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The Intensity of Attack of *Xylosandrus compactus* (Coloeptera: Curculionidae) on Cocoa in East Luwu Regency South Sulawesi

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Abstract. *Xylosandrus compactus (Coloeptera: Curculionidae)* is known as one of the important pests on coffee plants, but currently, *X. compactus* has been found to attack cocoa plants in East Luwu Regency, South Sulawesi, which can be damaged to sudden plant death. This study aims to determine the distribution and attack intensity of *X. compactus* pest on cocoa in Wotu District, East Luwu Regency. The research was conducted in the cocoa plantation area of farmers from June to December 2020. The observed variables in this study were attack symptoms of *X. compactus*; insect stadia found, the number of boreholes, and attack intensity of *X. compactus*. The results showed that most of the cocoa plantation area had been attacked by *X. compactus,* with the symptoms mostly occurring on the cocoa stem that caused damage and death of the plant. The highest attack intensity was found in Tarengge Village, Wotu District, East Luwu Regency at 77.50%.

INTRODUCTION

X. compatus is known as coffee twig borer or Ambrosia beetles [1]. In Indonesia, this pest is known as the 'branch and twig borer.' The *X. compactus* beetle is an invasive polyphagous pest native to Asia that has been found to date in tropical and subtropical areas of all continents. This insect entered the Americas in the 1970s. It was first detected in 1973 in Peru and then detected in the Peruvian Amazon in 1991. In 2011, *X. compactus* was first reported to attack forest crops in Europe, namely in Italy [2]. In 2017, the pest was reported to have attacked cacao crops in Peru, where it caused considerable damage [3].

A factor that has an important influence on population development and the attack of *X. compactus* is high humidity, especially during the rainy season. High humidity is needed not for beetle development but for the growth of pathogenic fungi in the borehole, which further increases the growth of larvae and the predation of adult female beetles. *X. compactus* is associated with fungi Fusarium and Ceratocystis, which are pathogenic to plants. Trunks, branches, or twigs that are drilled will wither, turn yellow, and dry out. The presence of pathogenic fungi helps to accelerate the death of branches and twigs [4]. In addition to high humidity, *X. compactus* attacks Arabica coffee and plants that are poorly maintained or have been weakened by attacks of other pests and diseases [5]. The *X. compactus* beetle can also damage robusta coffee plants in areas with high rainfall and humidity [6]. In South Sulawesi, this pest was found to attack cocoa in 2018, particularly in Wotu District, East Luwu Regency, which resulted in sudden plant death.

Currently, X.compactus pests on cocoa plants are still difficult to control optimally, especially in cocoa plantations that are not well maintained. Generally, control is done by reducing the humidity of cocoa plantations by pruning,

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improving waterways, garden sanitation, plant rejuvenation, and application of synthetic insecticides as preventive measures against *X.compactus* pests. However, it turns out that these chemicals have not fully provided effective results in suppressing pest attacks. The continuous and excessive use of synthetic chemical compounds will result in resistance and further cause environmental damage risk.

This study aimed to investigate the intensity of attack and the number of boreholes of the pest *X. compactus* on stems and branches in Wotu District, East Luwu Regency, South Sulawesi Province.

MATERIALS AND METHODS

Observation of the intensity of the attack was carried out by selecting an area of 1 ha on farmer's land in each village that was used as a sample. The sample selected was seven villages from 16 villages in Wotu District, East Luwu Regency. The land was chosen because it was attacked by X. compactus. The number of trees observed was 10 percent of trees per ha, which were identified as young and old plants. Observations were made on the intensity of the attack and the average number of boreholes on the branches and trunks. The tools and materials used in this research were magnifying glass, lux meer, labels, stationery, and a camera. The intensity of the attack is calculated using the formula [7]:

$$I = \frac{a}{b} x\ 100\% \quad (1)$$

Note:
I= Attack Intensity (%)
a = Number of affected plants
b = Total number of plants

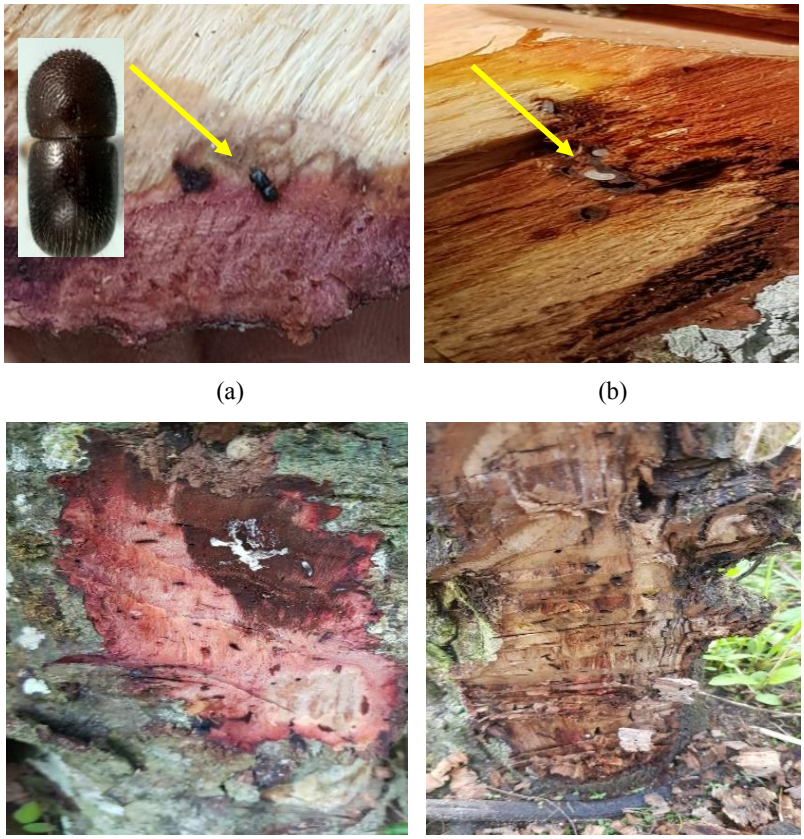
The intensity of the attack is classified into four classifications i.e., light (1-25%), moderate (26%-50%), heavy (51%-75%), and very heavy (>75%). All observed data were analyzed using variance analysis (ANOVA). The comparison of mean leaf damage intensity caused by pests and other parameters was made using the Duncan test at a 5% probability level.

RESULTS AND DISCUSSION

Attack Symptoms

The results showed that *X. compactus* had attacked cocoa plants in East Luwu Regency with the discovery of larvae and imago on the bark. The attack of the *X. compactus* was characterized by the presence of boreholes which were generally found on the main stem of the cocoa plant. The initial attack on the stem is in the form of a hole in the bark up to the main stem, which is marked by a small black hole in the bark, which eventually causes the plant to dry up and die. If a cacao stem that has a drill hole is cut transversely, the hole will be seen from the outer shell to the pith, forming a space for the beetle eggs until they hatch and become adult insects (Figure 1).

The intensity of stem damage that has been severe is characterized by the loss of the surface layer of the bark, and the cocoa stems drying out. This condition can cause a decrease in fruit production. This happens because cocoa is a plant that bears fruit on the stem (cauliflorous). From the observation of the symptoms of *X. compactus* attack, the intensity of the attack was higher on older plants with cocoa plantations that were not well maintained, but some young plants were also found to be attacked.



(a) (b)

(c) (d)

FIGURE 1. (a) *X. compactus* adult on cocoa stem bark; (b) *X. compactus* eggs found in the bark of cacao stalks; (c) Hole of *X. compactus* on the stem of a cocoa plant; (d) Follow-up attacks on cocoa plants that dry out and eventually die.

Attack Intensity

The results of observations on the intensity of *X. compactus* attacks in seven villages were included in two categories, namely heavy and very heavy in plants aged < 10 years, while in plants aged 1 - 5 years, it was still in the light category. The highest branch borer attack was found in Tarengge Village, with an attacking intensity of 22.75% on plants aged 1-5 years and 77.50% on plants aged > 10 years (Table 1).

From the results of observations on the number of *X. compactus* holes in cacao plants aged 1-5 years, there were an average of 2.14 - 4.20 holes found in the trunk and an average of 0.25 - 0.80 found in the branches. Meanwhile, the average holes found in plants >10 years old were 8.70-12.96 in the trunk and 1.20-2.80 in the branches (Table 2). Data on the average number of holes showed that *X. compactus* mostly attacked the stems of cocoa plants.

TABLE 1. The intensity of *X. Compactus* attack on cocoa plants in Wotu District, East Luwu Regency

Village	Attack Intensity (%)	
	1-5 years old	>10 years old
Tarengge	22.75a	77.50a
Tarengge Timur	12.50c	72.50b
Cendana Hijau	13.75c	63.25c
Pepuro Barat	16.25b	73.75b
Karambua	9.50d	63.25c
Lera	11.25c	53.75d
Bahari	8.50d	71.50b

Notes: The column number (followed by a similar letter) has no significant difference at 5% Duncan Test

TABLE 2. The average number of holes in cocoa stems and branches due to *X. Compactus* attack on cocoa plants in Wotu District, East Luwu Regency

Village	Average number of holes			
	1-5 years old		>10 years old	
	Stem	Brench	Stem	Brench
Tarengge	4.20a	0.80a	12.96a	2.80a
Tarengge Timur	3.75b	0.25c	11.40b	2.50b
Cendana Hijau	2.30c	0.60b	9.10c	1.90c
Pepuro Barat	2.25c	0.40b	12.48a	2.20b
Karambua	3.45b	0.43b	9.38c	1.40d
Lera	2.15c	0.30c	8.70d	1.20d
Bahari	2.14c	0.25c	9.62c	1.73c

Notes: The column number (followed by a similar letter) has no significant difference at 5% Duncan Test

The high intensity of attack on cocoa plants aged >10 years in Wotu District was considered due to the influence of high levels of shade density, causing the relatively lower intensity of incoming sunlight, decreased temperature, and increased humidity. This is supported by the results of measurements of the intensity of sunlight entering the cocoa plants in the seven villages with an average of 51.78% - 88.37%. Control with a cultivation approach needs to be done by pruning protective plants and branches to reduce humidity around the plant [5].

The presence of the *X. compactus* on cocoa plants in East Luwu Regency, South Sulawesi Province, which is directly adjacent to the Provinces of Central Sulawesi and Southeast Sulawesi, needs serious attention to prevent it from spreading. Control and prevention need to be carried out in an integrated manner between the government, academics, and quarantine centers so that pest attacks can be suppressed. The control that has been carried out by farmers in Wotu District, East Luwu Regency is by applying chemical insecticides to the stems and branches while the dead plants are cut down and replaced with new plants.

To control the pest X. compactus, the actions taken are monitoring the development of the pest population regularly, pruning as well as burning the affected branches and twigs [8]. In coffee plantations in Hawaii, control of X. compactus was carried out using traps, namely Verbenone and limonene compounds [9]. Research conducted at the National Coffee Research Institute in 2014 in Uganda showed Plagiolepissp ants have the potential to be used as X. compactus control agents, where these ants can prey on eggs and larvae within 24 hours [10]. In Uganda, the use of chemical pesticides to suppress the growth of Ambrosia mushroom mycelium was carried out using three fungicides, namely chlorothalonil (Glider), bisaconazole (Orius 25EW), and dimethomorph + mancozeb (Volar) [11]. The use of predatory Pheidolemegacephala as a biological control agent against X. compactus gave significant results in reducing attack intensity [12].

CONCLUSION

The attack intensity of X. compactus in Wotu District, Luwu Regency, South Sulawesi Province was included in the heavy and very heavy category, dominantly attacking the >10-year-old plants with holes mostly found in the stems. The presence of X. compactus is very dangerous because it can cause the sudden death of cocoa plants. This research

is very important and can be used as a reference in pest management, and quarantine measures need to be maintained so that these pests do not spread to other areas.

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