A study on the Effect of Air Quality on Orchids

Team Measuring the relative humidity of orchid plants

Wichienmatu School

THE GLOBE PROGRA

bal Learning and Observations to Benefit the Enviro

Abstract

Research Title : A Study of Air Quality Affecting the Growth of Orchid Plants in the Area of Wichienmatu School , Mueang Trang District, Trang Province

Researchers : Miss Pattamaporn Prabsiet ,Miss Phitsinee thongmuaen

Educational Level : Senior High School

Research Advisor : Ms. Khwanjai Karnchanasrimek , Ms.Naeriya Tonkrongchan , Ms.Chularat Singkaew

School : Wichienmatu school , Trang Province

This study investigated the effects of relative humidity and air temperature on the growth of orchid plants in the area of Wichienmatu School, Mueang Trang District, Trang Province. The objectives of this research were 1.) to compare relative humidity in shaded and open-air orchid growing areas and its effects on orchid growth; 2.) to compare air temperature in shaded and open-air orchid growing areas affecting orchid growth and 3.) to study the relationship between relative humidity and air temperature in shaded and open-air areas that influence orchid growth in the area of Wichienmatu School, Mueang Trang District, Trang Province. The results revealed that relative humidity and air temperature significantly affected orchid growth. Shaded areas provided the most suitable conditions for orchid growth, with lower average air temperature and higher average relative humidity. As a result, orchids grown in shaded areas exhibited higher growth rates than those grown in open-air areas. The relationship between relative humidity and air temperature was found to be inverse, particularly in open-air areas where higher air temperatures resulted in lower relative humidity.

Keywords: Open-air area, shaded area, relative humidity and temperature

Research Question

1. Do differences in relative humidity between open-air and shaded areas affect orchid growth? How?
2. Do differences in air temperature between open-air and shaded areas affect orchid growth? How?
3. Does the relationship between relative humidity and air temperature in open-air and shaded areas affect orchid growth? How?

Introduction

Orchids are economically significant ornamental plants known for their beauty and they are widely cultivated throughout Thailand. Thailand is considered one of the most suitable regions in the world for orchid cultivation due to its hot and humid climate and year-round sunlight, which allow orchids to thrive under natural conditions. Orchid growth and flowering depend on several environmental factors, such as light, temperature, water, and relative humidity. Among these, relative humidity directly affects water absorption, respiration, and the development of roots, leaves, and flowers. As epiphytic plants, orchids possess root systems that rely on atmospheric moisture to absorb water and minerals.

However, the efficiency of orchid physiological processes is strongly influenced by the interaction between temperature and relative humidity. In Mueang Trang District, the tropical monsoon climate presents unique challenges. High temperatures can increase the rate of transpiration, leading to water stress if relative humidity is insufficient to compensate for moisture loss. Conversely, a drop in temperature coupled with high humidity can create favorable conditions for pathogen development.

At Wichienmatu School, the microclimate is influenced by local vegetation and urban structures, which may cause fluctuations in these critical environmental parameters. If the air becomes too dry, the orchids' stomata close to prevent desiccation, thereby limiting carbon dioxide uptake and inhibiting growth. Therefore, understanding the specific environmental thresholds in this locale is crucial for sustainable cultivation. This research aims to analyze the influence of relative humidity and its correlation with ambient temperature on orchid growth. The findings will provide essential data for optimizing the nursery environment and ensuring that these ornamental plants reach their full aesthetic and biological potential within the school's unique ecosystem.

Furthermore, many orchid species that are commonly cultivated in Thai nurseries utilize Crassulacean Acid Metabolism (CAM). Unlike typical plants, CAM orchids primarily open their stomata at night to minimize water loss. This makes nighttime relative humidity a critical factor in biomass accumulation. If the microclimate at Wichienmatu School remains too warm or dry during nocturnal hours, the orchids may fail to fix sufficient carbon dioxide , leading to limited growth regardless of daytime cultivation practices.

Fiald Photos

Research Methods

Research Methods

Study Area

Open-air and shaded areas within Wichienmatu School, Trang Province.

Materials

1.) Thermometer

2.) Measuring tape

Part 1: To study the effect of relative humidity on orchid growth at Wichienmatu School, Trang Province.

1.1 Establish two experimental sites for orchid cultivation, both located within the community's orchid conservation zone. Site 1 Designated for orchids grown in an open-sun area, while Site 2 Designated for orchids grown in a shaded area.

1.2 Measure ambient temperature using an air thermometer positioned at a height of 2 meters. Additionally, record soil temperature readings. Data will be collected for a total of 15 observations.

1.3 Measure air humidity at all designated points using a thermometer (hygrometer) positioned at a height of 100 centimeters. Data will be collected for a total of 15 observations.

Part 2: Measurement of Orchid Growth

2.1 Orchid growth was observed by measuring plant height using a measuring tape once a week and recording the results.

Geographical Coordinates

Table 1 Geographical Coordinates of the Area at Wichienmatu School

Area	Geographical Coordinates	
	Latitude(N)	Longitude(E)
Open-air area	7.50441	99.62938
Shaded area	7.50412	99.62879

GLOBE Badges

• Be a Collaborator

The orchid relative humidity measurement group works as a team, collaborating to measure relative humidity and collect data.

• Be a Data Scientist

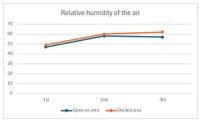
The group that measured the relative humidity of orchid plants presented the values in graphs and bar charts for easy understanding.

• Make an impact

Measuring the relative humidity of orchid plants and using local organic fertilizers to stimulate orchid growth will maximize the benefits of observing their growth.

Results

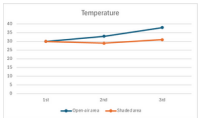
Part 1 : Study of Relative Humidity Affecting the Growth of Orchid in the Area of Wichienmatu School



Part 1: Relative Humidity

The graph of relative humidity showed that both areas had similar humidity values; however, the shaded area had higher relative humidity than the open-air area. During the third measurement, relative humidity in the open-air area decreased compared to the second measurement, while it increased in the shaded area.

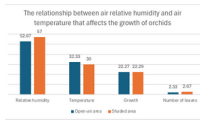
Part 2 : A study of air temperature affecting the growth of orchid in the area of Wichienmatu School , Trang Province



Part 2: Air Temperature

The air temperature graph indicated differences between the two areas. The open-air area had higher air temperatures than the shaded area. During the second and third measurements, air temperature in the open-air area increased, while the shaded area showed a decrease during the second measurement and an increase during the third measurement.

Part 3 : A study of the relationship between relative humidity and air temperature affecting orchid growth



Part 3: Relationship Between Relative Humidity and Air Temperature

The bar chart illustrated an inverse relationship between relative humidity and air temperature. The open-air area exhibited higher temperatures and lower relative humidity, while the shaded area had lower temperatures and higher relative humidity. Observations of orchid growth showed similar increases in plant height in both areas; however, orchids in the shaded area produced more new leaves on average, indicating that higher relative humidity and suitable temperatures promoted better leaf development.

Answer Research Questions

1. Differences in relative humidity between open-air and shaded areas affect orchid growth.
2. Differences in air temperature between open-air and shaded areas affect orchid growth.
3. The relationship between relative humidity and air temperature in open-air and shaded areas affects orchid growth

Discussion

The results of the study indicated that relative humidity and air temperature were environmental factors that significantly influenced orchid growth. Shaded areas provided more suitable conditions for growth than open areas because they had lower average air temperatures and higher average relative humidity. Such conditions were favorable for the physiological processes of orchids, including transpiration, photosynthesis, and nutrient uptake, resulting in higher growth rates in orchids cultivated in shaded areas.

The research findings support that orchid cultivation should take into account appropriate control of temperature and humidity, particularly by avoiding hot and dry environments. In future studies, additional factors such as light intensity, types of growing media, or water management may also be considered in order to gain a more comprehensive understanding of the factors affecting orchid growth.

Conclusions

This study clearly demonstrates that relative humidity and air temperature are the primary environmental factors determining successful orchid growth. Shaded areas create a more suitable microclimate by maintaining lower average air temperatures and higher relative humidity, conditions that closely align with the biological and physiological requirements of orchids. These conditions enhance essential physiological processes such as transpiration, photosynthesis, and nutrient uptake, resulting in higher overall growth rates.

In contrast, open-air areas tend to experience higher air temperatures, which lead to reduced relative humidity due to their inverse relationship. Such hot and dry conditions impose environmental stress on orchids, increasing water loss, reducing photosynthetic efficiency, and ultimately limiting overall plant growth.

Therefore, this research emphasizes that effective environmental management particularly through shading to reduce temperature and maintain adequate humidity is crucial for promoting sustainable orchid growth. Academically and practically, the findings highlight that avoiding hot and dry conditions is not merely a recommendation but a fundamental requirement for successful orchid cultivation.

Bibliography

Aradee Sawatcharin & Warunee Thiramongkol. (2003). Orchid and Ornamental Plant Cultivation Using Lightweight Ceramic Products: Final Research Report. TU Digital Collections.

Somchai Arayaprayoon. (2015). Research Report on Orchids. Maejo University.

Department of Agriculture. (2017). Orchid Cultivation and Maintenance. Bangkok: Ministry of Agriculture and Cooperatives.