



## *Azaleas*

### *- The ants' killer?*

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## **Abstract:**

In our school campus, there are a few pots of azalea at the corner besides the school hall. On the sepals of the azalea, many dead ants are discovered. How did they die on the sepals? Except those pots of azalea, this phenomenon also occurs to all other azalea found in school. Out of the curiosity of the death of the ants, we went on further observation and study.

We then observed the routes of ants and found that the ants had been walking around the leaves, stems and flowers of azalea. Did they want to find food? The location of the azalea flowers is much higher than the ant nest, why did the ants go to such a high place to find food? People always say sugary food will attract ants. Then, were the ants on the sepals attracted by the sugary smell of the nectar? Or is it just only by chance?

When we go on further observation, more species of bigger insects, even bees, are found to be trapped and dead on the sepals. This arouses our interest in the stickiness of the azalea sepals.

## **Reasons and objectives of investigation:**

One morning, we went to the corner under the school hall instead of classroom to have our biology lesson. We found that there were quite a lot of ants elsewhere and many were dead on the sepals of the azalea. At a closer look, we discovered there was a sticky layer covering the sepals. Some documents state that azalea is poisonous. Would it be the cause of death of the ants on the sepals? We wondered if the ants were dead because of the poison of azalea or starved to death after being trapped by the sticky layer.



Fig. 1 Dead ants on the sepals

The death of ants on the sepal also arouses our great interest in knowing why the ants would climb up to the azalea. We observed that the ants had been walking around the leaves, stems and flowers of azalea. Were they attracted by the smell of nectar or were they just wandering around without any target and find food by chance?

As there are so many ants around the school campus, we would like to find out some natural methods that can prevent ants from going into classroom and disturbing lessons.

Besides the azalea at the corner, we have observed other azalea in our school campus, for example, the white azalea near the canteen and the purple azalea next to the basketball court on the first floor. There are also dead ants on the sepals. We observed these azaleas for couples of days, we noticed that there are other bigger insects were dead on the sepals of azalea.

We have learned that the relationship between insects and flowering plants can be mutualism. Both of the insects and flowering plants gain benefits from each other. The insects get nectar as food from the flower and the insects act as an agent to help the flower to disperse pollen grains. However, the relationship between the ants or other insects and the azalea is not the case. Those insects died on the sepals of the flower. We want to know why this happened.

## **Principle of method:**

### **Experiment 1:**

This experiment aims to find out the food preference of ants. Different samples of smell are prepared by the method of grinding or simply dissolving. As steamed bun is edible for ants, it is used to line the side of 8 Petri dishes. The sample extracts are added to the steamed bun lining respectively. After that, ants are put into each Petri dish. Assuming ants halt on the steamed bun are eating the bread, by counting the number of halt on the steamed bun, the food preference of ants can be obtained.

### **Experiment 2:**

After finding the food preference of ants, this experiment aims to check the prediction of ants is using the sense of smell to find food is true or not. This time food substance that proved to be liked by ants is added to a part of steamed bun lining in a petri dish while an equal part with food substance that ants hate is also added. Ants would then be put in this set up. By observing the behaviour of the ants towards this setup, the ways of finding food of the ants can be known.

### **Experiment 3:**

This experiment is aimed to find out the stickiness of different parts of azalea. By putting short paper strips on those parts and observing the condition of the strips in a given time interval, the stickiness of different parts of azalea can be recorded. As different parts of azalea have different shapes and grow in different direction, the following controlled variable should be kept constant i.e. the contact surface area between the paper strip and the part of azalea should be the same.

## **Assumption of the experiment:**

1. The steamed bun do not affect the smell of the extract.
2. The experiment conducted on the Petri dish do not affect the behaviors of ants.
3. Ants caught in the same area and in same species have similar preference for food.
4. Ants halt on the steamed bun because they are attracted to the extract.

## Apparatus:

1. Petri dish x8
2. White tile x8
3. Dropper x8
4. Beaker x8
5. Forceps
6. Dissecting microscope
7. Mortar and pestle
8. Muslin cloth
9. Washing bottle with distilled water
10. Stopwatch
11. Knife
12. Labels
13. Plastic gloves
14. Chinese writing brush
15. Ant collector (including a conical flask with delivery tubes, a stopper, a rubber tube and a straw)
16. Digital camera

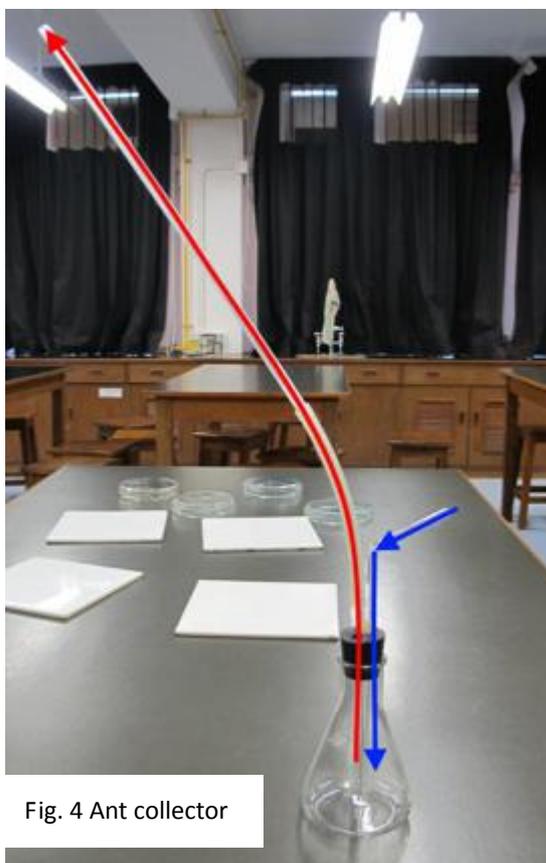


Fig. 4 Ant collector

## Material:

1. Distilled water
2. 1M sucrose solution
3. Garlic
4. Ginger
5. Paprika
6. Petals of azalea (white, purple, pink)
7. A4 paper
8. Steamed bun



Fig. 2 Apparatus



Fig. 3 Materials

Blue arrow : direction of ant enter the flask.

Red arrow : direction of sucking by mouth

## **Procedure:**

### **Experiment 1: Testing the food preference of ants**

1. Ants were collected by ant collector.
2. Steamed bun was cut into strips.
3. The inside edges of the eight petri dishes were lined by steamed bun.
4. Extracts of ginger, garlic, paprika and purple, white, pink azalea were obtained by mortar and pestle.
5. The extract obtained, water and glucose solution were dropped to the steamed bun strips in different petri dishes respectively using dropper.
6. Ants were put into different petri dishes and the stopwatch was started.
7. The petri dishes were covered by a lid.
8. The behaviour of the ants were observed for ten minutes.
9. The number of halts on the steamed bun lining were recorded.
10. The setup were left over night.
11. The observations were recorded.
12. The experiment was repeated in the next day.



Fig. 5 Making azalea petal extract

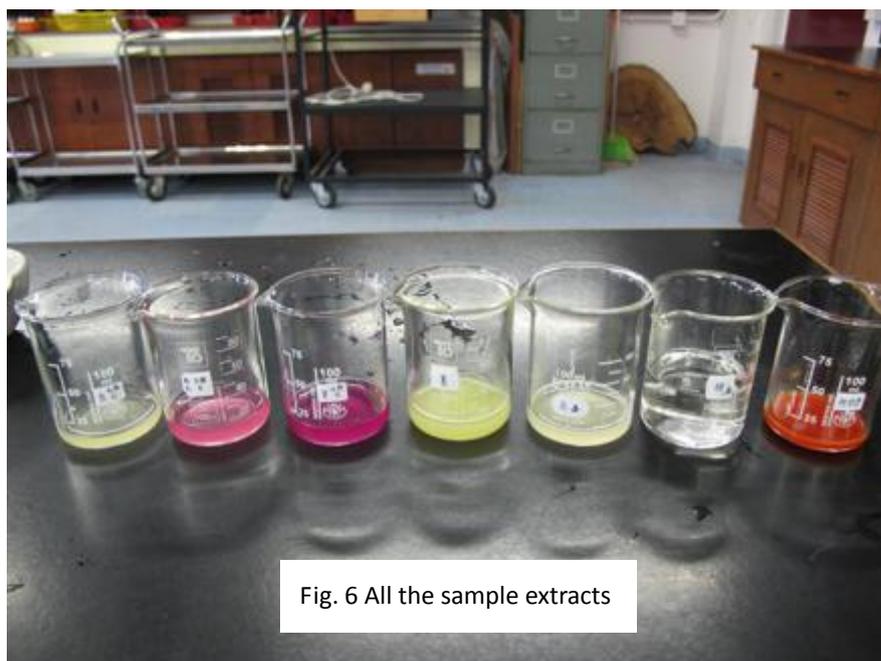


Fig. 6 All the sample extracts

## **Experiment 2: To find out the methods of forage of ants**

1. Ants were collected by ant collector.
2. Steamed bun was cut into four strips.
3. The inside edge of the petri dish was surrounded by the four steamed bun strips.
4. Based on the results of experiment (1), garlic, paprika, glucose and water were used as the food sample in this experiment.
5. Extracts of garlic, paprika were obtained by mortar and pestle.
6. The extracts obtained, water and glucose solution were added to each of the four quarters of the steamed bun lining using dropper.
7. An ant was put into petri dish and the stopwatch was started.
8. The petri dish was covered by a lid.
9. The behaviour of the ants were observed for ten minutes using dissecting microscope.
10. The results were recorded.
11. The ant was removed.
12. Another ten ants were put into the petri dish and steps 7-9 were repeated.
13. The results were recorded.



Fig. 7 Dissecting microscope

## **Experiment 3 : To find out the stickiness of different parts of azalea**

1. Paper was cut into strips with the same area.
2. The paper strips were put on the leaves, the sepals, the petals and the stem of azalea with the same contact area..
3. The result was recorded after one day



Fig. 8 Stickiness test

## **Results and observations:**

### **Experiment 1**

Date of experiment: 11<sup>th</sup> March, 2011

Result table A:

Samples	Number of halt	Live or die after one day?	Remarks
White azalea	0	Live	1. The ant moved to centre after touching. 2. The ant seldom moved.
Pink azalea	0	Die	1. The ant moved to centre after touching. 2. The ant seldom moved.
Purple azalea	0	Live	N/A
Ginger extract	0	Die	N/A
Garlic extract	0	Die	N/A
Paprika extract	0	Live	N/A
Glucose solution	1	Live	1. The ant used its antenna to touch the steamed bun. 2. The ant ate the steamed bun after touching it by antenna. 3. The ant escaped from the steamed bun to the lid of petri dish.
Water	1	Live	1. The ant halted on steamed bun for a long time.

*Table (a): Results of testing the food preference of ants*

Overall remarks: The ants licked its antenna after touching the food substances.



Fig. 9 An ant hesitating in front of the steamed bun

### **Experiment 1 (continued)**

Date of experiment: 18<sup>th</sup> March, 2011

Result table B:

Samples	Number of halt	Live or die after one day?	Remarks
White azalea	0	Live	1. The ant seldom moved.
Pink azalea	0	Live	N/A
Purple azalea	0	Die	N/A
Ginger extract	0	Die	1. The ant used its antenna to touch the steamed bun.
Garlic extract	0	Die	1. The ant went across the steamed bun and went to the ceiling of petri dish.
Paprika extract	0	Die	N/A
Glucose solution	1	Live	1. The ant halted on steamed bun after the third touching.
Water	1	Live	1. The ant halted on steamed bun for 24 seconds.

*Table (b): Results of testing the food preference of ants*

Overall remarks: The ants licked its antenna after touching the food substances.



Fig. 10 An ant eating the steamed bun

## **Experiment 2**

Date of experiment: 1<sup>st</sup> April, 2011

Result table C:

Samples	Number of touching	Number of halt	Remarks
Garlic extract	3	0	N/A.
Paprika extract	3	0	N/A
Glucose solution	20	1	1. The ant stayed on the steamed bun until the end of the experiment. 2. The ants ate the steamed bun.
Water	15	0	N/A

*Table (c): Results of finding out the methods of forage of an ant*

Results of finding out the methods of forage of 10 ants:

All ants stopped at the steamed bun with glucose solution after several random collisions.

## **Experiment 3**

Date of experiment: 1<sup>st</sup> April, 2011

The same contact surface area between the paper strip and the part of azalea

Result table D:

Different parts of azalea	Number of paper strips remained after three days
Leaves	0
Sepals	3
Petals	0
Stems	0

*Table (d): Results of the stickiness of different parts of azalea*

## **Interpretation of results:**

From the experiment 1, the ants didn't halt on the steamed bun with ginger, garlic and paprika which have some irritating smell. This shows that the ants did not prefer those substances.

The ants also did not halt on the steamed bun with the extract of white, purple and pink azalea. The ants may just be attracted by the smell on the nectar of azalea but not petal. Further study is necessary to prove this.

The ant halted on the steamed bun with glucose solution. Therefore, this shows that the ants prefer glucose solution.

From the experiment 2, the ant stayed on the steamed bun with glucose solution until the end of the experiment after several collisions to different strips of steamed bun with different extract. Under the dissecting microscope, we could see that the ants ate the steamed bun and frequently clean its antenna by their legs. To ensure other ants would also stay on the steamed bun with glucose solution, ten ants were

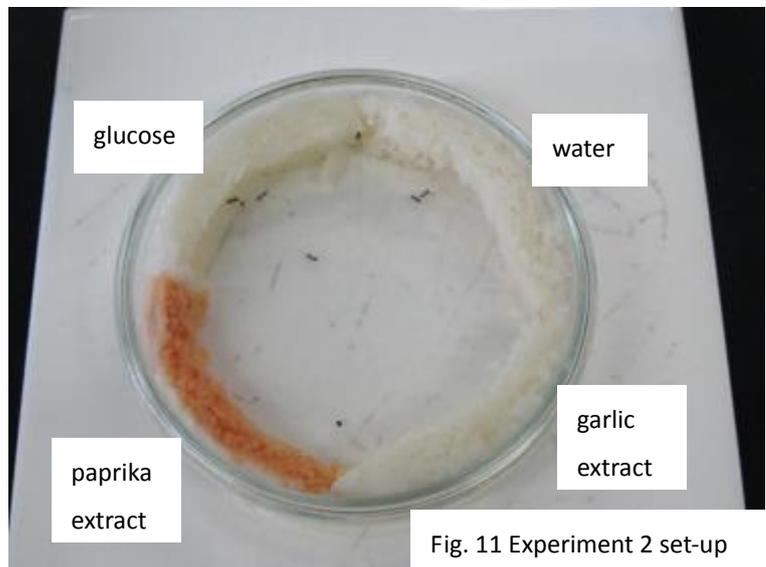


Fig. 11 Experiment 2 set-up

used instead of one and it showed the same result. Therefore, we can conclude that ants do not find food by smelling the scents through air but by touching the food with their antenna, because they eventually find their preferable food by a lot of random collisions, even to the food that are not preferable to them. This result also matches with the information we have found from the book (螞蟻的生活 黃瑾瑜譯). The book said that sense of smell of ants are located on the antenna, different section on the antenna are responsible for detecting different smells.

From the experiment 3, the paper strips on the leaves were blown off, this shows that the stickiness of the leaves is very low, it cannot hold any of the paper strips. The paper strips on the sepals remain the same even it was windy. This shows that the sepal is very sticky. We did not remove the paper strips and just left the strips on the sepal after the experiment, we could see that the strips remain on the sepal after three days. This really showed how sticky the sepal was.

## **Limitations of the experiment:**

In our experiment, we could only conduct the experiment by using one kind of ants. As there is another kind of ants that the number is very small, hence we do not prefer to do another experiment by using different kind of ants.

All the ants used in the experiment are caught near the azalea at the cornea besides the school hall. There are other places that have azalea in our school campus, near canteen and playground. However, the ants are difficult to catch in this area as the area has lots of soil and dust. It makes our ant collector does not work for catching ants. Therefore, we give up the experiment that using ants in other areas for comparison.

The sample size in the experiment is small. It is because we may injure the ants.

We have tried to put some sugar in different area in our school campus to see that whether the sugar really attracts the ants. After few hours, we came back to see what would happen. There were ants on the sugar, however, we could not sure that the ants were eating the sugar.

## **Possible source of errors:**

1. In experiment B, the extracts may contaminate each other at the boundaries of the steamed bun.
2. 10-minute observation is insufficient.

## **Ways of improvement:**

1. Use a small piece of paper to separate the boundaries of the steamed bun's strips.
2. Observe for a longer time.

## **Difficulties of the experiment:**

Ants are very small insects, this makes all the observation much more difficult. For example, we could see that the ant halt on the steamed bun but we could not know what beyond without a dissecting microscope.

Some of the area in our school campus is near to the hillside, such as the stairs near the canteen. Once, we have discovered that there are numerous ants. We think that the area could be the site for us to carry out some of the experiment about how the ants find food. Unfortunately, our school worker also found that there are lots of ants, she sweep away the fallen leaves and use bleach to eradicate the ants. We lose a very useful place for our experiment.

## **Conclusion:**

Based on the experiment we have done, the ants died on the sepal of azalea due to the ants were inescapable from the very sticky sepal.

The ants found food by the sense of smell through their antenna.

The food substances with irritating smell such as ginger seems to drive away ants.

## **Further study:**

During investigation about the dead ants on the sepals of azalea, we discovered that there are other dead animals such as flies, lace bugs, honeybees and spiders on the sepals of azalea.

Few bumble bees and quite a lot of honeybees are foraging for nectar in azalea and they can help the azalea to disperse the pollen grains at the same time. The floral bud scales of azalea secrete a viscous and sticky secretion, which appears shiny under sunshine, so as to protect the flower before it becomes mature. However, the insects accidentally stick on the floral bud scales, they usually die after struggling for a long time.



Fig. 12 Dead lace bugs on the floral bud scale

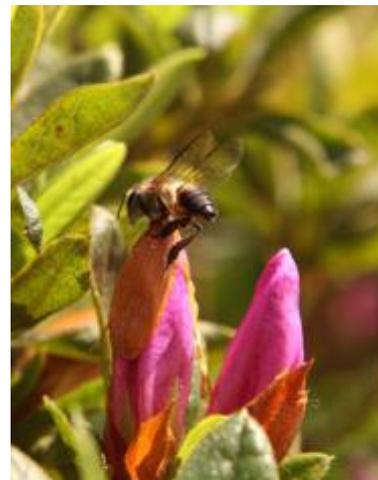


Fig. 13 A honeybee stuck on the floral bud scale

Some insects are known to be pests of azalea and they cause damage to leaves. We found that there are mites, azalea lace bugs and caterpillars on the azalea in our school.

Mites can cause white stippling damage on both sides of the leaves. Leaves will turn brown, die and may drop off the plant if they are heavily infested. Mites also leave a lot of their hatched egg shells and shed skins on the underside of the leaves.

Azalea lace bug has a needle like mouthparts and they use it to suck the plant sap from the leaves underside, causing white discolouration of stippling on top of the leaves where the chlorophyll has been removed. As the lace bugs are living on the underside of the leaves, most people do not discover them until the leaves are damaged.

Caterpillar is another pests that living on azalea. They feed on the leaves of the azalea, causing defoliation of azalea.

The sticky characteristic of the floral bud scales of azalea can thus help to protect the bud, which is essential to reproduction of the species, from being damaged by the pests by trapping all the pests reaching the floral bud on the surface and forbidding their movements and the pests eventually die on the surface without causing any damage to the flower bud.



Fig. 14 Dead big ant on the floral bud scale

floral bud scale

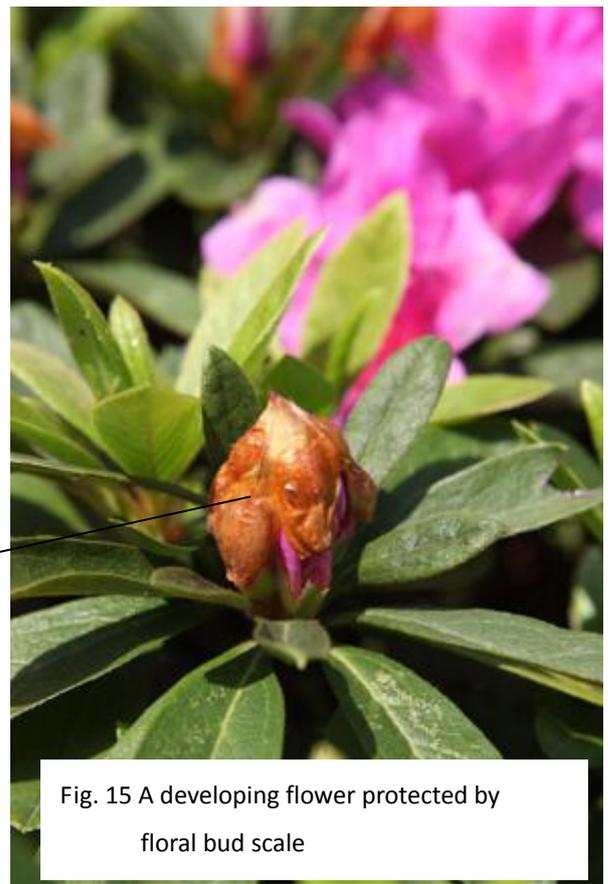


Fig. 15 A developing flower protected by floral bud scale

It is documented that azalea is poisonous and people and animals can be affected if they ingest azalea. All parts of the azalea are poisonous and the toxic agents are grayanotoxin, which is formerly known as andromedotoxin, acetylandromedol, and rhodotoxin. Human and animals will suffer from internal poisoning if they ingest azalea.

For human, the symptoms are:

1. Nausea
2. Salivation
3. Vomiting
4. Muscular weakness
5. Dizziness
6. Difficulty in breathing
7. Loss of balance
8. Stomach irritation
9. Abdominal pain
10. Abnormal heart rate and rhythm
11. Convulsion

In serious case, the ingestion of azalea may even cause coma and death. Moreover, 100 to 225 grams of azalea leaves can cause serious poisoning to a 55lbs child.

For animals, the symptoms are:

1. Stomach irritation
2. Abdominal pain
3. Abnormal heart rate and rhythm
4. Convulsion

Ingestion of azalea can also cause coma and death to animals and all animals maybe affected.

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