Chonradsadornumrung School

Correlation between Soil Quality and Biological Activities of Selected Plants in Coastal Zone of Samet, Chonburi, Thailand

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Abstract

Investigating the correlation between soil quality and biological activities of selected plants in coastal zone of Samet, Chonburi, Thailand is the main aim of the current environmental and biological research. The physicochemical factors of the soil were tested using the standard equipment from Extech. The extracts of the experimental plants were used for various screening to discover the capacity of the plant in inhibiting the growth of microorganisms and other plants like *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Saccharomyces cerevisiae*, and *Rhizopus nigricans*. The results of various experiments were observed, gathered, and compared using one-way ANOVA and Tukey HSD Test. Based on the experimentations, results and gathered data, the researchers concluded that there was a correlation between soil quality and biological activities of the selected plants in coastal zone of Samet, Chonburi, Thailand. The higher amount of soil nutrients enabled the plants to produce substances that yield to various biological activities. Moreover, there are significant differences ($p<0.05$) in soil temperature (5cm and 10cm depth) and relative humidity except for soil pH and air temperature ($p>0.05$). In addition, more research will be conducted to evaluate the other soil parameters and other biological activities of the experimental plants.

Keywords: Soil parameter, Biological Activity, and ANOVA

Research Questions

1. Is there a correlation between the soil quality and biological activities of selected plants in Samet, Chonburi, Thailand?
2. Is there a significant difference in soil parameters measured in coastal zone of Samet, Chonburi, Thailand?
3. What biological activity is possessed by Portia Tree (*Thespesia populnea*) and Tall-Stilt Mangrove (*Rhizophora apiculata*)?

Hypotheses

Alternative: There is a correlation between soil quality and biological activities of selected plants in Samet, Chonburi, Thailand and there is a significant difference in soil parameters measured in coastal zone of Samet, Chonburi, Thailand.

Null: There is no correlation between soil quality and biological activities of selected plants in Samet, Chonburi, Thailand and there is a significant difference in soil parameters measured in coastal zone of Samet, Chonburi, Thailand.

Introduction

Chonburi, an eastern coastal city, is well known for its rapid economic growth. As a result, various infrastructures have been constructed, including factories, bridges, and buildings. Moreover, living standards have greatly improved, which is advantageous to the locals. In addition, Chonburi boasts over 10,373 acres of mangrove forest, which is among the largest in the country (Department of Marine and Coastal Resources, 2018). Mangrove forests possess abundant natural resources and spectacular life forms. Plants like mangroves, produce various substances like secondary metabolites that protect them from microbial pathogens and abiotic stresses in their environment (Schafer et al., 2009). These compounds are also responsible for plants biological activities that are also beneficial to human beings. The production of these valuable compounds is linked to the nutrients that plant absorb from the soil. Previous research emphasized that reasonable proportion of nutrition (NPK) factors directly promote the absorption and assimilation of plants, thereby affecting their growth and development (Yildirim et al., 2011). However, the intensity of anthropogenic activities may have had an immense impact on the survival of plant especially, in terms of their nutrient absorption which has great impact on their growth and development. Given the rapid changes occurring in the coastal area of Samet, Chonburi, Thailand that could affect the diversity of life particularly the plants, it is imperative to evaluate the soil quality of this place.

The situations above prompted the researchers to conduct environmental research entitled "Correlation between Soil Quality and Biological Activities of Selected Plants in Coastal Zone of Samet, Chonburi, Thailand. This current study aimed to determine if there is correlation between the quality of soil and biological activities of the two selected plants namely Portia Tree (*Thespesia populnea*) and Tall-Stilt Mangrove (*Rhizophora apiculata*) that are abundant in the area.

Research Methodology

A. Study Site

B. Survey and preparation of Materials

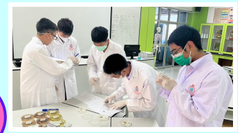
C. Soil Quality Testing

D. Screening for the Allelopathic Potential of Experimental Plants.

E. Agar Diffusion Test/ Kirby-Bauer Antibiotic Testing/ Antibacterial Screening

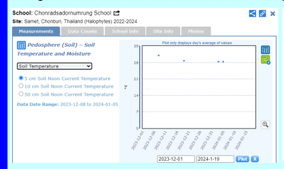
F. Agar Diffusion Test/Antifungal Screening

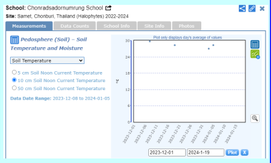
G. Analysis of data



Results

The figures below show the data encoded on Globe web page from December 2023 to January 2024.





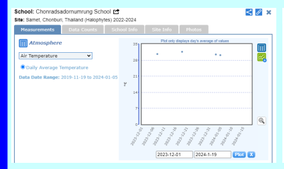


TABLE 1. Average results of soil characterization measured in coastal zone of Samet, Chonburi, Thailand.

Parameters	8 Dec. 2023 (4:20 PM)	19 Dec. 2023 (5:15 AM)	3 Jan. 2024 (4:30 PM)	5 Jan. 2024 (4:20 PM)
Soil pH	6.33	4.73	5.06	5.6
Soil Temperature (5 cm)	31	28.67	28.33	28.33
Soil Temperature (10 cm)	29.67	28.33	27	28.33
Relative Humidity (%)	65.33	48.33	49.33	51
Air Temperature (°C)	30.87	31.6	30.4	30.07
Soil Color	Gray	Gray	Gray	Gray
Soil Texture	Clay	Clay	Clay	Clay
Soil Consistency	Firm	Firm	Firm	Firm
Soil Moisture	Wet	Wet	Wet	Wet
Nitrogen (N)	High	High	High	High
Phosphorus (P)	High	High	High	High
Potassium (K)	High	High	High	High

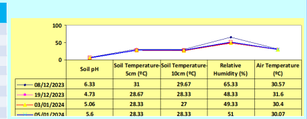


FIGURE 1. Average results of all soil parameters measured in coastal zone of Samet, Chonburi.

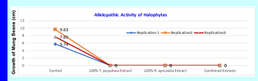
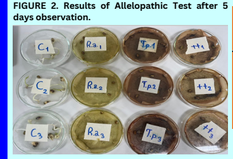


FIGURE 2. Results of Allelopathic Test after 5 days observation.

TABLE 2. Average zone of inhibitions of the plants against *Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Saccharomyces cerevisiae*, and *Rhizopus nigricans*.

Treatments	*B. subtilis* (mm)	*S. aureus* (mm)	*E. coli* (mm)	*S. cerevisiae* (mm)	*R. nigricans* (mm)
+ Control	58.5	54.4	61.40	36.10	42
- Control	0	0	0	0	0
T. populnea	10.4	0	6.43	0	0
R. apiculata	7.7	6.20	14.10	0	0
Combined Extracts	17.3	6.30	8.40	0	0



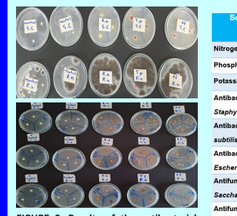


FIGURE 3. Results of the antibacterial and antifungal testing using the ethanolic extracts of selected plants.

Table 3. Soil Quality and Biological Activities of Selected Plants

Soil Quality and Biological Activities	*Thespesia populnea*	*Rhizophora apiculata*	Combined Extracts
Nitrogen (N)	High	High	High
Phosphorus (P)	High	High	High
Potassium (K)	High	High	High
Antibacterial Activity against *Staphylococcus aureus*	+	-	+
Antibacterial Activity against *Bacillus subtilis*	+	+	+
Antibacterial Activity against *Escherichia coli*	+	+	+
Antifungal Activity against *Saccharomyces cerevisiae*	-	-	-
Antifungal Activity against *Rhizopus nigricans*	-	-	-
Allelopathic Potential	+	+	+

Conclusion

Based on the experimentations, results and gathered data, the researchers concluded that there was a correlation between soil quality and biological activities of the selected plants in coastal zone of Samet, Chonburi, Thailand. Moreover, there are significant differences ($p<0.05$) in soil temperature (5cm and 10cm depth) and relative humidity except for soil pH and air temperature ($p>0.05$).

Recommendations

For the improvement of the study, further research will be conducted to evaluate the other soil parameters in Samet, Chonburi, Thailand also more biological activities of the plants will be investigated. Moreover, the phytochemical compounds of the plants will be evaluated.

Acknowledgment

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