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POPULATION STUDIES OF THE CITRUS MEALYBUG, PLANOCOCCUS CITRI (RISSO), AND ITS NATURAL ENEMIES ON PASSION-FRUIT IN SOUTH-EASTERN QUEENSLAND*

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SUMMARY

Field populations of *Planococcus citri* (Risso) and its natural enemies on passion fruit were sampled fortnightly from March 1974 to March 1976. Numbers of *P. citri* were lowest during September, increasing to peak populations between January and June.

Biological control was not effective against *P. citri*. *Cryptolaemus montrouzieri* Mulsant was the most abundant predator, with green lacewings, *Chrysopa* sp., and *Oligochrysa lutea* Esben-Peterson less common. Parasite activity was insignificant. Fungal attack caused mortality of *P. citri* during the wet season.

I. INTRODUCTION

Citrus mealybug, *Planococcus citri* (Risso), is one of the main pests of passion fruit, *Passiflora edulis* Sims f. *flavicarpa* Degener, grown commercially in south-eastern Queensland (Murray 1976).

Workers in other countries have established the overriding importance of natural enemies, particularly the predatory Coccinellid, *Cryptolaemus montrouzieri* Mulsant, in controlling *P. citri* on other crops (Smith and Armitage 1931; Quayle 1938; Bartlett 1957; Bartlett and Lloyd 1958). In Australia, where *C. montrouzieri* is a native insect, no such information is available although Summerville (1938) describes *C. montrouzieri* as the most useful of all Coccinellids found in Queensland. The purpose of this investigation was to record fluctuations in mealybug populations which occur throughout the year, and to determine whether natural enemies are effective in controlling this mealybug on passion fruit in south-eastern Queensland.

II. METHODS

Blocks of infested passion fruit located 5 km west of Nambour on the south-eastern Queensland coast were used as study sites from March 1974 to March 1976. Counts of *P. citri* and its predators were made from 3 March 1974 to 7 March 1975 in five plots, each of four vines, located in a 1-ha block of passion fruit. Similar counts were made from 12 March 1975 to 18 February 1976 from six plots, each of four vines, located in a 0·5-ha block situated near the first block.

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All adult female and nymphal *P. citri* present on 20 randomly selected leaves and 20 randomly selected 5-cm long nodal sections were recorded fortnightly from each plot. Numbers of diseased *P. citri* were recorded. Larvae of *C. montrouzieri* were counted in 1974–75 during a 3-min search of vines in each plot. During 1975–76, however, a separate count of *C. montrouzieri* larvae was made while sampling the 20 stem sections for mealybugs. Records were also kept in all 3 years on the occurrence of other predatory insects.

Parasite activity on each plot was assessed monthly on mealybugs collected in two 4-cm wide bands of corrugated cardboard placed around stem sections for 4 weeks. Any predatory insects were then removed and the bands were kept in plastic vials in the laboratory at room temperature for a further 4 weeks to allow parasites to emerge.

III. RESULTS AND DISCUSSION

The mean numbers per plot of *P. citri* and its predator are plotted in figures 1 and 2. There was a fall in the numbers of *P. citri* during the winter months of June to August, with a minimum population in September. During October 1974 and September 1975 the mealybug population consisted mostly of third-instar nymphs and adult females. Since there were no infested alternative hosts in the vicinity of the passion fruit block, the population increase which began in October and November, must have derived from the progeny of those mealybugs which survived the winter on the passion fruit vines. The most rapid increase was at the beginning of summer, during December, with peak populations occurring between January and June.

C. montrouzieri was the most abundant predator and figures 1 and 2 show that fluctuations in its numbers were positively correlated with those of *P. citri.* Seven other Coccinellid beetles were observed feeding on *P. citri,* but only one species, *Coccinella arcuata* Fabricius, appeared to be of any consequence. After *C. montrouzieri,* the next most common predators were Neuropteran larvae, *Chrysopa* sp. and *Oligochrysa lutea* Esben-Peterson.

Parasite activity on *P. citri* was minimal. Only one record was obtained of the Encyrtid, *Ophelosia crawfordi* Riley, as an egg predator. This parasite is recorded as an egg predator and a secondary parasite in parasitized mealybugs in California (Quayle 1938).

Infection of *P. citri* by a fungus similar to *Entomophthora fumosa* Speare (Speare 1922) occurred during a period of high rainfall and humidity in the wet season in 1976. Mortality due to this fungus on 4 January 1976 was recorded as 17·3% of the total mealybugs and 58·1% of third-instar nymphs and adults. In many cases females did not die until egg-laying was completed and viability of eggs was not affected.

From observations in the field a population of 35 *P. citri* on a sample of 20 leaves plus 20 stem sections is regarded as the threshold for economic damage to passion fruit. As seen in figures 1 and 2 this economic damage level was exceeded considerably in all three years of the study. Existing biological control of *P. citri* is therefore not considered adequate.

Predation at low host densities was insufficient to prevent *P. citri* surviving in numbers throughout the winter months and multiplying with the onset of warmer weather from October onwards (figures 1 and 2).

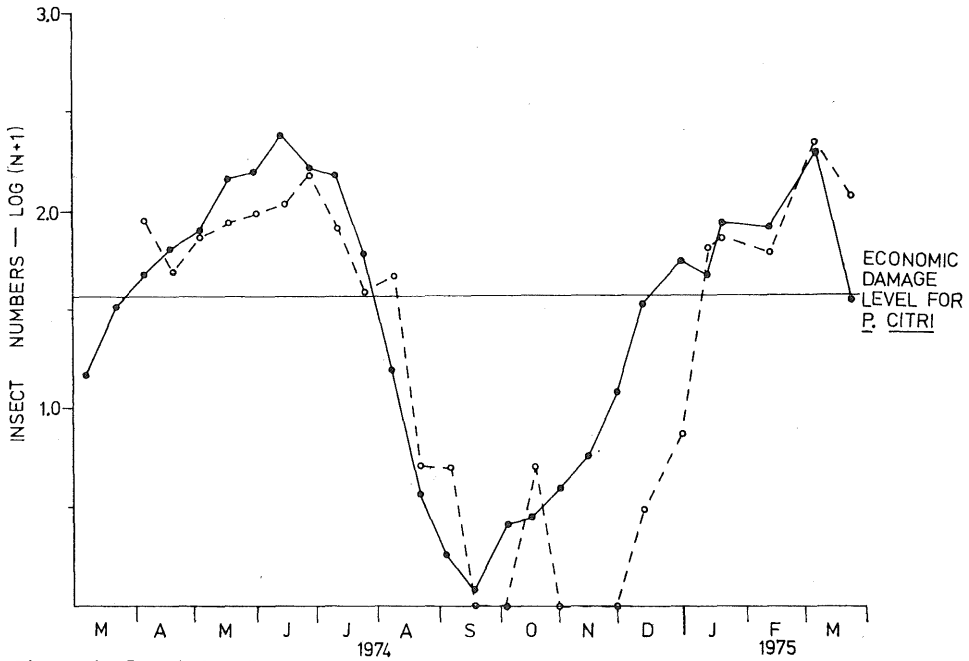

Figure 1. Population fluctuations in the number of P. citri *nymphs and adult females per plot (●) and the number (x10) of* C. montrouzieri *larvae per plot (o) on passion fruit during 1974–75.*

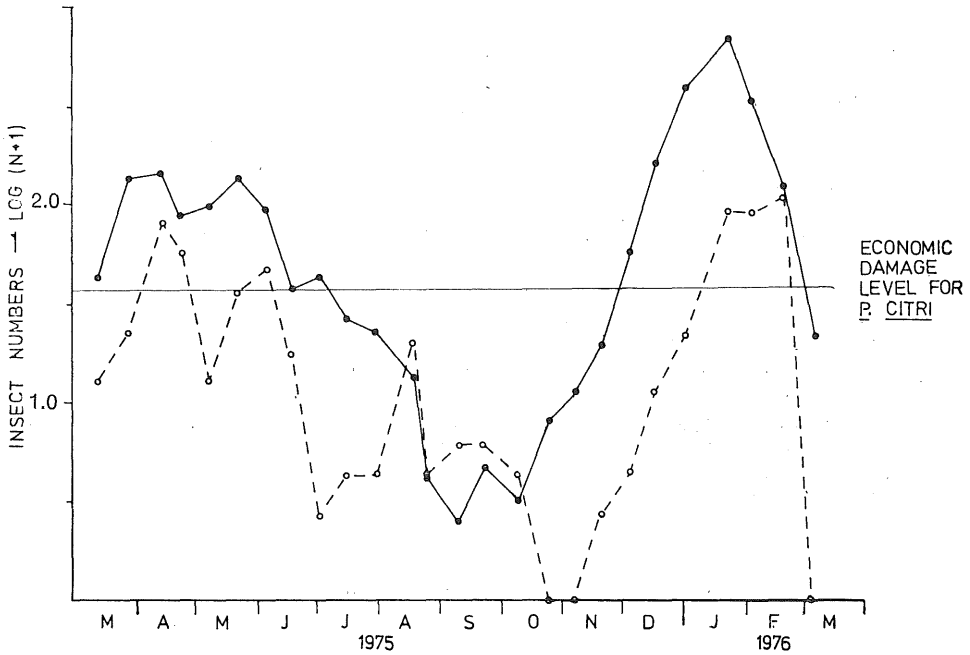

Figure 2. Population fluctuations in the number of P. citri *nymphs and adult females per plot (●) and the number (x10) of* C. montrouzieri *larvae per plot (o) on passion fruit during 1975–76.*

In California, where *C. montrouzieri* was introduced in 1892, this predator was also found to be inadequate unless periodic field releases of the beetle were made from colonies maintained in the laboratory (Quayle 1938). According to Fisher (1963), a period of 2 to 3 months elapses after release of *C. montrouzieri* before effective control of *P. citri* is obtained on citrus in California. Since the crop cycle on passion fruit in Queensland can be as short as 2 months and considerable *P. citri* damage can occur in that time, it would appear that mass release of *C. montrouzieri* on passion fruit could not be relied upon for control.

Existing parasites are not efficient enough to prevent occasional mealybug outbreaks, therefore the possibility of more effective control of *P. citri* by introduced parasites is worthy of consideration. These parasites will, in the opinion of Bartlett and Lloyd (1958), act principally as a restraint on low density mealybug populations rather than as a control of heavy infestations.

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