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Effect of temperature on the development time and pupation height of *Drosophila*.

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Temperature is important for the development of insects and other animals. Since insects are cold-blooded organisms, temperature is the most important environmental factor that can influence insect behavior, distribution, development, survival, aging, and reproduction (Mikasa and Narise, 1980; Gillooly *et al.*, 2002; Régnière *et al.*, 2012; Kelly *et al.*, 2013; Danjuma *et al.*, 2014). I chose *Drosophila* (fruit flies) to study the effect of temperature on development time, because they are easy to handle, well understood, possess a short life cycle of just two weeks, and are easy to keep in large numbers. They show complete metamorphosis. There are ~2000 species of *Drosophila* in the world. The average lifespan of *Drosophila* is about 50 days. A female can lay hundreds of fertilized eggs during her brief lifespan. *Drosophila* is also an excellent model organism to study human diseases.

Since temperature affects the development and survival of *Drosophila*, I chose a few laboratory populations to test the developmental time, pupation height, and number of flies emerged.

To perform the experiment, I used the following materials and equipment: 10-15 flies of Oregon-R and Canton-S (3-5 day old individually laboratory-mated female *Drosophila* for each temperature condition); fly food (containing yeast, sugar, agar, cornmeal, water, methylparaben, and ethanol); incubators to keep the flies for testing the development time [18°C, 25°C, and 29°C]; CO_2 chamber used when sorting; and microscope to examine flies.

I used 10-15 flies (males and females) from the main stock and individually transferred them into a fresh vial, while they were sleeping. I prepared three sets (replicates) of vials for each temperature setting (9 total vials with 10-15 flies each). I put these vials into incubators with temperatures set at 18°C, 25°C, and 29°C for 2 days. After 2 days, the flies were taken out from the vials and were observed throughout the developmental stages from egg/embryo until adult. I also observed the pupation height, which was based on the number of pupae resting on the side of the vials. In addition, I also counted the number of flies emerged. Data was analyzed and a graph was made on Microsoft Excel.

I tested if different temperature regimes affect the development time of *Drosophila* and found that at 18°C, flies grow much slower (development time ~20 days) as compared to 25°C (development time ~9 days) and 29°C (~7 days) (Figure 1). I performed these experiments in triplicate and found the same results. I also observed that at lower temperatures the size of the flies is much larger compared to higher temperatures. In addition, I also observed the lowest pupation height at lowest temperature (18°C; Figure 2). Furthermore, I noticed that at lower temperatures flies show less lethality compared to higher temperature.

The above-mentioned results suggest that at lower temperatures *Drosophila* develop slowly. These results also show that at a favorable temperature insects will grow much faster. It is possible that lower temperatures may decrease the rates of depletion of energy substrates (Koštál *et al*., 2016). More lethality observed at high temperatures in our experiments could be due to the accumulation of metabolic waste products or a higher rate of water loss, which is usually greater at later stages of development (Davidson,

1944). Based on my observations and results, I conclude that temperature plays a crucial role in the development of *Drosophila* and may affect the development of other insects, in general. Future experiments using natural and laboratory populations will be employed to test the adaptability and genetic factors on development time and aging.

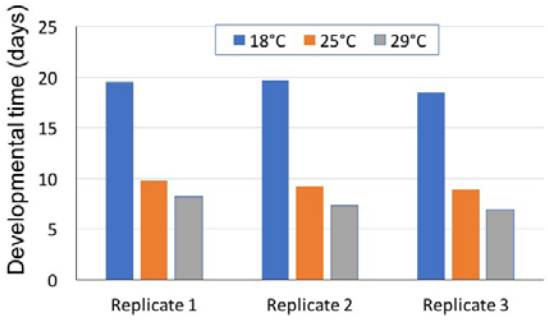

Figure 1.

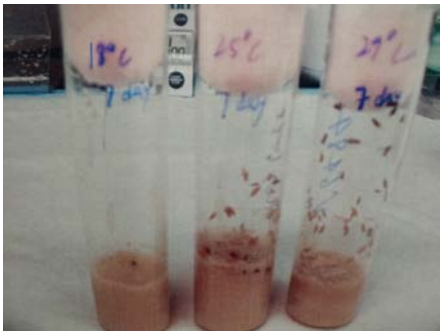

Figure 2.

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Inferring the evolutionary significance of chromosomal inversion polymorphism: insight from *Drosophila* model.

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Abstract

Inversions play a major role in shaping evolutionary processes like speciation and adaptation, by suppressing recombination between advantageous genes spanning inversion breakpoints. Chromosome inversion polymorphism is mostly found to be associated with disease pathogenesis in human beings; however, due to various study limitations, the molecular mechanism behind the appearance of this mutational change is poorly understood. A wealth of information was generated especially on frequency and distribution of chromosomal inversions in species populations using various *in vivo* systems. In addition, their evolutionary significance has been established by gaining knowledge from various cytogenetics and behavioral studies conducted using these model systems. To this respect, *Drosophila* is considered to be one of the popular model organisms as it carries polytene chromosomes in one of its larval stages. Also it shares 75% of genome homology with humans and the basic cellular and biological processes are found to be conserved amongst both of them, thus clearly showing the significance of the study outcome of this model in