



# Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.) Investment at *Agave* spp

Parnidi <sup>1\*</sup>, Dwi Adi Sunarto <sup>1</sup>, Marjani <sup>1</sup>

<sup>1</sup> Balai Penelitian Tanaman Pemanis dan Serat, Jl. Raya Karangploso KM 4, Indonesia

\* Correspondence: [nikicro@yahoo.co.id](mailto:nikicro@yahoo.co.id)

## Abstract

**Background:** Agave is known as one of the natural fiber-producing plants that have many benefits. Agave plants can grow well on dry land, however, many organisms can damage agave crops in the field. One of the agave plant is Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.). The purpose of this research is to get information about variation damage of agave germ plasma to Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.). **Methods:** The research was conducted at the *Agave balittas* collection in the Experimental Garden Balittas Karangploso. Observation of shoot borers beetle pest of coconut (*Oryctes rhinoceros* L.) was carried out on 6 plants. Observations were made by calculating the number of holes that were found on the leaves. **Results:** The results showed that the investment of Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.) causing damage to agave germplasm varies. The average percentage of damage to *Agave angustifolia* and *Agave cantala* in 2017 due to the investment in Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.) is range from 66.7 to 100%. The average damage caused by Shoot Borers Beetle Pest of Coconut (*Oryctes rhinoceros* L.) investment in *Agave sisalana* ranges from 0 to 16.7%. **Conclusions:** The investment of shoot borers beetle pest of coconut in agave plants has a big impact on decreasing crop production and fiber quality.

**Keywords:** Agave; germplasm; shoot borers beetle pest of coconut; *Oryctes rhinoceros*.

## Introduction

The agave plant is known as one of the natural fiber-producing plants that are classified as long fibers. Diversification of agave fibers is very much included for textile materials, temali ropes, paper, crafting building materials and construction, and synthetic fiber making materials (Budiman et al., 2006; Kusumastuti, 2009; Santoso, 2015) food and fresheners, medicinal ingredients (Debnath et al., 2010; Monterrosas-Brisson et al., 2013; Tewari et al., 2014). Agave plants can grow well on less fertile land and marginal land (Santoso & Cholid, 2019). In Indonesia, Agave crops have not become a promising commodity for farmers. This is due to the lack of steady cultivation technology and also the selling price of fiber that has not been profitable.

Limited information about the cultivation of Agave plants is suspected to cause a lack of agave plant development in Indonesia. The only Agave plant developer in Indonesia is PT. SBS (Sumbawa Bangkit Sejahter) is located in East Lombok with a development area of ± 400 ha and until now the company continues to develop and expand its planting areas. In areas where rainfall is less than 3 months such as East Lombok Agave plants can grow well (Santoso & Cholid, 2019).

The Sweetener and Fiber Plant Research Center (Balittas) has a collection of Agave spp with as many as 23 accession numbers. Planting is carried out in Karangploso Experimental Garden, Malang. Since 2012 after observations until 2015. In 2015 obtained



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information on the attack of coconut shoot borer pests (*Oryctes rhinoceros* L.) as it attacks on coconut and oil palm crops. According to (Siswanto & Trisawa, 2018) in addition to palms, betel nut, sago, pineapple and bananas, the Agave plant is one of the minor hosts of the coconut shoot borer pest.

Symptoms of *Oryctes rhinoceros* L. similar to the coconut plant, namely in the gap between the leaves there are remnant fibers of the geraan. Geraan leaves a mark in the form of a hole that is 1-3 cm in diameter with a depth of 4-5 cm. The geraan can penetrate up to the point of growing. Although not to the point of turning off the plant, but the growth of the plant can be disturbed and the leaves of the Agave spp plant look hollow (Parnidi et al., 2016). Based on observations in 2016 that the attack of *Oryctes rhinoceros* L. on the Agave plant showed unevenness. There are some Agave plants that are attacked and some are not attacked. Based on this, research was conducted on the attack of coconut shoot borer pests (*Oryctes rhinoceros* L.) on the Agave spp plant.

## Metode

Research was conducted on Agave plants in Karangploso Experimental Garden, Sweetening and Fiber Plant Hall - Malang. Agave plant was planted in 2012 using a planting distance of 2 m x 2 m and a distance between accessions of 5 m.

Observations of the attack of coconut shoot borer pests (*Oryctes rhinoceros* L.) on agave plants were carried out for 2 years, namely from January 2016 to December 2017. The age of the plant when observations are made about 4 to 5 years. The number of plants used as samples is as many as 23 accession numbers and each accession is folded 6 clumps of plants. In the observation of no repetition due to insufficient number of plants that exist.

### Data Collection and Data Analysis

Observation variables include:

1. Qualitative character of Agave plant which includes the color of the leaves, the color of the edges of the leaves and also the color of the thorns of the edges of the leaves. The grouping of Agave plant types is based on UPOV Agave (International Union for the Protection of New Varieties of Plants (UPOV), 2007).
2. The sign of the attack of coconut shoot borer pests is the presence of traces of geraan.
3. The degree of damage to the Agave plant due to the attack of coconut shoot borer pests.

The results of qualitative observations of the morphological characteristics of agave plants are carried out in descriptive analysis. The results of quantitative observations in the form of a percentage of damage to Agave plants due to the attack of coconut shoot borer pests are carried out by calculating the number of trees affected by the characteristics of hollow leaves or there are traces of geraan in one year divided by the number of trees observed. Classification of attack intensity of shoot borer beetle using the classification used (Fauzana et al., 2018) the attack intensity of the *Oryctes rhinoceros* L. beetle attack is light < 40%, the intensity of the attack is moderate 41-60%, and the intensity of heavy attack > 61%.

## Result

### Agave Plant Grouping

Based on the morphological characteristics of the existing Agave plant collection of the Sweetener and Fiber Plant Research Center planted in the Karangploso Experimental Garden, Malang is grouped into three groups as shown in Figure 1, Figure 2, Figure 3, and Table 1.



Figure 1. Agave angustifolia plant



Figure 2. Agave cantala plant



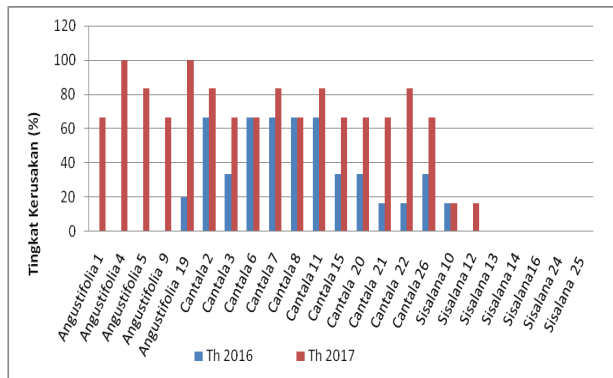
Figure 3. Agave sisalana plant

Table 1. Qualitative character of agave plants collection Balittas.

Accession name	Type	Leaf color	Leaf edge color	Leaf edge Thorns
Balittas 1	<i>A. angustifolia</i>	Green	Light green	Prickly large, numerous and twisted
Balittas 4	<i>A. angustifolia</i>	Green	Light green	Prickly large, numerous and twisted
Balittas 5	<i>A. angustifolia</i>	Green	Light green	Prickly large, numerous and twisted
Balittas 9	<i>A. angustifolia</i>	Green	Light green	Prickly large, numerous and twisted
Balittas 19	<i>A. angustifolia</i>	Green	Yellowish green	Prickly large, numerous and twisted
Balittas 2	<i>A. cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 3	<i>A. cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 6	<i>A. Cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 7	<i>A. Cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 8	<i>A. Cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 11	<i>A. Cantala</i>	Dark green	Dark green	Prickly large, numerous and twisted
Balittas 15	<i>A. Cantala</i>	Yellowish green	Green	Prickly large, numerous and twisted
Balittas 20	<i>A. Cantala</i>	Gray	Yellowish green	Prickly large, numerous and twisted
Balittas 21	<i>A. Cantala</i>	Gray	Green	Prickly large, numerous and twisted
Balittas 22	<i>A. Cantala</i>	Gray	Gray	Prickly large, numerous and twisted
Balittas 26	<i>A. Cantala</i>	Gray	Green	Prickly little a lot, upright
Balittas 10	<i>A. Sisalana</i>	Dark green	Dark green	Prickly little a lot, upright
Balittas 12	<i>A. Sisalana</i>	Dark green	Yellow	Prickly little a lot, upright
Balittas 13	<i>A. Sisalana</i>	Dark green	Yellow	Prickly little a lot, upright
Balittas 14	<i>A. Sisalana</i>	Green	Bright green	Big spiked slightly, crooked
Balittas 16	<i>A. Sisalana</i>	Gray	Gray	No thorns
Balittas 24	<i>A. Sisalana</i>	Gray	Gray	No thorns
Balittas 25	<i>A. Sisalana</i>	Gray	Green	No thorns

**Borer Pest Attack Rate on Agave Plants**

The intensity of the attack of coconut shoot borer pests on the Agave plant of the Balittas collection is based on classification as carried out. Based on the results of the study showed that the attack of coconut shoot borer pests (*Oryctes rhinoceros* L.) on Agave angustifolia by 16.66%, and in Agave cantala attacks reached 66.67% (Figure 4). Meanwhile, agave sisalana showed no attack. An attack of *Oryctes rhinoceros* L. on Agave cantala or Agave angustifolia in one year on one plant can occur at more than one point as seen in (Figure 5 and Figure 6).



**Figure 4.** Percentage of damage to agave plants due to oryctes rhinoceros L. attacks in 2016 and 2017.



**Figure 5.** a) Signs of agave plants are attacked by shoot borer pests, the presence of dry fibers coming out from between the leaves. b) New shoot borer pest organisms attack plants



**Figure 6.** Former shoot borer investment in Agave cantala, one plant there is more than one former gerkon.

The hole of the gerkon marks on the leaves of the *Agave spp* plant is between 1-3 cm in size or about 1/5 - 1/3 leaf width as seen in Figure 7.



**Figure 7.** Holes of the former *oryctes rhinoceros* L. gerekan on the leaves ready to be harvested.

## Discussion

Agave plant is a succulent plant that is easy to grow on various types of land even on dry land that is less fertile, *Agave spp* grows well. This is indicated by good plant growth even in dry weather or dry season (Santoso & Cholid, 2019). According to the results of the grouping conducted by (Parnidi et al, 2016) that the Agave plant collection of sweetener and fiber plant hall based on morphological character is grouped into *Agave sisalana*, *Agave cantala* and *Agave angustifolia*.

Agave plants are plants that tend to be safe from the disruption of plant disrupting organisms (OPT). This is shown by the absence of reports related to Agave plants damaged by a pest of pests, but since 2016 - 2017 in the agave plant collection in karangploso experimental garden - Balittas, Malang shows the attack of coconut shoot borer pests, which often attack coconut or oil palm plants such as Figure 4.

Coconut shoot borer pests have been known as pests that attack coconut or oil palm plants with a reduced population of coconut plants on the island of Java there is a tendency to move habitat from coconuts in plants other than coconut including agave or which is still one genus with coconut. (Siswanto & Trisawa, 2018) reported that coconut shoot borer beetle pests also attack sago, sugarcane, and nenas plants.

In 2016 the rate of attack of coconut shoot borer pests on *Agave cantala* showed moderate with an average attack intensity of 50.5% (moderate). The rate of attacks of coconut shoot borer pests in 2017 occurred throughout *Agave cantala* and showed an increase in attacks with an average of 74.8% (weight).

The 2016 year on *Agave sisalana* showed no attack of coconut shoot borer pests. Meanwhile, in 2017 attacks only occurred on *Agave sisalana* 10 with an average attack of 16.7% (light).

In 2016 attacks on *Agave angustifolia* were on *Agave angustifolia* Balittas 7 with an average attack of 20% (light). But in 2017 the infestation of coconut shoot borer pests occurred in the entire *Agave angustifolia* plant with an average of 83.3% (weight). Attack of coconut shoots borer pests, on one Agave plant can occur at more than one point as seen in Figure 6. This is in agreement with (Fauzana et al, 2018; Lukmana & Alamudi, 2018) stated that coconut shoot borer pests can attack coconut or palm shoots more than once on the same plant.

In 2017, the attack of coconut shoot borer pests on the Agave plant showed an increase compared to 2016. This is as the case in oil palm plants where the damage to oil palm leaves can reach 50% and seen in the next 2-3 years (Lukmana & Alamudi, 2018; Rizki, 2016).

Pest borer shoots adult coconut shoots both male and female feed on the title of the plant through the base of the leaves of the *Agave spp* plant into the growing point. This activity gives rise to a collection of fibers that are in the swallowing hole (Figure 4). Gerekan pest borer coconut shoots produce a hole mark at the base of the leaves with a

depth of up to 10 cm, holes to penetrate the growing point (apical meristem). The leaf morphology of the young Agave plant covers each other or is layered. When the leaves open, almost every leaf sheet looks hollow-hole which is a mark of pest borer borer coconut shoots (Figure 7).

Up to the age of 2 years of observation, the attack of coconut shoot borer pests showed that it did not result in death in the Agave plant. The attack of coconut shoot borer pests is able to reduce production and also decrease the quality of fiber. The decrease in the quantity and quality of Agave plant fibers is due to many fibers being cut off due to the former gergakan. According to (Parnidi et al., 2016) due to the infestation of shoot borer pests on agave plants can reduce the wet weight of leaves up to 7.69% while the decline in fiber yield reached 17.42%.

The high attack of coconut borer pests on Agave plants is suspected to be due to a less clean environment of organic ingredients leftover harvest and weeding waste that is piled up on the edge of the garden which is a food ingredient for coconut shoot borer beetles. To overcome the magnitude of the attack of coconut borer pests, it can be done cleaning the garden from organic waste around the garden that can be used by borer beetle pests as foodstuffs and hatch their eggs. If there has been an attack, the control of coconut shoot borer pests on Agave plants can be done by thinning larvae and beetles, chemical insecticide applications, the use of entomopatogen mushrooms and the use of aggregate pheromones (Athifa et al., 2018; Rianto et al., 2017; Wardana, 2016; Widyanto et al., 2014).

## Conclusions

The presence of coconut shoot borer pest attacks on Agave planting is a new phenomenon that needs to be studied and anticipated early. The attack of coconut shoot borer pests on the Agave plant continues to increase every year. The attack of coconut shoot borer pests on the largest agave plants is found in Agave cantala an average attack of 74.8%. The attack of coconut shoot borer pests on the smallest Agave plants occurred in Agave sisalana 10 with an average attack of 16.7%.

## Declaration statement

The authors reported no potential conflict of interest.

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