Students：
CHEN, YI-LIN
LI, YU-BO

Environmental Variables Affecting the Growth and Flowering of Ceiba speciosa

Teacher:
Lee, Yu-Hsien
Chen, Pei-Cheng

Summary

On our way to the school, we have a daily routine of visiting the parking lot behind the station to admire the beautiful scenery of the Ceiba speciosa.Whenever they bloom, the pink petals attract people to come and admire their beauty. As we visited more and more, we gradually noticed that most of the trees grew uniformly upwards, but there was one tree that curved in a specific direction and bloomed earlier than the rest. This made us curious about the factors that affect its growth and flowering, so we decided to conduct a study to investigate the factors that affect the growth and reproduction of the Ceiba speciosa.

Research purposes

By observing the different growth conditions and environmental factors surrounding the Ceiba speciosa, we aim to investigate their unique growth direction and the order of their blooming time. We will conduct research and explore the main factors that influence the growth of Ceiba speciosa.

Research method

We will take pictures of the flowering status and growth direction of the Ceiba speciosa, and observe the changes on different dates. At the same time, we will analyze different meteorological observation data and observe various environmental factors, such as temperature, rainfall, sunshine duration, wind direction, and soil nutrients, and identify the main factors to understand their degree of influence on the growth and flowering. Finally, we will use statistical methods to analyze the research results, determine the degree of influence of each factor on the growth and flowering of silk floss trees, and explore their possible mechanisms of action.

Discussion:

Environmental characteristics of Kinmen

Kinmen is a continental island formed by the rising sea level. Its climate is classified as a subtropical marine climate. Due to differences in the characteristics of the land and sea, the temperature in Kinmen is lower than that of Taiwan with significant temperature differences between day and night. The annual average temperature is around 20.8 degrees Celsius with long sunshine hours. Kinmen is often foggy from March to May and experiences its rainy season from April to June. In the summer, it is hot and may be affected by typhoons, while the winter is characterized by strong northeast monsoons and is relatively dry and cold.

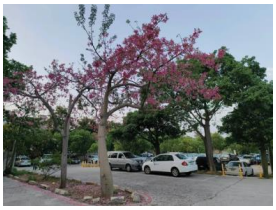
Basic knowledge of Ceiba speciosa

scientific name：Ceiba speciosa

Origin: Brazil, Argentina

This plant is suitable for a full-sun environment and can tolerate dry conditions, but it may not grow well in waterlogged soil. Dry weather can promote flowering by causing the plant to shed its leaves, and the lack of leaves during flowering increases its ornamental value. During the rainy autumn season, however, flowering may be poor, and the leaves may not fall completely, resulting in both flowers and leaves being present at the same time. The plant's most distinctive features are its bottle-shaped trunk, small thorns on the surface of the bark, and pink petals. It is often used as a street tree or landscape tree, and in its native habitat, indigenous people hollow out the trunk to make canoes or use the cotton-like fibers of the fruit for clothing and other items.

Weekly Photo Record

			
9/19	10/14	10/20	11/2
			
11/15	11/22	11/28	12/8
			
12/13	12/20	12/26	12/31
Weekly observation (photographing) change table			

Research 1 - Growth Direction of the Ceiba speciosa

Initial research

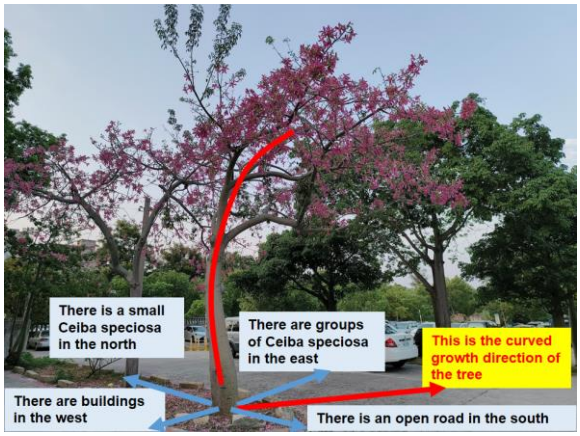
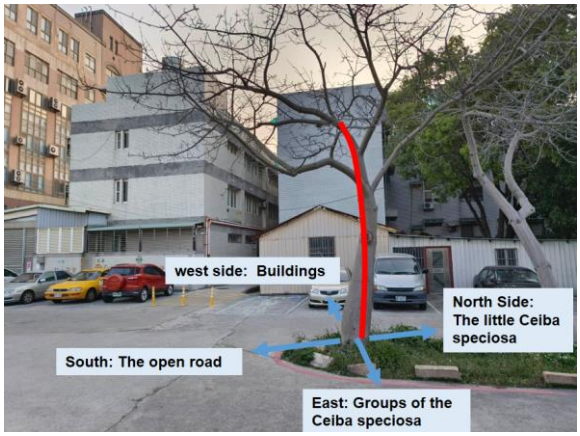
Growing in the same climate, the first Ceiba speciosa tree (Tree 1) in front grows in a curved direction with a bow-shaped trunk, while the second Ceiba speciosa tree (Tree 2) behind grows uniformly upwards. Through our observation, we found that these two Ceiba speciosa trees were subject to different environmental factors due to their different growing positions. Our research has shown that the main factor affecting

Ceiba speciosa trees is sunlight, so we will conduct a study on the different effects of sunlight exposure on these two Ceiba speciosa trees.

Ceiba speciosa 1 (significant deformation)

Growth and Environment

Growth direction: curved
Trunk shape: bow-shaped (mainly growing towards the southeast direction)
Location: There is a building on the west side, clusters of Ceiba speciosa on the east side (but with some space in between), a small beautyberry tree on the north side (closer to this tree), and open roads on the south side.

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>Observation angle 1</td><td>Observation angle 2</td></tr>
<tr><td colspan="2">Observation of ceiba speciosa(The deformation caused by the influencing factors is significant.)</td></tr>
</table>

Observation and research

1.The sun's angle of incidence in Kinmen during the time of our filming was such that the sunrise shone from a southeastern direction, while the sunset shone from a southwestern direction.
2.Additionally, due to the presence of a building on the west side of the tree we observed, the afternoon and sunset sunlight was blocked, depriving the tree of sunlight for part of the day. Because this tree is a long-day plant, it will grow towards the southeast to obtain more sunlight.

3.As for the small Ceiba speciosa growing on the north side, it competes with the other trees for sunlight, affecting the amount of sunlight received and hindering growth. Therefore, it will grow towards the more open south side.

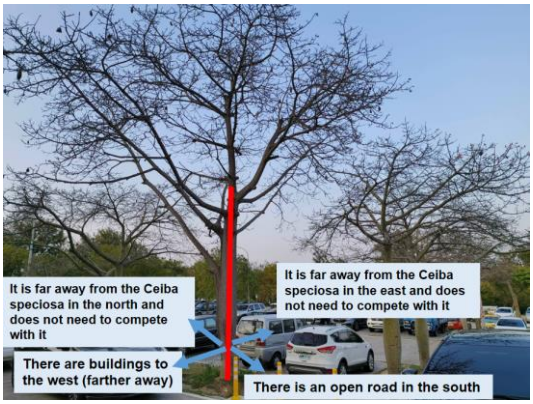
Ceiba speciosa 2 (small deformation)

Growth and Environment:

Growth direction: straight

Trunk shape: uniformly growing upwards

Location: There is a building on the west side (but at a distance), clusters of Ceiba speciosa on the east side (but with some space in between), another Ceiba speciosa on the north side (but at a distance from this tree), and open roads on the south side.

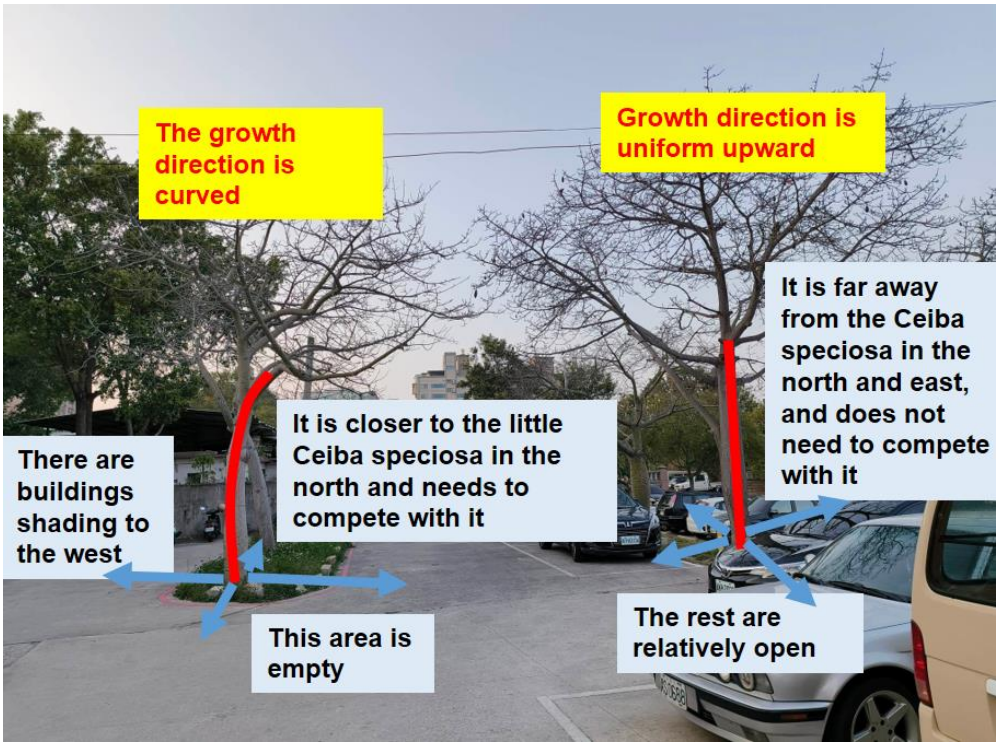


ceiba speciosa 2 (small deformation)

Observation and research

1. There are no other trees to compete for sunlight (longer distance), they can grow in all directions, and the branches are staggered to receive sunlight, so in order to get more sunlight, their best way is to grow in all directions, so the trees behind Only then will grow evenly upward.

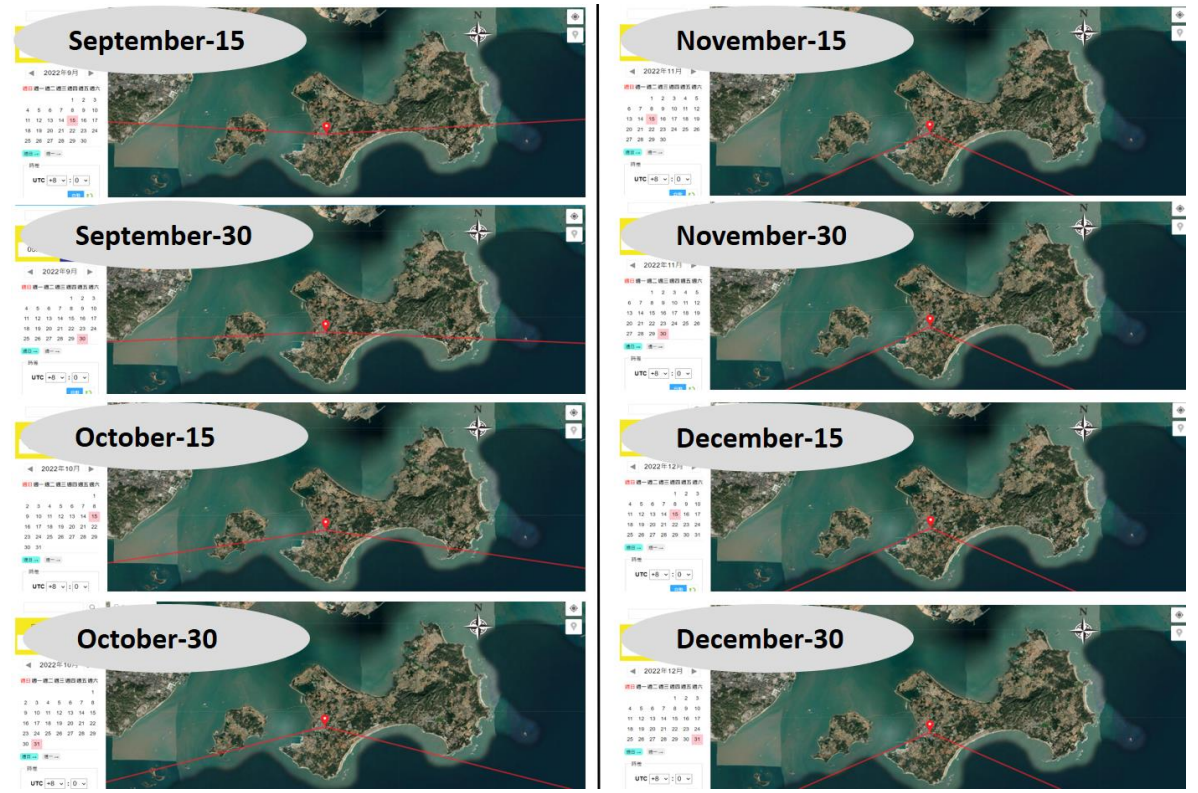
2. Because the tree is far away from the buildings on the west side, it will not block the sunlight, so there will be no reason for it to be biased in other directions.



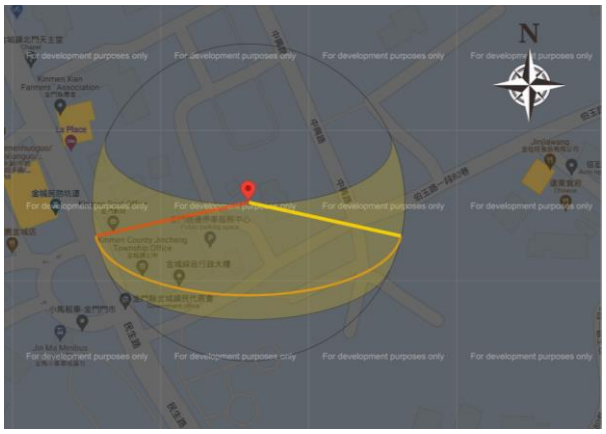
Comparison of environmental factors and growth directions of two trees

In short

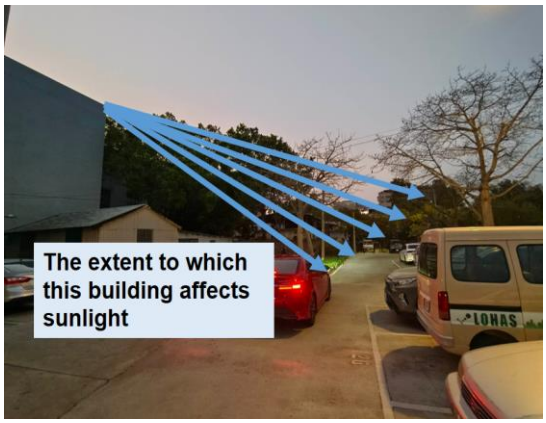
The influence of the beauty tree we observed is mainly affected by the sun's sunlight, which caused a large change in the shape of the tree. Among them, the azimuth angle of the sunlight (Azimuth illumination of south by southeast and south by west) and the amount of sunlight (compared with the surrounding tree competition, away from the shaded part of the building) are the most influential factors, making the growth direction of this beauty tree grow to the southeast.



Kinmen September-December 2022 Sunshine and Sunset Azimuth Comparison Chart



Main sunlight angles at the location of the ceiba speciosa



Areas that are shaded by buildings and exposed to direct sunlight

Research 2 - The Ceiba speciosa flowering earlier or later

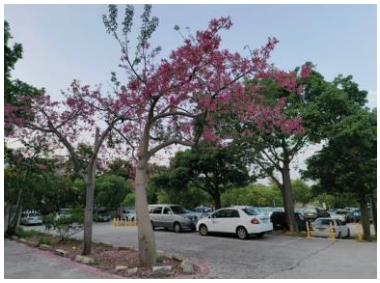
Basic Knowledge of Ceiba speciosa Flowering

In Taiwan, the flowering season for this plant usually falls between September and November, with earlier blooms appearing in the northern regions. If there is less rainfall, the plant will drop its leaves before flowering to store nutrients, resulting in a phenomenon where flowers and leaves do not coexist during the flowering period.

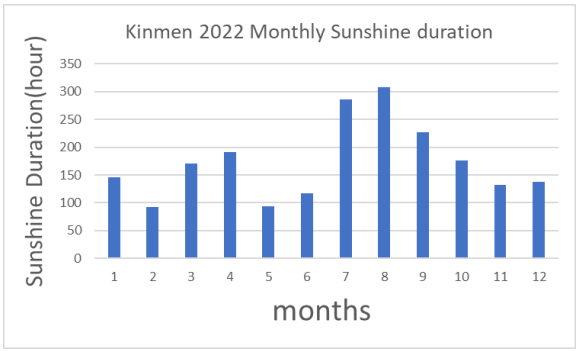
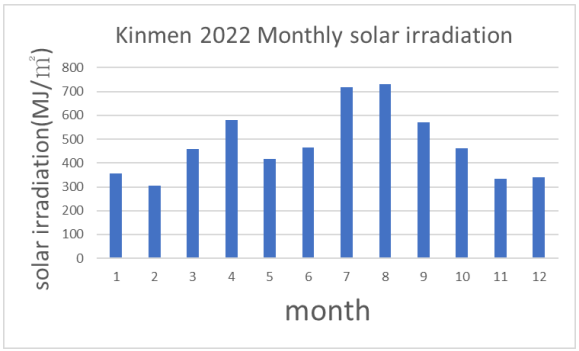
Additionally, it is worth noting that the further north the plant is located, the earlier it blooms. This is due to the photoperiodic flowering mechanism in plants, which means that their flowering time depends on the amount of daylight they receive. When the daylight duration exceeds a certain threshold, the plant will initiate the flowering mechanism. Therefore, in colder areas in the north with shorter daylight hours, some plants will flower earlier to ensure that their reproductive cycle can be completed within a limited time frame. In contrast, in warmer southern regions with longer daylight hours, some plants will delay flowering to adapt to the climate.

Initial research

Ceiba speciosa was blooming on September 19, but the eastern beauty tree bloomed gradually on November 19 and the most blooming on November 28. We infer that it is due to the difference in the amount of water absorbed and the length of sunshine

		
9/19 Ceiba speciosa 1 flowering	11/15 Ceiba speciosa 2 flowering	11/15 Ceiba speciosa 2 close up

Sunshine time

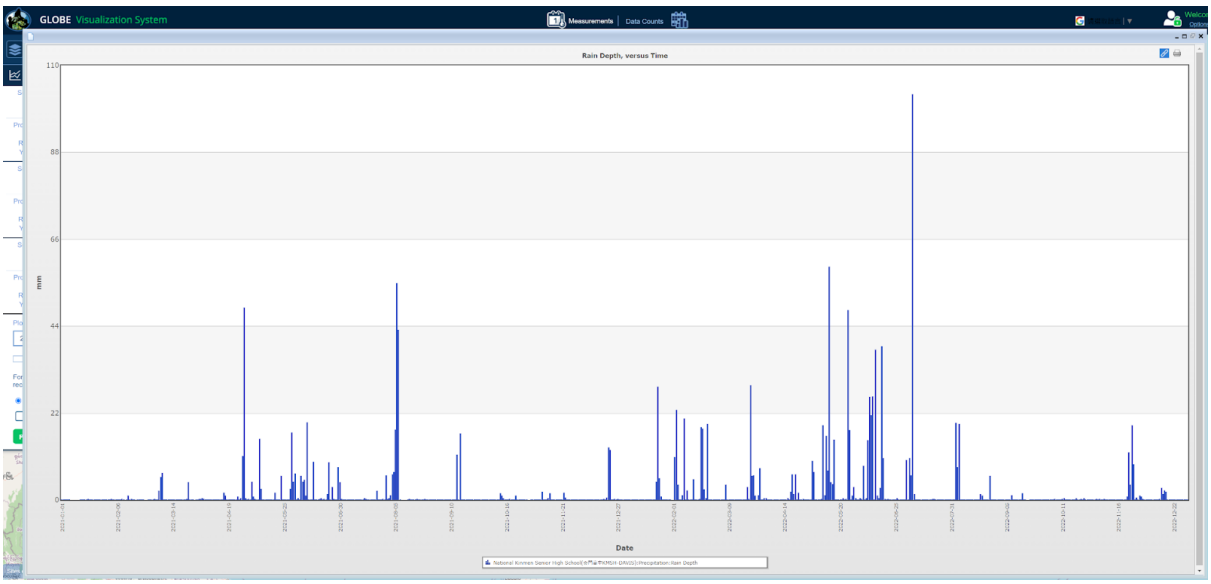
	
Kinmen 2022 Monthly Sunshine duration	kinmen 2022 Monthly solar irradiation

Based on the above diagram, it can be seen that Kinmen has relatively higher sunshine hours and radiation levels during the months of July to September, which is suitable for the growth of Ceiba speciosa in an environment with full sunlight (6-8 hours of daily sunshine time). The higher the sunshine hours and radiation levels, the more suitable the growth of Ceiba speciosa. The sunshine hours during the period of July to September are within this range. However, for the Ceiba speciosa at the front, its western side is covered by a building, which affects its sunshine hours and causes its exposure to be shortened.

Amount of water

According to the rainfall data from our school's meteorological station in 2022, there was hardly any rain from September to November. Additionally, the two Ceiba speciosa trees are located at different elevations, resulting in differences in the amount of additional water they receive and hence differences in nutrient and water absorption. The Ceiba speciosa tree located at the higher elevation may have a lower nutrient uptake due to its location, leading to the possibility of being affected by the plant flowering mechanism and causing it to bloom earlier than the lower-elevation Ceiba speciosa tree, resulting in different flowering times between the two trees.

Schematic diagram of terrain height between two trees



2022 Jinmen High School Weather Station Rainfall Map

In short

There are two main factors that affect the flowering time of the two Ceiba speciosa trees. Firstly, the duration and intensity of sunlight (which is influenced by the size of buildings blocking the sunlight) can vary, resulting in different amounts of sunlight received. Secondly, the height of the ground creates a phenomenon where water flows towards lower ground, causing differences in the supply of water and nutrients between the two areas. The result of these two factors is that one beauty tree can obtain more nutrients, water and sunlight, while the other tree's survival conditions are relatively poor. Therefore, the latter tree is affected by the plant flowering mechanism and blooms earlier, resulting in different flowering times for two Ceiba speciosa trees in the same area.

Conclusion

Environmental Variables Affecting the Growth and Reproduction of Ceiba speciosa Tree

The main factor is sunshine

1. Azimuth angle: affect the growth direction and shape of plants
2. The amount of sunlight: affect the direction of plant growth, advance or delay flowering

Secondary factors are

1. Competition of plants: affecting plant growth
2. The height of the ground: resulting in the amount of water supply and nutrients obtained

References

美人樹 - 農業知識入口網

kmweb.coa.gov.tw

認識植物-美人樹

kplant.biodiv.tw

美人樹 - 台灣景觀植物介紹

tlpg.hsiliu.org.tw

荒野保護協會-植物目錄-美人樹

sowhc.sow.org.tw

觀測資料查詢系統 V7.2 - 中央氣象局

e-service.cwb.gov.tw

SunCalc.net