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Size of Colony Population of Macrotermes gilvus Hagen (Isoptera: Termitidae) in different habitats on Cocoa Plantation, Aceh Province, Indonesia

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Abstract: *Termite pests are attracted to habitats that contain high organic matter and are thought to be related to habitat conditions that have high humidity with low temperatures.This research aims to study the effectiveness of each habitat for the survival of termites in cocoa plantations. This research was conducted in the Cocoa Plantation of Bandar BaruSubdistrict, Pidie Jaya Regency, from February to November 2019. The equipment used was Petridish, Olympus brand optical microscope (CX21FS1), Thermometer, Gauze, Tissue, Jars, Knives, Sterile Cotton, Aluminum foil and stationery. The materials used are termite pests, pine wood. The method used is the triple mark recapture technique (Marini & Ferrari 1998). The results of the observation show that the termites of Macrotermesgilvus damage cocoa plants in Bandar Baru District, Pidie Jaya Regency. Cocoa plants that are not treated well experience a higher level of damage than those that are well cared for. Growth and development of M. gilvus colonies increased in habitats that were not sanitized by weeds and organic matter waste.*

Keywords: ***Termite, habitat, cocoa, Plantation, pest***

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I. Introduction

Cocoa is an economically valuable plantation who gave resources to foreign exchange. Locations that have been determined by the government for cocoa cultivation in Aceh Province include Pidie District. Cocoa cultivation in the Regency experienced many obstacles, one of which was a termite pest attack which is difficult to detect and if the attack has been chronic the plant becomes sick and unable to take nutrients from the soil, and the leaves of the plant become withered, yellow until the plant dies.Termite pests move to other healthy plants if the food source from a place has been eaten. Termites will build roads from soil material to go to other healthy plants that will become new sources of food. If control is not immediately carried out, the ability of plants to increase production capacity is low which has a negative effect on the success of the government's program to realize cocoa as a leading national export commodity in the plantation sector (Sayuthi et al. 2011)

So far, termite pest control is carried out by farmers using synthetic insecticides and has a negative impact on the environment. Farmers' trust in using synthetic insecticides for termite pest control needs to be given an understanding of the impact that will be generated especially if it is associated with termite bioecology which has a closed population and is different from other insect pests (Sayuthi 2012). According to Oka (2005) the use of synthetic insecticides in the field results in poisoning for users, killing of natural enemies and environmental pollution. Therefore, it is necessary to control other ways by utilizing the entomopathogenic fungi biological agents to be applied on these plantations. This study aims to produce entomopathogenic fungi of local isolates as biothermitis for termite pests and the success of government programs to increase cocoa production as a national export commodity through the use of appropriate technology for the management of termite pests on cocoa plants environmentally friendly

II. Material And Methods

This research was carried out at the Plant Protection Basic Laboratory of the Plant Protection Study Department at the Syiah Kuala University and in the Cocoa Plantation of Bandar Baru Subdistrict, Pidie Jaya District, from February to November 2019. The equipment used is laminar air flow cabinet, Petridish, Olympus brand optical microscope (CX21FS1), autoclave, incubator, Erlemeyer, measuring cup, spatula, haemacytometer, thermometer, gauze, tissue, jars, knives, sterile cotton, aluminum foil and tools write it. The materials used are termite pests, local isolate entomoptogen fungus, Potato Dextrose Agar (PDA), Aquades, Alcohol and detergent, Tween 20, Chloramfenicol.

Trapping Bait Preparation.

Bait trap preparation as the observation station is prepared by digging the soil at a depth of 20 cm with a diameter of 14 cm. 3 inch diameter Polivinylchoride (PVC) pipes are planted vertically into each hole that has been prepared as a barrier between the ground and the walls of the observation station room. Vertically feed wood is buried in holes as deep as 15 cm and as long as 5 cm at ground level. The distance between each observation station varies (5m, 10m, 15m, 20m). A week later an observation station was set up that had been attacked by termite pests on a cocoa plantation. The surface of the PVC pipe is closed (Sayuthi et. al. 2011)

Third phase

The procedure for the third stage is carried out as in the first and second stages.

For estimating population size in termite colonies, Begon (Marini & Ferrari 1998) methods are used, namely:

$N = (\sum Mi.ni) / [(\sum mi) +1]$

$SE = N / \{[1 / (\sum mi) +1)] + \{(2 / ((\sum mi) +1) 2 [(6 / (\sum mi) +1) 3]\}$ ½

Where:

N = Population size,

SE = Standard deviation,

ni = Total number of termites caught at i-th capture,

mi = Mi = The total number of termites marked up to collection on i.

Mi = Total number of termites marked until i-th arrest

III. Result

1. Size of *M. gilvus* termite colonies in the intensive care of the cocoa plant

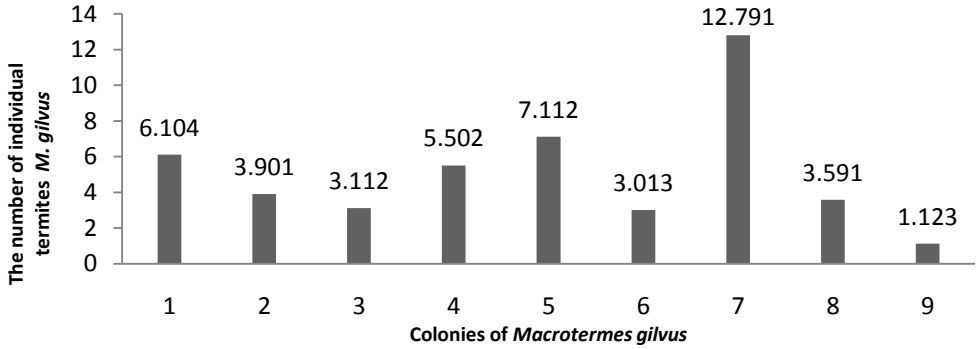

Figure 1. Number of colonies and population size of *M. gilvus* termites in cocoa plants with good maintenance

2. Size of *M. gilvus* termite colonies on cocoa plants in areas with a lot of organic matter.

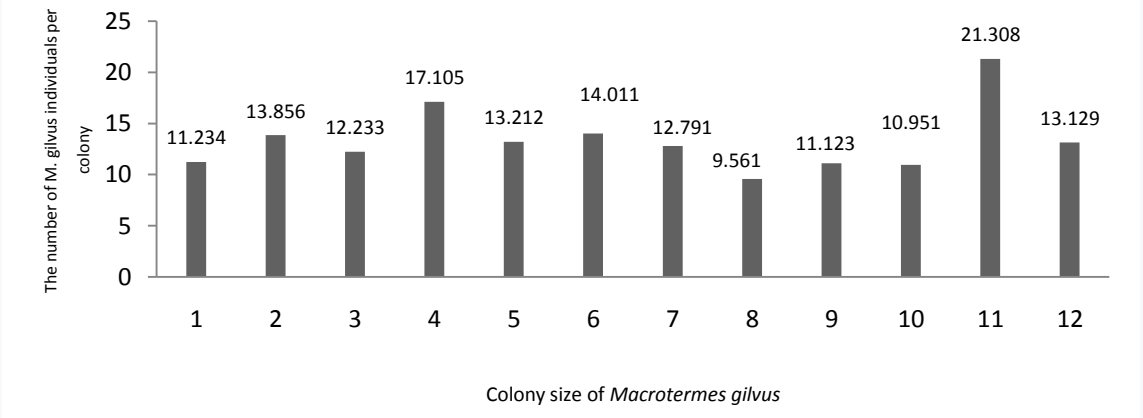

Figure 2. Size of each population of *M. gilvus* termite colonies in cocoa plantations in the presence of weeds and the presence of pulp material from cocoa plants.

3. The population size of each *M. gilvus* termite colony in the cocoa plantation is not well cared for with cocoa leaves and weed growth.

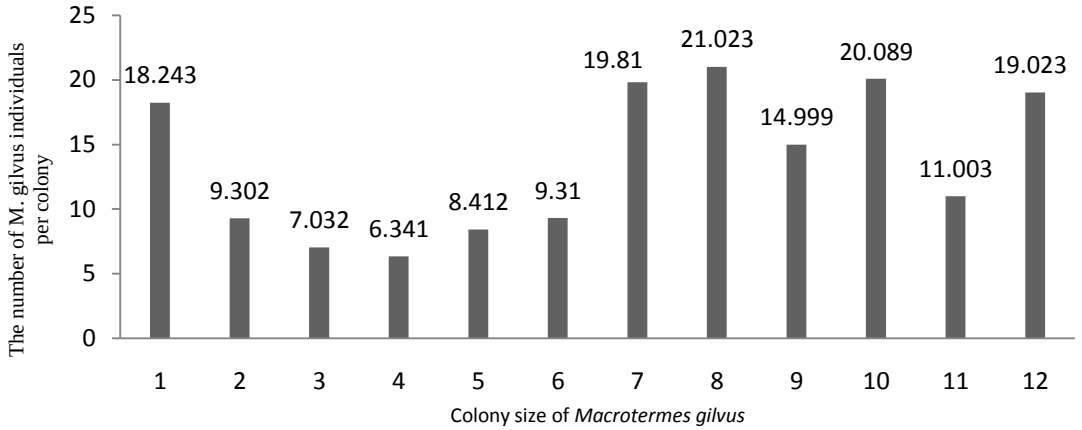

Figure 3. Population size of each M. gilvus termite colony in cocoa plantations is not well maintained

4. Size of *Macrotermes gilvus* termite colony in weeds which are vegetated with weeds and organic waste

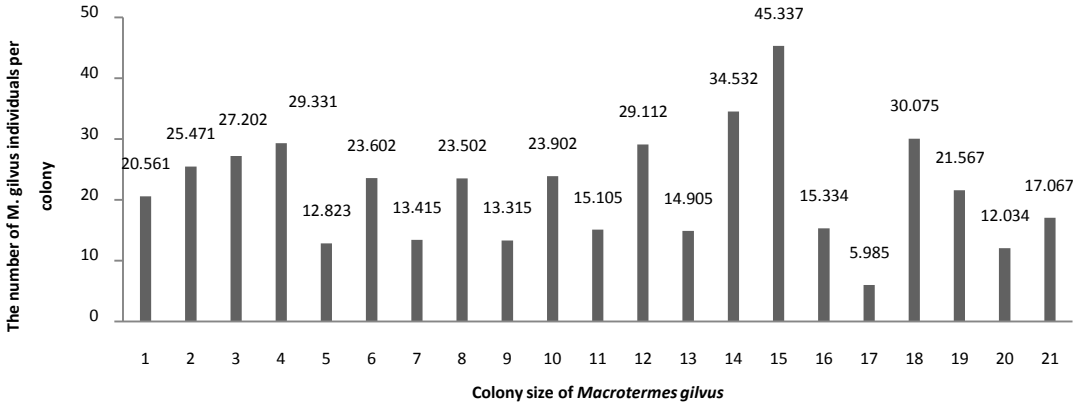

Figure 4. Condition of cocoa plants attacked by termite pests and weed growth

5. Size of *Macrotermes gilvus* Termite Pest Colony Population

Table 1. Populations of Macrotermes gilvus termite pest colonies in cocoa plantations, Bandar Baru District, Pidie Jaya District)

Block number	Number of Colonies	Population Size (Individual)	Maintenance Cocoa Plant	Total area (m2)
I.	9	446.249	efektif	1.000
II.	12	160.514	ineffective	1.000
III.	12	138.379	ineffective	1.000
IV.	21	431.562	ineffective	1.000
Total	54	78.914		4.000

IV. Discussion

The size of individual termites from each colony at this location is relatively small and is thought to be a new colony. Allegedly related to habitat conditions that are not optimal for the life of termite pests. Food source is not available. Then the temperature and humidity factors do not support the survival of termites (Figure 1).

Observations at this location contained 11 small size colonies (the population size of each colony is less than 20,000 individuals) and one large colony (more than 20,000 individuals) (Figure 2). The number of termite colonies that are found is less than 20,000 individuals which are categorized as small size colonies, allegedly related to the movement of termites from another location that aims to find food sources and build new colonies at this location, and are thought to be related to optimal environmental conditions and has abundant food sources. According to Nandika et.al. (2003) that if the number of termite individuals in a colony is less than 20,000 individuals, then the colony is classified as a small colony. According to Tarumingkeng (1992) the food source available in a habitat is a determining factor for the presence of termites at that location (Figure 2)

The observations showed that at this location, 12 M. gilvus termite colonies consisted of 2 large colonies and 10 small colonies. The small colony at this location is thought to be a new colony. Other allegations that this colony is separation from the old colony caused by several things such as interference from human behavior such as opening new land so that the environmental conditions of termites are disrupted (Figure 3)

Figure 4. shows that habitat conditions with weed vegetation in the environment are very optimal and effective for the growth and development of termite pests. This is because the humidity and temperature factors are very optimal for the termite pest habitat. Termite pests like high humidity with low temperatures. Related to these conditions, the termites are very effective to carry out their lives in these environmental conditions.

Table 1 Population size of M. gilvus termite pest colonies from cocoa plantations in Bandar Baru Subdistrict, Pidie Jaya Regency. The size of the colony population for each block is different. Percentage of large size colonies in blocks I, II, III and IV differ in the number of individuals in each colony. Worker caste is more dominant than other castes. and There are a number of termite individuals from the army caste. This shows that the working caste plays an important role in the formation of new colonies.

The habitat in the cocoa plantation is optimal as the habitat of M. gilvus termites and has a caste of soldiers up to 25% of the total caste of workers in each colony in the Cocoa Plantation. This is thought to be related to ant activity around the habitat which is the main enemy of termites. so by the reproductive caste (the termite queen) for the defense of the colony by producing the number of individual caste warriors needed to be able to protect the colony from ant attacks or predators. However, there is a termite colony of M. gilvus, which 90% of its colony members are from the workers' caste compared to the warrior caste, which is only 10%. the habitat environment for the termite species M. gilvus is closely related to the behavior of termites. Termites as organisms and to maintain life, always make observations on the situation and environmental conditions, whether beneficial or not. If the environment is not favorable, the termite species will still survive by conditioning their colonies to be optimal and effective, so they can survive. If there are ants around the termite colony, then the reproductive caste of the termite (Queen) will codify the colony to produce a warrior caste more so as to protect the colony from predatory attacks, such as ants (Nandika et al. 2003).

The population size of termite colonies M. gilvus is thought to depend on the age of the queen (age of the colony), the older the queen's age, the capacity to lay eggs will be higher and vice versa the younger the queen's age, the ability to lay eggs will be lower. According to Faulet et al. (2006) the population size of a termite colony with less than 20,223 individuals (50% of the working castes and 10% of the army caste) is included in the small size colonies, whereas those larger than that size are grouped into large size colonies. The size of the colony's population is influenced by the queen's age and environment and the presence of other organisms such as ants (Krishna & Weesner 1969). Lee at al. (2007) added that if the environment is not favorable then the size of the colony population does not grow and develop. Various environmental factors such as soil, vegetation type, climate, and water availability, greatly affect the size of the termite colony population. The cocoa plantation environment of Pidie Jaya Regency is characterized by a relative humidity level of 76 to 88%, surface temperature of 22-26 ° C, relatively better air circulation, high organic matter content and optimal growth of the population of M. gilvus termite pest colonies.

V. Conclusion

Conclusions from the results of this study are as follows: Termite pest species that damage cocoa plants in Bandar Baru District, Pidie Jaya Regency, are *Macrotermes gilvus*, Cacao plants that are lacking in maintenance have a higher level of damage due to termite pest attacks than well-maintained cacao plants, The growth of termite population of *M. gilvus* termites is higher in the habitat location where cocoa plants are less considered than the habitat of cocoa plants that are well cared for.

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