Searching for Nature Stories 2017

Kwun Tong Government Secondary School (Team R1)

"Blood" from Elephant's Ear

Tree sap from *Macaranga tanarius*

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Content

Abstract

Macaranga tanarius a species of Elephant's ear. It contains a large amount of iron in its tree sap. This feature makes the tree sap be oxidized when it is in contact with oxygen in air and reacts with the water in tree sap. As a result, the colour of the tree sap of Elephant's ear changes from colourless to red after it is oxidized.

In this project, our objectives are to investigate the effect of temperature on the rate of colour change of elephant’s ear, the effect of light intensity on the rate of colour change of elephant’s ear and the significance of the red colour from the oxidized sap of elephant’s ear in repelling, preventing or attracting insects.

From the data collected from the results of the experiments, it was believed that temperature is a factor affecting the rate of colour change of the tree sap of elephant’s ear, where a specific temperature(20°C)has the fastest reaction rate, while light intensity is not a factor affecting the rate of colour change. The red colour of its tree sap cannot repel insects.

Introduction

2.1 Introduction to research topic

Elephant's ear (Macaranga tanarius) is a tree commonly seen in Hong Kong. It is really shocking to see the broken branches of an Elephant's ear as some red liquid flows out from the broken branches. Hence, the Chinese name of Macaranga tanarius means bloody tree. When the tree sap of the Elephant's ear comes into contact with air, it turns blood red after oxidization. That is why we see the tree is bleeding. Finding this phenomenon is interesting during our field trip, our group decided to investigate the effect of different environmental factors on the rate of colour change of Elephant's ear .Also, we would like to find out the use of the red colour of its tree sap.

2.2 Objective

2.2.1.To investigate the effect of temperature on the rate of colour change of elephant's ear(*Macaranga tanarius).*

2.2.2.To investigate the effect of light intensity on the rate of colour change of elephant's ear(*Macaranga tanarius).*

2.2.3. To investigate the significance of the red colour from the oxidized sap of elephant's ear(*Macaranga tanarius)* in repelling, preventing or attracting insects.

2.3 Research question

1.How does the temperature affect the rate of colour change of the sap of elephant's ears?

- *Does the phenomenon of changing colour of elephant's ears from colourless to red become faster on a hot day?*

2. How does the light intensity affect the rate of colour change of the sap of elephant's ears?

- *Does the phenomenon of changing colour of elephant's ears from colourless to red become faster on a sunny day?*

3. Why do elephant's ears have sap in red colour after it is oxidized?

- *Does the red colour help repelling insects?*

- *Does the red colour attracts inserts?*

2.4 Background information of *Macaranga tanarius*:

2.4.1. Taxonomic Hierarchy

Kingdom	Plantae
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Superdivision	Embryophyta
Division	Tracheophyta
Subdivision	Spermatophytina
Class	Magnoliopsida
Superorder	Rosanae
Order	Malpighiales
Family	Euphorbiaceae
Genus	Macaranga Thouars
Species	Tracheophyta

2.4.2. Description

It is a shrub or bushy tree, sometimes reaching 12 metres tall and with a stem diameter of 40 cm. The trunk is short and crooked, bark being grey-brown, with bumps and irregularities. The branchlets are smooth, bluish grey with prominent leaf scars. Its crown is thick, dome-shaped in individuals growing in the open, and often bluish-green from a distance.

Branches are many, slender and rounded.When its branches break, the sap is oxidized and turns red like blood. Whenever strong wind breaks the branches, there will be bloodshed.

Leaves are alternate, and round with a tip, 8 to 23 cm long, greyish or white on the underside. It has prominent leaf stalks 8 to 20 cm long which connect within the leaf itself. Nine main veins radiate from the leaf stalk, easily noticed on the upper and lower leaf side.

Yellow-green flowers form on panicles in the months of October to January (in New South Wales). Female and male flowers grow on different trees. The fruit is a prickly three-celled yellow capsule, 9 mm in diameter, maturing in January to February (in New South Wales). There is one black seed in each of the cells. Germination from fresh seed occurs without difficulty. Cuttings strike well.

Methodology

3.1 Working Schedule

	Date	Time	Venue	Event
1st field study	13-4-2017	13:00-16:00	Shui Long Wo	searching for the elephant's ear and making observation
2nd field study	18-4-2017	8:30-12:00	Shui Long Wo	collecting the branches of elephant's ear for investigating the effect of temperature and light intensity on the rate of colour change of elephant's ear
3rd field study	19-4-2017	4:00-5:00	Field near our school	collecting the tree sap of elephant's ear and leaves of plants, and catching insect for investigating the significance of the red colour from the oxidized sap of elephant's ear in repelling, preventing or attracting insects

3.2 Field study

Study site: Shui Long Wo

3.3 Objective 1:

To investigate the effect of temperature on the rate of colour change of elephant's ear(*Macaranga tanarius).*

Hypothesis**:**

The rate of colour change of elephant's ear would increase in higher temperature.

Experiment:

- Apparatus:

Name of apparatus	Number of apparatus required
1. Warm water bath	2
2. Large beaker	3
3. Thermometer	3
4. Test tube rack	1
5. Boiling tube	5
6. Timer	3

- Materials:

Name of material	Amount of material required
7. Ice	a small amount
8. Scissors	one pair
9. Branch of elephant's ear	5
10. Water	430cm³ per beaker

- Procedure:

1. Prepare two warm water baths with a constant temperature of 30°C and 35°C respectively.
2. Use a pair of scissors to obtain two branch segments,1.5cm long each.
3. Place a branch into a boiling tube(Boiling Tube A), put the boiling tube into a 30°C warm water bath.
4. Place another segment of the branch into another boiling tube(Boiling Tube B), put the boiling tube into a 35°C warm water bath.
5. Record the time taken by the branch segments to change the colour of the sap from colourless to deep red.
6. Prepare three beakers of water, each beaker contains 430 cm³ of water. The water temperature of each beaker should be 15°C, 20°C and 25°C respectively.
7. Obtain 3 branch segments of 1.5cm and place them into three different boiling tubes.
8. Put the three boiling tubes into beakers with 3 different temperatures(Boiling Tube C:15°C, Boiling Tube D: 20°C, Boiling Tube E: 25°C)
9. Ice is used the lower the water temperature of Boiling Tube C to 15°C.
10. Place a thermometer into the 3 beaker to ensure the temperatures are constant.
11. Record the time taken for the tree sap to change its colour from colourless to deep red.

Fig. 1 30°C warm water bath

Fig. 2 35°C warm water bath

Fig. 3 15°C beaker

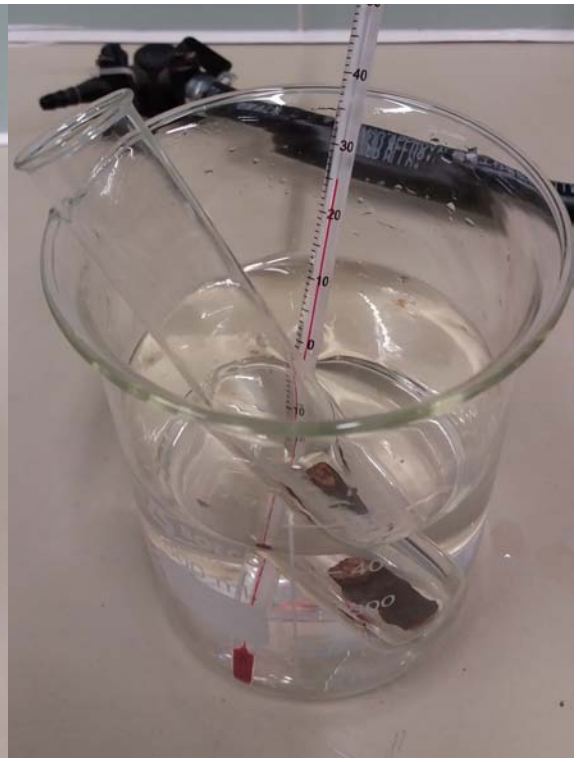

Fig.4 25°C beaker

3.4 Objective 2:

To investigate the effect of light intensity on the rate of colour change of elephant's ear(*Macaranga tanarius).*

Hypothesis:

The rate of colour change of elephant's ear would increase with a higher light intensity.

Experiment:

- Apparatus:

Name of apparatus	Number of apparatus required
1. Lamp (100W)	5
2. Small beaker	5
3. Boiling tube	5
4. Test tube rack	5
5. Timer	5

- Materials:

Name of material	Amount of material required
1. Branch of elephant's ear	5
2. Ruler	1

- Procedure:

1. Fill in water in the 5 small beakers. Turn on the lamps.
2. Obtain 5 branch segments, 1 cm long each.
3. Place the 5 segments into 5 different boiling tubes respectively. Put the boiling tubes into different test tube racks.
4. Put a beaker of water in front of each boiling tube to prevent heat released by the lamp affecting the results.
5. Measure the distance between the lamps and the boiling tubes in each set up, the lengths should be 2 inches, 4 inches, 6 inches, 8 inches and 10 inches respectively.
6. Record the time taken by the sap to change its colour from colourless to deep red.

Fig. 5 Obtaining branch segment

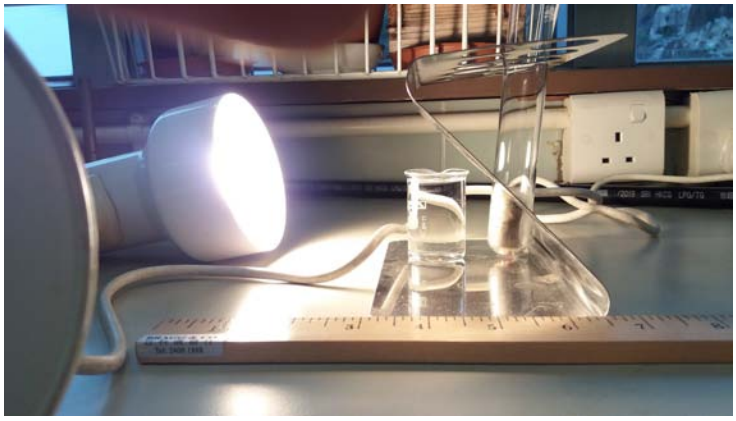

Fig. 6 Distance=6 inches

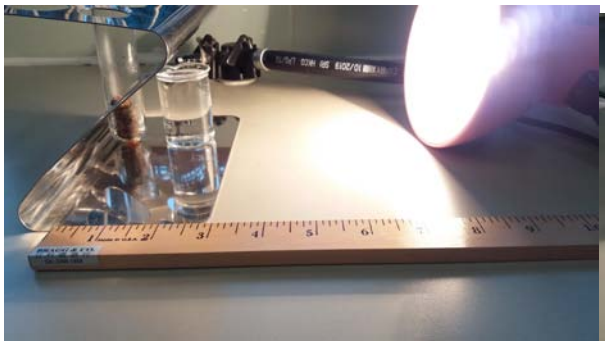

Fig. 7 Distance=8 inches

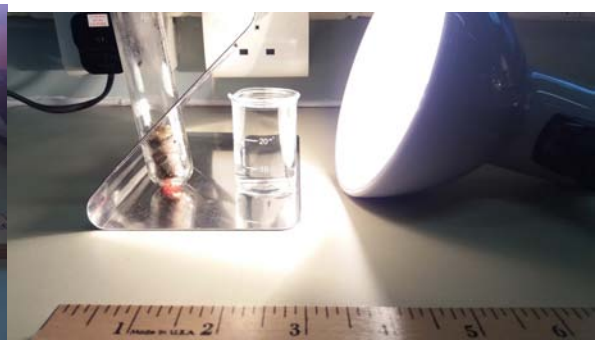

Fig. 8 Distance=4 inches

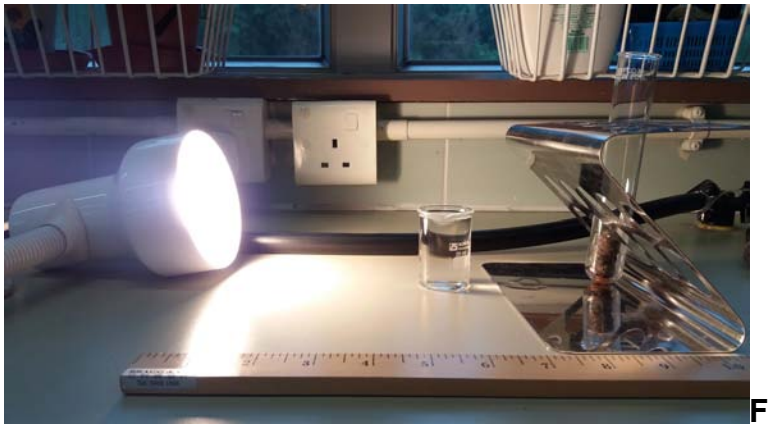

Fig. 9 Distance=10 inches

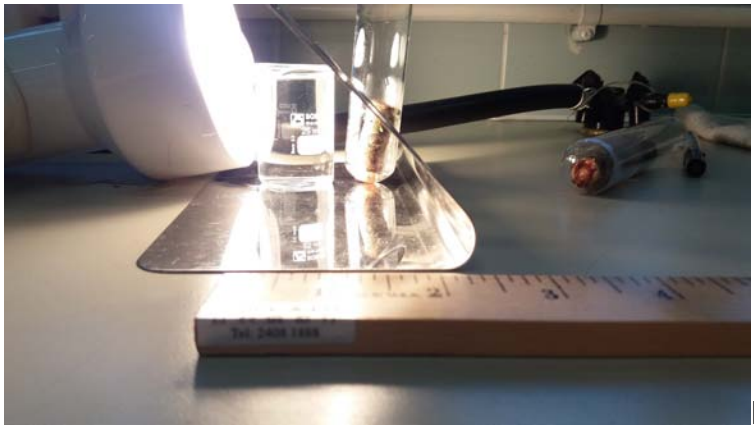

Fig. 10 Distance=2 inches

3.5 Objective 3:

To investigate the significance of the red colour from the oxidized sap of elephant's ear(*Macaranga tanarius)* in repelling, preventing or attracting insects.

Hypothesis:

The red colour of the tree sap would repel, prevent or attract insects.

Experiment:

- Materials:

Name of material	Amount of material required
1. Ant	1
2. Green leaf	2
3. Tree sap from elephant's ear	a small amount

- Procedure:

1. Coat a small amount of tree sap of elephant's ear onto a green leaf, no other substance is added onto another leaf.
2. Observe the behaviour of an ant being trapped together with the two leaves to prediction the significance of the red colour.

Fig. 11 Set-up

Fig. 12 Set -up

Results

Variable	Time recorded
2 inches	28mins56secs
4 inches	29mins50secs
6 inches	18mins46secs
8 inches	12mins51secs
10 inches	31mins26secs
15°C	14mins21secs
20°C	06mins37secs
25°C	10mins28secs
30°C	27mins13secs
35°C	29mins58secs

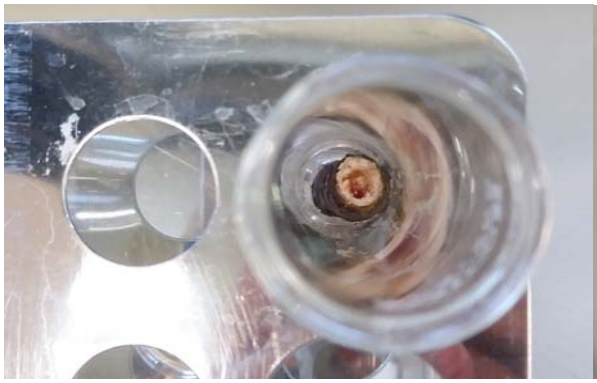

Fig. 13 2 inches

Fig. 14 4 inches

Fig. 15 6 inches

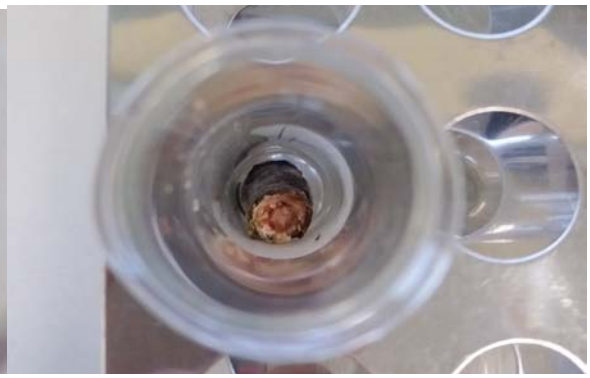

Fig. 16 8 inches

Fig. 17 10 inches

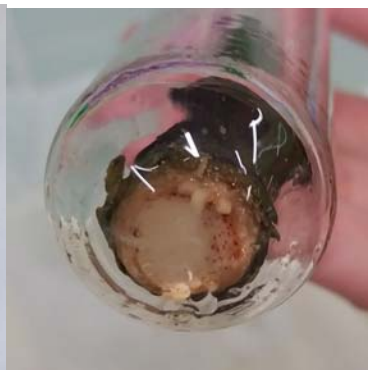

Fig. 18 15°C

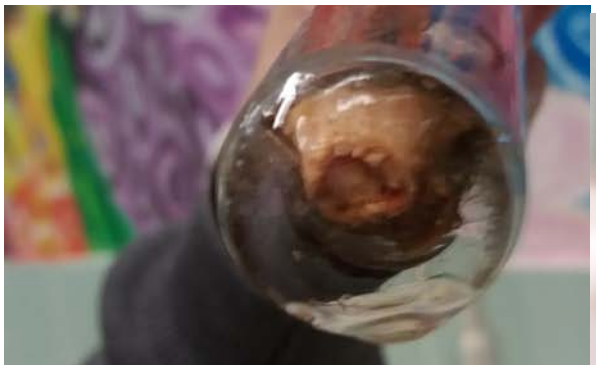

Fig. 19 20°C

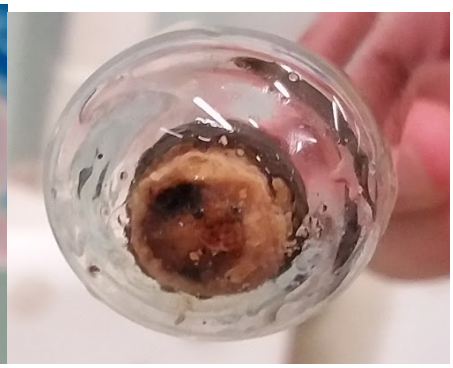

Fig. 20 25°C

Fig. 21 30°C

Fig. 22 35°C

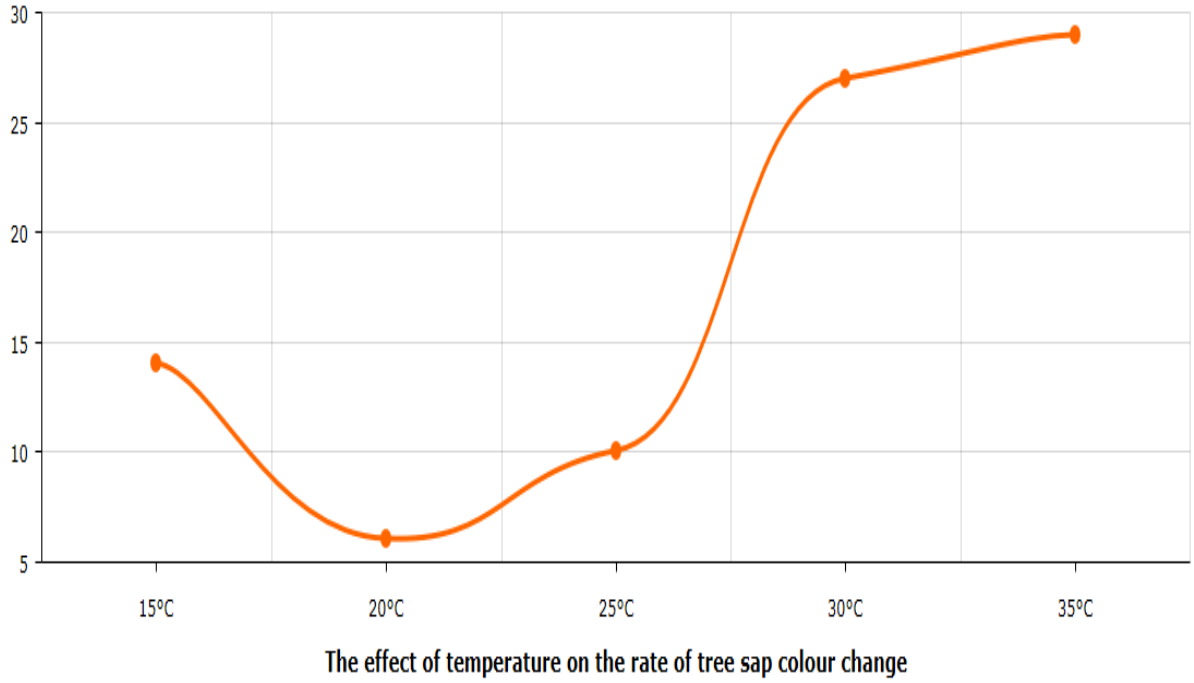

Table 1 The effect of temperature on the rate of tree sap colour change

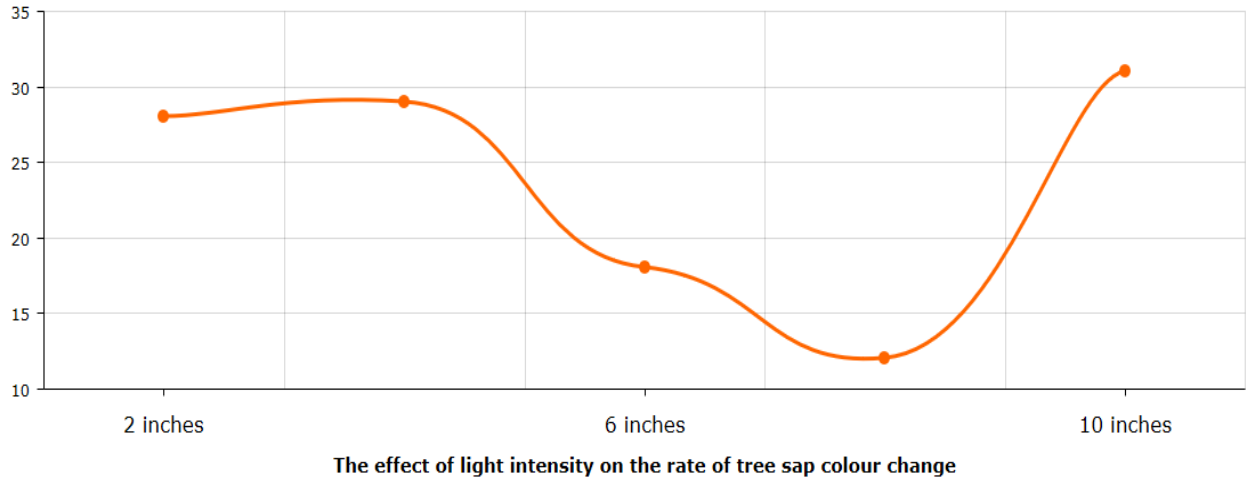

Table2 The effect of light intensity on the rate of tree sap colour change

Fig. 23 The ant will not be scared away because of the red appearance

Discussion

5.1 Limitation

Since we conducted our experiments in the school laboratory, the ventilation was not very good. Oxygen supply was not in excess. This may hinder the results and the effect of oxidation.

In addition, the tree sap oxidizes very easily, we have to work very fast so that we would not affect the results.

5.2 Error

Human error was involved in measuring the colour intensity. There was no accurate measurement to show the levels of colour changed.

Too much experiments were being carried out at the same time, so not all of them was looked after for the whole process(were left behind). We just stopped the timer when we realised that the colourless sap turned red already. This would affects the results.

5.3 Improvement

Experiments can be repeated so that we could get a more accurate result. We could gather the results and find out the average or trends, making our results more obvious and clear.

Methods for removing oxygen can be used, therefore the result is more accurate.

Conclusion

1. Light intensity is not a factor affecting the rate of colour change of the tree sap of elephant's ear.
2. Temperature is a factor that directly affects the rate of colour change of the tree sap of elephant's ear, where a specific temperature(20°C)has the fastest reaction rate.
3. The ant will not be scared away because of the red appearance of the tree sap of elephant's ear. It cannot repel insects.

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