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The Temperature Effects on Weight Gain and Wing Area of Drosophila Melanogaster

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ABSTRACT

Temperature has been known to cause weight gain on ectoderm species such as Drosophila melanogaster. Drosophila melanogaster also known as fruit flies, were kept at two different temperature settings 18 and 25 degrees Celsius and two vials in each temperature. Also the two vials will have two different levels of yeast placed in the culture 1.5mg of yeast and 10mg of yeast. Drosophila was then measured after they have reached adult hood, the mass, the right wing length, and thorax length was measured for this experiment. At lower temperatures at 18degrees C, drosophila showed larger mass and longer wing area than those at 25degrees Celsius. At lower temperatures drosophila seemed to use their food more generously and because there was no heat stress in their environment their activity was not as effect as those in higher temperatures. The yeast amounts did not show any influence on the weight gain of the fruit flies. This indicates that temperature was the main factor in the weight gain and increase wing area in drosophila.

Keywords: *Drosophila, Fruit Flies, Temperature, Yeast*

INTRODUCTION

The gradual growth through a series of progressive changes can be altered with minor changes in the environment such as temperature and amount of food supply. Temperature can affect the many different phenotypic traits that an organism has and food supply may limit the organism to feed less or intake more food. Also, temperature can effect at the rate of growth and the rate of physical activity. Organisms that fall into this category are ectothermic individuals such as reptiles, amphibians, and fish. Ectotherms increase in heart rate as the temperature increases because they have a body temperature that's controlled by their environment. Ectotherms such as Drosophila melanogaster have been used to test certain theories about temperature and amounts of food places in their environment. What is already known is that development at a lower temperature both resulted in higher thorax length and wing area. Given its similarity to the evolutionary response, the increase in body size and cell size resulting from development at low temperature may be a case of adaptation. Larvae reared at a lower experimental temperature of 18 degrees Celsius, have a higher metabolism than those reared at a higher temperature at 25 degrees Celsius (Partridge 2001). Because the larvae use their food more efficiently they are likely to live longer and possibly have a smaller body size than those of the higher temperature drosophila. Flies that were maintained continuously at 18, 21, 27 or 30 degrees C or succession to 21 and 27 degrees C and vice versa support the concept that the life span is influenced by temperature, in agreement with the rate of living theory, flies live faster at higher temperature (J. Miguel 1976).

Phenotypic plasticity is the ability of an organism to change its phenotype in response to changes in the environment. A minimal requirement of adaptive phenotypic plasticity is that the phenotype and the environment interact to enhance individual fitness, that is, the phenotype induced by a particular set of environmental conditions results in a fitness gain that is specific to those conditions (Cheung 1997).

To measure their metabolism and wing size, different amount of yeast will be added to their culture. The quantity of yeast was provided are from previous studies and have shown that this is a sufficient amount of food for the majority of the larvae to reach adulthood (Partridge 2001).Usually around day 11-12 the stage of eclosion begins(Warder 2002). This meaning they can begin to reproduce.
Temperature affects the rate at which the drosophila develops over their life time. Flies can begin to reproduce and start laying eggs after they have hatched from the pupa. The question to be answered is "What are the effects of temperature and yeast on adult weight and the wing area of drosophila melanogaster?" The reason behind the choice of organism was because they are small, easy to observe, portable, and have a short life expectancy to where they will not take long to get results. This will be observed by placing them at two different incubators with two different temperatures and with two different amounts of yeast being added to each vial. The importance is to observe if there is a correlation between temperature and yeast (food supply) may have on the weight gain or length of an organism.

MATERIALS AND METHODS

Drosophila melanogaster (fruit flies), were obtained

from previous vials that were used during a pilot run of this experiment. The drosophila was kept in culture vial prior to the start of the experiment for roughly a week in order for the drosophila to mate and lay eggs. The culture vial included Drosophila Media, Blue Formula 4-24 that was purchased from Carolina and added into the vial with 30mL of water. There are four vials total for this experiment.

The four vials are labeled at different temperatures and different amounts of yeast such as 1.5mg and 10mg that were added to the vials, two vials are 25 degrees Celsius and two others at 18 degrees Celsius, at the same time the vials at the two different temperatures have a different amount of yeast. These were kept in two different incubators that allow the temperature to be constant. In each temperature there is a different amount of yeast; one has 1.5mg and other 10mg of yeast.

At this point, parental flies were placed in the vials to lay eggs and ensure that there will be larval growth. After the parental flies are in the vials, the next step is to place them in their designated temperatures. The flies will be kept for observations until they have reached adulthood, which would be an estimate of 11-12 days give or take a couple days due to the temperature. After the flies have reach adulthood, they will be put to sleep using fly nap. The flies will be measured by using a unit ruler that is held within the eye piece lens of the microscope. The eye piece is placed in the dissecting scope in order to prevent smashing the fly and they can lie out on their side. This will measure their right wing length and thorax. Next, their mass will be measured by placing them individually in a sensitive scale that reaches to the 0.0001 place and record.

RESULTS

There was a significant difference in the mass and a significance difference in the wing length of drosophila in both temperatures. There was a more of an influence of temperature on the mass of the fly than the yeast. With a P-value of 0.493, P=0.006 and a mean of 5.48e-6 showed that there was a higher mass in the high high section meaning high temperature and high amount of yeast, but the low temperature and low amount of yeast came close to (Figure1).

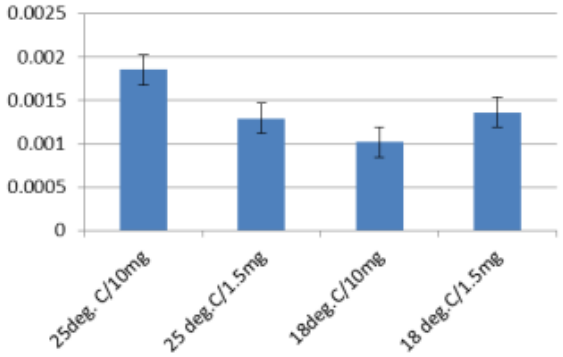

Figure 1: Drosophila body weight in mg, at 18 C and 25 C degrees incubated in a vial with 10mg and 1.5mg of yeast food.

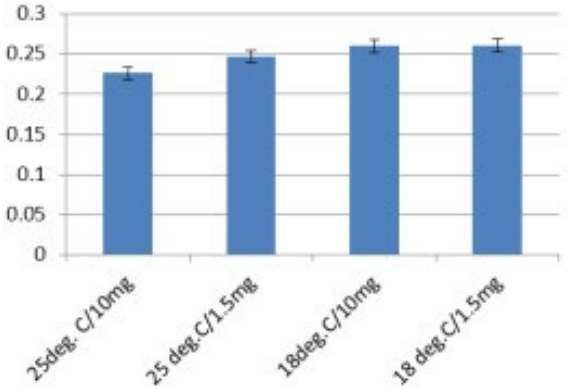

Figure 2: Drosophila right wing length in mm, at 18 C and 25 C degrees incubated in a vial with 10mg and 1.5mg of yeast food.

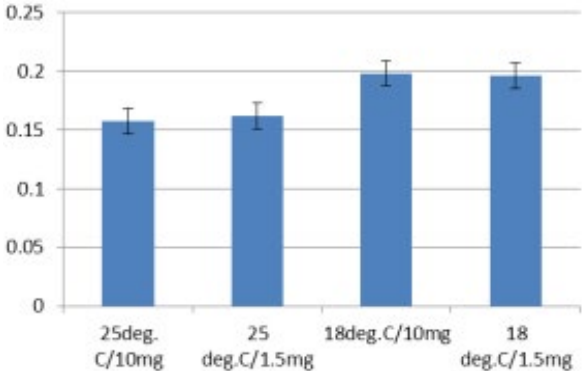

Figure 3: Drosophila thorax length in mm, at 18 C and 25 C degrees incubated in a vial with 10mg and 1.5mg of yeast food.

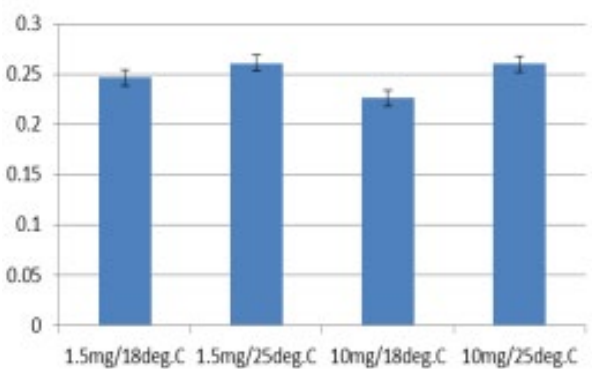

Figure 4: Showing interaction between wing length and yeast food amount in mm, at 18 C and 25 C degrees incubated in a vial with 10mg and 1.5mg of yeast food.

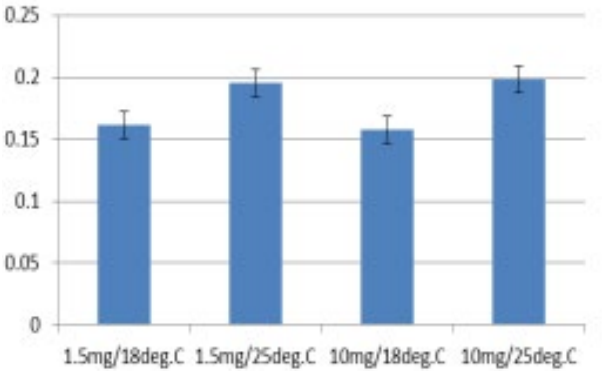

Figure 5: Showing interaction between thorax length and yeast food amount in mm, at 18 C and 25 C degrees incubated in a vial with 10mg and 1.5mg of yeast food.

As seen in Figures 4 and 5, temperature was the noticeable variable and the yeast not as must. Temperature showed a significance in this experiment P<0.0001 and a p-value of 0.513 and P=0.0326 when compared with yeast values.

DISCUSSION

The experiment was designed to measure the mass, the wing area, and the thorax length of drosophila melanogaster at two different temperatures (25 degrees and 18 degrees C) and at two different levels of yeast (1.5mg and 10mg). Temperature has large effects on the rate of growth of these Ectotherms. Drosophila had similar masses but had a slightly higher mass at high temperatures and high levels of yeast. When it came to the wing area, the drosophila at 18degrees C had a greater wing area than the drosophila at 25degrees C. Drosophila at lower temperatures showed they had greater thorax length than those raised and grown at higher temperatures. Even though they had different levels of yeast they did not show a difference in size, they were really close in value.

Table 1: ANOVA table of analysis of results

ANOVA						
mass						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	1818.859	179	10.16122	1.00009	0.493981	1.232455
Columns	44597.98	2	22298.99	2194.715	1.1E-201	3.020941
Error	3637.391	358	10.16031			
Total	50054.23	539				
right wing length						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	1811.109	179	10.11793	0.993656	0.51384	1.232455
Columns	43796.6	2	21898.3	2150.577	3.3E-200	3.020941
Error	3645.343	358	10.18252			
Total	49253.05	539				
thorax length						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	1810.767	179	10.11602	0.993377	0.514705	1.232455
Columns	44022.76	2	22011.38	2161.482	1.4E-200	3.020941
Error	3645.681	358	10.18347			
Total	49479.21	539				

These results suggest that Ectotherms are highly influenced on the temperature of the environment they are placed in. The fixed amount of food that was present did not necessary have an impact on the mass of the drosophila. As referenced to the Partridge article and experiment, these results continue to prove that the temperature was the variable that is strongly correlated closely with mass. Wing length could have increased due to the size of the drosophila has increased to in mass. The wings have to be able to support the fly.

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