

MEALYBUGS and THEIR NATURAL ENEMIES DIVERSITY on CASSAVA CROPS (*Manihot esculenta* Crantz)

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Abstract

These recent two years, cassava production has been threatened by mealybugs invasion. Cassava mealybugs are new pest that potentially decrease crop production, especially cassava. One of pest control towards mealybugs on cassava is using their natural enemies like parasitoids, predators, and pathogens. This research conducted to discover mealybugs and their natural enemies diversity on cassava crops. This research using direct observation method with simple random sampling technique applied at four different locations in Banyuwangi. This research was held on November 2014 until December 2014. The result showed that there are two specieses found at four defined locations in Banyuwangi. Those two specieses are *Paracoccus marginatus* and *Ferrisia virgata*. The highest diversity index was found at Glenmore, Sub District Glenmore ($H' = 2.47$) and the lowest diversity index was found at Sobo, Sub District Banyuwangi ($H' = 1.63$). The highest average of *P. marginatus* was also found at Glenmore, 28.65; while the lowest average of *P. marginatus* was found at Secang, 6.5. The highest average of *F. virgata* population was also found at Glenmore, 13.6 and the lowest average of *F. virgata* population was found at Secang, 1.3. There was only one mealybugs predator found in this research, *Hemerobius* spp. The conclusion of this research are that mealybugs' diversity index was put on medium category and there were two specieses found, *P. marginatus* and *F. virgata*. Mealybugs natural enemies diversity was on low category, with only one mealybugs predator found from *Hemerobius* spp species.

Keywords: mealybugs. natural enemies, diversity

Introduction

Cassava is one of lots important crops for human being, because of their advantage as food, animal feed, as industrial and bioethanol raw materials[1]. In these recent two years, cassava production sustainability was threatened by mealybugs invasion. *Phenacoccus manihoti*, *Paracoccus marginatus*, and *Ferrisia virgata* are three mealybugs species attacked cassava crops. Mealybugs are kind of pest with wide range host such as physic nut, cashew nut, tomato, avocado, melon and papaya. Pesticides are the common mealybugs pest control taken by lots of farmers. But the use of pesticides at some defined concentrations will raise some side effect to the environment and to the mealybugs natural enemies as well. Considering that pesticides can cause a resistance, an environmental friendly pest control for long term is badly needed. One possible alternative is using their natural enemies, such as predators, parasitoid or pathogens[2]. This research conducted to discover mealybugs diversity on cassava crops (*Manihot esculenta* Crantz) because mealybugs is one of some factors that affected cassava production. This research is also conducted to discover any mealybugs natural enemies as the pest control for long term application.

Methods

This research has been taken for two months, from November to December 2014 at four different locations in Banyuwangi District. Those four locations are Secang, Kemiren, Sobo, and Glenmore. The methods using on this research were direct and sample observations. The procedures taken during this research are sample collection, rearing, and natural enemies' identification. Samples are collected by taking some infected leaves from some different plants. Rearing process was held for 7 to 14 days to trap mealybugs parasitoids.

Shannon-Wiener index[3] was used to discover species' diversity at each locations, with equation below:

$$H' = -\sum p_i \ln p_i, p_i = \frac{n_i}{N}$$

with:

H' = Shannon Wiener Index

n_i = amount of pest observed

N = total amount of all pest caught

Diversity index categorized into three category. If $H' < 1$, the species diversity was on low category. If $H' = 1 < H' < 3$, the species diversity was on medium category. And if $H' > 3$, it means the species diversity was on high category.

Sorensen index of similarity[4] was used to count the species similarity between two defined locations.

$$IS = \frac{2c}{A+B} \times 100\%$$

with :

IS = Sorensen index of similarity

A = amount of mealybugs species at location1

B = amount of mealybugs species at location 2

C = amount of same mealybugs species at both locations.

If index value > 50%, it means species similarity between two locations compared is on the high category, and so otherwise, if index value <

50% means species similarity between two locations compared is on the low category. 3.

Result and discussion

The result achieved through this research is that only two mealybugs species found through this research. Those two species are *P. marginatus* and *F. virgata*. The amount of *P. marginatus* caught at Secang, Kemiren, Sobo, and Glenmore are 130; 250; 173; and 573. And the amount of *F. virgata* found at Secang, Kemiren, Sobo, and Glenmore are 26; 47; 61; dan 272. The biggest amount of *P. marginatus* and *F. virgata* was found at Glenmore. Diversity index at Secang, Kemiren, Sobo, and Glenmore are 1.80; 1.63; 1.89; 2.47.



Figure 1. *Ferrisia virgata*



Figure 2. *Paracoccus marginatus*

The highest mealybugs index of diversity was found at Glenmore with some reason. Glenmore has the highest population of mealybugs and cassava crops as the main host observed. Mealybugs population defined by some factors and host population is one of them. It explains why the highest mealybugs index of diversity was found at Glenmore, the location with the widest field of cassava crops. Other plants being surround main host also define mealybugs abundance, and affecting the species distribution pattern as well. The distribution pattern of mealybugs was determined by the values of z , \bar{x} , dan v . Value for z achieved by using equation $z = (\bar{x} - v) / (std/\sqrt{n})$. Z

value determining the species distribution pattern at defined locations. If z value is $-1.96 > z > 1.96$, the distribution pattern is random one. If counted z is beyond that value and average point (\bar{x}) is larger than diversity value (v), it means the species distribution pattern is regular pattern. And if the average point is smaller than the diversity value, it means the species distribution pattern is the clustered one[5].

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F. virgata distribution patterns for all locations are clustered, except at Kemiren. Clustered distribution pattern happened when a species is already settled down at the defined location for long enough. *F. virgata* distribution pattern at three locations showing that this species was already invaded the locations for years. While why *F. virgata* distribution pattern at Kemiren is still on random pattern which happened when a species is just fill in the place is that because at Kemiren there are some other plants that possibly become alternative hosts for mealybugs attacked cassava crops. The plants are papaya, tomato, physic nut and chili pepper. These plants are placed close enough to the cassava crops, that some mealybugs migrations are possible to be happened between cassava crops and the surround plants or otherwise. It explains why the distribution pattern of *F. virgata* at Kemiren is random. *P. marginatus* distribution patterns are clustered for all locations except at Secang. The explanation for this case is also about the others plants around cassava crops field. Some plants found surrounding cassava crops field at Secang are silk tree, eggplants, chili pepper and papaya which planted randomly close enough to the cassava crops field as the main observation objects. Some plants surround cassava crops are suspected causing the *P. marginatus* distribution pattern at Secang is random one. Those plants are available to be another hosts for *P. marginatus* especially papaya plants which are the main host of *P. marginatus*. *P. marginatus* distribution pattern at other locations are clustered, which means that this pest is already settled down at those locations eventhough *P. marginatus* is a newly attacking pest. It showed that this pest invasion was quietly fast through these years.

The amount and diversity of mealybugs species was also affected by abiotic factors such as temperature, lights, and rainfall intensity beside

biotic factors such host and food abundance, surround plants, and natural enemies being.

Index of similarity of all species found are in high category, with index value 100%. The mealybugs species found at four locations are all the same. The species similarity determined by host similarity and abiotic factors at the location observed.

Hemerobius spp is the only mealybugs predator found through this research. There is no mealybugs parasitoid found at four defined locations in Banyuwangi District.

Conclusion

There are two mealybugs species found at four different locations in Banyuwangi District. Those two species are *P. marginatus* and *F. virgata*. The diversity index of mealybugs are on medium category for all locations. *Hemerobius* spp. is the only mealybug predator found through this research and there is no mealybug parasitoid found.

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