ABUNDANCE OF MEALYBUGS (HEMIPTERA: PSEUDOCOCCIDAE) ON SEVERAL VARIETIES OF CASSAVA (*Manihot spp*) IN BULELENG REGENCY

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ABSTRACT

Abundance of Mealybugs (Hemiptera: Pseudococcidae) on several varieties of cassava (Manihot spp.) in Buleleng Regency. This study was conducted with the aim of determining population abundance, diversity index, composition and similarity index of mealybugs (Hemiptera: Pseudococcidae) that attack cassava in several varieties in Buleleng Regency. This study used a survey method starting from September 2022. The location for the research in Buleleng Regency was determined diagonally so that 5 sample units were obtained. For each sample unit, 5 plants were taken and observed purposively. On each plant, 3 leaves were taken from the top, 3 in the middle and 3 at the bottom which were attacked by mealybugs. The results showed that there were 4 species of mealybugs that attacked 5 varieties of cassava plants with an abundance of 2,142 mealybugs recorded. The species of mealybugs that attacked the Anturan, Cicih, Gadang, Kuning and Prau varieties were Phenacoccus manihoti-Ferrero, Paracoccus marginatus Williams & Granara de Willink, Ferrisia virgata Cockerell and Pseudococcus jackbeardsleyi Gimpel-Miller with a low diversity index (<1.5). The composition of mealybugs showed that there were 2 dominant species, namely P. manihoti (49%) with a population density of 4.844 individuals per leaf and P. marginatus (48%) with a population density of 4.436 individuals per leaf. the similarity index for each variety has a value ranging from 0.67 to 1.

Keywords: Buleleng, Cassava, Mealybug, Population Abundance

1. INTRODUCTION

Cassava is one of the secondary crops that is widely cultivated in Indonesia, other crops such as soybeans, peanuts, corn, green beans, and sweet potatoes (Novaldi *et al.,* 2022). Cassava plants have the advantage of being easier to cultivate and more resistant to biotic and abiotic stresses than rice and maize (Caniago *et al.,* 2014). Cassava contains the main nutritional value in the form of carbohydrates, besides that cassava also contains a lot of nutritional value for the body, namely glucose, protein, fat, calcium, phosphorus, sodium and magnesium. Cassava plants are widely used as food raw materials, because they have a distinctive taste and good nutritional content such as: carbohydrates (161 Kcal), water (60%), protein, minerals, fiber, calcium, phosphate (Noerwijati and Mejaya, 2015).

Indonesia's cassava production is very large and abundant, so it is very suitable to be selected as an alternative food to replace rice. This can be seen from data on Indonesia's cassava production which reached 21 million tonnes (BPS 2016). In line with its high production, cassava occupies the top position as a food crop export commodity according to the 2015–2019 Ministry of Agriculture Strategic Plan, in contrast to wheat, soybean, corn and rice commodities which contribute to imports when Indonesia's trade in food crop commodities is in a deficit position or net importers (Harsita and Amam 2019).

According to Muslim (2017), the cassava harvested area in Indonesia for the 1980–2016 period fluctuated, but tended to decrease from 1.41 million ha in 1980 to 0.87

million ha in 2016. Cassava production from 2006 to 2012 tended to increase from 19.986.640 tonnes to 24.177.372 tonnes (Ministry of Agriculture, 2015). According to the Central Bureau of Statistics (2016) at a fixed rate in 2015 in Indonesia the area of cassava harvested in Indonesia has decreased from 2013-2015, namely from 2013 as many as 23,936,921 tons, to 21,801,415 tons in 2015. Decreased cassava production caused by plant pests (OPT). One of the pests found to attack cassava plants is the mealybug.

Mealybugs are insects that belong to the Phylum Arthropoda, Class Insecta, Order Hemiptera, Suborder Stenorrhyncha, Superfamily Coccidea, and Family Pseudococcidae. Mealybugs have a white waxy coating in almost all parts of their body which is secreted by the trilocular porus in the cuticle through a secretory process (Nurhayati, 2012; Wardani, 2015). Mealybug is a pest that threatens cassava production in Indonesia. Mealybug attacks on cassava plants cause yield losses of around 30-50% (Dwianri, 2013; Wardani, 2015). According to Rauf in Compas.co (2014) mealybug attacks in Indonesia in 2014 if converted to rupiah reached IDR 900 billion.

So far, detailed information on mealybug infestations on several varieties of cassava in Buleleng Regency has never been reported. Therefore, this research really needs to be done to get an overview of mealybug attacks on several cassava varieties in Buleleng Regency as basic information for controlling mealybug pests on cassava plants. Some of the problems that this study seeks answers to are: (1) How is the diversity and abundance of mealybug species (2) the population density of mealybugs, (3) the similarity index of mealybug species in several varieties of cassava.

2. RESEARCH METODOLOGY

This research was conducted in the field. Field research was conducted on cassava land owned by farmers in Buleleng Regency. This research was carried out from September 2022 until completion. This research was conducted by survey method. Exploration of mealybugs on several varieties of cassava was carried out by taking samples of the leaves of the crystal guava plant which contained mealy bugs. The determination of the research location was carried out by diagonal sampling. Sampling in the sampling unit was carried out using a purposive method with 5 sample plants in each sample unit (Pangestu, 2017; Wahyuni *et al.,* 2017). Each plant sample was taken 9 leaves of plants attacked by mealybugs. The collected mealybugs were then identified with the Williams & Granara de Willink identification key (1992).

Diversity, abundance, similarity, and population density of mealybugs at each location were calculated using the formula:

Shannon-Wienner diversity index (Magurran, 2005):

$H' = - \Sigma Pi \ln Pi \longrightarrow pi = ni/N$ (1)

Information :

H' : diversity index
Pi : ni/N
ni : number of individuals of type i
N : total number of individuals

Description Index value:

< 1,5 : low diversity index
1.5-3,5 : moderate diversity index
> 3,5 : high diversity index

The composition of mealybugs was calculated using the Odum formula (1996).

$Pi = \frac{ni}{N} x\ 100\%$ (2)

Note: Pi: species composition
ni : the number of types to-i
N : total amount

The Similarity Index uses the Sorensen index formula (Astuti and Ruslan, 2019)

$$S = \frac{2.C}{A+B} \quad (3)$$

Information :
A : the number of species in sample A
B : number of species in sample B
C : the number of the same type in both samples

Population density is calculated using the formula Pebriani *et al.,* (2018).

$$KP = \Sigma \frac{JK}{DB} \quad (4)$$

Information :
KP : population density
JK : number of mealybugs
DB : number of leaves

3. RELATED RESEARCH/LITERATUR REVIEW

Cassava

Cassava is a herbaceous plant originating from the Americas, to be precise, Brazil. Cassava plants spread almost all over the world, including Africa, Madagascar, India and China (Abrori, 2016). Cassava plants are widely used as a source of food and industrial raw materials (Pramesty *et al.,* 2017).

Cassava plants can grow at rainfall of 760-1,015 mm/year, humidity of 60-65%, sunlight exposure of 10 hours/day and temperatures of 18^{o}C-35oC (Abrori, 2016; Pratama, 2017; Samosir, 2016). Temperatures below 10^{o}C will hamper the growth of cassava plants and will not even form tubers (Pratama, 2017; Sundari, 2010).

Mealybugs

Mealybugs are insects belonging to the Phylum Arthropoda, Class Insecta, Order Hemiptera, Suborder Stenorrhyncha, Superfamily Coccidea, and Family Pseudococcidae. Mealybugs have a white waxy coating in almost all parts of their body which is secreted by the trilocular porus in the cuticle through a secretory process (Nurhayati, 2012; Wardani, 2015). The Pseudococcidae family is an insect that has a wide host range, so it is polyphagous. These insects attack several types of plants such as coffee, cocoa, oranges, mangoes, sugar cane, palms, orchids, cassava and various fruit trees and ornamental plants (Williams & Granara de Willink, 1992). Mealybugs began to attack cassava plants at the age of eight weeks after planting (MST) (Nurmasari, 2015). Mealybugs generally reproduce asexually, both ovivar and viviparous, but there are several species of mealybugs which have viviparous and ovoviviparous reproduction.

Williams *et al.,* (1992) reported that there were 19 species of Mealybugs found attacking cassava plants, most of which were spread in hot climates and several species in tropical areas. According to Lovalini (2016) and Nurmasari (2015) in Indonesia there are four species of mealybugs found attacking cassava plants including *P. marginatus, F. virgata, P. jackbeardsleyi* and *P. manihoti*.

Abundance

Abundance is the amount present by each species from all individuals in the community (Campbell, 2010). Based on this understanding, it can be concluded that abundance is the number or number of individuals in a certain area in a community. According to Nybakken (1992) abundance is a simple measurement of the number of species present in a community or trophic level.

4. RESULTS AND DISCUSSION

The observations showed that there was a diversity of mealybug species found on several varieties of cassava in Buleleng Regency (Table 1). Observation of cassava varieties in Buleleng Regency showed that there were 5 cassava varieties consisting of Anturan, Cicih, Gadang, Kuning and Prau varieties. Observations of the abundance of mealybugs on several varieties of cassava in Buleleng Regency totaled 2,142 individuals consisting of four species of mealybugs. The four species are *Phenacoccus manihoti* (1090 individuals), *Paracoccus marginatus* (998 individuals), *Ferrisia virgata* (35 individuals) and *Pseudococcus jackbeardsleyi* (19 individuals). Population abundance in the field is usually influenced by intrinsic and extrinsic factors (Yudha *et al.,* 2019).

Table 1. Abundance of mealy bugs on cassava plants in Karangasem Regency

Variety	Spesies Mealybugs				Total Population
	P. manihoti	*P. marginatus*	*F. virgata*	*P. jackbirdsley*	
Anturan	68	187	15	6	276
Cicih	211	155	0	0	366
Gadang	177	156	5	11	349
Kuning	302	213	15	2	532
Prau	332	287	0	0	619
Total	1090	998	35	19	2142

Source: Primary data, 2022

Table 1. shows the differences in the diversity of mealybug species in each variety of cassava. The Anturan, Gadang and Kuning varieties were recorded as being attacked by 4 species and the Cicih and Prau varieties were attacked by 2 species of mealybug (Table 1.). The highest abundance of mealybug populations was found in the Prau variety with 619 individuals and the smallest was found in the Anturan variety with 276 individuals. Differences in species and abundance of mealybug populations in several cassava varieties are thought to be due to differences in leaf structure in each cassava variety.

Table 2. Mealybug population density per leaf

Variety	Spesies Mealybugs				Total Population
	P. manihoti	*P. marginatus*	*F. virgata*	*P. jackbirdsley*	
Anturan	1,51	4,16	0,33	0,00	6,00
Cicih	4,69	3,44	0,00	0,00	8,14
Gadang	3,93	3,47	0,11	0,01	7,52
Kuning	6,71	4,73	0,33	0,00	11,78
Prau	7,38	6,38	0,00	0,00	13,76
Total	4,844	4,436	0,156	0,002	9,437

Source: Primary data, 2022

Based on observations of population density, *P. manihoti* had the highest population density with an average population of 4.844 mealybugs per leaf, followed by *P. marginatus* with 4.436 individuals/leaf, *F. virgata* with 0.156 individuals/leaf and *P. jackbeardsleyi* with 0.002 individuals/leaf (Table 2). The high population of *P. manihoti* and *P. marginatus* is because the mealybug has a short life cycle of around 20-25 days (Lidya, 2010) and has an egg fertility rate of 80-90% at 20-30° C (Amarasekare *et al.,* 2008). Based on field observations, the high population of mealybugs P. manihoti and P. marginatus was caused by the many other host plants around the cassava fields observed, such as papaya, citrus, beans, avocado and others.

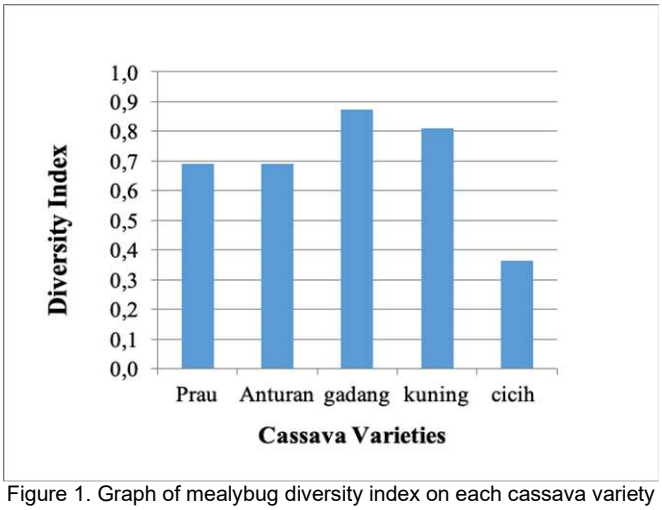

Figure 1. Graph of mealybug diversity index on each cassava variety

Based on the Shannon-Wienner diversity index value indicator (Magurran, 2005), the diversity level of mealybugs in each cassava variety in Buleleng is classified as low diversity because it has a diversity index value (H') <1.5. According to Soegianto (1994), the low value of diversity (H') of mealybug species is caused by the presence of one species that dominates a community. The higher the species dominance in a community, the lower the diversity (H') value of mealybugs and the lower the dominance, the higher the diversity (H') value of mealybugs. Dominance is expressed as the balance of the number of individuals of each species. Dominance of species in a community is caused by the presence of individuals who have more than the number of individuals of other species.

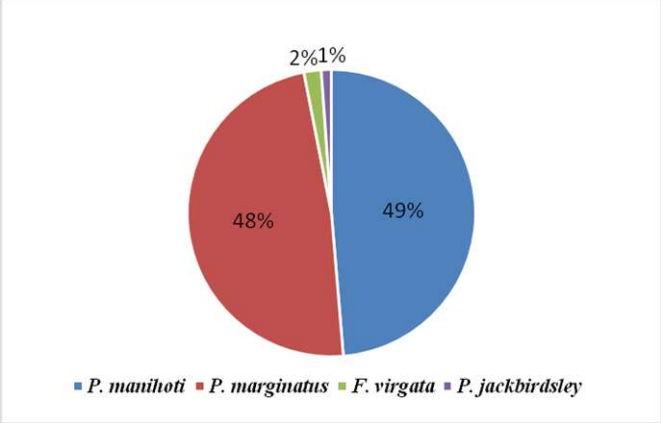

Figure 2. Species composition of mealybugs in Buleleng Regency

The composition of mealybugs showed that there were two dominant mealybug species in Buleleng Regency, namely *P. manihoti* (49%) and *P. marginatus* (48%)

(Figure 2). This dominance shows that *P. marginatus* and *P. manihoti* have high populations and a wide distribution in Karangasem Regency compared to the mealybugs F. virgata and P. jackbeardsleyi.

Table 3. Species similarity index values for each cassava variety

Varietas	Anturan	cicih	Gadang	kuning	Prau
Anturan		0,67	1,00	1,00	0,67
cicih			0,67	0,67	1,00
Gadang				1,00	0,67
kuning					0,67
Prau					

Source: Primary data, 2022

The similarity of the types of mealybugs in various varieties in Buleleng Regency shows the similarity index values that vary for each variety. The results of observations on each variety showed similarity index values ranged from 0.67 to 1. The highest similarity index occurred in the varieties Anturan-Gadang, Anturan-Kuning, Cicih-Prau and Gadang-kuning which had a similarity index value of 1.00. . The lowest similarity was shown in the varieties Anturan-Cicih, Anturan-Prau, Cicih-Gadang, Cicih-Kuning, Gadang-Prau and Kuning Prau which had a similarity index value of 0.67 (Table 3). According to Magurran (1998) a similarity index value equal to 1 indicates that there is full similarity or a series of species in the two communities that are compared identically. If the similarity index value is close to 0, it indicates that a series of species in the two locations are reduced or absent compared to the similarities.

5. CONCLUSION

Based on the results of the research that has been done, it shows that there are 4 species of mealybugs that attack cassava varieties Anturan, Gadang Kuning and 2 species attack cassava varieties Prau and Kuning in Buleleng Regency. The four species that attacked cassava in Buleleng Regency consisted of *P. marginatus, P. manihoti, F. virgata* and *P. jackbeardsleyi* with a low diversity index (<1.5). The composition of mealybugs showed that there were 2 dominant species, namely *P. manihoti* (49%) with a population density of 4.844 individuals per leaf and *P. marginatus* (48%) with a population density of 4.436 individuals per leaf. The similarity index ranges from 0.67 to 1.

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