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## Research Article

# Plantain Squirrel Attack Rate (Sciuridae) on Cocoa Farming (*Theobroma cacao* L.) in Lima Puluh Kota Regency, West Sumatra

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## Abstract

**Background and Objective:** Cocoa is the mainstay plantation crop of Lima Puluh Kota Regency, West Sumatra. This research aimed to study the rate of plantain squirrel attacks on cocoa plants in Lima Puluh Kota Regency, Sumatra Barat. **Materials and Methods:** The research was conducted from April to May, 2021 at people's cocoa plantations in Lima Puluh Kota Regency. The survey method was used in this study with the purposive random sampling technique to select sample plants. Three districts with the largest cocoa land in Lima Puluh Kota District were selected as research locations: Bukit Barisan, Guguk and Payakumbuh. Each sub-district selected the second-largest land with criteria of the area of land  $\pm 0.5$  ha ( $\pm 400$  stems of cocoa plants) with a plant life of >4 years and has been in production. In each land, 10% of the plants were selected as sample plants. **Results:** The results showed that plantain squirrel attacks were spread evenly in Lima Puluh City Regency with the percentage of plants affected by 37.14% and the percentage of fruit affected by 55.25%. The highest plantain squirrel attacks were found on cocoa farming in the Payakumbuh sub-district, with the percentage of plants affected by 37.14% and the percentage of fruit affected by 55.25%. **Conclusion:** Plantain squirrel attacks have been evenly distributed on cocoa farming in Lima Puluh Kota Regency, with the percentage of crops affected by 32.25% and the percentage of fruit affected by 27.57%. The highest plantain squirrel attacks were found on cocoa farming in the Payakumbuh sub-district, with the percentage of plants affected by 37.14% and the percentage of fruit affected by 55.25%.

**Key words:** Plantain squirrel, cocoa, attack rate, Lima Puluh Kota, West Sumatra

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

Cocoa (*Theobroma cacao* Linn.) is one of the mainstay commodities of plantations whose role is important for the national economy. In addition, cocoa is the third-largest foreign exchange producer of plantation sub-sectors after palm oil and rubber. Cocoa plantations are evenly spread on almost all major islands in Indonesia<sup>1</sup>. Indonesian cocoa centres spread on Sulawesi island as much as 59%, in West Sumatra by 8% and the remaining 33% comes outside the island of Sulawesi and West Sumatra Province<sup>2</sup>. Indonesia is currently the third-largest cocoa producer globally after Ivory Coast and Ghana<sup>3</sup>.

In West Sumatra, cocoa is also the third export commodity after palm oil and rubber, with 53.07 thousand tons in 2020<sup>4</sup>. One of the centres of cocoa production in West Sumatra is Lima Puluh Kota Regency. Lima Puluh Kota Regency is located at 0°25'28.71"LU-0°22'14.55"LS and 100°15'44.10"BT-100°50'47.80"BT. The area has geographical conditions from sloping land to hills, 110 m 2,261 above sea level (asl)<sup>5</sup>. Fertile soil conditions cause many commodities that grow well in this area one of the cocoa plants. The area of cocoa land in this district amounted to 4,196 ha, with a production of 4.09 thousand tons in FY2020<sup>6</sup>.

The main problem in the cultivation of cocoa plants is the attack of plant disrupting organisms (OPT) and one OPT that can reduce cocoa production significantly is plantain squirrel<sup>6</sup>. Plantain squirrel (Sciuridae) is a treeshrew<sup>7</sup>. Plantain squirrel and Treeshrews come from different orders at the order level because coconut plantain squirrel comes from Rodentia and Treeshrews are from Scandentia<sup>8</sup>. The distribution of plantain squirrel includes Semenanjung Malaya, Thailand, Sumatra, Kalimantan, Java, Bali and Lombok and the surrounding islands, which are at an altitude of 500-1100 m above sea level<sup>9</sup>. Plantain squirrel is generally the main pest of coconut plants. However, some reports also show that plantain squirrel becomes the main pest of cocoa plants, especially coconut plants that become protective cocoa plants<sup>10</sup>. The results showed that the average cacao fruit affected by plantain squirrel is 10.72 per tree or equivalent to 423 g of seeds into the ring every 6 months (846 g/year). The total loss of dry seed weight per hectare is 921.3 kg/year or Rp 20.23 million/year (market price at the west Sumatra farmer level Rp 22,000 kg<sup>-1</sup>)<sup>11</sup>. The purpose of the study was to study the rate of plantain squirrel attacks on cocoa farming in the Lima Puluh Kota Regency.

## MATERIALS AND METHODS

**Time and place:** The research was conducted at people's cocoa plantations in Lima Puluh Kota Regencies in Payakumbuh, Guguak and the Bukit Barisan Districts from April to June, 2021.

**Research methods:** The survey method was used in this study with the purposive random sampling technique to determine cocoa plant samples. The criteria used for determining the sample location were per cocoa plant with a land area of  $\pm 0.5$  ha ( $\pm 400$  stems of cocoa plants) and the age of the cocoa plant  $>4$  years has been in production.

**Determination of research location:** Based on the cocoa rice area's criteria, three sub-districts in Lima Puluh Kota are determined: Bukit Barisan, Guguak and Payakumbuh. Each subdistrict selected the 2 largest lands with criteria of the land area of  $\pm 0.5$  ha ( $\pm 400$  stems of cocoa plants) and the age of cocoa plants  $>4$  years and has been produced.

**Determination of sample plants:** Sample crops are taken 10% of the 400 cocoa plants in the plantation area on each land. In each sample plantation, there are 40 sample plants. The determination of sample plants was done systematically by creating the longest diagonal lines and straight lines. On each diagonal line are selected 15 sample plants and the longest straight-line was 10 plants. The distance between one sample plant and another sample plant is determined later because the number of cocoa plants in one diagonal line is unknown and depends on the garden's condition.

**Conduct of research:** Before the study, a preliminary survey was conducted first. Activities in the form of reviewing the research location and interviews were carried out with farmers as land managers. This interview provides information about the condition of cocoa land.

In the early stages, cocoa farmland meets the criteria for observation and sample crops to be observed, then conducted observations of the rate of plantain squirrel attack on the cocoa fruit of the sample plant.

Observation parameters in the form of symptoms of an attack, per cent of the percentage of cocoa plants, affected and cocoa fruit affected. Calculation of plantain squirrel attack rate in the form of a percentage of cocoa plants affected and cocoa fruit affected. The percentage of cocoa plants affected based on the formula<sup>12</sup> used under this:

$$P (\%) = \frac{a}{b} \times 100$$

Where:

P = Percentage of plants affected

a = Number of plants affected

b = Total number of plants

To calculate the percentage of cocoa fruit affected, the formula used is:

$$Pb (\%) = \frac{A}{B} \times 100$$

Where:

Pb = Percentage of affected fruit per sample plant

A = Number of affected fruits per sample plant

B = Total number of fruits per sample plant

**Statistical analysis:** The data were analyzed by Microsoft Excel 2019 Program.

## RESULTS AND DISCUSSION

**Symptoms of a plantain squirrel attack:** In general, the condition of cocoa farming in the Lima Puluh Kota Regency showed that the cultivation of cocoa plants has not been done well. Based on observations, the symptoms of plantain squirrel attack were found in ripe cocoa fruit and, near the affected cocoa plant, found splattered cocoa beans. Plantain squirrel only eats the flesh ripe cocoa fruit, while the fruit's flesh is not eaten. Usually, under the affected fruits are always splattered cocoa beans<sup>6</sup>.

The typical behaviour of plantain squirrel in cocoa is to eat the same fruit repeatedly every day until the seeds in the fruit are depleted. If a used cocoa fruit is eaten by a plantain squirrel but has not run out of seeds, the next day, the plantain squirrel will come again to eat the fruit. On fruit that is old and ready to be harvested, plantain squirrel eats the flesh of the cocoa fruit (pulp) and drops the hard beans, but on the young cacao fruit, plantain squirrel eats fruit meat and cocoa beans<sup>7-11</sup>.

**Percentage of cocoa plants and fruits affected:** The results showed that the plantain squirrel attack was evenly distributed on cocoa farming in Lima Puluh Kota with a

percentage of crops affected by 32.25% and the percentage of fruit affected by 27.57% in Table 1. The highest plantain squirrel attack was found in the Payakumbuh sub-district, with a percentage of a plant affected by 37.14% and the percentage of fruit affected by 55.25%.

Field conditions play a role in influencing pest attacks from both invertebrate and vertebrate groups<sup>13</sup>. OPTs from vertebrate groups that attack cocoa plants such as squirrels affect cocoa production significantly and damages both quality and quantity production. Squirrel attacks occur because cocoa fields are close to or adjacent to the forest, causing squirrels to look for food other than those found in the forest<sup>6</sup>. In addition, the shade found in cocoa farming areas such as coconut becomes a food alternative for vertebrate pests, especially plantain squirrel. Coconut is the main food source for plantain squirrels<sup>10</sup>. Cocoa protective plants such as coconut plants and unmanaged gardens correlate with a high infestation of plantain squirrel pests on cocoa plants.

Observations made in Guguak Subdistrict point to a different thing. The results of observations in the Guguak subdistrict showed that the rate of plantain squirrel pest attacks in this sub-district was lowest among the three districts observed, with the percentage of plants affected and fruit affected by 29.65 and 6.36%. This condition is caused by the well-maintained condition of cocoa. Farmers in both lands are also always in the garden during the day to maintain cocoa crops. Plantain squirrel behaviour in finding food sources will usually avoid human presence<sup>14</sup>. The selection of cocoa trees to be attacked is influenced by safety and comfort considerations at the time (situational). Cacao trees are generally lower than protective plants such as coconuts, so this good-security bandage is important. Plantain squirrels will avoid meeting humans<sup>15</sup>.

Cocoa fruit is one of the preferred types of food, especially in the unavailability of fruits<sup>10</sup>. Samoan plantain squirrel increases in the dry season because there are no or very few other fruits that can be eaten. In the rainy season, this is the season of fruits, the plantain squirrel attack on cocoa fruit decreases<sup>11</sup>.

Table 1: Percentage of cocoa plants affected and cocoa fruit affected in Lima Puluh Kota Regency

| District      | Plants affected (%) | Fruit affected (%) |
|---------------|---------------------|--------------------|
| Bukit Barisan | 30                  | 21.11              |
| Guguak        | 29.62               | 6.36               |
| Payakumbuh    | 37.14               | 55.25              |
| Average       | 32.25               | 27.57              |

## CONCLUSION

Plantain squirrel attacks have been evenly distributed on cocoa farming in Lima Puluh Kota Regency, with the percentage of crops affected by 32.25% and the percentage of fruit affected by 27.57%. The highest plantain squirrel attacks were found on cocoa farming in the Payakumbuh sub-district, with the percentage of plants affected by 37.14% and the percentage of fruit affected by 55.25%.

## SIGNIFICANCE STATEMENT

This study discovered the plant squirrel attack rate in Lima Puluh Kota regency can be beneficial for this pest control. This study will help a researcher to uncover the critical areas of plant squirrel attack rate that many researchers were not able to explore. Thus a new theory on plant squirrel rate-controlling may be arrived at.

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