The Effects of Plant Nutrients on Biological Parameters of Crapemyrtle Bark Scale (*Acanthococcus lagerstromiae*)

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Introduction

Crapemyrtle Bark Scale (*Acanthococcus lagerstromiae*; CMBS) is a non-native pest species that feeds on the phloem of several economically important plants. The damages of CMBS include accumulation of black sooty mold, slow/weakened plant growth, leaf abscission, no flowering, death of branches, and in severe cases the death of the juvenile seedling or young trees.

Better understanding of plant-insect interaction may provide alternative pest management strategies in controlling this pest insect. In this study, the effects of plant metabolic state on the performance of CMBS were evaluated. Current results suggest that an optimized plant nutrient supplement regime may be in aid of current pest control strategies for CMBS.

Figure 1. Crapemyrtle Bark Scale infestation.

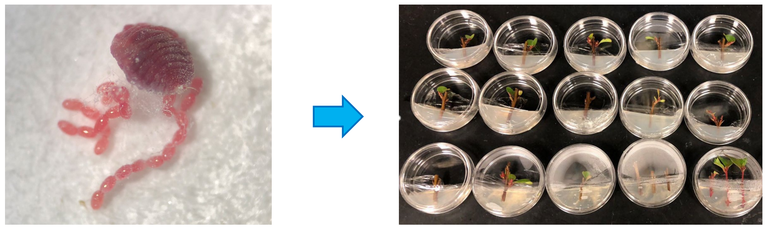
Objective

To investigate the effect of plant nutrients on biological parameters of CMBS through the age-stage, two-sex life table analysis.

Materials and Methods

Collecting CMBS eggs

Day-1 eggs were collected and kept under 25 °C until hatched in the rearing experiment (Figure 2A).



A B

Figure 2. (A) Female CMBS producing eggs within 24 hrs; (B) CMBS feeding chambers containing detached plant stems as food source and agar medium.

Insect rearing experiment

Stem cuttings of 'Fantasy' crapemyrtle seedling were used as food sources and placed in feeding chambers (Figure 2B). Newly hatched crawlers were transferred on detached stem in separate feeding chambers.

Treatments

Nutrient deficient (water) agar and 0.1 MS agar were used as medium for maintaining the plant material (Figure 3). 30+ nymphs reared on plants grown under two different nutrient conditions.

Materials and Methods

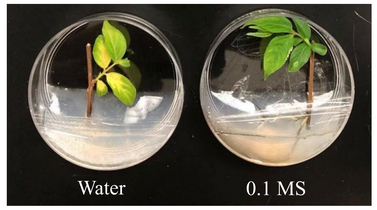


Figure 3. Rooted cuttings of *Lagerstroemia* 'Fantasy' seedling under two different nutrient conditions at week 8.

Data collection

The developmental stages of both male and female CMBS were determined by the number of times the nymphs molt. The duration of each developmental stage (including each nymphal stage, pupa, and adult stage) were recorded. The life history data of CMBS were analyzed according to age-stage, two-sex life table theory (H. Chi & Liu, 1985; H. J. E. E. Chi, 1988; scan OR code for details).

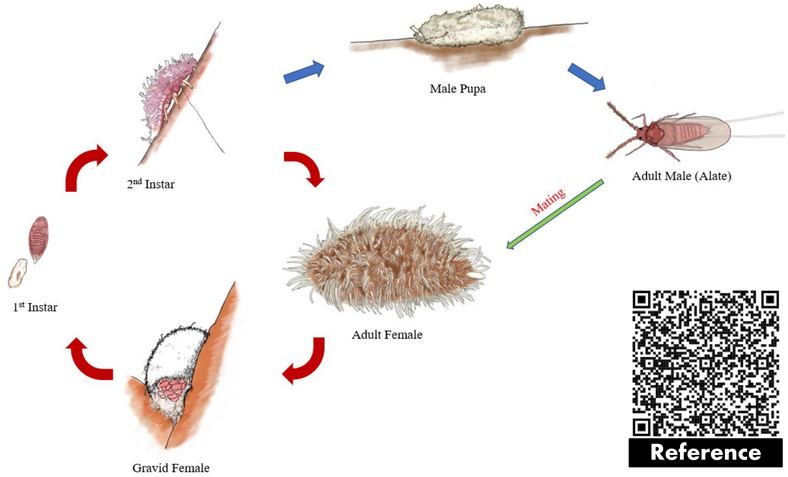


Figure 4. Life cycle of crapemyrtle bark scale.

Results

Overall, CMBS performed better when reared on 'less healthy' looking plants as a result of nutrient deficiency. Crapemyrtle bark scale reared on 'Water' condition had higher longevity and low mortality rate (Table 1).

Biological Parameters	Water	N	0.1MS	N
1st instar duration (days)	18.4 ± 0.5	30	18.4 ± 0.5	34
2nd instar duration (days)	63.5 ± 6.1	11	51 ± 11	2
Overall longevity (days)	59.1 ± 7	35	47.8 ± 4.7	37
1st instar mortality (%)	9.09	33	8.33	36
2nd instar mortality (%)	42.1	19	90	20
Overall mortality in 105 days (%)	71.4	35	100	37
Percentage of 1st instar molts	90.9	33	91.7	36
Percentage of 2nd instar molts	57.9	19	10	20
Percentage of CMBS reached adult stage	31.4	35	5.4	37

Table 1. Biological parameters of crapemyrtle bark scale on *Lagerstroemia* 'Fantasy' seedlings under different nutrient conditions.

Results

Treatment	r (days^{-1})	λ	Ro	T (days)	GRR (offspring/individual)
Water	0.01 ± 0.007	1.01 ± 0.007	4.98 ± 2.87	103.77 ± 14.42	22.07 ± 10.22
0.1 MS	N/A	N/A	0	N/A	0

Table 2. Population parameters including the intrinsic rate of increase (r), the finite rate of natural increase (λ), net reproduction rate (R_o), mean generation time (T), and the gross reproduction rate of crapemyrtle bark scale on *Lagerstroemia* 'Fantasy' seedlings under different nutrient conditions.

Under the experimental conditions, CMBS did not produce a second generation (Table 2), which suggested healthy plants might be able to 'fend off' CMBS at a certain degree.

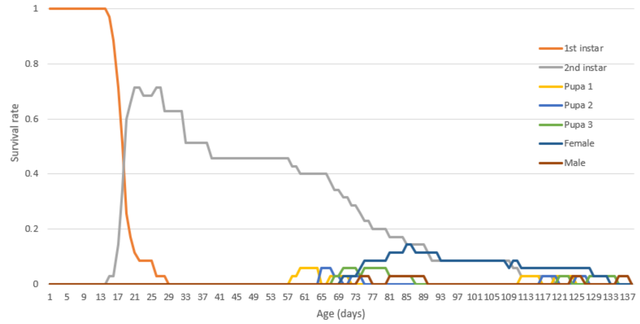


Figure 5. Age-stage specific survival rate (Sxj) of crapemyrtle bark scale reared on *Lagerstroemia* 'Fantasy' seedlings under nutrient deficient conditions.

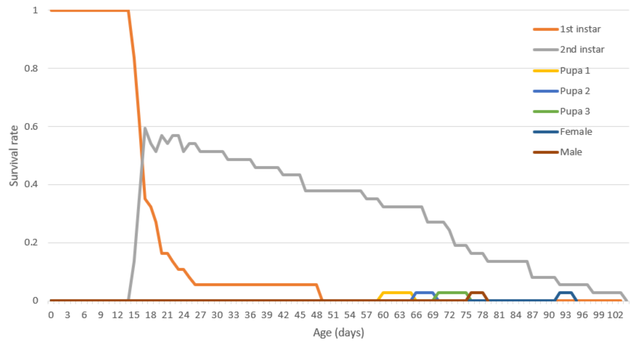


Figure 6. Age-stage specific survival rate (Sxj) of crapemyrtle bark scale reared on *Lagerstroemia* 'Fantasy' seedlings under nutrient sufficient conditions.

Conclusion

The results indicate that the metabolic state of the host plant might play an important role in its acceptance of CMBS, which suggests that an optimized plant nutrient supplement regime may be an aid of current pest control strategies for CMBS.

Acknowledgments

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