. The activity of *T. coccidivora* in cooler months is similar to that of *Diadiplosis* sp. as reported by Ghose (1971). In the present investigation, the predators *S. coccivora*, *C. montrouzieri*, *S. epius* and *M. boninensis* were observed in March-April when the grape mealybug population was high. This is in conformity with Berlinger (1977) who reported that the appearance of predators in the vineyards coincided with high density of mealybugs.

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REFERENCES

Berlinger, M. J. 1977. The mediterranean vine mealybug and its natural enemies in Southern Israel. *Phytoparasitica*, **5**, 3-14.

Charles, J. G 1982. Economic damage and preliminary economic thresholds for mealybug, *Pseudococcus longispinus* T. T. in Auckland vineyards. *N. Z. J. Agric. Res.*, **25**, 415-420.

Ghose, S. K. 1971. Predators, parasites and attending ants of the mealybug, *Maconellicoccus hirsutus* (Green) (Pseudococcidae : Hemiptera). *Plant Prot. Bull.*, **22**, 22-30.

Ghose, S. K. 1972. Biology of the mealybug, *Maconellicoccus hirsutus* (Green) (Pseudococcidae : Hemiptera). *Indian J. Agric.*, **16**, 323-332.

Hall, W. J. 1921. The *Hibiscus* mealybug, *Pseudococcus hibisci* (Hemip.). *Bull. Soc. Ent D' Egypt, Cairo.*, **14**, 17-29.

Manjunath, T. M. 1985. *Maconellicoccus hirsutus* on grapevine. *FAO Plant Prot. Bull.*, **33**, 74.

Misra, C.S. 1919. "Tukra" disease of mulberry. *Proc. Third Ent. Mtg.*, Pusa, p. 610-618.

Singh, M. D. and Ghosh, S. N. 1970. Studies on *Maconellicoccus hirsutus* (Green) causing bunchy top in mesta. *Indian J. Sci. & Ind.*, **4**, 99-105.