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Inventory of Pest Types Attacking Canary Plants (Canarium indicum L) in Wail Matai Hamlet, Morella Village, Leihitu District

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ABSTRACT

The research was conducted in July 2025 using an inventory method by establishing observation transects measuring 100 m in length and 20 m in width. Pest sampling was carried out using several techniques, including hand collecting, pitfall traps, sweep nets, and bait traps. Data analysis was performed by calculating the intensity of pest attacks and the percentage of infestation area on observed plants. The results showed that three main pest species attacked candlenut plants: termites (Cryptotermes sp.), ambrosia beetles (Xylosandrus crassiusculus), and wood grasshoppers (Valanga nigricornis). The highest damage intensity was caused by wood grasshoppers at 26.12%, categorized as moderate damage, while ambrosia beetles caused 4.36% damage and termites 1.10%, both categorized as minor damage. The percentage of infestation area across five observation plots ranged from 50.00% to 69.57%, classified as moderate to severe infestation. The high level of pest infestation was influenced by environmental factors such as temperature, humidity, food availability, and habitat conditions that support insect population development. In conclusion, pest attacks on candlenut plants in Wail Matai Hamlet are relatively high, particularly caused by wood grasshoppers that damage the leaves. Therefore, integrated pest management and regular monitoring are necessary to prevent further damage to candlenut plants in the area.

INTRODUCTION

Plants of the genus Canarium from the family Burseraceae consist of approximately 100 species worldwide. One of the species in this genus is Canarium indicum L., which is native to Indonesia, particularly in the eastern regions such as the Maluku Islands (Rahman et al., 2019). The candlenut tree can grow up to a height of 20 meters and is resistant to strong winds (Wattimena & Fransina, 2023).

However, its existence cannot be separated from plant pest organisms which can reduce production both in quality and quantity, thereby causing losses to the community. Plant pest organisms include plant pests. Forest damage is not only caused by human activities but can also result from pest attacks (Wattimena et al., 2020).

Pest attacks are one of the biggest challenges in plant cultivation, whether in agriculture, plantations, or forest plants. Plant pests can cause direct disturbances to plants and may be caused by insects, mites, vertebrates, and mollusks. In fact, most pests that damage forests and forest products are animals belonging to the insect group, accounting for nearly 90% compared to other pests (Wattimena, 2019). Candlenut is one of the forest plant species that can be attacked by pests. Pests can cause damage to plants, reduce yields, and even cause plant death.

Dusun Wail Matai is located in Morella Village, Leihitu District, Central Maluku Regency, an area that has a high diversity of plant species. These plants also have high economic value. Plant species found around Dusun Wail Matai include candlenut, nutmeg, langat, and durian. However, this plant diversity is also accompanied by threats from various pests that can damage crops, such as insects, caterpillars, and mammals. Pest attacks can cause varying levels of damage depending on the type of pest and plant involved. Pests can attack certain parts of the plant such as leaves, stems, flowers, and fruits. Symptoms of pest attacks include holes in leaves, wilting, discoloration, inhibited growth, and bite marks.

RESEARCH METHODS

Place and Time of Research

This research was conducted in July 2025 in Wael Matau Hamlet. Morella Village, Leihitu District.

The tools and materials used in this study included several insect collection instruments such as *Hand Collecting* (manual hand collection), *Pitfall Traps, Sweep Nets, Bait Traps, tweezers, thermometers, measuring tapes, raffia strings, a digital camera, plastic plates, and plastic cups.

The materials used consisted of water, detergents (Rins & Daia), sugar solutions, and fish (Momar fish & tuna).

The research was conducted using a sampling method, an observation path was created using an inventory method to collect insect data with a width of 20 meters and a length of 100 meters with a distance between paths of 20 meters, then pest data was collected.

Sampling Techniques

Pests in Wail Matai Hamlet, Morella Village will be collected using 4 pest collection techniques, namely.1. Hand Collecting. The hand collecting method involves direct sampling. Each type of insect found is collected manually by hand or using tweezers and then placed into collection bottles containing 70% alcohol. All types of pests living around low plants, rocks, the soil surface, mounds of soil, and broken wood are observed (Hasimoto, 2001 in Berlindus et al., 2023). This trap uses one pack of detergent weighing 1.8 kg, one bar of soap weighing 380 grams, one dish soap weighing 1.5 liters and 5 liters of water to catch pests that live above the ground surface. The trap is installed on each observation path. Placed and planted a plastic cup with a diameter of + 15 cm, the surface of the cup is planted parallel to the ground surface with a distance between the pitt fall trap every 10 m filled with clear water mixed with soap as much as 400 ml. left for 24 hours, taken the next day. The captured insects are put into a sample bottle 3. Sweep Net. This trap is made of a lightweight, strong material like gauze, is easy to swing, and traps the trapped pests. Pests are captured using a net along each observation path. The captured pests are then placed in a plastic bottle filled with alcohol. 4. Bait Trap. The traps were baited with sugar solution, rice, bread, raw fish, and canned fish placed in plastic plates. The plates were tied to trees every 10 meters along each observation route, left overnight, and then retrieved the next day.

Data analysis

Intensity of Haa paida Attack on Canary Plants

To calculate the intensity of damage to walnut plants, the following formula is used (Heneda & Suheri 2018):

$$\mathbf{IS(\%) = X\ 100\%}$$

Where:

IS = Past Attack Intensity

X = Number Observed

X1 = Number of Lightly Infested Trees (Score 1)

X2 = Number of Trees Affected Moderately (Score 2)

X3 = Number of Severely Infested Trees (Score 3)

X4 = Number of Severely Infested/Dead Trees (Score 4)

YI-Y4 Score I to 4 for each plant showing symptoms of attack light until dead (no signs of life)

Criteria:

0 = Healthy

1-25 (>0-25) = Light Damage

26-50 (>25-50) = Moderately Damage

51-75 (>50-75) = Seriously Damage

>75 = Dead

Percentage of Attack Area

The area of pest attack uses the attack area formula and the attack categories are based on those put forward by Natawigena (1982) in Sugiharso (1988)

Where:

P = Wide Attack

a = Number of Planst Affected

b = Number of Planst Observed

Criteria:

0 = Healthy

1-25 (>0-25) = Light Damage

26-50 (>25-50) = Moderately Damage

51-75 (>50-75) = Seriously Damage

>75 = Dead

General condition of the location

Wail Matai Hamlet, located in Morella Village, Leihitu District, Central Maluku Regency, is a forest area managed by the local community, covering an area of 2,880 m2. The boundaries of Morella Village are as follows. To the west it borders Mamala Village, To the east it borders Liang Village, To the south it borders Tulehu Village and Waai Village.

RESULTS AND DISCUSSION

Insect Species Inventory

Insect Species

Based on identification results and direct field observations, the pests found in Wail Matai Hamlet, Morella Village, Leihitu District, attacking *Canarium inducum L.* plants include *Cryptotermes sp*., *Xylosandrus crassiusculus*, and *Valanga nigricornis*

Cryptotermes sp.

Kingdom Eukaryotes ,Phylum Arthropoda, Class Insecta, Order Dictyotera, Family Reticulitermes, Specie *Cryptotermes sp.*

Figure 6. *Cryptotermes sp.*

Cryptotermes sp. that attack walnut plants can be seen in Figure 6. Termites are social insects, the termites found have soft bodies and are light brown in color, measuring 3mm. Termites have three pairs of legs, have three body parts: head, thorax, abdomen. Termites attack walnut plants at the tree level. Termites attack the tree trunk by making nests in the tree trunk and causing damage to the tree trunk. (Hand Collecting) and direct sampling was carried out.

Cryptotermes sp. are a serious threat to canary plants (*Canarium indicum* L.), because termites tend to attack the wood, stems, roots and branches as seen in Figure 7. This attack can weaken the structure of the plant and reduce crop yields. The presence of termite pest attacks occurs because termites eat cellulose in wood as a primary food source. This is in line with the research of Muhammad Saleh (2024), termites eat materials containing cellulose such as wood and its derivative products such as paper, cellulose is an organic compound that is abundant in nature but cannot be digested by humans or other higher organisms while termites can easily digest this compound.

Figure 7. Symptoms Of Termite Attacks On Walnut Trunks

Pests can also attack plants due to high humidity, temperature, and rainfall. Some termites live in humid underground habitats, while others live in dry, above-ground habitats. Subterranean termites generally live in wood in direct contact with the soil, tunneling underground to access moisture. Temperature and humidity play a crucial role in termite activity and development. High humidity facilitates termite colony growth because these conditions are ideal for the survival of eggs and larvae. The average temperature at the research site was 28°C and humidity ranged from 82.0 to 86.5%.

Rainfall also plays a crucial role in the development of external reproduction and can stimulate termites to emerge from their nests to forage. Furthermore, the presence of organic matter around the village, such as rotting twigs or tree trunks, also contributes to the growth of termite populations. These organic remains serve as food reserves and safe hiding places for termites. According to research by Cookson (2002), the main environmental factors that influence termite distribution include temperature and humidity, while other supporting factors are rainfall and vegetation.

Xylosandrus crassiusculus

Kingdom Animalia, Phylum Arthropods, Class Insecta, Order Coleoptera, Family Curculionidae, Species *Xylosandrus crassiusculus.*

Figure 8. *Xylosandrus crassiusculus*

Source: Landi ddk, 2027

Xylosandrus crassiusculus vary in body color, but many are yellowish-brown, brown, black, or a combination of both. *Xylosandrus crassiusculus* have a transversely cylindrical body. They have a distinctive head structure and compound eyes. Strong mandibles, used for digging and consuming wood, are seen in Figure 8. *Xylosandrus crassiusculus* attack walnut trees at tree level. Trees infested by ambrosia beetles cause the bark to dry and peel. Ambrosia beetles also bore into the tree trunks to create holes, as seen in Figures 9 and 10. Abortion beetles were found in hand-collecting traps (direct sampling) and pitfall traps (Pitt Fal Traps) using Rinson detergent.

Some *Xylosandrus crassiusculus* species carry symbiotic fungi that kill trees or cause major tree diseases (Muhammad, 2022). *Xylosandrus crassiusculus* infestation include the beetles creating small holes in the wood, causing holes in the trunk. The structural strength of the wood is not seriously affected, but infected wood shows defects such as pinholes, black holes, black spots or saw-cut lines that spoil the appearance of plywood and ornaments (Nair, 2007). *Xylosandrus crassiusculus* cannot eat the main part of the wood, so they feed on the fungus that is a symbiote.

This fungus is carried by ambrosia beetles to other plants with the help of specialized flies called mycangia (Muhammad, 2022). This is why *Xylosandrus crassiusculus* infestations are so difficult to control, as in addition to damaging wood, ambrosia beetles can also cause plant disease. Environmental conditions with high humidity and abundant wood availability strongly support the growth of ambrosia populations.

Figure 9. Symptoms of *Xylosandrus crassiusculus* Attack on Hollow Tree Trunks

Figure 10. Symptoms of *Xylosandrus crassiusculus* Attack on Drying and Peeling Tree Bark

Valanga nigricornis

Kingdom Animalia, Phylum Arthropods, Class Insecta, Order Orthoptera, Family Acrididea, Spesies *Valanga nigricornis.*

Figure 11. *Valanga nigricornis*

He *Valanga nigricornis* has a light green nymph color resembling grass, which changes to greenish yellow in the 3rd or 4th instar. In the adult phase, the color is brownish gray. The hind legs are longer and stronger, functioning to jump long distances as seen in Figure 11. The wood locust attacks canary shoots at the seedling and weaning levels on the leaves. The damage that occurs to canary plants caused by the wood locust is in the form of bites on the edges of the leaves and causes holes from small to large especially on the leaves as seen in Figure 12. The *Valanga nigricornis* was found using traps (Hand Collecting) sampling was done directly.

The *Valanga nigricornis* is a destructive pest that primarily attacks leaves. Infected leaves will appear damaged by its activity. *Valanga nigricornis* feed on a variety of plants, and both larvae and adults can eat leaves. In large numbers, they can eat entire leaves down to the veins. Infected leaves will appear damaged, characterized by irregular bites on their surfaces. *Valanga nigricornis* feed actively, both in their larval and adult stages. *Valanga nigricornis* are polyphagous, meaning they can feed on a variety of plants without distinguishing between host species. Infection typically begins at the leaf edges and then spreads to the center, sometimes leaving only the veins.

Figure 12. Symptoms of *Valanga nigricornis* Attack on Walnut Plants

The factor causing *Valanga nigricornis* pests to attack walnut leaves is the abundant plant population (food) on the walnut plant. According to Wattimena et al. (2023), the plant population size determines the amount of food, thus significantly influencing the presence of a pest species in the environment. If the *Valanga nigricornis* population is very large, they can quickly consume

the entire leaf area of a plant. Grasshoppers are known as polyphtrous insects (Wattimena et al., 2023). The impact of *Valanga nigricornis* attacks not only reduces leaf area but can also reduce overall plant productivity. Plants that lose most of their leaves will experience reduced growth, weaken, and become susceptible to other diseases.

In addition, food and environmental factors such as temperature and humidity can also influence the presence of wood locust pests. The temperature at the research site was 28°C, and humidity was 82.0-85.6%. According to Haneda et al. (2013), increased soil temperature and humidity will affect insect activity, including grasshopper activity, such as jumping.

Intensity of Damage to Canary Plants

The level of pest infestation affects the health of canary plants. The higher the infestation, the lower the health of the canary plants. The results of the analysis of the intensity of damage to canary plants caused by termites *Prorhinotermes sp., Xylosandrus crassiusculus, and Valanga nigricornis* are shown in Table 3.

Table 3. Intensity of Damage to Canary Plants

Plot	Jenis Hama		
	Cryptotermes sp.	***Xylosandrus crassiusculus***	***Valanga nigricornis***
	IS (%)	**IS (%)**	IS (%)
I	0	6,81	29,54
II	0	4,76	27,54
III	2,27	3,40	22,72
IV	0	3,57	20,53
V	3,27	3,26	30,43
Rata-rata	1,10	4,36	26,12
Attack Category:	Light Damage	Light Damage	Moderately Damage

Based on the research results in Table 3, the intensity of damage occurring in the five observation plots in Wail Matai Hamlet, Morella Village, was highest due to the wood locust *Valanga nigricornis* at 26.12%, categorized as moderate damage. The least damage was caused by *Cryptotermes sp*., at 1.10%, categorized as light damage. The intensity of damage caused by *Xylosandrus crassiusculus* at 4.36%, categorized as light damage.

The intensity of damage to walnut trees is classified as moderate. This is influenced by various factors, including internal factors influencing the presence and development of pests in a location, such as their ability to reproduce (Wattimena et al., 2016). External factors that also influence the

presence and development of pests in a location include the quality and quantity of food available to the walnut trees.

The research location provided an abundance of food preferred by the wood locust. This is in line with research (Pratiwi, ddk 2022) that the wood locust species *Valanga nigricornis* can be said to be phytophagous or eats all types of plants and is included as a natural enemy of weeds. The low intensity of damage caused by *Cryptotermes sp.* and *Xylosandrus crassiusculus* is caused by limited food sources available at the location, plus the presence of natural enemies such as predators and parasites that effectively control the pest population. In accordance with research by Walli & Ningkeula (2019), the availability of food and the lack of natural enemies (predators) are beneficial for pest development. Furthermore, the factor causing the emergence of pests is also the lack of development of appropriate pest control strategies carried out by the local community.

Extent of Infestation on Canary Plants

he extent of infestation on canary plants caused by *Cryptotermes sp*, *Xylosandrus crassiusculus* and *Valanga nigricornis* can be seen in Table 4.

Table 4. Extent of Pest Infestation in Wail Matai Hamlet, Morella Village

Plot	Observasi Plants	Attacked Plants	LS (%)	Attack Category
1	22	15	68,18	RB
2	21	14	66,67	RB
3	22	13	50,09	RS
4	28	14	50,00	RS
5	23	16	69,57	RB

Research results in Table 4 show that the highest insect infestation area occurred in plot 5, with 69.57% of the area severely damaged. The lowest infestation area occurred in plot 4, with 50.00% moderate infestation. Plot 1 had 68.18% severely damaged, plot 2 had 66.67% severely damaged, and plot 3 had 50.09% moderate infestation. The high percentage of infested plants in Wail Matai Hamlet, Morella Village, was due to favorable environmental conditions, such as high temperatures and humidity for pest growth, and high rainfall, which led to rapid pest population growth.

The high percentage of infested plants in plots 1, 2, and 5 was due to favorable environmental factors, such as high temperatures and humidity, which favor pest growth. According to Untung (1984), the life of pests and diseases is greatly influenced by environmental factors. One factor influencing the presence of pests is the abundance of food, such as weeds, in these plots. If food is available in sufficient quantities and meets the pest's needs, the number of pests can increase rapidly. Slanky & Rodriguez (1987) state that food is an essential factor that plays a vital role in the development of an organism. The quantity and quality of food for certain insects are crucial factors for their survival and generation (Harahap, 2003). If all factors are sufficient in these plots, they are susceptible to pest attack. Conversely, in plots 3 and 4, if environmental factors are supportive but food is scarce or unsuitable, the number of pests will decrease. Each type of pest usually has more than one type.

Factors Affecting Canary Plants

Table 5: Physical Factor Measurement Results in Wail Matai Hamlet, Morella Village

Plot	Light Intensitas (lux)	Humidity (%)	Temperature ˚C
1	50,6	82,0	28˚C
2	44,6	82,0	28˚C
3	38,8	83,0	28˚C
4	41,3	84,5	28˚C
5	35,9	86,5	28˚C

Factors affecting canary plants in Wail Matai Hamlet, Morella Village: light intensity, humidity, and temperature.

Habitat conditions have a significant impact on plant growth and development, including canary plants. Complex changes in habitat quality can disrupt physiological and morphological processes in plants, resulting in reduced productivity. In other words, the primary environmental factor determines the success of canary plants and their development.

Factors Affecting Pest Life

Factors affecting pest life include temperature, humidity, and light intensity.

Temperature

***Cryptotermes sp*.**

Cryptotermes sp. thrive optimally at temperatures of 25–30°C. At this temperature, termites are more active in foraging, nest building, and reproduction. For example, termite eggs hatch more

quickly, and larvae develop more efficiently due to optimal digestive enzymes. This temperature supports colony homeostasis, where termite workers maintain stable nest humidity and temperature. According to research by Ardiansya et al. (2025), the optimal temperature is between 25°C and 30°C, which supports termite activity and reproduction.

Xylosandrus crassiusculus

This beetle exhibits maximum growth and development at temperatures between 23°C and 27°C. Under these temperature conditions, the metamorphosis process from egg to adult occurs rapidly, typically taking around 20 to 40 days, depending on the humidity level of the surrounding environment. Indrianti et al. (2017) found that optimal environmental conditions for ambrosia beetles are 23°C-27°C.

Valanga nigricornis

The *Valanga nigricornis*, as a poikilothermic insect, has a body temperature that is highly dependent on the temperature conditions of its environment. Environmental temperature plays a crucial role in determining its activity level, development, and survival. The optimal temperature for wood grasshoppers and other insects is generally around 15°C-45°C, which is the temperature at which reproductive capacity is at its peak and mortality rates are at their lowest. Irham et al. (2015) stated that the *Valanga nigricornis* can survive in plant areas with temperatures of 15°C-45°C.

Humidity

Cryptotermes sp.

Humidity significantly influences termites, particularly wood-destroying species. They rely heavily on high environmental humidity—generally in the range of 75–90%—to support all aspects of their lives. This humidity level is not only necessary for termites to maintain their water content and physiological functions, but also plays a crucial role in individual development, foraging activities, and overall colony stability and growth. Ardiansya et al. (2025) found that termites require high humidity to survive, with optimal humidity between 75% and 90%.

Xylosandrus crassiusculus

Xylosandrus crassiusculus require air conditions with a fairly high humidity level, around 50–60%, to ensure optimal growth of the ambrosia fungus, which serves as the primary nutrient source for larvae in the wood galleries. The humidity level for ambrosia beetles is 50–60% (Indrianti et al., 2017). This high humidity is crucial because the ambrosia fungus can only thrive in a humid environment, ensuring its presence and a continuous food supply for larval development.

Valanga nigricornis

The *Valanga nigricornis* requires a fairly high humidity level, generally in the range of 76–92%, for optimal daily activity, metabolic processes, and nymphal development. Humidity above 76% is crucial because it helps prevent dehydration, maintains internal water balance, and allows the

insect to move and reproduce more smoothly. Pariyanto (2017) stated that a maximum humidity of around 76–92% is favorable for the survival of the wood locust, as air humidity significantly influences its reproduction, growth, and activity.

Light Intensity

Cryptotermes sp.

Termites are photophobic insects that avoid bright light and prefer conditions with very low light intensity or darkness. The ideal light intensity for termite life and activity is below approximately 50 lux, where they can carry out feeding and nest-building activities without disturbance.

Xylosandrus crassiusculus

Xylosandrus crassiusculus tend to prefer environments with low to moderate light intensity, as most of their life stages occur within dark, damp wood galleries, protected from direct sunlight. Their natural habitat, deep within wood tissue, allows them to adapt to minimal lighting conditions, so ideal light levels for them are typically below 100 lux or even lower.

Valanga nigricornis

Valanga nigricornis generally perform best in low to moderate lighting conditions, ranging from 100 to 500 lux. These insects tend to avoid intense direct sunlight, so they are more often found under the shade of plant canopies, shrubs, or other shaded areas with moderate light levels.

Conclusion

The conclusions of this study are:

1. Pests attacking walnut plants in Wail Matai Hamlet, Morella Village, are termites *Prorhinotermes sp*, ambrosia beetles *Xylosandrus crassiusculus*, and *Valanga nigricornis*.
2. Pest intensity on walnut plants in Wail Matai Hamlet, Morella Village, includes *Valanga nigricornis* with 26.12% being categorized as moderately damaged, causing holes in the leaves; *Xylosandrus crassiusculus* with 4.36% being categorized as lightly damaged, causing holes in the stems and peeling; and *Prorhinotermes sp* with 1.10% being categorized as lightly damaged, attacking the stems by building nests and causing tree trunk damage.
3. The extent of attacks on Walnut plants in Wail Matai Hamlet, Morella Village caused by *Valanga nigricornis*, *Prorhinotermes sp*. and *Xylosandrus crassiusculus*. The highest extent of attacks occurred in plot 5 69.57% with a severely damaged area of attack, the extent of attacks in plot 1 68.18% with a severely damaged area of attack, in plot 2 66.67% of the area of attack was severely damaged, in plot 3 50.09% with a moderately damaged area of attack and the smallest extent of attacks occurred in plot 4 50.00% with a moderately damaged area of attack.

Suggestions

Local community pest control efforts are needed, such as weed removal, regular pesticide use, trapping, and other measures. This is to ensure appropriate preventative and control measures are taken to prevent pests from threatening overall plant growth and productivity.

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