Identifying the Terminal Growth Phase in Mosquitoes

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Biology & Biochemistry

Background

All animals exhibit nutritionally-induced plasticity in size; poor diets result in smaller size at maturity whereas rich diets produce larger adults. Variation in the degree and developmental timing of size plasticity affects the expression and evolution of morphology. In fully metamorphic insects such as bees, butterflies and beetles, the terminal growth phase (TGP) determines the magnitude of nutritionally-induced size plasticity. Once a larva achieves the minimum threshold size for pupation, an irreversible endocrine cascade is initiated that culminates days later in metamorphosis. It is only during the TGP that diet can affect the final size of the body and other morphological structures. Here, I sought to identify the TGP and quantify the degree of nutritionally-induced size plasticity in two species of mosquito. My findings will form the foundation for my future studies on how nutritional variation affects the growth and evolution of morphology in this system.

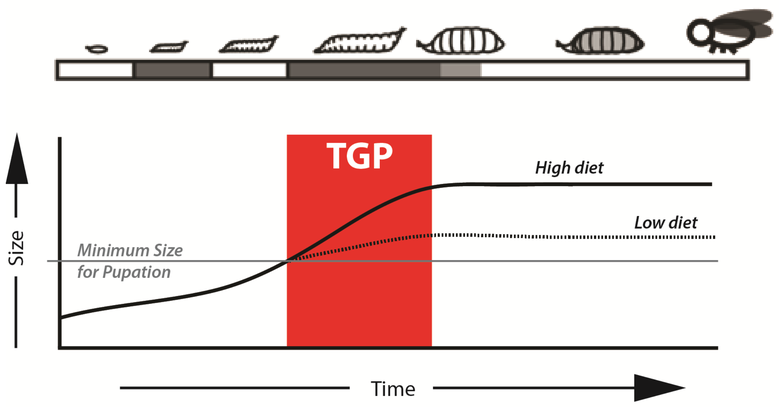
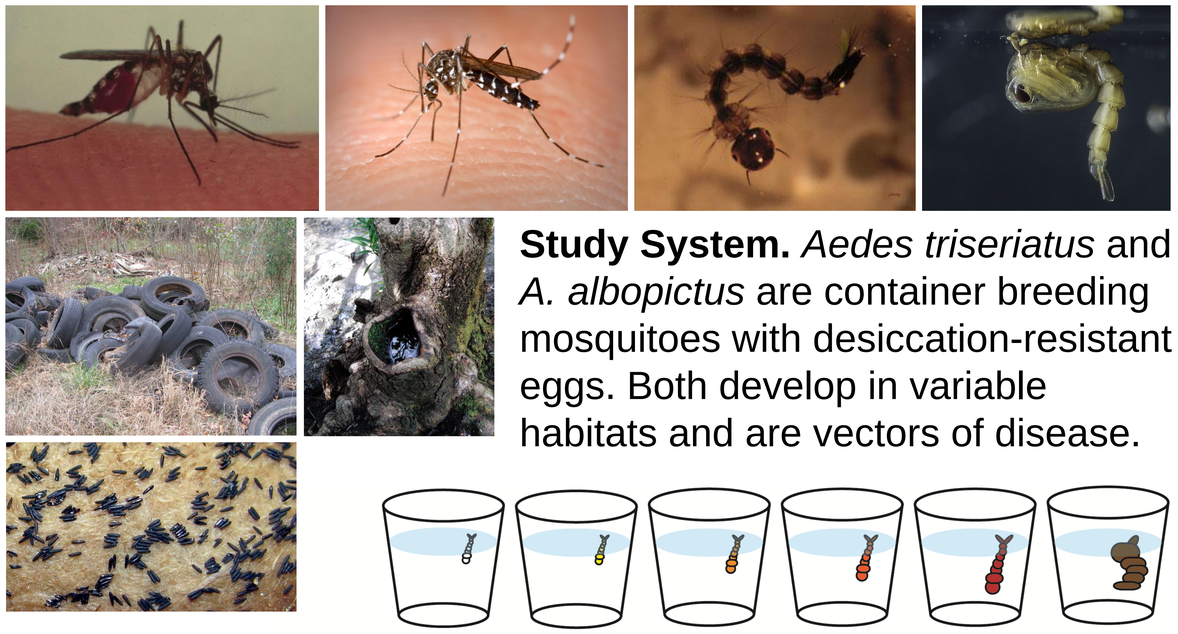


Fig. 1. Variation in diet during the TGP affects adult size. Once the minimum critical size is achieved, a commitment to metamorphosis is initiated. Growth during the intervening time is dependent on nutritional intake, producing variation in adult size. Nutritionally-induced size plasticity is shown by the magnitude of the difference between adult size in individuals from low and high quality diets.

Results, Discussion & Future Work

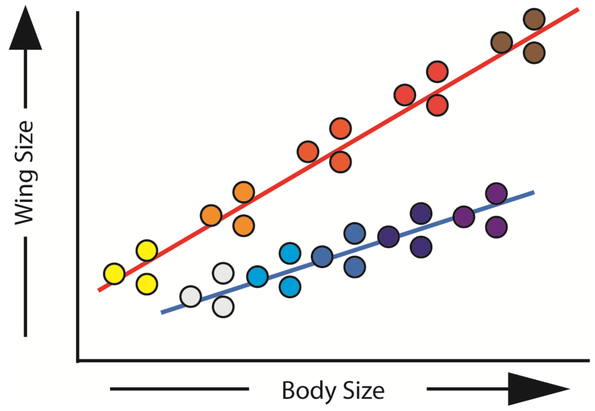
We initially had great difficulty rearing larvae through the 4th instar. We hypothesized that larvae suffered from a local pathogen, and spent weeks refining protocols to circumvent this problem. In late September, we switched to a different larval food supplier, and have now reared larvae to adulthood. Preliminary trials indicate that the TGP occurs essentially at the onset of the final (4th) larval instar and lasts ~four days at 22C. Trials are currently underway to quantify the degree and pattern of intra- and interspecific nutritionally-induced phenotypic plasticity in the size of morphological traits and the body.

Methods



Study System. *Aedes triseriatus* and *A. albopictus* are container breeding mosquitoes with desiccation-resistant eggs. Both develop in variable habitats and are vectors of disease.

Fig 2. Developmentally timed starvation produces size variation. The cool colored species has a larger minimum critical size for pupation and exhibits lower nutritionally-induced size plasticity than does the warm-colored species. Variation in access to nutrition affects size and shape differently between these two hypothetical species.



I hatched cohorts of mosquito eggs synchronously on consecutive days and reared larvae on a fixed per-capita diet. When the first (oldest) cohort pupated, larvae in all cohorts were cut off from food. This manipulation varies the nutrition consumed by each cohort, and thereby identifies the developmental onset of the TGP. It also reveals the degree of nutritionally-induced phenotypic plasticity in body and trait size in this system. Differences in plasticity are indicated by divergent variance in trait or body size across diet regimes. Differences in the slope of the morphological scaling relationships indicates that variation in diet affects the expression, and presumably the evolution, of shape differently between these two species.

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