



The effect of temperature on the *Dendroctonus frontalis* community.

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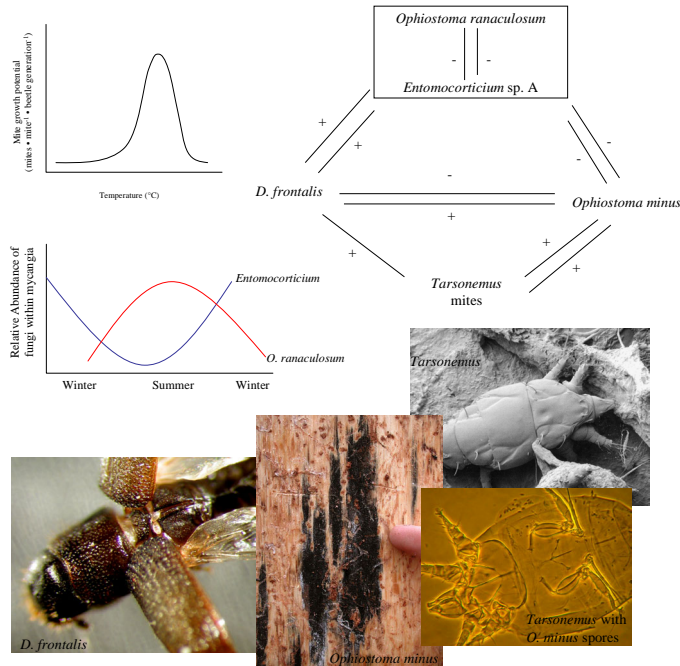
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Introduction

- Temperature has pervasive strong effects on metabolic processes of individuals and demographics of populations.
- Temperature effects on ecological communities are not well known.
- It has been suggested that metabolic processes explain community structure.
- How temperature affects communities may be predictable from the additive effects of each species' individual response.
- Species with strong interactions can also be affected by any factors that affect their associates.
- Temperature could produce more complex effects on communities by altering species interactions.
- Communities may be the product of both species' individual responses to temperature and species interactions.

Study system

- Species within the southern pine beetle (*Dendroctonus frontalis*) community are linked by many strong direct and indirect interactions.
- Temperature has strong effects on species within the system.
- Multiple pathways through which temperature could affect the system.

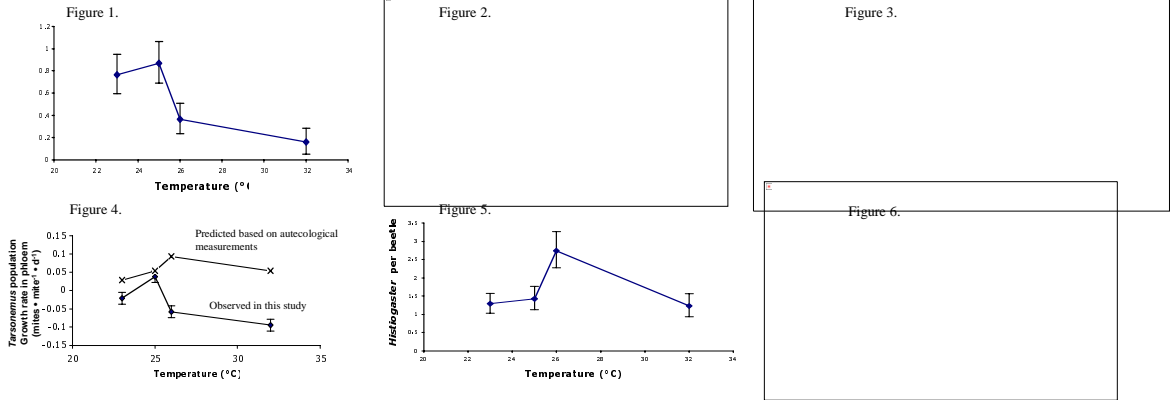


Methods

- Tested the effects of temperature on communities by manipulating the temperature of the intact *D. frontalis* community within naturally infested trees.
- Collected attacking (parent) beetles from around slash pine and recorded mite abundance and presence of mycangial fungi and *O. minus*
- After attacks had ended, we felled the trees, and placed bolts into containers
- 7 trees (2 bolts each) x 4 temperatures - 23, 25, 26, 32 °C
- We collected every emerging adult (progeny and parental beetles) and subsampled the progeny at three stages of emergence (early, peak, and late) for mite abundance and presence of mycangial fungi and *O. minus*
- After emergence ended, within each bolt we recorded *O. minus* abundance, beetle entries, and gallery densities, and recorded mite abundance (*Tarsonemus* and non-*Tarsonemus*) in 1cm² sample plots in both clean phloem and areas colonized by *O. minus*



Results



- *D. frontalis* reproduction decreased at higher temperatures (Fig. 1).
- *O. minus* abundance was not related to beetle reproduction, and could not explain temperature's effect on beetle reproduction (Figs. 2 & 3).
- *Tarsonemus* mite populations had highest growth rates at 23 - 25 °C and sharply decreased at 27 °C, contrary to autecological predictions (Fig. 4).
- *O. minus* abundance could not explain *Tarsonemus* response to temperature, as their responses were different (Figs. 3 & 4).
- *Histogaster* (a fungivorous mite) per beetle peaked at 27 °C, suggesting the possibility of interactions between mite genera with *Tarsonemus* (Fig. 5).
- Species association tests showed no associations between *Tarsonemus* and non-*Tarsonemus* mites within the phloem.
- *Entomocorticium* performed poorly at higher temperatures, corresponding to an increase in beetles with no mycangial fungi (Fig. 6). This was likely the cause of decreased beetle reproduction at higher temperatures.
- *O. ranaculosum* was not affected by temperature (Fig. 6).

Conclusions

- Communities experiencing different temperatures developed different community structures.
- Temperature impacted species directly through physiological effects and indirectly through associated species.
- Community structures were partly predictable from knowledge of the temperature response of individual species.
- Results also indicate that the effect of temperature on communities can only be understood when it includes species associations (e.g., temperature affects mycangial fungi abundance which then affects beetle reproduction).
- The effect of an exogenous factor on communities may not be as simple as the additive effects on individual species.
- Community structure is the product of both autecological responses of species to temperature and species interactions.

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