**Stage Structure**

Result: Increased synchrony of adult emergence in the spring decreased the probability of plume continuity.

Synchrony was manipulated by changing the standard deviation (sigma) of emergence dates for the parent generation (Fig. 2).

Plume continuity was most sensitive to sigma when the number of colonizing adults was large (Fig 3).

**Predation**

Result: For a given level of predation and phenological synchrony, the probability of plume continuity increases with population size at the scale of a forest (Fig 5).

**Discussion**

A seasonal departure from stable stage distribution should be advantageous for an organism which must mass-attack its host to overwhelm host defenses.

However, synchronous adult emergence in the spring leads to a decreased probability of plume continuity over the first generation of infestation growth.

Consequence?:

- winters cold enough to synchronize a population (sensu Powell et al. 2000) may be followed by a high rate of infestation failure in the spring. Plume continuity may also be disrupted by high summer temperatures via brood mortality (Beale 1931) or delayed emergence (R. Billings, personal observation).

Plume continuity is more likely if predation is low.

Consequence?:

- predation on southern pine beetles by its specialist clerid predator may contribute to infestation failure by reducing the average life span of adults.

Threshold aggregation behavior in southern pine beetles can lead to an Allee effect at the scale of whole forests.

Consequence?:

- an Allee effect can modulate the transition between endemic and epidemic states in outbreak pests (Berryman 1986).

**Literature Cited**


Gilbert, E., J.A. Powell, J.A. Logan. B.J. Bentz. 2004. Comparison of three models predicting developmental milestones in woodboring beetles can lead to an Allee effect at the scale of whole forests.


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