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BIOCHEMICAL DEFENSES OF MANGROVE PLANTS AGAINST VARYING PHYSICO-CHEMICAL FACTORS OF SEAWATER IN BANG SAI DISTRICT, CHONBURI, THAILAND

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Abstract

Determining the biochemical compounds used by Red mangrove (*Rhizophora mangle*) and Tall-stilt mangrove (*Rhizophora apiculata*) against various physicochemical factors in the seawater is the main goal of this current investigation. Using the standard equipment from Extech, the researchers characterized several physico-chemical factors of the seawater in Bang Sai, Chonburi such as water temperature, TDS, dissolved oxygen, electrical conductivity, salinity, transparency, water pH, air temperature, and relative humidity. Based on the experimentations, results and gathered data, the researchers discovered that there was a significant difference ($p < 0.05$) in all of the physico-chemical factors measured in the natural habitat of mangroves in Bang Sai, Chonburi, Thailand such as water temperature, transparency, dissolved oxygen, total dissolved solids, electrical conductivity, water pH, air temperature, salinity, and relative humidity. Moreover, the selected mangroves contain diverse biochemical compounds that protect them from varying physico-chemical conditions in their habitat. For the improvement of the study, the researchers recommended conducting further research to evaluate the other parameters in the seawater and expanding the investigations to more locations in Bang Sai, Chonburi for the current physico-chemical factors that could affect the survival of various mangrove species in the intertidal zones.

Keywords: Biochemical defenses, Physico-chemical factors, mangrove

Research Questions

1. Is there a significant difference in the physico-chemical factors of seawater where selected mangroves are thriving in Bangsai, Chonburi coastal area?
2. What are the biochemical defenses of the selected mangroves against varying physico-chemical factors of seawater?

Hypotheses

Alternative: There is a significant difference in the physico-chemical factors in the seawater of Bangsai, Chonburi, Thailand and the selected mangroves possess various biochemical defenses against varying physico-chemical factors of seawater.

Null: There is no significant difference in the physico-chemical factors in the seawater of Bangsai, Chonburi, Thailand and the selected mangroves do not possess various biochemical defenses against varying physico-chemical factors of seawater.

Introduction

The coastal area of Bangsai District, Chonburi, Thailand contains diverse species of mangroves that thrives well from the past to its present condition. Despite the drastic changes due to economic activities in the place, the mangrove plants manifested resilience and adaptability to their ever-changing environment. Plains and littoral areas constitute the majority of the district's overall landscape. As a result of these geographical qualities, this area has experienced a variety of natural phenomena such as storm surges, tidal variations, sedimentation, sea level rise, and so on. Anthropogenic activities such as urbanization, residential sewage, and other economic activity in the catchment area cause variations in the physicochemical parameters of saltwater, resulting in a worsening of water quality (Verma et al., 2012). Water quality indicates the relation of all hydrological properties including physical, chemical and biological properties of the water body. Hence, water quality assessment involves analysis of physico-chemical, biological and microbiological parameters that reflects the biotic and abiotic status of ecosystem (Smitha, 2013).

With the constant change in their habitat, the mangrove plants have to produce substances that are essential for their survival (Briskin, 2000). As stated in the book of Guevara, et al., 2005; plants produce a great number of compounds of various chemical structures known as secondary metabolites which plants utilize to counteract the adverse effects of various factors around them. These are constituents present in smaller quantities in the plant but are of high value compared to the primary metabolites. Secondary compounds, often unique to a particular species, include the alkaloids, the steroids, flavonoids, tannins, and others. These compounds are highly significant because they act as anti-feedants, sex attractants, or antibiotics. Currently, the area experienced drastic change due to urbanization and other human activities like building new bridges and improper waste disposal. This could lead to imbalance of the ecosystem and generate pollutants that can affect the physicochemical and biological quality of the area.

The situations stated above prompted the researchers to conduct a study entitled "Biochemical Defenses of Mangroves against Varying Physicochemical Factors of Seawater in Bang Sai District, Chonburi, Thailand". This study aimed to characterize the physico-chemical factors surrounding the mangroves in the area as well as evaluate the secondary compounds produced by the plants that helps them to survive continuously.

Research Methodology

A. study site
The study site is located at Bang Sai Park. Latitude 13°23'02"N, Longitude 100°59'00"E

FIGURE 1. The study site at intertidal zones of Bang Sai, Chonburi, Thailand.

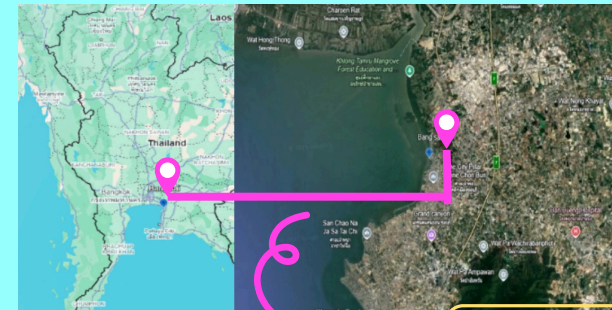


FIGURE 2. The study site at Bang Sai, Chonburi, Thailand.



FIGURE 3. Assessing the physico-chemical factors of seawater.



B. Survey and Preparation of Materials

C. Evaluation of Physio-chemical Factors of Seawater

FIGURE 4. Collecting the leaves of mangrove plants.



FIGURE 5. Phytochemical screening of the biochemical compounds of mangrove plants.



Results

Figure 6. Globe Data Entry for air temperature.

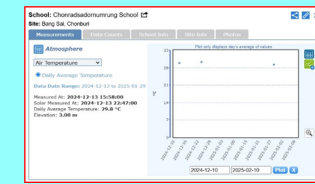


Figure 8. Globe Data Entry for relative humidity.



Figure 10. Globe Data Entry for water temperature.

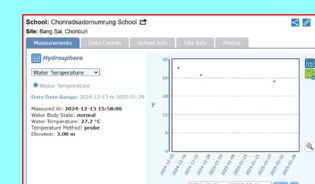


FIGURE 12. Average Water temperature (°C) in Bang Sai.

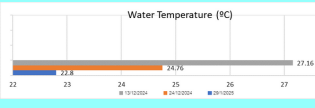


FIGURE 14. Average TDS (ppm) in Bang Sai.

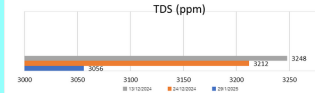


FIGURE 16. Average water pH in Bang Sai.

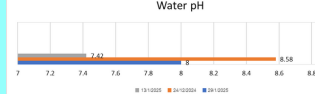


FIGURE 18. Average relative humidity (%) in Bang Sai.

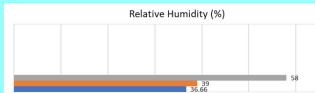


FIGURE 20. Average air temperature (°C) in Bang Sai.

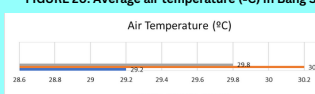


TABLE 1. The average results of physico-chemical factors measured from Bang Sai, Chonburi, Thailand.

	13 Dec. 2024 (4:00 PM)	24 Dec. 2024 (4:20 PM)	29 Jan. 2025 (2:30 PM)
Water Temperature (°C)	27.16	24.76	22.80
Dissolved Oxygen (mg/L)	2.04	2.63	1.75
TDS (ppm)	3248	3212	3056
Electrical Conductivity (µS/cm)	6424	6412	6201
Transparency (m)	0.20	0.25	0.13
Water pH	7.42	8.58	8.00
Salinity (%)	34.30	34.60	35.33
Water color	Turbid	Turbid	Turbid
Relative Humidity (%)	58.00	39.00	36.66
Air Temperature (°C)	29.80	30.20	29.20

Figure 7. Globe Data Entry for dissolved oxygen.

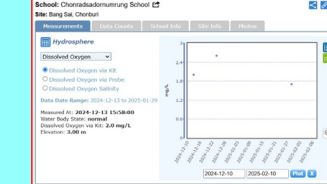


Figure 9. Globe Data Entry for water pH.

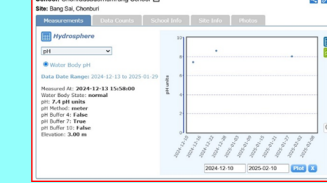


Figure 11. Globe Data Entry for integrated hydrology.

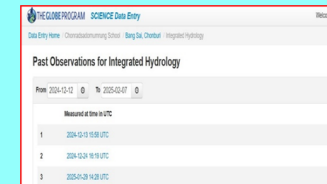


FIGURE 13. Average Dissolved Oxygen (mg/L) in Bang Sai.

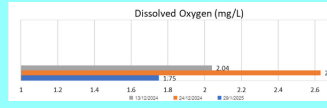


FIGURE 15. Average electrical conductivity (µS/cm) in Bang Sai.

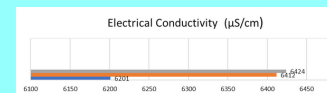


FIGURE 17. Average water transparency (m) in Bang Sai.

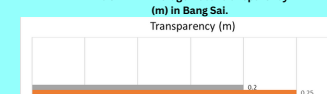


FIGURE 19. Average salinity level (%) in Bang Sai.



TABLE 2. The result of Phytochemical screening of the secondary compounds of mangrove plants.

Phytochemicals	Red Mangrove	Tall-stilt mangrove
Alkaloids	Positive	Positive
Saponins	Negative	Negative
Tannins	Positive	Positive
Phenolic Compounds	Positive	Positive
Flavonoid	Positive	Positive
Leucoanthonyins	Positive	Negative

Conclusion

Based on the experimentations, results and gathered data, the researchers concluded that there was a significant difference ($p < 0.05$) in all of the physico-chemical factors measured in the natural habitat of mangroves in Bang Sai, Chonburi, Thailand such as water temperature, transparency, dissolved oxygen, total dissolved solids, electrical conductivity, water pH, air temperature, salinity, and relative humidity. Furthermore, the selected mangroves contain diverse biochemical compounds that protect them from varying physico-chemical conditions in their habitat.

Recommendations

For the improvement of the study, the researchers recommended conducting further research to evaluate the other parameters in the seawater and expanding the investigations to more locations in Bang Sai, Chonburi for the current physico-chemical factors that could affect the survival of various mangrove species in the intertidal zones.

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