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Article

Termites Attack on Residential Houses at Sialangmuggu, Tuah Madani, Pekanbaru

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A B S T R A C T

Termites can damage wood in building construction and other cellulosic materials in buildings, making them a pest that causes problems for humans. This research is expected to provide information on how insect pest termites (*Coptotermes curvignathus*) are disturbed in Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru. Termites that are found in the presence of their burrows are then collected. The method used is the *hand-picked* method where this method directly uses the hand when the presence of termites is known. Surveys and interviews were conducted to determine the intensity of damage to houses. Based on the results of the study, it can be concluded that in Villa Savana Housing there is one type of subterranean termite, namely *C. curvignathus*. Then the results of the survey of damage to house buildings show that most of the house buildings are in good condition (80.03%). In addition, damage due to dry-wood termite attacks was also found, but no examples of termites were found.

1. BACKGROUND

1.1 Introduction

Termites play an important role in human life as decomposers (Saputra *et al* 2016, 2018). However, termites can damage wood in building construction and other cellulosic materials in buildings, making them a pest that causes problems for humans. The value of losses due to termite attacks tends to increase from year to year. Currently, termite infestation in buildings is a very important problem. Buildings such as office buildings, schools, and residential houses are often damaged by termites.

Termites are small white insects that feed on cellulose such as wood and other wood-derived products. One of the most important building pests is subterranean termites (*Coptotermes curvignathus*) (Saputra *et al* 2017). Subterranean termites can be inferred to represent 10% of other termite species that commonly feed on wood. Various species of wood-destroying termites will still exist in the human ecosystem. The increasing number of buildings makes termite colonies increase in number.

The current residential area of Villa Savana, Sialang Munggu, Tuah Madani, Pekanbaru, has favorable natural conditions for termite colonies, namely humidity and shrub areas. Building damage such as cracks and leaks can provide access for biological destructive factors, especially termites and fungi to invade the house. Termites can not only attack building components that contain cellulose, such as frames, doors, roof components, and ceilings, but termites also attack the contents of the building. This of course causes very high economic losses.

Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru has been established since 2019. The building is more than 3 years old and until now the potential diversity of termites and the intensity of damage to the building has never been known. Early indications are that several wooden furniture began to be attacked by termites. For this reason, it is necessary to research Termite Pest Insect Disturbance in Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru. The results of this study are expected to provide information on how termite insect pests are disturbed and find solutions so that termite pests do not further damage buildings in Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru.

1.2 Research Purposes

This research is expected to provide information on how insect pest termites (*Coptotermes curvignathus*) are disturbed in Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru.

2. LITERATURE REVIEW

2.1 Termites

Termites are known as social insects that are small in size up to medium, live in colonies, and share their main activities in specialized castes. A termite colony consists of three castes with a clear division of tasks. The castes in question include:

1. The Warrior caste is characterized by a large head and noticeable thickening, and its role in the colony is to protect against external disturbances. The warrior caste has very large *mandibles* that termites use as weapons for self-defense.
2. The Worker Caste is characterized by having a pale body color, a little cuticle, and resembles a nymph. The worker caste makes up about 80-90% of the population in a termite colony. This caste has a role as food seekers, feeders of termite queens, and nest builders and is responsible for moving food when nest conditions are threatened, as well as protecting and nurturing termite queens.
3. The Reproductive Caste is the termite queen, a caste with sexual individuals consisting of females in charge of laying eggs and males in charge of fertilizing eggs. Termite queens have a body size exceeding 9 cm.

Termites are insects that belong to the Order Isoptera. There are three families of termites in Indonesia, namely: Kalotermitidae, Rhinotermitidae, and Termitidae. In Indonesia, there are two families of subterranean termites, Rhinotermitidae and Termitidae. This group of termites is known as a pest that attacks wood and damages buildings widely.

In the biosphere, termites have an important role as decomposer insects that benefit the environment. However, the increasing population has turned termite habitats into residential buildings, narrowing the termite living environment and reducing termite food sources. To survive, termites expand their range in search of food sources by attacking anything they encounter.

2.2 Economic Losses Due to Termites

Many cases of economic losses due to termite infestation in buildings in Indonesia have been reported. Currently, termite attacks on buildings are a major problem, considering that the intensity of termite attacks on buildings is getting higher and more widespread so the value of losses due to termite attacks on buildings tends to increase from year to year. The presence of termites is often underestimated, even though the consequences of their attacks can be fatal, both in terms of building construction and the safety of its inhabitants. Economic losses due to termite infestation in residential buildings in Indonesia have reached 1.67 trillion rupiah.

Therefore, it is necessary to control termite attacks on buildings, which include methods before the house is built (pre-construction) which refers to SNI-03-2404-1991, and methods in finished buildings (post-construction) which referees to SNI-03-2405-1991. Factors cousin building destruction factors. One of the steps taken is to identify the type of termites that attracks. Identification of termite types aims to make extermination and protection treatments easier and more effective according to the type of termite.

2.3 Residential as a Research Location

Villa Savana Housing is located in Sialang Munggu Village, Tuah Madani District, Pekanbaru City, Riau. It used to be a housing estate with former rubber plantations. Ex-rubber plantation housing has a great risk of termite infestation because it is one of the suitable habitats for the life and development of various types of termites. This is because when clearing and dredging the soil in the former rubber plantation, it is possible to leave the remains of roots or wood under or around the building that was built. These organic remains can become termite nesting centers and potential food sources for termites.

Based on this background, researchers are interested in researching the disturbance caused by termite pests (*Coptotermes curvignathus*) in Villa Savana Housing, Sialang Munggu, Tuah Madani, Pekanbaru.

3. METHODOLOGY

3.1 Identification of Termite Species in Villa Savanna Housing

Termites that are found in the presence of their burrows are then collected. The method used is the *hand-picked* method where this method directly uses the hand when the presence of termites is known. Termites that have been found are immediately taken from the soldier caste and put into a termite collection bottle containing 70% alcohol. Furthermore, termites that attacked the building/wood/furniture were identified in the laboratory based on the literature or identification key of Tho (1992). The collected termite samples were then photographed using a stereo microscope with 10 times and 30 times magnification. Observations of termite species that attack wood include overall observations of the termite body and also observations on the size of the termite head and the parts contained in the termite head. Observations using a microscope with a magnification of 10 times were made to observe the termite body as a whole. Observations using a microscope with a magnification of 30 times were made to observe the body of the termite head which includes the antennae and mandibles of the termite.

3.2 Intensity of Damage to Residential Buildings

Surveys and interviews were conducted to determine the intensity of damage to houses. There were 39 houses surveyed. In each house, observations were made on the presence or absence of damage to the building components, namely building components on roof coverings, frames, ceilings, wall frames, walls, floors, frames, windows, door leaves, foundations, drainage systems, and utilities. In addition, observations were made of the causes of the building damage. The results of the observations were recorded on the questionnaire sheet provided. Each building component observed was given a score according to predetermined criteria (Table 1).

Table 1. House building value score

Conditional	Score	Description
Good	5	Building components are still functioning properly and there is periodic maintenance.
Medium	4	Building components are still functioning properly and there is no regular maintenance.
Lightly Damaged	3	Building components are still functional but <10% of parts the component is experiencing symptoms of deterioration (weathering, cracking, termite infestation, discoloration).
Medium Damaged	2	Building components are still functional but 10%-40% suffered functional damage (weathering, cracking, attacked termites, discoloration, etc)
Severely Damaged	1	40% of building components are damaged functional (weathering, cracking, termite infestation, discoloration), etc).

Source: Suryadi (2005)

Weighting is needed to determine the priority scale of building components. The weighting value is influenced by the side effects caused by damage to the building component to other components if the component is not repaired immediately. The weighting technique for each work group can be seen in Table 2.

Table 2. Weighting technique for each work group

No.	Object studied	Activity Weight (%)
A	Roof Work	27
B	Foundation	21
C	Wall frame	19
D	Ceiling	10
E	Wall	9
F	Door frame/leaf	6
G	Floor	4
H	Drainage System	3
I	Utilities	1
Total		100

Source: Suryadi (2005)

To get the value of building conditions is obtained by the formula as The following:

$$NK = \frac{\text{Total number of BB x Sn}}{500} \times 100\%$$

Description:
NK= Building condition score (%)
BB = Activity weight (%)
Sn = Score value
500 = Constant value obtained from total BB multiplied by the best value score

The house condition categories were then grouped into five condition classes, depending on the final percentage obtained. The building condition score categories and their predicates are contained in Table 3:

Table 3. Building condition score categories and their predicates

NO	Building Condition Score (%)	Category Prediction
1	81 - 100	Good
2	61 - 80	Medium
3	41 - 60	Lightly damaged
4	21 - 40	Moderately damaged
5	0 - 20	Severely Damaged

Source: Sulaeman (2005)

3.3 Data Processing Technique

In this study, data processing of building damage intensity was carried out using *Microsoft Excel* 2010. While the data analysis used to determine the relationship between age, frequency of maintenance, and maintenance (renovation) to the condition of the building is *Cross-tabulation Chi-square* using SPSS 16.0 *for Windows* software.

The type of research used is literature review research. This research is another term for *literature* review, literature review, theoretical review, theoretical basis, literature review, and theoretical review. What is meant by literature research is research conducted only based on written works, including research results both published and unpublished (Embun, 2012).

4. RESULTS AND DISCUSSION

4.1. General Condition of Villa Savana Housing

Villa Savana housing was built in 2019 and began to be occupied in 2020. This housing is located in the Sialang Munggu area, Tuah Madani, Pekanbaru. Before being built into the housing, this area was an area of former acacia forest turned into an oil palm nursery and then turned into housing.

The area of this housing is 5880 m2. The details of land use are for effective land use of 4680 m2, use of infrastructure for roads of 1200 m2, and for public facilities of 160 m2. Public facilities consist of shophouses and a front yard before entering the housing complex. The number of lots in this housing complex is 39 units consisting of five types, namely, type 50 (building area 50 m2 and land area 120 m2), and type 52 (building area 52 m2 and land area 120 m2). Each lot unit consists of a one-floor building.

As for unoccupied, there are 10 units. Permanent buildings are the form of all houses in this housing estate. Floors are generally made of ceramic tiles (100%). All buildings in the study site have brick walls with plastered surfaces. Door frames and window frames are generally made of wood (98.12%) and the rest are made of aluminum (1.87%). The ceiling of the houses is generally made of gypsum. Horses are usually made of mild steel (99.06%). In addition, almost all houses use roof coverings made of aluminum metal roof tiles.

4.2. Frequency of Damage to Villa Savana Residential Buildings

Simple buildings can be studied by reviewing the parts that are the main parts of the building and its sanitation facilities. These parts consist of roofs, foundations, wall frames, ceilings, walls, sills/leaves, floors, yard drainage, and utilities (Puspantoro 1996). The condition shows that most (80.03%) houses in Villa Savana Housing are in good condition, while the rest are in good condition (16.76%) and slightly damaged condition (3.21%). This is presumably because the condition of the housing is still in the category of newly completed construction so the frequency of maintenance and maintenance of house buildings is relatively high. and those that are slightly damaged due to vacant and abandoned.

4.3. Diversity and Distribution of Subterranean Termite Species

Direct survey in the residential area of Villa Savanna, Sialang Munggu, Tuah Madani, Pekanbaru, indicated signs of termite presence seen from their burrows, namely 15 houses. After observation, in some houses, there was some furniture that had begun to be attacked by termites, and as many as 7 houses indicated that termites had begun to invest. The

location is not part of the housing directly but managed to find termites, namely on one dead tree in the bushes next to the housing. The identification results according to Tho (1992) show that in the Villa Savanna housing estate, one type of subterranean termite was found, which is a member of one family, Rhinotermitidae, and one subfamily, Coptotermitinae. The species found at the observation site, *Coptotermes curvignathus* Holmgren, attacked 7 houses whose furniture indicated the presence of *C. curvignathus* Holmgren and 8 houses indicated burrows of this type of termite (Nu-Atiqah *et al* 2017).

C. curvignathus belongs to the subfamily Coptotermitinae and the family Rhinotermitidae. It has a yellow head, with a body length of 3.17-4.91 mm, maximum head width of 0.72-1.01 mm, head length with mandibles of 1.29-1.97 mm, head length without mandibles 0.99-1.32 mm, and 15 antennae. The shape of the mandible is like a sickle and curved at the end. Figure 1 shows the soldier caste of *C. curvignathus* found at the study site. According to Harris (1971), there are 120 species of termites that attack buildings and 64 of them are very important names. *C. curvignathus* is the most ferocious termite species and is very common in Indonesia (Nandika *et al* 2003).

Fig 1. Soldier caste of *C. curvignathus at* 10 times magnification

In Indonesia, the two families of wood-destroying termites included in the subterranean termite group are Termitidae and Rhinotermitidae (Tarumingkeng 2000). The results showed that the Rhinotermitidae family (100%) was found. The Rhinotermitidae family was found at 15 observation points (Caraka *et al* 2020).

According to Wang *et al* (2003), species of Rhinotermitidae members are more often found outside natural forests or in natural forest areas that have been converted into plantation and settlement areas. The subfamily of Rhinotermitidae was found at the research site, namely Coptotermitinae with members of *C. curvignathus*. The Rhinotermitidae family is a family that has a large number of members and often attacks buildings. According to Tarumingkeng (2000), members of the Rhinotermitidae family that mostly attack buildings are species of the genus *Coptotermes* spp. According to Tambunan and Nandika (1989), the types of termites of the *Coptotermes* genus that damage wood in tropical areas such as Indonesia include *C. curvignathus*.

Simple buildings can be studied by reviewing the parts that are the main parts of the building and its sanitation facilities. These parts consist of roofs, foundations, wall frames, ceilings, walls, sills/leaves, floors, yard drainage, and utilities (Puspantoro 1996). Observations show that most (80.03%) houses in Villa Savana Housing are in good condition, while the rest are in good condition (16.76%) and slightly damaged condition (3.21%). This is thought to be because the condition of the housing is still in the category of newly completed construction so the frequency of maintenance and maintenance of house buildings is relatively high. and those that are slightly damaged due to vacant and abandoned.

The condition of the houses included in the right and moderate condition is generally carried out with routine maintenance and care. The maintenance carried out is not much because this housing has just been built and does not require extra care, but there are several houses that carry out maintenance such as painting with a frequency of once a year. Meanwhile, the most common building maintenance is maintenance on the frames, doors, and windows that are attacked by termites and other destructive organisms. This is thought to be because the wood used at the beginning of construction was a type of wood that had a low level of durability and strength, so there was a lot of damage in the form of termite attacks, beetles, mold, and cracks. Meanwhile, house buildings that are included in lightly damaged conditions generally do not carry out routine maintenance and care or are left empty (empty).

4.4. Types and Forms of House Building Damage

Factors that cause damage to buildings are biological factors, mechanical factors, and physical factors. Biological phenomena that affect buildings are interactions between buildings and their biotic environment in the form of plants and animals (Watt 1999). Wood as a building material for housing and buildings can be damaged or weathered due to attacks by wood-destroying organisms such as insects and fungi (Hariyanto *et al* 2000). Biological destructive factors that cause the most damage to buildings include termites, beetles, fungi, and mildew. Biological damage is not only limited to components made of wood, but to all components made of organic materials or materials containing cellulose. Mechanical damage is a type of damage caused by forces, both static and dynamic. The form of damage is generally in the form of cracks or breaks. Mechanical damage usually occurs in almost all building components. Meanwhile, physical damage

is generally caused by local climate factors, such as temperature and humidity. Damage occurs in the form of discoloration, fading of paint, and peeling of paint layers. In general, physical damage to buildings occurs on roof truss components, ceilings, windows, and doors.

Direct observations showed that the type of damage due to biological factors was the factor with the highest intensity (64.88%). This was followed by damage due to mechanical factors (27.64%) and physical factors (24.55%). The most common biological damage was weathering of window and door frames. Therefore, it is suspected that the weather factor in Pekanbaru City supports the development of wood-destroying organisms in house buildings. In addition to weathering, another biological damage that occurs is in the form of attacks by subterranean termites, dry wood termites, beetles, mold, and mildew. Mechanical damage found at the research location is cracking or breaking. While physical damage is in the form of peeling paint and discoloration (fading).

Damage to frames, doors, and windows. Almost all houses in this housing estate use wood as the material for frames, doors, and windows. The most common damage found is the attack of subterranean and dry-wood termites. Tarumingkeng (2004) states that dry wood termites usually attack in two ways: larval flight into the wood, then breeding, and attacks that spread from other objects that have been attacked and are located nearby. In the house building, many frames, doors, and windows were found to be porous due to termites. This is thought to be caused by the use of low-durability wood species that are easily attacked by termites. In addition to termite attacks, dry powder beetles and fungi were also found. In addition, damage also occurred in the form of cracks and rot, peeling paint on the door leaf and frame, cracked/ broken window glass, and damaged hinges. This damage can be attributed to poor installation and lack of maintenance on the frame, door, and window components.

5. CONCLUSION

Based on the results of the study, it can be concluded that in Villa Savana Housing there is one type of subterranean termite, namely *C. curvignathus*. Then the results of the survey of damage to house buildings show that most of the house buildings are in good condition (80.03%). In addition, damage due to dry-wood termite attacks was also found, but no examples of termites were found.

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