
TOPIC OF STUDY:

HOW TO PROTECT YOUR VALUABLE GARDENS AND
FARMS FROM THE SNAIL PESTS?

School name: Pope Paul VI College

Teacher Advisor: Mrs Chu

Member: Janice Tung F.5

Jessica Sy F.5

Winnie Ip F.5

Daisy Lai F.5

Kirsty Yiu F.5



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Abstract

The first 2 experiments of our investigation were conducted to find out the eating habits of *Helix aspersa*. We noticed that *Helix aspersa* mainly fed on vegetables and fruit and it could consume amount of vegetables in a single night. No wonder it is considered to be an agricultural pest. Therefore, the third experiment was conducted to test whether the entrance of *Helix aspersa* can be restricted by certain substances so as to prevent them from eating up the valuable crops in a garden. Eventually, we successfully discovered that snails are repellent to copper.

Introduction

It was always raining cats and dogs in April and May. The streets were quiet since most of the people had decided to stay at home. Yet, some organisms do not. On a typical rainy day in mid April, we found a rainy-day-lover - *Helix aspersa*. *Helix aspersa*, commonly known as garden snail, is a species of land snails. It has pale grey moist skin. Four tentacles are set at the front part of its bodies. Two shorter tentacles are for stimulation while the other two longer ones are for sight. The colour of this species' shells ranges from light brown to dark brown.

In this investigation, we aimed at finding out the environmental conditions which best-suit *Helix aspersa*, hence finding out ways to remove them from gardens and farmlands in accordance to some of their characteristics.



Methods of investigation

1. Field work at Central Kwai Chung Park

Chinese has a saying that 'To know one's own strength and the enemy's is the sure way to victory.' It is important for us to know *Helix aspersa*'s favourable living conditions if we want to remove them from our places. Therefore, we conducted a few field visits to Central Kwai Chung where many *Helix aspersa* can be found.



Central Kwai Chung Park is located at the centre of Kwai Chung. Building along the hillside and with exuberant vegetation and extensively planted trees, Central Kwai Chung Park is always the home for many birds and small animals including *Helix aspersa*.



Fig.1 Location of Central Kwai Chung Park I

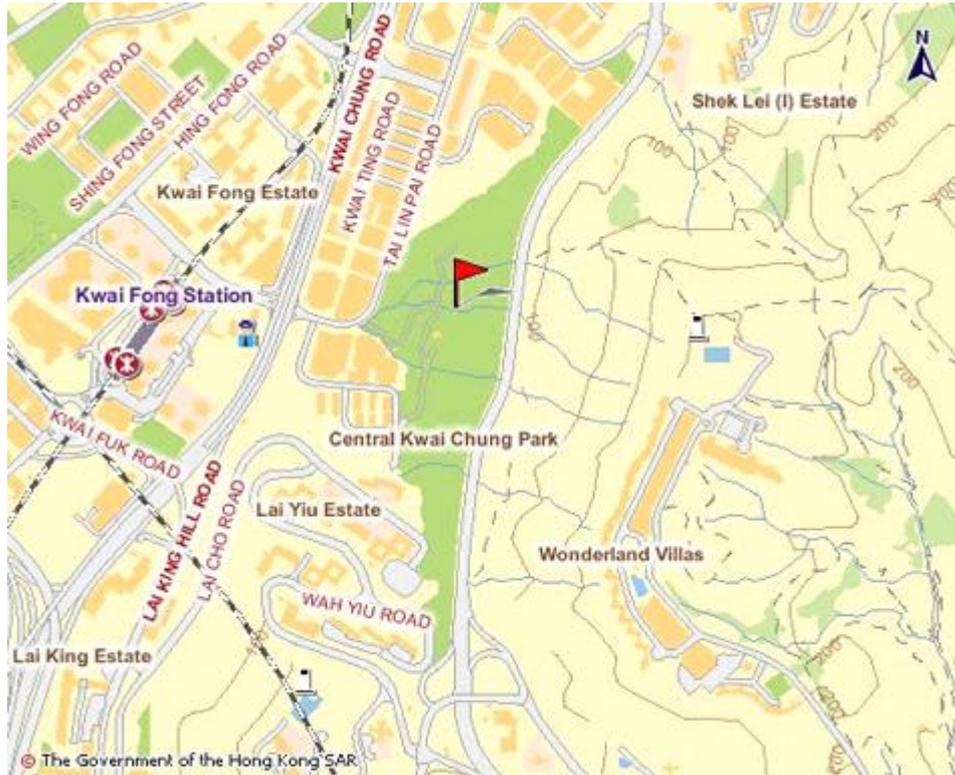


Fig. 2 Location of Central Kwai Chung Park II

Table1: Records of field work and observation

Date	Time	Light intensity (lux)	Weather	Relative Humidity (%)	Temperature (°C)	Number of snails recorded
17/4	7:30a.m	2687	Rainy Cloudy	73	22	7
	12:00p.m	14294		57	26	2
	8:00p.m.	1982		72	21	12
20/4	7:00 a.m.	2780	Rainy Cloudy	66	22	5
	12:00p.m	12338		56	27	0
	8:00p.m.	2246		66	22	10
25/4	7:30p.m	2937	Rainy	67	23	2
	12:00p.m	11542		53	25	0
	8:00p.m.	2298		62	20	13
30/4	7:30a.m	2541	Cloudy	63	23	1
	12:00p.m	10166		58	26	0
	8:00p.m.	2130		64	22	9

From the above observation, we discovered that the number of Helix aspersa spotted was usually more at nights and in rainy days. We believe the reason why Helix aspersa chooses to stay under the soil at noon when light intensity is high and relative humidity is low is to prevent excessive water loss from its body. Meanwhile in rainy days, soil is flooded with water. Helix aspersa may find it hard to breathe under soil, so it comes up to the ground. A few Helix aspersa also came out in the morning when the light intensity was not very high. We believe they came out for food. To sum up, we believe Helix aspersa are nocturnal animals as they are more active at night.

2. Laboratory work

Bringing 26 Helix aspersa back to our school laboratory, we continued further investigation on them.

Experiment 1: To find out what food the Helix aspersa prefers

Identification of variables:

Controlled variables	Dependent variables	Independent variables
1.The amount of each type of food for feeding <u>Helix aspersa</u> 2.The distance between the food and <u>Helix aspersa</u>	The types of food for feeding <u>Helix aspersa</u>	The number of <u>Helix aspersa</u> that choosing each type of food

Apparatus used:

Diced apple X 5g
 Meat X5g
 Bakchoi X 5g
 Bread X 5g
Helix aspersa X5

Procedure:

1. Different types of food sample were placed in front of the *Helix aspersa*.
2. The movement of *Helix aspersa* were observed when they reached and ate the food sample.

Result:

Table2: The number of *Helix aspersa* choosing the four types of food in five trials

Food\Trial	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Meat	0	0	0	0	0
Diced apple	1	1	2	1	1
Bread	0	0	0	1	1
Bakchoi	3	3	2	2	2



Types of Food Garden Snails Like to Eat

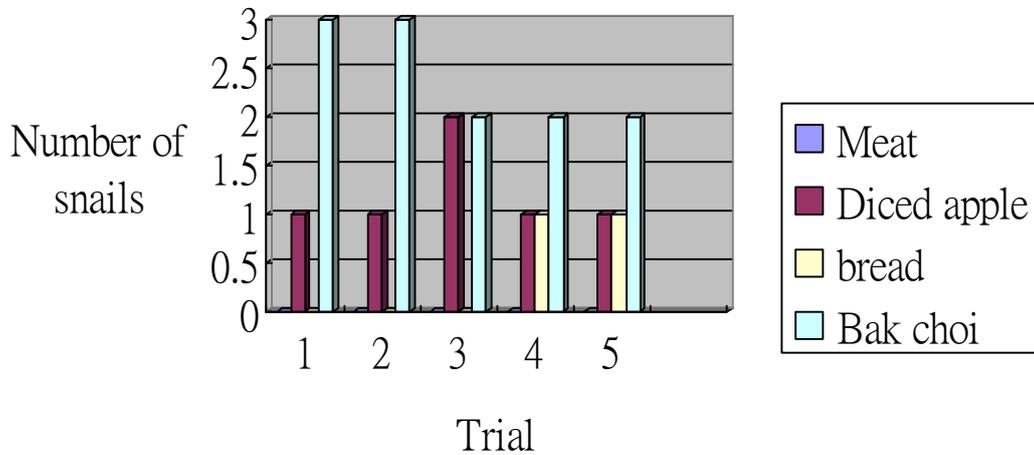


Fig3. Types of food *Helix aspersa* like to eat

Interpretation of result:

After performing the experiment for several times, we had found that *Helix aspersa* preferred Bakchoi the most since the number of *Helix aspersa* chosen Bakchoi is the highest among the three other food types in four trials. The second preferred food choice of *Helix aspersa* is apples. The number of *Helix aspersa* chosen apples is higher than the other two food types (bread and meat) in three trials. Apart from that, *Helix aspersa* also fed on bread, but the number of *Helix aspersa* chosen it is much lower. However, *Helix aspersa* didn't feed on meat.

Source of error:

1. The *Helix aspersa* are non-identical. The smaller one may be pushed apart by the larger *Helix aspersa* so that it cannot choose its preferred food sources.
2. *Helix aspersa* may like to crawl along the edge or concentrate at the corner. So they may stay at the vegetables side which is arranged at the corner.

Improvement:

1. *Helix aspersa* of approximately same size should be caught.

2. The experiment may be carried out on a laboratory table so that there is no corner or edge. Therefore we have further modified our experiment and have carried out it for several times to obtain the datas above.

Follow up:

In this experiment, we have found that *Helix aspersa* like to eat vegetables and fruit the most. So, it is a harmful agricultural pest which may cause sereve damage to plants.

Therefore, we have designed another experiment to find out how great is the damage of *Helix aspersa* bring to agriculture by measuring their eating speed.

Experiment 2: To find out the eating speed of *Helix aspersa* by measuring the amount of vegetables a *Helix aspersa* can eat in a single night

Identification of variables:

Controlled variables	Independent variables	Dependent variables
Temperature inside the container holding <i>Helix aspersa</i>	Sizes of <i>Helix aspersa</i>	The eating speed of <i>Helix aspersa</i> in terms of the amount of vegetables a <i>Helix aspersa</i> had eaten within a single night
Humidity inside the container holding <i>Helix aspersa</i>		
Amount of vegetables inside the container		

Apparatus used:

Container x5

Helix aspersa x5

Electronic balance x1

Vegetables x1000g

Procedure:

1. The weight of 5 *Helix aspersa* were measured and recorded by using an

electronic balance respectively.

2. The 5 *Helix aspersa* were placed into 5 containers respectively.
3. 200 gram of fresh vegetables were put inside the 5 containers respectively.
4. The *Helix aspersa* together with the containers were left for a single night.
5. The weight of the vegetables in the 5 containers were taken out and measured in the next morning.
6. The eating speed of each *Helix aspersa* and thus the average eating speed of *Helix aspersa* were calculated.



Result:

Table3: The amount of vegetables a Helix aspersa can eat in a single night

<u>Helix aspersa</u>	Weight of <u>Helix aspersa</u> (in g)	Amount of vegetables left in one night (in g)	Amount of vegetables eaten in one night
A	191.40	8.56	200 - 8.56 = 191.44
B	186.81	8.79	200 - 8.79 = 191.21
C	187.75	8.75	200 - 15.3 = 191.25
D	186.09	8.82	200 - 8.82 = 191.18
E	187.79	8.72	200 - 8.72 = 191.28
Total amount of vegetables eaten:			956.36

Average weight of the each Helix aspersa: :

$$(191.4+186.81+187.75+186.09+187.79)/5=187.97g$$

Total amount of vegetables eaten by the each Helix aspersa in one night: 956.36

Average amount of vegetables eaten by each Helix aspersa in one night: $956.36/5= 191.27g$

Average eating speed of each Helix aspersa: 191.27g/ per night

Interpretation:

The total amount of vegetables eaten by 5 Helix aspersa in one night is 956.36g and each Helix aspersa consumes 191.27g of vegetables on average, which is considered to be a very huge amount when compared to their average body size 187.97g . We observe that the larger the Helix aspersa, the more the amount of vegetables it consumes. This is because a larger Helix aspersa needs a greater food supply for carrying out respiration to support its higher level of muscle movement. Also the average eating speed of each Helix aspersa is 191.27g/per night which is considered to be very fast. Finally, we observe that the larger the Helix aspersa, the faster the eating speed it is because they need a higher level of respiration.

Source of error:

1.The Helix aspersa varies in size and age so that the amount of vegetables they consume may vary.

Improvement:

1.Due to the difference in size and age of Helix aspersa, we can choose the similar weight of Helix aspersa to carry out the experiment. Although we cannot figure out the age of Helix aspersa, we can simply choose the small Helix aspersa.

Follow up:

From the result, we can know that the rate of Helix aspersa's consumption is rapid and the amount of food that Helix aspersa consume is in large amount. These indicate Helix aspersa can cause a serious damage to the products in farmlands.

Apart from this, the more the Helix aspersa, the more the area and numbers of products are destroyed.

Experiment3: To find out the reaction of *Helix aspersa* towards some metals

Identification of Variables

Controlled variables	Independent variables	Dependent variables
The length and width of barriers, The amount of diced apple The distance between the diced apple and the <i>Helix aspersa</i>	The materials of the barriers	The number of <i>Helix aspersa</i> crossing the barriers

Apparatus used:

Helix aspersa X6

Barriers (Sand paper, Newspaper, wooden splint, Copper, Nickel, Zinc and Magnesium)

Tape X1

Apple X1/2

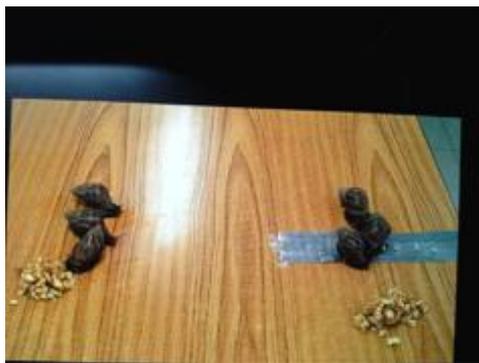
Procedure:

1. Several pieces of copper were stuck together by the tape in a rectangular shape with a length of 14cm and width of 5cm.
2. Three *Helix aspersa* were placed in front of the copper strips and diced apple was placed behind the copper.
3. The movements of *Helix aspersa* were observed.
4. A similar set-up with no copper in front of *Helix aspersa* was conducted as a control set-up at the same time.
5. The experiment was repeated with other kinds of barriers(Sand paper, Newspaper, wooden splint, magnesium).

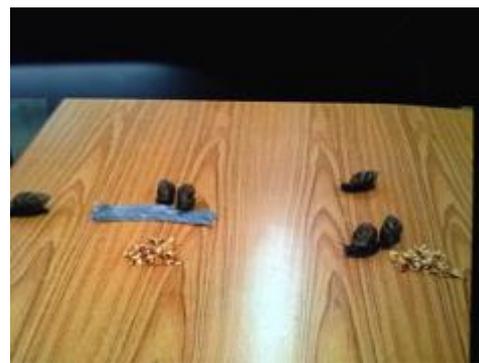
Result:

Table4: The number of snails crossing the borders made of different materials.

border\Trial	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Copper	0	0	0	0	0
Nickel	1	2	2	3	2
Zinc	2	1	1	1	2
Magnesium	2	3	3	2	2
Newspaper	1	1	2	2	3
Sand paper	1	2	2	2	3
Wooden splint	2	3	3	2	2



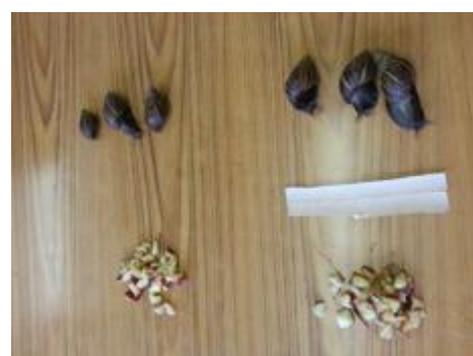
Nickel



Magnesium



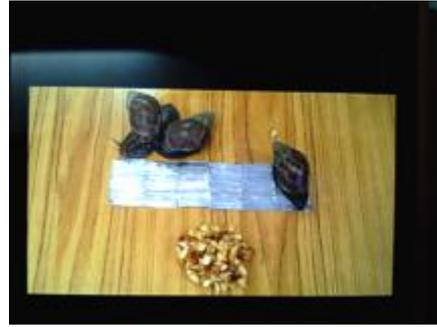
Newspaper



Sand paper



Wooden splint



Zinc



Copper

Interpretation:

After carrying out the experiments, we had observed that *Helix aspersa* didn't cross the border of copper metal to the other side. None of *Helix aspersa* had crossed the copper metals in all the trials. But there were *Helix aspersa* crossing the borders of other materials to eat the food, showing that *Helix aspersa* were not repelled by other materials other than copper metals in our experiment. This is mainly because of the reaction between the *Helix aspersa's* mucus and copper metal which give an unpleasant electro-neural signal which is similar to an electrical shock that repels them.

Source of error:

1. The metal strips may react with oxygen in air to form an oxide layer
2. The metal strips were irregular so that the movement of *Helix aspersa* was restricted.

Improvements:

1. Use sand paper to rub the metal strips in order to make the metals more pure by removing the contaminated layer.
2. Use a larger piece of metal strips so as to make the pathway more flat.

Overall discussion

Experiment1:

According to the result of experiment1, we notice that Helix aspersa likes to eat vegetables and fruit the most. Therefore, it is a kind of harmful agricultural pest which may cause serve damage to plants' growth. However, our experiment environment does not provide a suitable light intensity and humidity for Helix aspersa to adapt. So, it may weakens Helix aspersa's sensation and ignore some of the food.

Experiment2:

Regarding experiment2, we can conclude that each Helix aspersa can take in a large amount of food. Yet, we cannot prevent the difference of size and age of Helix aspersa, resulting in some errors of their amount and speed of food consumption.

Experiment3:

After performing experiment 1 and 2 to find out the eating behaviours of Helix aspersa, we can conclude that Helix aspersa are a harmful pest which will bring great damage to agriculture if they are not treated probably. So we carry out the third experiment to find out whether Helix aspersa are repelled by certain materials so that we can use the materials as a barrier to stop Helix aspersa from getting to the vegetables. And we successfully found out that Helix aspersa are repelled by copper metals among the three types of metals, newspaper, wooden splint and sand paper. However, due to the limitation of equipment, we cannot further investigate the reason for why copper metals repel Helix aspersa. But luckily according to some research, Helix aspersa are repelled by copper metals because its mucus reacts with copper to give them an unpleasant feeling of electrical shock. We would like to perform this experiment in the next time.

Implication

We know from the investigation the Helix aspersa is in favour of fruit (apple) and vegetables (Bakchoi), and it can consume a large amount of its favourite food - Bakchoi in just one night. Since Bakchoi is one of the major crops that grows on farmlands, so we believe that excess amount of Helix aspersa will eventually lead to a great loss in agriculture.

According to our findings in Experiment 2, each Helix aspersa can consume 191.27g of Bakchoi in one night, meaning each of them can annually consume 69813.55g of Bakchoi which, as stated in the Consumer Council, is sold at \$7.9 per Kg in the supermarkets. By calculation, each of them will cause a loss of \$551 of Bakchoi in a year. If Helix aspersa is largely introduced to farmlands, the loss in harvest of Bakchoi and agricultural revenue will be unbearable.

So how can we stem Helix aspersa away from agricultural farmlands to protect our crop yield? Surrounding agricultural farmlands with copper can be one. As shown in Experiment 3, Helix aspersa cannot cross the copper strip to get the food in front of it as its mucus reacts with copper to give them an unpleasant feeling like electrical shock. Helix aspersa rebels against copper. So we suggest farmers to surround their farms by copper. Furthermore, we suggest the farmers to burn the fallen leaves in their farmlands to avoid creating a favourable living condition for Helix aspersa since we found out that Helix aspersa liked to stay at damp places such as under layers of leaves from the observation in experiment one.

Limitations of investigation

Owing to the limited time and apparatus we had, we could not study whether the size would affect the rate and amount of food consumption of Helix aspersa. Besides, Helix aspersa are more active under dark condition. Most of our experiments were held under light condition. We could not measure the more accurate rate of movement and food consumption of Helix aspersa.

Furthermore, we did not provide a higher humidity for Helix aspersa, so they might not adapt to the environment and affect their speed of action.

Suggestions of further investigations

1. Process of the reproduction of *Helix aspersa* since they are hermaphroditism
2. How *Helix aspersa* interact with other organisms (relationship of commensalism or mutualism or parasitism)
3. Any natural predators that can kill the *Helix aspersa* if they are in huge population

Conclusion

Helix aspersa are herbivores since it fed on vegetables, apples and bread (carbohydrates) but not meat. The larger the *Helix aspersa*, the faster the eating speed and it can consume a large amount of food in one night. So, *Helix aspersa* is considered as a pest in farmlands and gardens. Yet, it can be removed by copper fence since *Helix aspersa* repels against copper.

Reflection

Through the investigation, we realize the tenacious vitality of *Helix aspersa*. They are tough to survive for a long period of time even without the supply of water and food. Yet, we are stunned later when *Helix aspersa* for experiments basically consume vegetables and apples our team provided with no leftover. Having said that, we are worried about how harmful impact these tough and vegetable-loving *Helix aspersa* will bring to the agricultural land.

The investigation gives us a golden opportunity to designing experiments ourselves. We design experimental set-ups to study on the eating habit of *Helix aspersa* and to avoid *Helix aspersa* getting close to foods using copper. This is somewhat different than what we learn in class.

The investigation also allows us to learn to cooperate. We have developed a team spirit when working together. We have had a great honor to participate in this competition, exploring the myths of nature.

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