



Temperature-based phenology models and life table parameters for Antestia bug, *Antestiopsis thunbergii*, on arabica coffee

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INTRODUCTION

Antestia bug, *Antestiopsis thunbergii* (Gmelin), is a major coffee pest in East Africa. Both nymphs and adults attack all vegetative and fruiting parts of the coffee tree, and reduce the yield by up to 45%. In addition, they have been reported to cause the 'potato taste' defect in arabica coffee, reducing its quality and competitiveness in foreign markets. The economic threshold level for taking action against this pest is one or two bugs per tree. Climatic factors such as temperature and humidity are primary factors that affect growth and development of insects; therefore, global warming may have potential impact on the population dynamics of antestia bugs, and this may lead to crop losses.

METHODS

We obtained adults of *Antestiopsis thunbergii* from coffee farms and kept them in the laboratory. Freshly laid eggs obtained from these adults were put individually in plastic containers (3.5 x 3.9 cm), which were stored in incubators set at different constant temperatures of 18°C, 20°C, 23°C, 25°C, 28°C, 30°C, and 32°C. Relative humidity (RH) was 85% and photoperiod 12:12 L:D. The number of eggs used for the experiments was 200, 155, 130, 140, 165, 178 and 239, and temperatures used were 18°C, 20°C, 23°C, 25°C, 28°C, 30°C and 32°C, respectively. These individuals were observed daily to monitor change in life stages, as well as survival and fecundity for adult females. Fresh green berries and leaves were changed every two days for feeding nymphs and adults.

CONCLUSIONS

- Temperature affects the developmental capacity and population growth parameters of *A. thunbergii*.
- The second nymph stage seems to be the most susceptible to temperature.
- The intrinsic rate of natural increase is high (20°C), and decreases with an increase in temperature; and the population growth becomes negative at 30°C, which indicates that climate change may have an impact on the distribution of this pest.
- The optimum temperature of this pest ranges from 20°C to 25°C. At 30°C, the population cannot double, while above 32°C the pest cannot survive.

IMPACT

- Because the optimum temperature of this pest ranges between 20°C and 25°C, the pest may cause serious damage on coffee at high altitudes; therefore, appropriate control strategies should be taken in these areas.
- The highest mortality rate of *A. thunbergii* was observed at second nymph stage, whereas the mortality rate of other nymph stages decreased; therefore, second nymph stage should be targeted in the control strategies, because it is the most sensitive stage.

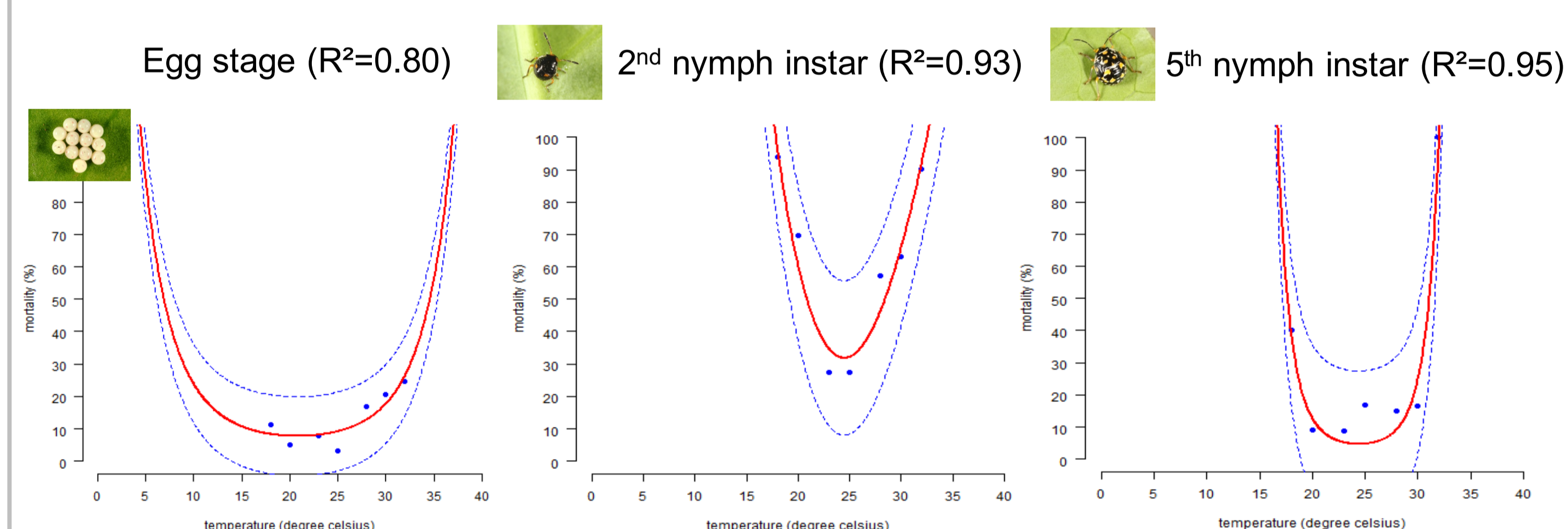
OBJECTIVES

- To construct temperature-based phenology models to predict development time, survivorship, and development rate of *A. thunbergii* on coffee.
- To describe the life table parameters of *A. thunbergii* under different constant temperatures in the laboratory using life table analysis.

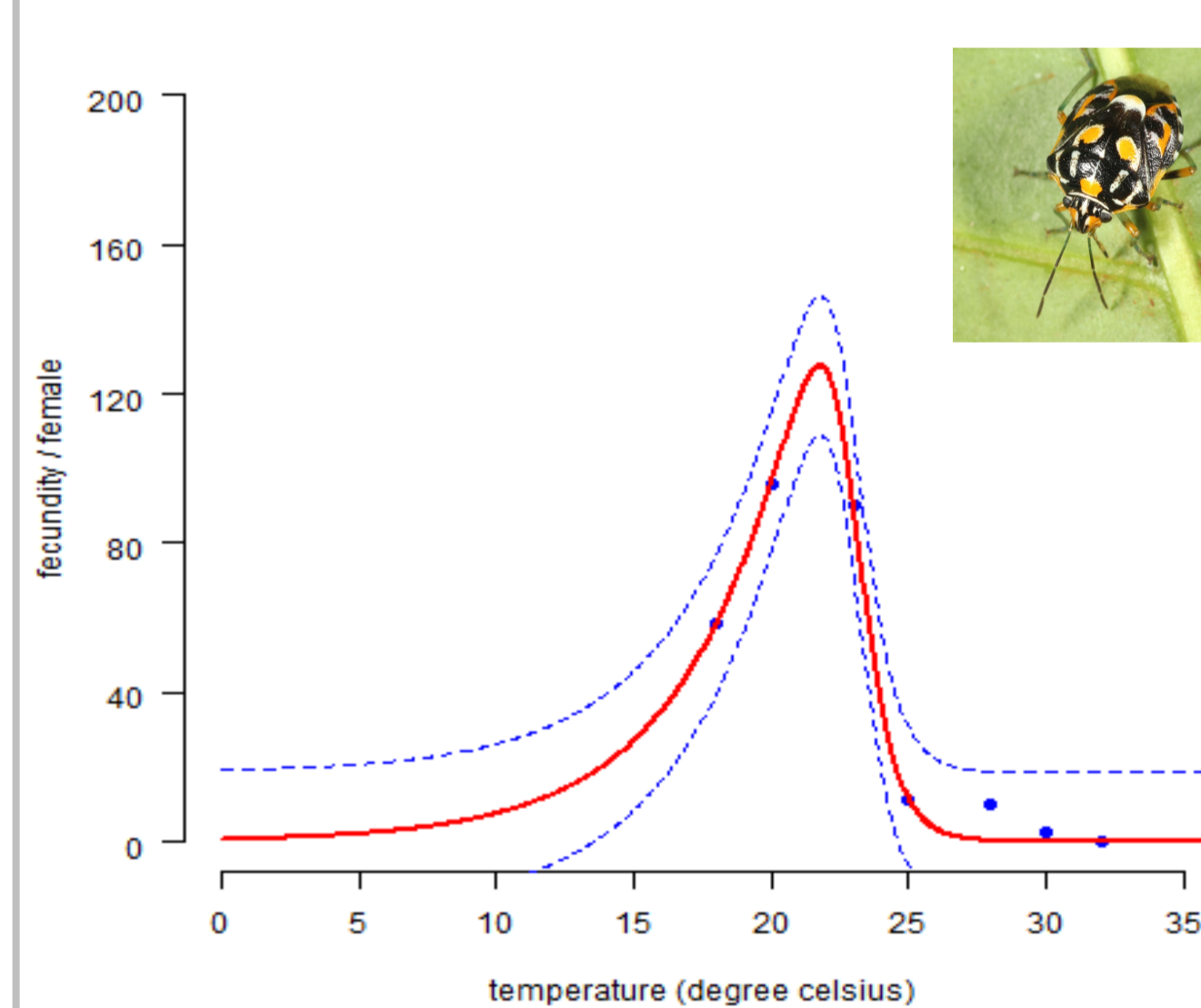


RESULTS

A) Temperature-dependent mortality rate for *A. thunbergii*



B) Temperature-dependent female oviposition



C) Life table parameters

Parameter	20°C	25°C	30°C
Gross Reproductive rate (GRR)	48.03	6.05	0.75
Net Reproductive rate (R_0)	9.61	2.60	0.08
Mean generation time (T_c)	140.9	101.6	83.9
Intrinsic rate of increase (r)	0.016	0.009	-0.029
Doubling time (T_d)	43.3	73.3	—
Finite rate of increase	1.050	1.00	—

REFERENCES

- Craves J. (2012) Potato taint in African coffees. *Coffee and Conservation*. Available at <http://www.coffeehabitat.com/2012/01/the-potato-taint/>
- McNutt D. N. (1979) Control of *Antestiopsis* spp. on coffee in Uganda. *PANS* 25, 5–15.
- Mugo H. M., Kimemia J.K. and Mwangi J.M. (2013) Severity of antestia bugs, *Antestiopsis* spp. and other key insect pests under shaded coffee in Kenya. *International Journal of Science & Nature* 4, 324–327.
- Zaslavski V. (1988) *Insect Development: Photoperiodic and Temperature Control*. Springer, New York, Berlin. 187 pp.