

Comparison of soil characteristics and properties that affect the biodiversity of termites in the coconut plantation and oil palm plantation in Hua Sai Sub-district, Hua Sai District, Nakhon Si Thammarat Province.

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Abstract

This study investigates the influence of physicochemical soil factors on termite biodiversity in coconut and oil palm plantations in Hua Sai District, Nakhon Si Thammarat Province, Thailand. Soil and termite samples were analyzed from six study sites using GLOBE protocols for physical characteristics and standard methods for chemical properties (pH, N, P, and K). The results indicated that while soils in both plantations exhibited granular structures, they differed significantly in texture and moisture content. Coconut plantation soil was characterized as silty loam with lower moisture ($28.59 \pm 1.44\%$), whereas oil palm plantation soil was clay loam with significantly higher moisture ($47.78 \pm 7.21\%$). Two termite species from the family Termitidae were identified: *Macrotermes gilvus* and *Microcerotermes minutus*. Notably, *M. gilvus* was restricted to the high-moisture oil palm environment, while *M. minutus* occurred in both habitats. Statistical analysis confirmed that average soil temperature, pH, and nutrient levels did not differ significantly between the sites ($p > 0.05$). These findings suggest that soil texture and moisture are the primary determinants of termite distribution in these agroecosystems. Specifically, *M. gilvus* requires high soil moisture, whereas *M. minutus* demonstrates broader ecological tolerance. This research contributes valuable baseline data for ecosystem conservation and agricultural soil management.

Keywords: Soil properties, termite, *Macrotermes gilvus*, *Microcerotermes minutus*, Nakhon Si Thammarat

Introduction



Research Questions

Did the physical characteristics and soil properties of different areas between coconut plantations and oil palm plantations affect the biodiversity of termite species in each area? How?

Hypothesis

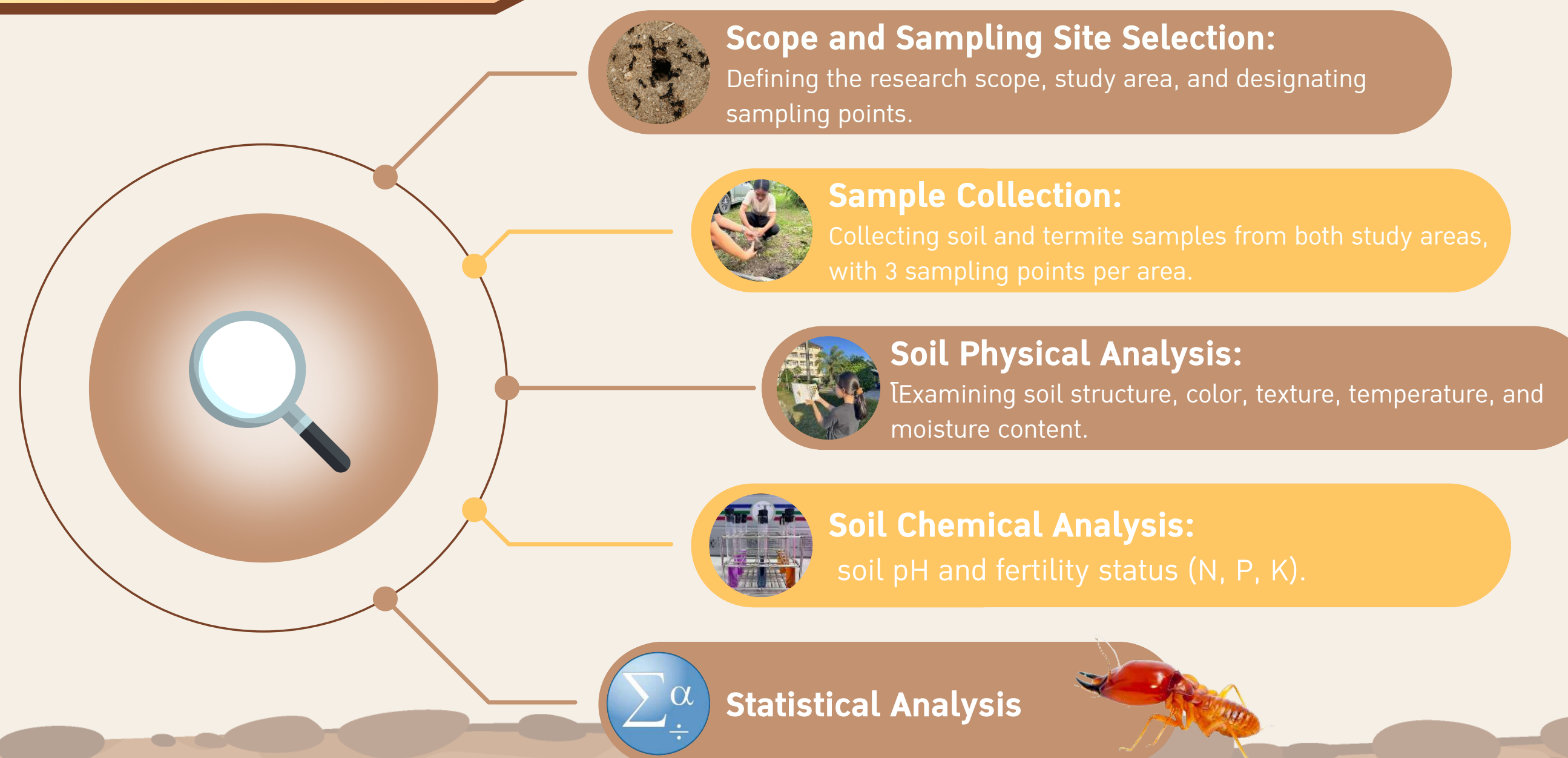
Distinct soil physical and chemical profiles in coconut versus oil palm plantations are expected to result in disparate termite species assemblages.

Study site

coconut plantation and oil palm plantation in Hua Sai Sub-district, Hua Sai District, Nakhon Si Thammarat Province.



Methodology



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Results

1. Physical Characteristics of Termite Mounds

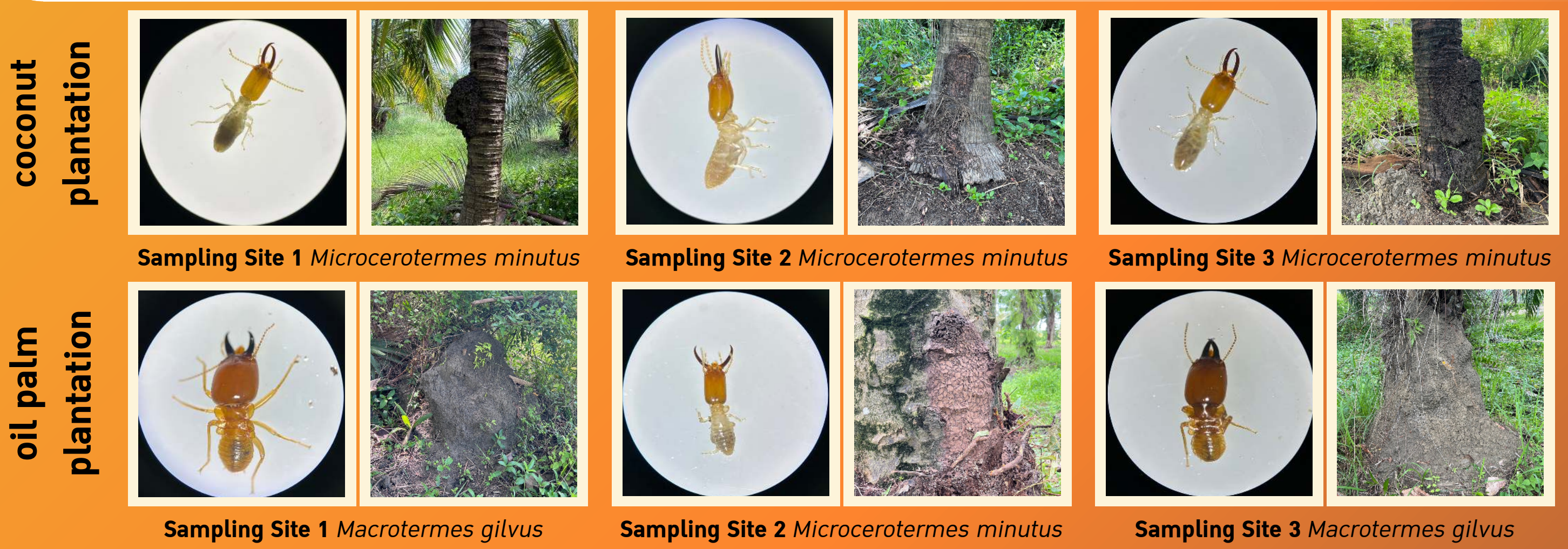
Table 1 Dimensions of termite mounds and termite species identified in coconut and oil palm plantations.

Study Area	Sampling Site	Mound Height ^a (m)	Mound Width ^b (m)	Height Above Ground ^c (m)	Cardinal Direction	Termite Species	Feeding Group
Coconut Plantation	1	0.37	0.40	0.89	North	<i>M. minutus</i>	W
	2	0.38	0.17	0.05	West	<i>M. minutus</i>	W
	3	0.54	0.27	0.08	Northwest	<i>M. minutus</i>	W
Mean ± S.D.		0.430 ± 0.095	0.280 ± 0.115	0.340 ± 0.477			
Oil Palm Plantation	1	0.87	1.20	0.00	North	<i>M. gilvus</i>	F
	2	0.45	0.23	0.64	North	<i>M. minutus</i>	W
	3	1.21	1.23	0.00	West	<i>M. gilvus</i>	F
Mean ± S.D.		0.843 ± 0.381	0.887 ± 0.569	0.213 ± 0.370			

Remarks: ^aValues are presented as Mean ± Standard Deviation (S.D.) derived from the total experiment with 2 replicates per sampling site.
^bTermite Feeding Groups: W = Wood-feeder, F = Fungus-grower.
^c*** indicates no significant difference at the 95% confidence level ($p > 0.05$).



2. Morphology of termite mounds and termite species identified in the six study sites.



3. Physical properties of soil surrounding termite mounds in coconut and oil palm plantations.

Table 2 Physical properties of soil surrounding termite mounds in coconut and oil palm plantations.

Physical Parameters	Study Area	
	Coconut Plantation	Oil Palm Plantation
Soil Structure	Granular	Granular
Soil Texture	Silty loam	Silty clay loam
Soil Color	Grayish brown - Dark grayish brown	Dark gray - Dark grayish brown
Soil Temperature (°C)		
Depth 5 cm	28.97 ± 0.301	29.14 ± 0.201
Depth 10 cm	28.56 ± 0.326	28.57 ± 0.287
Soil Moisture Content (%)	28.59 ± 1.440 ^a	47.78 ± 7.210 ^a

Remarks: ^a Values for temperature and moisture content are presented as Mean ± Standard Deviation (S.D.)
^b Different superscript letters (^{a, b}) in the same row indicate a significant difference at the 95% confidence level ($p < 0.05$).

4. Chemical properties of soil surrounding termite mounds in coconut and oil palm plantations.

Table 3 Chemical properties of soil surrounding termite mounds in coconut and oil palm plantations.

Study Area	Sampling Site	Replicate	pH ^a	Soil Nutrient Status		
				N	P	K
Coconut Plantation	1	1	7.00	Very low	High	Very low
		2	6.50	Very low	Very low	Very low
	2	1	6.50	Very low	Medium	Very low
		2	6.50	Very low	High	Very low
	3	1	7.00	Very low	Very low	Very low
		2	7.00	Very low	Very low	Very low
Mean ± S.D.			6.75 ± 0.112	Very low	Very low	Very low
Oil Palm Plantation	1	1	7.00	Very low	Very low	Very low
		2	7.00	Very low	Very low	Very low
	2	1	7.00	Very low	High	Very low
		2	7.00	Very low	Very high	Very low
	3	1	7.00	Very low	Low	Very low
		2	6.50	Very low	High	Very low
Mean ± S.D.			6.92 ± 0.083	Very low	Low	Very low

Remarks: ^a Values for pH are presented as Mean ± Standard Deviation (S.D.)
^b *** indicates no significant difference at the 95% confidence level ($p > 0.05$).
^c Nutrient levels (N, P, K) are interpreted based on standard soil fertility guidelines.

Conclusion

- Termite Identification:** Two species from the family Termitidae were identified: *Macrotermes gilvus*, found in oil palm sites 1 and 3, and *Microcerotermes minutus*, found in all coconut sites and oil palm site
- Physical Properties:** Both areas exhibited granular soil structures but differed in texture. Coconut soil was silty loam (grayish brown), while oil palm soil was silty clay loam (dark gray) with significantly higher moisture content ($p < 0.05$).
- Soil temperatures** showed no significant variation. Chemical Properties: Soil pH and fertility status showed no significant differences between the two plantations, indicating similar chemical environments in both ecosystems.

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