

The distance slaters travel in different temperatures biology essay



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Introduction: The Slater Porcellio Scaber is an Arthropod and is a member of the biological class Crustacea. The Slater has a flattened segmented body and 7 pairs of legs. The Slater is nocturnal and feeds on dead plant matter and vegetables. The Slaters I collected were found in dark and damp places with a temperature of 17.4 degrees Celsius in a gully behind bark on rotting trees and under rocks. The Slaters I found were clumped together as this is a method of conserving water in warmer temperatures or in regions of low humidity. Water loss can lead to desiccation as can the exposure to light so the Slaters I found were unexposed to light. This is due to Slaters being negative photo taxis as exposed to light Slaters can suffer desiccation ("Desiccation is the state of extreme dryness, or the process of extreme drying" quote from <http://en.wikipedia.org/wiki/Desiccation>.) This is because Slaters do not have a waterproof waxy cuticle to keep water/moisture inside their body. Also Slaters lose more water than other Arthropods because their lungs are located on the abdomen and during respiration water is a product which can be lost via a small pore on the outside of the body. Due to losing water more rapidly than other Arthropods Slaters have physical and behavioural adaptations to maximise and maintain their water intake in order to avoid desiccation.

A structural adaptation Slaters have is a pair of uropods. Slaters are able to absorb water through uropods. The uropods are located on the posterior of the insect. To obtain the water the Slater will squeeze the uropods together and touch it against the surface with water on it. Capillaries located inside the uropods 'suck' the water up and into the anus.

Slaters are able to absorb water directly through their exoskeleton. However this is only possible in regions of high humidity.

A behavioural adaptation is in hot or dry conditions the Slater is able to release a body odour that attracts other Slaters. The Slaters then clump together as a form of defence to prevent loss of water. They do this because they need to reduce their surface area and for a lone Slater this is not possible. Reducing surface area means reducing the area in which water is lost via diffusion through the exoskeleton due to the lack of the waxy cuticle.

Slaters are nocturnal. Although this is also to avoid predators such as birds, frogs, some beetles and some spiders it is also to avoid sunlight which can lead to water loss and desiccation. Also at night the temperature would be a lot cooler than during the day. Slaters may have developed this behavioural adaptation because being active during the day would lead to significantly more water loss than when they are active at night. A large loss of water can lead to desiccation.

My investigation is based on whether the temperature in which the Slaters live in naturally benefits their survival or not. As warmer temperatures can lead to water loss and for Slaters this can lead to desiccation. I have designed an experiment to measure the activity levels of Slaters by measuring the distance they travel (in cm) at different temperatures (5 degrees Celsius, 10 degrees Celsius, 15 degrees Celsius, 20 degrees Celsius, 25 degrees Celsius and 30 degrees Celsius). The results from this experiment will allow me to determine whether or not Slaters have increased or decreased activity levels in warmer or cooler temperatures. Results will

allow me to make a conclusion on whether the temperature in which they live in naturally plays a vital role in the survival of Slater populations. I would expect to see in my experiment Slaters covering a larger amount of distance in the warmer temperatures. I am expecting to observe this behaviour because the Slaters will be trying to avoid these warmer temperatures in order to prevent water loss which could then lead to desiccation.

Aim: To determine whether Slaters (*Porcellio Scaber*) have an increased/or decreased activity levels in different temperatures measure by the distance they travel in a set amount of time. Using the results make a conclusion on whether temperature plays a vital role in the Slaters survival as a population in their natural environment by reducing the risk of desiccation.

Hypothesis: I think the Slaters will cover more distance in the warmer temperatures (e. g. 20°C, 25°C and 30°C) as an attempt to find an escape to a cooler temperature. This is because in warmer temperatures more water is lost and excessive water loss can lead to desiccation. I think that in the cooler temperatures the Slaters will not cover as much distance because they will not be trying to avoid the temperature as desiccation would occur at a significantly slower rate in colder temperatures.

Method:

Equipment List:

Lux meter

Data logger with humidity measure attachment

Ice cream container

Thermometer

Stop watch

Sharpie

String

Boiling water (depends on the temperature you are trialling)

Ice water (depends on the temperature you are trialling)

200 similar sized Slaters (Porcellio Scaber)

Paper (to line the bottom of the ice cream container with)

Cello tape

Question: To measure how temperature affects Slaters activity levels by the distance they travel in a set time. With the results make a conclusion on whether the temperature in which they live in naturally benefits their survival.

Gather 200 similar sized Slaters. Slaters need to be of similar size as larger Slaters may be able to cover further distance than smaller Slaters are able to. Keep Slaters in a tank outside (out of direct sunlight) that replicates their natural environment. Also during the experiment we want to replicate their natural environment as much as possible (e. g. light intensity and humidity).

This is to ensure the Slaters respond to the changes in temperature and not other factors.

Collect a sharpie, string, measuring instrument, thermometer, lux meter, humidity meter, boiling water(depends on the temperature), ice water (depends on the temperature), data logger, ice cream container.

Line the bottom of an ice cream container with a sheet of white paper. Ensure you use the same size container for all of the trials during your testing. As a change in size may change the Slaters movement and then it would not be a fair test. Also ensure container is same height as if the container were to be not as high for some temperatures in your experiment the Slater may spend the 2minutes trying to climb out and not moving around the container in response to the temperature.

When carrying out the experiment make the room as dimly lit as possible. This is to prevent the Slaters from moving in response to bright light and not temperature. As Slaters are negative photo taxis (move away from light) having the experiment in a bright room will cause the Slaters to move in response to the light as they will be trying to move away from it. Light is a controlled variable so measure the light intensity using a lux meter before every trial and every change in temperature. Take 5 readings and calculate an average. You must take 5 readings to obtain the average as light intensity is constantly changing so by taking 5 readings and calculating an average you will be getting a more accurate light intensity measure rather than if you were to just use one reading as your light intensity. Also the humidity of the room is another controlled variable. Measure humidity using a data logger

with a humidity measurer attachment after every trial and change in temp just to ensure it remains fairly constant (within 10% difference in the humidity readings). We must keep the humidity level as constant as possible as different humidity levels may cause the Slaters to act differently and we want a response from the Slaters due to temperature to which they are exposed to and not humidity levels.

To obtain cooler temperatures (e. g. 5 and 10 degrees Celsius) cool down the inside of the ice cream container by placing it in a water bath containing ice water. Once the temperature has reached the desired coolness and has remained at the desired temperature for 5minutes you are ready to start testing. Measure temperature using a thermometer. Ensuring the temperature maintains the same for 5minutes means when you start the testing it won't start changing. This is important because if the temperature were to increase or decrease during the testing the Slater would respond to the change in temperature and not to the original temperature which is the one we are testing the Slaters activity levels on.

Place a randomly picked Slater in the ice cream container. (Do not get the Slater from the tank you are keeping it in until you are ready to start the testing). Measure the Slater using a ruler to check it is between 1-1.5cm. The Slaters used for testing must all be between 1-1.5cm because if you were to use smaller Slaters and larger Slaters for the experiment you may receive different results as the larger Slaters may be able to move faster so they could cover a larger distance in the 2minutes. Wait for 2minutes to allow the Slater to adjust to its new environment. If you were to start timing

straight away the Slaters response may not be due to the temperature but due to its new surroundings.

After the 2minutes ensure the temperature is still constant. Now start a timer for 2minutes and as the Slater moves around the ice cream container draw a line behind it and line the path it takes. Make sure you do not follow the Slater with the sharpie too closely as it may respond to the sharpie following it and not the temperature. Leave about a 10cm gap between sharpie and the Slater.

Once the 2minutes is up remove the Slater and place in a separate tank to the other Slaters that replicates its natural environment. We don't want to use the same Slater for the trials as this would not be a large enough sample size to represent a population.

Using a piece of string follow the lines (the path the Slater took) around the piece of paper that lined the bottom of the ice cream container. You may need to use cello tape to keep the string in place along the Slaters path. Once you have the length of string with the distance the Slater travelled in the 2minutes measure it using a ruler and record in a results table. A large amount of distance= high activity levels. A low amount of distance= low activity levels.

Now you are going to repeat the trial again so measure the temperature to ensure it is still constant. You may have to add more ice to the water bath to cool it down to the desired temperature again. Once the temperature is constant again and has remained constant for at least 5minutes you are able to repeat the trial again for 9 more Slaters. Each temperature you test you <https://assignbuster.com/the-distance-slaters-travel-in-different-temperatures-biology-essay/>

must have a sample size of Slaters of at least 10. This is because a large sample size will mean more accurate and reliable results that can represent a whole population of Slaters.

For each different temperature you test (5, 10, 15, 20, 25 and 30 degrees Celsius) repeat the same method but to heat up the inside of the ice cream container place the container in a water bath full of hot/boiling water and have the room well heated.

For each temperature use 10 Slaters and each temperature must be trialled 3 times (so 30 similar size Slaters will be used per temperature overall). This is to ensure accurate and reliable results as the sample size must be able to represent a whole population.

Record all results in a table. Remember between each trial and sets of testing record light intensity and humidity to make sure the two controlled variables remain as constant as possible. Also remember to measure temperature before each Slater is tested to make sure it is still at the desired temperature.

With results work out averages from each temperature (using the averages from the 3 trials per temperature). Use the averages to make a conclusion whether Slaters benefit their survival in their natural environment by living in the temperature they live in.

Controlled variables:

Light intensity: You must maintain a constant low light intensity throughout the testing. Because Slaters are negative photo taxis we want the room as

dark as possible whilst performing the experiment so the Slaters respond to the temperature and not to the light intensity.

Humidity: You must maintain a constant humidity reading throughout the testing. You want the Slaters to respond to temperature and not humidity levels.

Perform testing at roughly the same time every day: Because Slaters are nocturnal we must perform the testing if done on different days at roughly the same time. If you were to perform some trials during the evening this is when the Slaters are normally active so if you had done the rest of the tests during the day your results would not be accurate.

Perform testing in same container: Make sure the container is the same length; width and height (preferably keep it the same container throughout the whole testing process). If the container were to change the Slaters may act differently. If the container were to be not as high as the original the Slaters may spend the 2minutes trying to climb out the container and not moving around the container in response to temperature.

Use similar sized Slaters for the testing and the same type of Slater: Make sure all the Slaters you use in your testing are between 1-1.5cm in length. Check this by measuring them with a ruler before you start the testing. The Slaters used for testing must all be between 1-1.5cm because if you were to use smaller Slaters and larger Slaters for the experiment you may receive different results as the larger Slaters may be able to move faster so they could cover a larger distance in the 2minutes. Also make sure you are using

the right type of Slater as there are many different types found in New <https://assignbuster.com/the-distance-slaters-travel-in-different-temperatures-biology-essay/>

Zealand. You are using Porcellio Scaber, this Slater cannot roll into a ball and it is a little bit blue in colour so it is easily recognisable.

Final Results:

Temperature

Average Distance in cm the Slaters Travelled in the 2 minutes.

5°C

10°C

15°C

20°C

25°C

30°C

1. 92cm

11. 98cm

23. 08cm

65. 20cm

83. 21cm

95. 86cm

As seen on the table the Slaters travelled a very little amount of distance in the 5°C with an average distance of 1.92cm and as the temperature increased so did the amount of distance the Slaters travelled. All the measurements of distance shown are final averages from the 3 trials per temperature.

Conclusion: My aim was to determine whether Slaters have an increased/or decreased activity levels in different temperatures by the distance they travel in a set amount of time. In conclusion from the results of my experiment it shows that as the temperature increases so does the Slaters movement. This is shown by the distance in cm Slaters travelled in the 2minutes. For 5°C the Slaters travelled an average distance of 1.92cm. In 10°C the Slaters travelled an average distance of 11.98cm. In 15°C the Slaters travelled an average distance of 23.08cm. In 20°C the Slaters travelled an average distance of 65.20cm. In 25°C the Slaters travelled an average distance of 83.21cm and in 30°C the Slaters travelled an average distance of 95.86cm. Therefore my hypothesis was correct with my assumption that the Slaters would cover more distance in the warmer temperatures.

Discussion: The purpose of my investigation was to determine whether Porcellio Scaber have increased/or decreased activity levels in different temperatures. A trend was seen in the results I obtained. As the temperature increased by 5°C the Slaters movement increased by 10-20cm with the exception of the temperature change from 15°C to 20°C. The difference of the Slaters movement between the two temperatures was 42.12cm. From the results of my experiment it was clear the Slaters preferred the

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temperatures between 10°C and 15°C. 5°C was too cold for the Slaters and they moved a very minimal distance (average of 1.92cm). This is because as Slaters are cold blooded and are not self heating so they take in the temperature of their environment. In the cold temperatures Slaters cannot move quickly as particles are denser and thus move slower and enzymes cannot catalyze reactions as quickly in the cooler temperatures. If the Slaters were to live in a cold environment such as 5°C they would struggle to move especially away from predators and it would take them longer to find food as they could not travel as fast. This would be a disadvantage to the survival of Slaters as they would be more likely caught and eaten by predators and they may not be able to find enough food for them to survive as they would be moving very slowly. The other extreme is in the warmer temperatures the Slaters covered a large amount of distance. In 5°C on average the Slaters travelled 1.92cm and in 30°C on average the Slaters travelled 95.86cm. The difference of 93.94cm between the two temperatures for the Slaters movement is a significant difference. In the warmer temperatures (e. g. 20°C, 25°C and 30°C) the Slaters all covered a large distance. This is due to the Slaters trying to find an area that is cooler to escape the heat. Heat causes particles to move more rapidly as they become less dense. Therefore diffusion occurs at a more rapid rate in warmer temperatures and Slaters lose water via diffusion through their exoskeleton. This can then lead to desiccation. Desiccation is the dryness resulting from the removal of water. Slaters are more prone to desiccation than other arthropods as they lack a waxy cuticle on their exoskeleton. The waxy cuticle which is found on other arthropods prevents water loss. Slaters also lose water through respiration as water is a product of the chemical reaction. Also the Slaters lungs which

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are located on the abdomen open to the outside of the body via a pore. This means Slaters will lose a greater amount of water from their respiratory surfaces than other Arthropods. From my experiment part of my aim was to find out whether temperature plays a vital role in the Slaters survival as a population in their natural environment. From my results of my experiment I have come to the conclusion that temperature does play a vital role in the survival of Slater populations. Optimum temperature for Slaters would be around 15°C because the Slaters were still able to move at a rate and cover a suitable amount of distance (23.08cm) in the 2minutes that would allow them to escape from predators. At around 15°C the Slaters would not have to be concerned of excessive water loss which could lead to desiccation. The jump of the distance travelled by the Slaters between 15°C and 20°C (42.12cm) shows that when the temperature is around 20°C the Slaters start trying to escape and search for an area cooler in temperature so this would not be an ideal temperature as they would be prone to desiccation in this temperature.

Evaluation: My results and conclusion from my experiment are valid because I made sure my method was reliable by controlling any factors that the Slaters could respond to if they were to change. The steps I took to make my experiment a fair test to ensure valid results are:

When I collected the Slaters from the gully and put them into a tank I made sure that the tank replicated their natural environment as much as possible by placing pieces of bark off the tree I found them on in the tank. I also added leaves, dirt and other plant debris. Also each day I added some water into one corner of the tank and also gave the Slaters vegetables such as <https://assignbuster.com/the-distance-slaters-travel-in-different-temperatures-biology-essay/>

potatoes to eat. The reason I kept the tank the Slaters were in as similar to their natural environment as possible and fed them is because I did not want the Slaters to become stressed or deprived of food and water as this could have significantly changed my results.

During the testing I controlled light intensity by measuring the light intensity using a lux meter after every trial and before every change in temperature. I also kept the room as dark as possible because Slaters are negative phototaxis which means they move away from light. If I were to perform the testing in a room well lit up the Slaters would respond to the light and temperature not just the temperature which is the only factor we want the Slaters to be responding to in order to receive valid results.

I also controlled humidity levels by measuring humidity before after every trial and before every change in temperature to ensure it remains relatively constant. I tested the humidity levels using a data logger with a humidity reader attachment. The reason for controlling humidity is if the humidity were to change for different temperatures the Slaters may respond to the humidity level but temperature is the only factor we want the Slater to be reacting to.

I performed the test at roughly the same time of the day if I was doing trials on different days. I did this because Slaters are nocturnal which means they are active at night. If I were to perform the testing in the evening the Slaters would already be more active in their natural environment so than if I were to perform the testing during the day so this could cause my results to be unreliable. To eliminate this from happening I ensured that I performed the

testing midday-early afternoon as this means that all the Slaters I would have used for testing would be displaying the same activity levels at that time of the day in their natural environment.

During my experiment I used the same size container to perform the testing in. This is important because if I were to change the height of the container the Slaters may spend more time trying to climb out than moving around the container in response to temperature. In the bottom of my container I made sure I used the same surface for all the trials (sheet of plain white paper). If I were to not use paper on the bottom the Slaters may find the surface slippery and not be able to move naturally which could lead to inaccurate results.

During my testing I made sure that when I was dotting/lining the path the Slaters took around the bottom of the container I did not follow them too closely with the pen. I left around a 10cm gap between the sharpie and the Slater. I did this because if I were to line the path the Slater took directly behind the Slater as it moved the Slater may become frightened and try to avoid the pen so it would be moving in response to the pen behind it following too closely and not the temperature.

Another way of ensuring I obtained valid results from my experiment is if I started testing but found the Slater was acting abnormally I did not use the results from that experiment. If I were to use the results from the trial it may make my mean a lot smaller or a lot larger than what it really should be. An example of not using Slaters that act abnormally is I started to test one of the Slaters in 25°C and very quickly I noticed it had 2 legs missing which

affected the way it moved and it was not covering the same amount of distance all the other Slaters had in 25°C. So I placed the Slater back into the set up tank and chose another Slater to use for the testing. If I were to use this Slater's results it may have brought down the average distance travelled for 25°C.

The Slaters I used for the testing were all between 1-1.5cm in length. I measured the Slaters I used for the testing because I had to make sure they were all similar in length. This is because if I were to use a large Slater for one test it may be able to cover a larger distance than smaller Slaters are able to. Having the same sized Slaters means that in a constant temperature they should all be able to cover equal amount of distance.

Another way of ensuring I had valid results was I made sure the Slaters got used to the environment before I started testing. I did this by leaving the Slater in the cooled down or heated up ice cream container for 2 minutes before I started timing and recording its movement. I did this because if I were suddenly to grab a Slater from its natural environment and place it in an ice cream container and start timing straight away the Slater may respond to all the factors in its new surroundings and not to just the temperature.

For each temperature I tested 10 Slaters and I then repeated that 2 more times so in total I used 30 Slaters per temperature over 3 trials per temperature. So overall I used 180 Slaters for my experiment. I used such a large sample size because I needed to perform a test with enough Slaters so that it could represent a population of Slaters. If I had not used such a

large sample size I may have had inaccurate results as only a few Slaters cannot represent a whole population. If I had used a few Slaters they may have had a disease or not be acting normally due to a change in environment that consists of far less Slaters than what they were used to. This would of affected their natural behaviour because they would not be able to clump together to reduce water loss as there may not be enough Slaters for this to work. If I had then chosen to go ahead with my experiment using only a small sample size my results would be invalid and not be able to represent a whole Slater population. I also repeated my trial per temperature 3 times. I repeated my trials 3 times per temperature using 10 Slaters per trial because repeating the experiment multiple times verifies that your results are accurate and consistent. If I had only used 10 Slaters per temperature and not repeated this 2 more times I may have inaccurate results because some of the Slaters used may have displayed unusual reactions to the temperatures which would have resulted in my final averages being inaccurate. But because of having a large sample size and trialling the experiment 3 times if one Slater had not moved as far or too far in the 2minutes it would not affect the averages or have very minimal effect. Because of all the precautions I took to ensure my test was a fair test I am positive my results are valid which lead to a valid conclusion.