

Diversity of Termite Species Based on Building Age in Balik Bukit District, West Lampung – Lampung

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ABSTRACT

Termites in nature operate as cellulose decomposers, giving vital ecosystem services to nature, but they may also inflict significant damage to building structures. The durability of the wood construction of the building decreases with age, and the possibility of termite infestation increases. This study is a descriptive-analytic study that uses quantitative research methodologies and a cross-sectional research design. The study was carried out between May and July 2022 in Balik Bukit District, West Lampung Regency - Lampung. Building data gathering techniques were used by delivering questionnaires to 100 building owners utilizing accidental sampling techniques. Termites were discovered at the age of the building of more than 26 years, with the finding of four types of termites, namely *Macrotermes gilvus* (Hagen), *Bulbitermes constrictiformis* (Holmgren), *Schedorhinotermes mediobcorus* (Holmgren), and *Coptotermes gestroi* (Wasmann).

Keanekaragaman Jenis Rayap Berdasarkan Umur Bangunan Di Kecamatan Balik Bukit, Lampung Barat – Lampung

ABSTRAK: . Rayap di alam bertugas sebagai pengurai bahan selulosa, menyediakan jasa ekosistem yang berharga bagi alam, namun mereka juga dapat menyebabkan sejumlah besar kerusakan pada struktur bangunan. Semakin tua umur bangunan maka keawetan konstruksi kayu yang ada di dalamnya cenderung menurun dan potensi serangan rayap akan semakin meningkat. Penelitian ini merupakan penelitian analisis deskriptif menggunakan metode penelitian kuantitatif dengan desain penelitian cross sectional. Penelitian dilakukan pada bulan Mei – Juli 2022 di Kecamatan Balik Bukit, Kabupaten Lampung Barat – Lampung. Teknik pengumpulan data bangunan menggunakan teknik accidental sampling dengan menyebarkan kuesioner pada 100 bangunan. Titik ditemukan rayap adalah pada umur bangunan >26 tahun dengan ditemukannya empat jenis rayap yaitu *Macrotermes gilvus* (Hagen), *Bulbitermes constrictiformis* (Holmgren), *Schedorhinotermes mediobcorus* (Holmgren), *Coptotermes gestroi* (Wasmann)

INTRODUCTION

Termites (order: Isoptera) are generally referred to as "*anai-anai*" by locals and can be found in a variety of environments, including forest ecosystems, agricultural plantations, and residential or urban ecosystems (Tarumingkeng, 2001). Termites are the primary agents in the decomposition process, and organic matter plays a role in the nutrient cycle process (Vargo, 2019). Termites are found in tropical and subtropical environments (Su et al., 2000). (Enagbonma et al., 2019). The quantity of vegetation also influences termite dispersal, closely tied to temperature and rainfall, so most termites are found in the tropical lowlands and just a tiny fraction in the tropical highlands (Aini et al., 2006); (Le et al., 2020).

Termites contribute to ecosystem production capacity through energy flow, decomposition, and mineralization of nutrients from various organic matter sources, buffering functions, and soil resistance to risks of environmental change and aiding in the long-term supply of nutrients (Zulkaidhah et al., 2021). Termites degrade cellulose materials as well, but they can also harm structural structures significantly (Nandika et al., 2021). In the United States, homeowners spend more than USD 11 billion each year on termite control and damage restoration (Rust & Su, 2012); (Fagundes et al., 2021); (Felicitas et al., 2018).

Humid climatic conditions, high rainfall and temperatures, and many destructive biological elements such as termites and fungi drive the reduction in building material quality in Indonesia. In Indonesia, it is estimated that most of the damage to buildings is caused by damaging factors that are not given much attention, namely water and living things such as termites and fungi (Aini et al., 2006); (Alamu et al., 2018); (Zulkaidhah et al., 2021). According to the Indonesian home-building sector, termite attacks account for 12.5% of total housing construction expenditures

each year (Rachmawati, 1996); (Pratiknyo & Setyowati, 2020); (Abdul & Zulkaidhah, 2019).

Damage to older buildings is more common. The endurance of the wooden construction inside the building decreases with age, and the risk of termite attack increases (Hasman et al., 2019); (Sitorus et al., 2018); (Arif et al., 2020). West Lampung is a perfect site for termites to dwell and thrive due to the temperature and humidity (Pemerintah Kabupaten Lampung Barat, 2018). As a result, a study on the diversity of termite species in buildings based on the age range of buildings in Balik Bukit District, West Lampung Regency, is required.

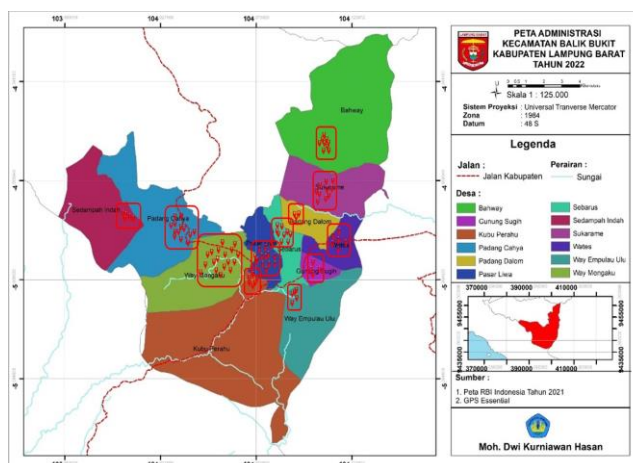


Figure 1. Research Site

METHOD

This study is a descriptive-analytic study that uses quantitative research methods and a cross-sectional research design. The study was carried out in Balik Bukit District, West Lampung - Lampung Regency, from May to July 2022. The building data collection technique employs the accidental sampling technique, which entails distributing questionnaires to each dwelling or building that the researcher has chosen to serve as a sample.

The subjects of this study were 100 households dispersed throughout two Sub-Districts and ten Pekon/Villages in Balik Bukit District. Building data for West Lampung Regency was gathered from the Central Bureau of Statistics for 2020. The specimen collection approach employs an

active collection strategy in which collectors actively participate in the insect collection process. Hand-gathering is the most basic method of collecting insects (Trianto et al., 2020).

The termite identification technique was carried out by observing the morphology of termite castes such as the head, mandible, pronotum, antenna segments, and sersi using a termite identification key based on Tho (1992) Nandika et al., (2003) Ahmad (1958). The Shannon-Wiener index (Odum, 1971) was employed in data analysis to estimate the value of termite diversity discovered.

RESULTS AND DISCUSSION

The Physical Condition of the Site

The Balik Bukit District is located in the West Lampung Regency. As shown in Figure 1, this site comprises two sub-districts and ten *pekon*/villages. The sub-district covers 175.63 Km² (17,563 Ha) (Pemerintah Kabupaten Lampung Barat, 2018).

Based on observations of the houses used as research samples, it was discovered that the conditions of the buildings differed substantially. The first criterion is that there exist structures in the Village/Pekon Sebarus that are still in their original 1937 condition, with many locations of a termite attack inside (inactive) and outside the building (active) Figure 2(b). Buildings over 85 years old have seen a significant reduction in the integrity of their structural components due to physical (weather and corrosion), mechanical (cracked and broken), and biological (termites and moss) elements, as seen in Figure 2.

The second criterion is that the house is occupied, but the owner is unconcerned about it. Buildings that receive little or no upkeep are more prone to be attacked by termites. This is owing to the house's state, which includes numerous piles of dead wood in the surrounding region. As

indicated in Figure 3, Figure 3a can be a food source for termites to live and breed.



Figure 2. Termite Attack on 85-Year-Old Building



Figure 3. Termite Attack on Building Structures

The third problem is that there are houses that the owners rarely occupy. Thus little attention is paid to the building, and weathering or corrosion happens in some areas of the house, such as pillars, doors, windows, and so on. These factors cause the appearance of termites in structures due to the condition of the house, which is seldom cleaned, and humidity conditions, which are extremely high due to the house's very limited access to sunlight, as shown in Figure 4.

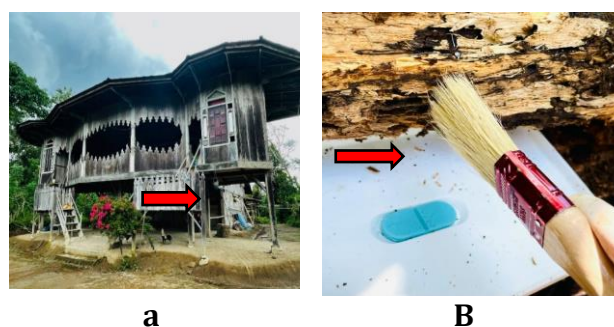


Figure 4. Termite Attack on Houses on Stilts

Termites are considered wood-destroying insects because some species live and feed on wood (Nandika, et al., 2003).

The eating behavior of termites in the field is determined by the location of the colony and the number of populations present. Termite species can influence the severity of damage to attacked building components (Vargo, 2019);(Enagbonma et al., 2019). For example, in the *Macrotermes gilvus* (Hagen) termite colony illustrated in Figure 6, the termites build their nests in the ground and do not use wood as a substrate for nesting; wood (cellulose) is only used as a source of food and nutrition for these termites (Nandika et al., 2021);(Tarigan et al., 2018). As a result, the intensity of this type of termite attack is relatively low compared to other forms of termites (Witasari et al., 2022). When termites are faced with numerous food options, they will select the food they like and abandon other food sources. In addition to the species of termites, the age of the building might influence the extent of termite damage to the residence (Hanantatur, 2018).

Findings of Termite Types in Balik Bukit District

Based on observations from a total of 100 structures, only 61 were attacked by termites, with 31 actively attacked (termite individuals discovered) and 30 inactively attacked (termite individuals were not found). *Macrotermes gilvus* (Hagen), *Bulbitermes constrictiformis* (Holmgren), *Schedorhinortermes mediobcorus* (Holmgren), and *Coptotermes gestroi* (Wasmann) were discovered in aggressively attacked buildings. This termite is a termite that is commonly found in residential constructions.



Figure 5. Major soldier caste (a), minor soldier caste (b), and worker caste (c) of *Macrotermes gilvus* (Hagen)

M. gilvus (Hagen) is a termite that is very easy to find around plantations and residential areas. This type of termite is very easy to recognize from the shape of its distinctive nest, which is a mound of soil that emerges from the ground, as shown in Figure 6. The structure of the nest is quite hard because the outer part of the nest is composed of a hard clay mixture.

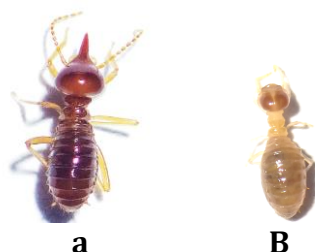


Figure 6. Soldier caste (a) and worker caste (b) of *Bulbitermes constrictiformis* (Holmgren)



Figure 7. Major soldier caste (a), minor soldier caste (b), and worker caste (c) of *Schedorhinortermes mediobcorus* (Holmgren)

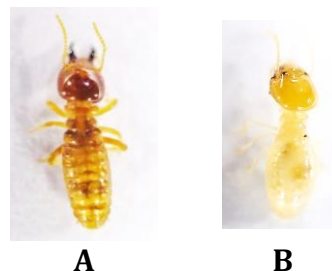


Figure 8. The soldier caste (a) and the worker caste (b) of *Coptotermes gestroi* (Wasmann)

According to field observations, the termite *S. mediobcorus* (Holmgren) was only discovered in the Bahwy Village/Pekon area, as shown in table 2. These termites were discovered in only one region of the total sample examined.

Table 1. Distribution of Termite Types in Buildings in Balik Bukit District

No	Village/Pekon	Termite Types				
		1	2	3	4	5
1	Bahway	I	I	III	-	-
2	Gunung Sugih	IV	IV	-	-	-
3	Kubu Perahu	I	I	I	-	-
4	Padang Cahya	II	IV	I	-	-
5	Padang Dalom	II	I	-	-	-
6	Pasar Liwa	IV	IV	IV	I	-
7	Sebarus	IV	I	I	-	-
8	Sedampah Indah	I	-	-	-	-
9	Sukarame	I	I	-	-	-
10	Watas	I	-	-	-	-
11	Way Empulau Ulu	IV	IV	-	-	-
12	Way Mengaku	II	IV	IV	I	I

Description: *M. gilvus* (Hagen) (I), *B. constrictiformis* (Holmgren) (II), *S. mediobcorus* (Holmgren) (III), *C. gestroi* (Wasmann) (IV)

According to the research findings, housing quality has diminished because all aspects of the structure have been utilized for a long time. Various causes, including physical, mechanical, and biological variables, can cause a loss in building quality. One building renewal type is replacing broken or long-used building elements.

The community most frequently encounters the physical aspect among the causes that destroy the structure, as stated (Nuswantoro & Raya, 2018). The physical element is the material's ability to accept external environmental stimuli. Hot weather, cold weather, and rust are all examples. Aside from physical issues, biological elements also play a role in the extent of damage to buildings (Luth, 2020).

According to the findings of a study conducted in the Balik Bukit District, the maximum number of locations discovered by termites was at buildings older than 26 years, with the discovery of four varieties of termites, namely *Macrotermes gilvus* (Hagen), *Bulbitermes constrictiformis* (Holmgren), *Schedorhinortermes mediobcorus* (Holmgren), and *Coptotermes gestroi* (Wasmann).

Table 2. Distribution of Termite Species in Various Age Ranges of Buildings in Balik Bukit District

No	Building Age (Year)	Termite Types	Finding	Total
1	<13	<i>M. gilvus</i>	4	4
2	13-16	<i>M. gilvus</i> <i>C. gestroi</i>	6 7	13
3	>26	<i>M. gilvus</i>	5	14

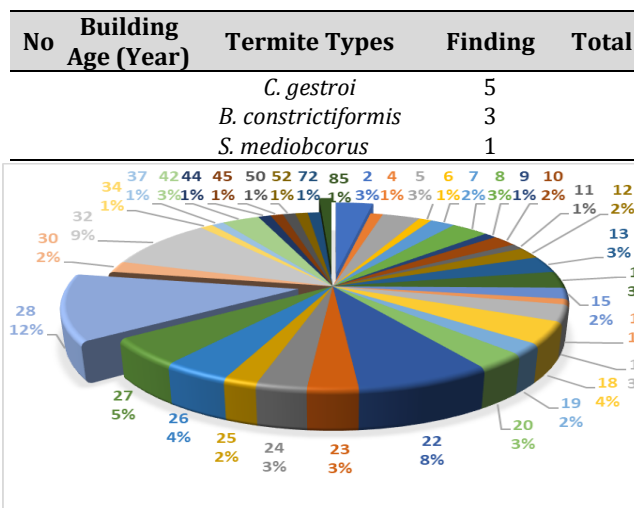


Figure 9. The Percentage of Building Age

Based on the data collected, it is estimated that biological forces, specifically termite attacks, cause around 30% of the damage to residential buildings.

This finding is consistent with Adytia & Syaokani (2017) assertion, where nuisance creatures such as termites and ants, based on research in general, can be assumed that termites have attacked roughly 10% of buildings in the tropics.

According to the study's findings, (40%) of the residents' houses at the observation sample locations were between the ages of 21 and 30 years, followed by houses between the ages of 11 and 20 years (24%), buildings between the ages of 32 and 50 years (17%), buildings between the ages of 2 and 10 years (16%), and buildings between the ages of 52 and 85 years (3%). According to the total number of buildings observed, 100 sample houses spread across 12 villages/Pekon in Balik Bukit District, 12% of buildings are 28 years old, as shown in Figure 9. This is due to the earthquake that occurred in West Lampung in 1994, which had a significant impact on the building of people's houses, as many people's houses were destroyed by the shock of the earthquake, which was quite large, so many people rebuilt their houses that year.

The quality of house buildings has declined since all aspects of the building have been used for an extended period; the

fall in building quality can be caused by various variables, including physical, mechanical, and biological issues (Leuser et al., 2022). One type of building renewal that is carried out is the replacement of broken or long-used building elements (Ibrahim, 2021);(Meidianto et al., 2019).

Based on the data collected, it is estimated that biological forces, specifically termite attacks, cause around 30% of the damage to residential buildings. This is consistent with the assertion of Sulantika dan Diba (2019), where nuisance creatures such as termites and ants, based on general studies, it can be assumed that termites have attacked roughly 10% of buildings in the tropics.

The Results of Termite Diversity Analysis

Analysis of termite diversity data in Balik Bukit District was conducted using the Shanon-WIENER index, as presented in Table 3.

Table 3. Diversity Value

No	Type of Termites	Individual Number	ni/N	Inni/N	H'
1	I	16	0.516	-0.661	-0.341
2	II	1	0.032	-3.433	-0.110
3	III	11	0.354	-1.036	-0.367
4	IV	3	0.096	-2.335	-0.226
		31			1.046

Description: *M. gilvus* (Hagen) (I), *B. constrictiformis* (Holmgren) (II), *S. mediobcorus* (Holmgren) (III), *C. gestroi* (Wasmann) (IV)

According to Table 3, the *Macrotermes gilvus* (Hagen) termite dominated the four termite species detected in 31 buildings in the Balik Bukit District, with the *Schedorhinortermes mediobcorus* (Holmgren) termite ranked the lowest. Based on the Shanon-Wiener index calculation, the number 1H'3 is derived, indicating that termite diversity in the area is moderate. The temperature and humidity in Balik Bukit District are ideal for termites to survive and grow. This factor is one of the elements influencing termite diversity in the region, which is described as moderate.

CONCLUSIONS AND SUGGESTIONS

The termite species variety in the Balikpapan sub-district includes four

varieties of termites: *Macrotermes gilvus* (Hagen), *Bulbitermes constrictiformis* (Holmgren), *Schedorhinortermes mediobcorus* (Holmgren), and *Coptotermes gestroi* (Wasmann). Termite diversity value is moderate, with the greatest number of termite species found in buildings older than 26 years. *Macrotermes gilvus* (Hagen) was the most common termite detected at all locations.).

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