

Searching for Nature Stories 2010 (Investigatory Field Study Competition)

Study whether snails have sense of smell and their favorite smell and taste.



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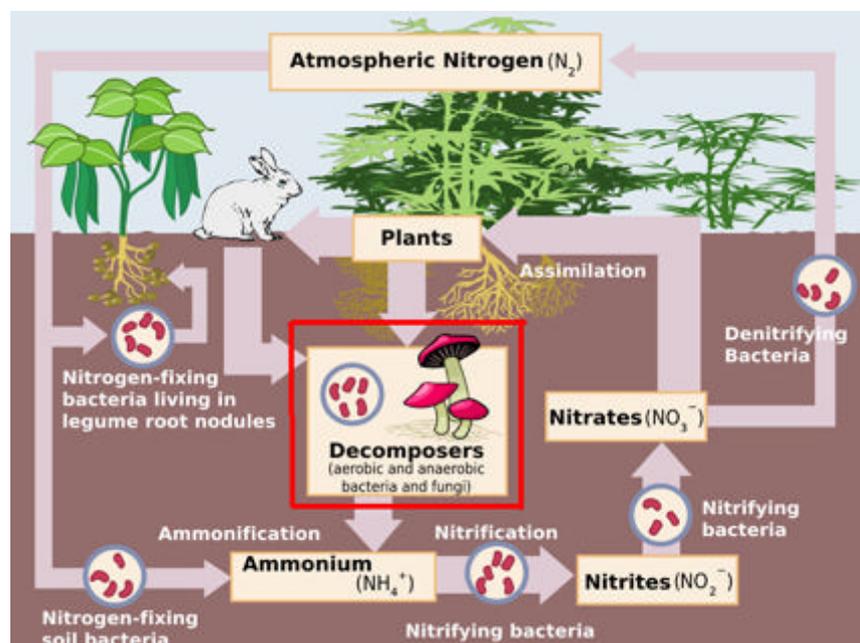
Abstract

Snails play an active role in the process of material recycling. In our experiment, we are going to study and investigate whether snails are smell sensitive and see which conditions and elements the snails favor or not favor most. The conditions and elements the snails favor most can attract snails in order to increase the rate of decomposition efficiently. The conditions and elements do not favor the snails can drive away the snails as they may eat the shoots or burgeons of vegetables in the farm. The crop in the farm may be damaged by the snails.

Reasons and objectives of the investigation

The process of material recycling is very slow. Snails are then playing an active role to advance the speed of decomposers to decompose because snails can digest decayed leaves into feces.

Feces of snails can produce humus to increase the rate of decomposition. Humus is an important source of inorganic nutrients for plants. It is decomposed by microorganisms. The increase of humus advances the speed of decomposition.



(Source from wikipedia)

Snail can be found in a humid, damp and warm area. We are going to find out which condition favor the snail most, in acidic or alkaline medium? And which element the snail likes the most, sweet or sour taste?

The more favorable condition and elements, the more the snails are gathered and reproduced. The more the snails present, the faster the rate of decomposition.

Once we noticed which factors affect the most, we can add that ingredients to the soil or water, helping the decomposition process. The faster the decomposition of dead bodies and wasted organisms , the material recycling can be faster , more useful product can be collected , for example , ammonium (NH_4^+) , nitrite(NO_2^-) , nitrate(NO_3^-) and nitrogen(N_2) .

Classification of snails

Prosobranchia

Superorder Neritopsina

Superfamily Neritoidea

Family Hydrocenidae



Family Helicinidae



Family Cyclophoridae



Family Diplommatinidae



Family Pupinidae

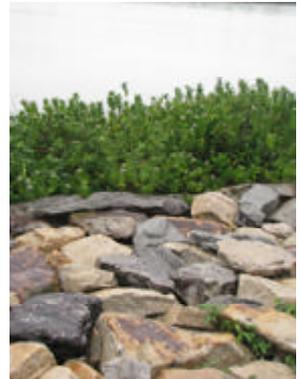


Field Study

Observation of snails

Date : 6th March 2010

Location : Yuen Long – Shan Pui River , Kim Tin River



Collection of snails

Date : 20-28th March 2010

Location : Parks , near the river



Experiments on snails

Date : 30th -31st March 2010

Location : School Biology Laboratory



Apparatus used

1. 5 Droppers	2. 5 Agar Petri dishes	3. 1 Beaker	4. 1 Cork borer
5. 1 Mortar and pestle	6. 10mL measuring cylinder	7. 50mL measuring cylinder	8. 1 Boiling tubes
9. 10 Test tubes	10.1 Dissection board	11. pH paper	12. 5 Forceps
13. Blotting tissue			

Material and solution used

1. Snails	2. 10 mL vinegar	3. 10 mL NaHCO ₃	4. 10 mL lemon juice
5. 10 mL tangerine juice	6. 10 mL mango juice	7. 10 mL papaya juice	8. 10 mL celery juice
9. 5 mL chinese tea	10. 10 mL Granulated sugar	11. 10 mL crystal sugar	12. agar (very sweet)
13. agar (sweet)	14. agar (neutral)	15. agar (very salty)	16. Agar (salty)
17. Distilled water			

Method of investigating

A. Test for smell

We are going to construct some experiments to test whether the snails favor the smell of some required substance. For example, acid, alkali, fruits and vegetables are used to see whether the snails are attracted by that smell or refuse to that smell. The states of antenna of snails will change when they detect the smell. A control test has been set up by using a forceps (with no smell).

This helps us to find out whether snails have the olfactory cells which give the smell sensation.

B. Test for taste

We are going to perform some experiments to test whether the snails favor the taste of the same substances which have been stated above and different tastes of agar. If they favor the taste, they will stay on the substance. Otherwise, they will turn away and refuse to stay.

This help us to find out which condition or element snails like the most and which they like to stay with .

Experiment for investigation

A. Preparation for different substance

White vinegar	N/A
0.5M sodium hydrogen carbonate	N/A
Lemon	The lemon is sliced into thin pieces. Two of the pieces are squeezed hardly. Enough lemon juice can be collected.
Tangerine	Tear the skin of the fruit
Mango	Press the fruit and collect the juice.
Papaya	After cutting a piece of papaya and celery out, add water to the mortar.
Celery	With the help of mortar and pestle, juice can be collected easily.
Chinese tea	The tea leaves are soaked in 15 mL water
Granulated sugar	Make a saturated sugar solution.
Crystal sugar	Make a saturated sugar solution.
Agar (very sweet)	Agar is boiled till liquid state.
Agar (sweet)	200 mL agar solution is mixed with different ingredients to make different taste
Agar (neutral)	very sweet : 25 mL cane sugar solution
Agar (salty)	sweet: 15 mL cane sugar solution
Agar (very salty)	neutral : nothing is added salty : 5 mL salt solution very salty : 15 mL salt solution

1. The solutions were prepared by the above table.
2. The solutions were transferred to test tubes respectively.
3. The test tubes were labeled.
4. Moist blotting tissues were used to cover a dissection board.
5. Snails were put onto the dissection board.



Weighing the mass of granulated sugar



Using cork borer to cut the papaya



Using mortar and pestle to make papaya juice



Pressing the tangerine and collect the juice



Cutting celery



Using mortar and pestle to make celery juice



Transferring the celery juice to a test tube



Cutting lemon



Pressing the lemon and collect the juice



Preparing granulated sugar solution



Transferring the granulated sugar solution to test tubes



Substances in test tube and agar prepared in Petri dishes



Wetting the board and paper by distilled water



Some prepared substances in different test tubes

B. Test for smell

1. A forceps was put near a snail.
2. The response of the snail was observed and recorded.
3. A dropper was used to withdraw the white vinegar.
4. The dropper was put near a snail.
5. The response of the snail was observed and recorded.
6. Steps (3)-(5) were repeated by using another 5 more snails.
7. The dropper was rinsed by distilled water.
8. Steps (3)-(7) were repeated by using the following solutions.
 - i. 0.5M sodium hydrogen carbonate
 - ii. Lemon juice
 - iii. Tangerine juice
 - iv. Mango juice
 - v. Papaya juice
 - vi. Celery juice
 - vii. Chinese tea
 - viii. Granulated sugar
 - ix. Crystal sugar



Withdrawing the celery juice



Withdrawing the tangerine juice



Withdrawing the crystal sugar Solution



Withdrawing the mango juice



Withdrawing the papaya juice



Putting the dropper near the snail

C. Test for taste by different solution

1. A dropper was used to draw the lemon juice.
2. The lemon juice was added on the dissection board in front of a snail.
3. The response of the snail was observed and recorded.
4. Steps (1)-(3) were repeated by using another 5 more snails.
5. Steps (1)-(4) were repeated by using the following solutions.
 - i. Tangerine juice
 - ii. Mango juice
 - iii. Papaya juice
 - iv. Celery juice
 - v. Chinese tea
 - vi. Granulated sugar
 - vii. Crystal sugar



Adding the papaya juice on the board



Observing the movement of the snail

D. Test for taste by different agar

1. The agar was cut into cylinders by cork borer.
2. The "very sweet agar cylinders" were put in front of a snail.
3. The response of the snail was observed and recorded.
4. Steps (1)-(3) were repeated by using another 5 more snails.
5. Steps (1)-(4) were repeated by using the following agar.
 - i. sweet
 - ii. neutral
 - iii. salty
 - iv. very salty



Putting the snail in front of the very sweet agar



Putting the snail in front of the sweet agar

Observation during experiments

A. Test for smell

Substance tested	Result of the test for smell	Photo
Forceps	The snail cannot detect the smell.	
White vinegar	The snail rejects. Its antenna shrink.	
0.5M sodium hydrogen carbonate	The snail cannot detect the smell, like the forceps.	
Lemon solution	The snail cannot detect the smell, like the forceps.	
Tangerine solution	The snail is attracted by the smell of tangerine solution. Its antenna elongate.	
Mango solution	The snail cannot detect the smell, like the forceps.	

Papaya solution	The snail is attracted by the smell of papaya solution. Its antenna elongate.	
Celery solution	The snail is attracted slightly.	
Granulated sugar solution	The snail is attracted slightly.	
Crystal sugar solution	The snail is attracted slightly.	
Chinese tea	The snail cannot detect the smell, like the forceps.	

B. Test for taste by different solution

Substance tested	Result of the test for taste	Photo
White vinegar	The snail tries to escape immediately. Vinegar just as a barrier.	

0.5M sodium hydrogen carbonate	The snail turns around when it gets contact with the alkali.	
Lemon juice	The snail turns around when it gets contact with the lemon juice.	
Tangerine juice	The snail doesn't escape but it strides across the tangerine juice.	
Mango juice	The snail doesn't turn away but it strides across the mango juice.	
Papaya juice	The snail stays with the substance for a long time.	
Celery juice	The snail turns away immediately.	
Granulated sugar solution	The snail decelerates and strides across the sugar solution slowly.	

Crystal sugar solution	The snail decelerates and strides across the sugar solution slowly.	
Chinese tea	The snail across the tea just like water.	

C. Test for taste by different agar

Agar (very sweet)	It spends some time to detect the agar. The snail moves slowly on the agar.	
Agar (sweet)	It spends some time to detect the agar. The snail moves slowly on the agar.	
Agar (neutral)	It moves on the agar slowly.	
Agar (salty)	It spends some time to detect the agar. The snail turns away finally.	
Agar (very salty)	It spends some time to detect the agar. The snail turns away finally.	

Discussion with analysis

A. Smell

Snails can sense some kinds of smell. In the control test, they cannot smell the forceps but they give response in strong sour smell that their antenna bent immediately.

The snails have no response when they smell lemon while they move away when they smell white vinegar. Although the two solutions both have sour smell, snails only give response to strong sour smell. This indicates that snails do not favor strong sour smell.

The snails give different response to strong smell solutions. They move towards tangerine, papaya, celery, granulated sugar and crystal sugar while they give no response to Chinese tea and mango. This indicates that snails can smell tangerine, papaya, celery, granulated sugar and crystal sugar but cannot smell Chinese tea and mango.

B. Taste

The snails favor the very sweet agar and sweet agar as they stay and move on the two kinds of agar. This indicates that the snails favor the taste of sweet.

The snails move away when they move onto the "very salty agar" and "salty agar". This indicates that the snails do not favor the taste of dissolved salt.

The neutral agar acts as a control set up. The snails move along the neutral agar but do not stay on the neutral agar. This indicates that the snails neither favor the taste of water nor hate it

Snails are attracted by the smell and taste of papaya and sugar but they do not favor that of acid and dissolved salt. Obviously, they prefer sweet condition than that of salty condition.

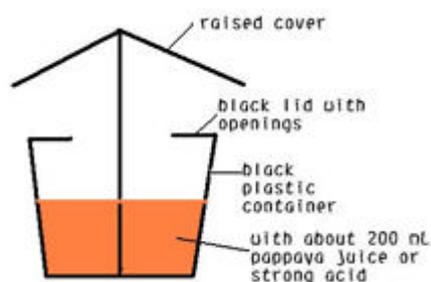
Conclusion

Snails can sense some kinds of smell. They favor the smell and taste of SWEET and PAPAYA, but they are not favor of strong sour smell.

Application

We have found that the snails favor the smell of papaya while refuse the smell of strong sour smell in our experiment. We have design a device (shown in the following diagram) that can attract the snails or drive away the snails based on the result we have found. The papaya solution or strong acid is hold by an opened container so that the smell can escaped from the container. A raised cover is used to cover the container in order to prevent other substances falling into the container.

If the device is filled with papaya solution, the smell of papaya can attract the snails and facilitates the decomposition of dead bodies and wasted organism. It is beneficial to decomposition so that more useful nutrients can be formed for the plants. If the device is filled with strong acid, the strong sour smell can drive away the snails while there are too many snails. The shoots or burgeons of vegetables in the farm can be protected. So the crop of the farm will not be affected.



Reflection

In this experiment, we have encountered some difficulties. Our initial design of the experiment is to drop various solutions into water to observe the response of snails. Yet, the diffusion of solutions is too fast that it is difficult to observe the response of snails. Hence, we have tried another method that is dropping the solutions into the Petri dishes which contain agar. However, the snails move to the edge of the dish that we cannot distinguish the response of snails to different solutions. Therefore, we use the method that putting the snails on the dissection board with moist blotting tissues to observe the response of snails to the solutions. The reason for choosing wet blotting tissues instead of dry one is that snails is moist animals and dry blotting tissues may absorb the water of snails. Snails cannot move in the dry blotting tissues. We choose dissection board for the experiment is that it can provide a large surface area for testing the response of snails.

Bibliography

Website

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Book

Title : Advanced-level Biology for Hong Kong

Author : Y.K. Ho

Publisher : Manhattan