

THE PRESENCE OF PEST *PARACOCCLUS MARGINATUS* AND NATURAL PREDATORS ON CASSAVA PLANTS IN KINTAMANI, BANGLI

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ABSTRACT

Manihot esculenta Crantz is an important commodity in tropical regions but is vulnerable to pest attacks such as the mealybug (*Paracoccus marginatus*). This study aimed to document the occurrence of mealybugs and their natural predators in cassava agroecosystems in Kintamani, Bangli. The research was conducted from June to August 2025 in four cassava plots using a survey method. In each plot, 20 sample plants were observed, and three leaves from each plant were collected to count mealybug and predator populations. Data were analyzed to determine prevalence, density, and the relationship between predators and pests. The observations revealed that the population of *P. marginatus* increased over time, with the highest average density of 14.3 individuals per leaf in location 4. The overall mean population density across the four sites ranged from 7.67 to 8.71 individuals per leaf. The predator *Cryptolaemus montrouzieri* was found in all sites but at relatively low densities, ranging from 0.42 to 0.71 individuals per leaf. The low predator density is thought to be influenced by the presence of tending ants that protect mealybug colonies. Nevertheless, a negative correlation was observed between mealybug density and predator abundance, indicating the potential role of *C. montrouzieri* as a biological control agent. These findings are consistent with previous reports that predators from the Coccinellidae family play an important role in suppressing mealybug populations, although their effectiveness is strongly influenced by environmental conditions, farming practices, and interactions with other organisms. The low predator-to-pest ratio in this study area indicates that natural control capacity remains limited. Therefore, integrated biological control strategies are needed through the conservation of natural enemies, predator augmentation, and the implementation of environmentally friendly farming practices. This study highlights the importance of natural predators in supporting the sustainability of mealybug management in cassava, particularly in the highland areas of Kintamani.

Keywords: Cassava, *Paracoccus marginatus*, *Cryptolaemus montrouzieri*, natural predators

1. INTRODUCTION

Cassava plant (*Manihot esculenta*) Crantz is commodities important in the area tropical as source food and materials standard industry. However, its productivity often disturbed by the attack pests, especially lice white (family Pseudococcidae) which is known as *Cassava mealybug* (*Phenacoccus manihoti*, as well as insect other suckers such as *Bemisia tabaci* (Aleyrodidae) (Bashir *et al.*, 2014; Supartha, 2022). Attack This pest can cause growth plant stunted, leaves curly, the appearance soot black, to decline results significant harvest (Neuenschwander, 2001) . Invasion *P. manihoti* in Asia, including Indonesia, causes threat Serious Because its rapid spread and wide adaptation to condition climate (Parsa *et al.*, 2012). In Bali, reports latest show infestation lice white on the ground cassava with potential loss for farmer local (Supartha, 2022; Fanani *et al.*, 2024). Factors environment, practice

cultivation, as well as interaction biotic like connection mutualistic with ants the more strengthen challenge control this pest (Gupta, 2021; Othim, 2024).

Enemy experience play a role important in pressing population lice white. Predator of the families Coccinellidae, Chrysopidae, and the parasitoid Hymenoptera are known effective reduce density pests, although the result depending on the conditions environment (Aguilera *et al.*, 2021; Burgio *et al.*, 2025). Release of the parasitoid *Anagyrus Vladimir* reported successful in several area, whereas conservation of local predators is also an issue approach potential (Burgio *et al.*, 025). However, the practice use excessive insecticide precisely often bother population enemy natural and aggravating explosion pests (Aguilera *et al.*, 2021; Fanani *et al.*, 2024). Changes climate participate influence distribution and prevalence pest and predators. Research show that pattern fluctuations population *B. tabaci* and *P. manihoti* very influenced temperature, humidity, and altitude (Criticos *et al.*, 2020). This makes the plains area tall like Kintamani, Bangli interesting to research, because own climate different micro from area plains low. Information specific about existence lice white and its predators in this area are still limited, even though very important to support strategy Integrated Pest Management.

Inventory population pests and enemies experienced in cassava in Bali before show variation significant spatial and temporal (Supartha *et al.*, 2022). Although Thus, the study connecting ecology prevalence pests with an abundance of predators in the plains tall Kintamani has never been conducted. This research aims to documenting existence lice white, identifying associated natural predators, as well as analyze connection beginning between population pests and enemies naturally. This finding is expected to be base development strategy control effective, environmentally friendly environment, and according to conditions agroecology local.

2. RESEARCH METHODS

Location and Period Study

Study implemented in 4 plots land cassava in the village Sekaan, District Kintamani, Regency Bangli, which represents variation cultivation plant cassava. Implementation study done in June until August 2025. Observation techniques done in a way survey to identify population pests and enemies natural (Criticos *et al.*, 2020; Fanani *et al.*, 2024).

Sampling Techniques

Study use type direct research (survey) with sampling in each plot 20 plants observed sample then each plant takes 3 leaves (Parsa *et al.*, 2012)

Pest and Predator Observation

Observation roomy includes: (1) calculation individual lice white per leaf / location attack (density); (2) recording prevalence (% of plants) attacked by counting proportion plant positive to the total number of plants observed (Aguilera *et al.*, 2021; Supartha *et al.*, 2022). Method taking sample covering visual inspection, to catch more active predators use net insects (Bashir *et al.*, 2014; Fanani *et al.*, 2024).

3. LITERATURE REVIEW

White lice papaya (*Paracoccus marginatus*) is one of the pest important thing that attacks various plant tropical, including cassava (*Manihot esculenta*). This pest is known as insect sucker fluid plants that cause symptom chlorosis, leaves rolling, and decreasing growth vegetative as well as productivity plants (Amarasekare *et al.*, 2008). In attack weight, population *P. marginatus* can cover surface leaves and stems, causing plant become weak, and reduce results harvest up to more than 50%. *P. marginatus* first reported attack plant cassava and papaya in the area tropical wet, then spread to the plains high (Marsadi & Dirgayana, 2023; Muniappan *et al.*, 2008). This spread is driven by the activity of trading seeds plants, conditions climate damp, and the absence of enemy natural effective at this stage beginning invasion. Environment in the Village Sekaan, Kintamani, has temperature cool ranges from 18–25°C and humidity relatively high (>70%), very severe condition support development eggs and nymphs *P. marginatus*. Combination factor climate and

availability plant host throughout the year causes population This pest is capable of survive and thrive in a way sustainable in the region.

The presence of natural predators in the ecosystem agriculture Village Sekaan own role important in pressing population pest in a way natural. Some common predators found including beetles *Cryptolaemus montrouzieri* (Coccinellidae), ladybug *Scymnus sp.*, and the predatory fly *Diadiplosis karnyi* (Dirgayana *et al.*, 2021). This predator preys on eggs, nymphs, and lice white mature young, so that help guard population *P. marginatus* at a non-harmful level (Herlinda *et al.*, 2019). Predatory activity tends to increases in season dry when population pest reaches the peak. Besides factor biotic, wild vegetation around garden cassava also plays a role role important as an alternative habitat for predators and parasitoids. Vegetation the provide source feed addition like nectar and pollen, as well as place take shelter for predators during period population pest low (Mani & Shivaraju, 2016). This condition supports stability predator population in the long term long and contributing to control sustainable biodiversity management *P. marginatus* in the Village Sekaan need directed at conservation enemy experience through restrictions use pesticide synthetic, planting refugia vegetation, as well as population monitoring in a way periodically. This strategy is not only pressing population pest but also maintain balance ecology and diversity life in agroecosystems cassava plains high. Through this approach, the system agriculture in Kintamani can be developed going to agriculture environmentally friendly sustainability environmentally friendly, productive, and stable in a way ecological.

4. RESULTS AND DISCUSSION

Paracoccus Pest Population Marginatus

The results show that attack pest *Paracoccus marginatus* is found in plants cassava in the village Sekan Kintamani, Bangli. Appearance lice white is shown in figure 1.



Figure 1.
Source: Dirgayana (2025)

Based on results observations in Table 1 show that population lice white *P. marginatus* on plants cassava in the village Sekaan, Kintamani increase from beginning until end observations, with an average density highest reached 14.3 individuals per leaf at location 4. The average total density population in four location ranging from 7.67–8.71 individuals per leaf. The pattern of increase This population is in line with the findings Parsa *et al.* (2012) who reported that condition climate tropical plains tall very support mealybug development. In addition, the weather like rainfall suitable rain and humidity will be cause growth population pest Significant *S. marginatus*. Humidity levels high in Kintamani (>70%) is known speed up reproduction pest suction. Temperature air in the area Kintamani is relatively cool (18–25°C) to factor main thing that accelerates development eggs and nymphs *P. marginatus* (Amarasekare *et al.*, 2008). Humid environment help maintain layer candle body protector pests, so that increase resilience to factor environment like rain and wind. In addition, the conditions shoot young and soft cassava become ideal place for lice white to suck fluid plants, causing leaf curling, yellowing, and dropping activity photosynthesis.

Table 1. Population size pest *Paracoccus marginatus* in plants cassava in the village Sekaan, Kintamani

Observation of the	Average Number of Pests/ Leaf			
	Location 1	Location 2	Location 3	Location 4

1	3.7	4.3	4.0	4.7
2	5.0	5.7	5.3	5.7
3	5.3	5.7	5.0	6.3
4	7.3	7.0	7.7	8.0
5	8.3	8.7	9.3	9.7
6	9.0	9.7	8.7	9.3
7	10.3	10.7	11.3	11.7
8	12.3	12.7	13.7	14.3
Total Average	7.67	8.04	8.13	8.71

Compared to the plains area low population *P. marginatus* in Kintamani relatively higher. This is consistent with the report Supartha *et al.*, (2022) who stated that agroecosystem plains high in Bali tends to own greater vulnerability to mealybug attack due to lack of practice rotation plants. Factors monoculture cassava is dominant in the village Sekaan also strengthens sustainability population pests. Distribution higher population at location 4 is suspected influenced by density plants and existence ant protector from the genus *Anoplolepis* and *Solenopsis* which intertwine connection mutualistic with *P. marginatus* (Mani & Shivaraju , 2016). Ants the protect colony lice white from natural predators like *Cryptolaemus montrouzieri*, so extend age life population. This condition is in line with the report Muniappan *et al.* (2008) that interaction mutualistic between ants and fleas white be one of factor driver explosion population in the area tropical.

Difference population between location can also be caused by conditions different microclimates, including intensity light, aeration air, and variation varieties planted cassava. In locations with denser shade, the population tends to be higher Because stable humidity support reproduction pests. While in more open locations, exposure ray direct sunlight and higher temperatures can reduce population through improvement death eggs and nymphs. In In general, these results indicate that *P. marginatus* own ability high adaptation in the ecosystem plains Bali's high population. The population continues to grow increase without control strong natural potential cause damage economy significant. Therefore, the approach control-based ecology like natural predator conservation and management surrounding vegetation land very important implemented (Herlinda *et al.*, 2019) Strategy it is not only pressing population pest but also maintain balance agroecosystem in the Kintamani region.

Predator Population *Cryptolaemus Montrouzieri*

Presence of the predator *Cryptolaemus montrouzieri* found at the location research is shown in Figure 2, although in much lower numbers compared to population lice white , with an average of 0.42–0.71 individuals per leaf as shown in Table 2. The low this predator population may influenced by the height interaction mutualistic between lice white and ants the shepherd who protects colony pests (Gupta & Ghosh, 2021). Othim *et al.* (2024) also reported that activity ants can lower the effectiveness of natural predators by driving away Coccinellidae attack. Pest *C. montrouzieri* still considered as agent controller biological important. Burgio *et al.* (2025) stated that This species is capable of lower mealybug population in general significant in conditions Good habitat conservation . Nurfuadianti *et al.* (2022) added that release *C. montrouzieri* in the field cassava capable pressing level damage up to 40% in season dry season. In the village Sekaan, though its population low, the presence of correlation negative between density lice white and predators indicate role potential *C. montrouzieri* as a regulator.

Table 2. Population of the *Cryptolaemus montrouzieri* predator on pests *Paracoccus marginatus* in the Village Sekaan, Kintamani

Observation of the	Average Number of Predators/ Leaf			
	Location 1	Location 2	Location 3	Location 4
1	0.0	0.3	0.3	0.0

2	0.7	0.7	0.7	0.0
3	1.0	0.7	0.7	0.3
4	0.7	1.0	0.3	0.3
5	0.7	1.0	0.7	0.7
6	1.3	0.7	0.7	0.3
7	0.7	0.7	0.7	0.7
8	0.7	0.3	0.3	1.0
Total Average	0.71	0.67	0.54	0.42

Average difference in predator population between location (0.42–0.71) indicates existence influence condition microhabitat to existence enemy natural. Variations landscape, availability of refugia, and level use pesticide very influence abundance of natural predators. Aguilera *et al.* (2021) also showed that practice fertilization organic can increase generalist predator population. In the context of ecology, predator– pest ratio in the village Sekaan Still far below threshold control natural. According to Southwood & Henderson (2000), the effective predator: pest ratio usually around 1:20 or better. Meanwhile, in Figure 2 it can be seen that at the location this study, with density lice white average 8–9 individuals / leaf and predators less than 1 individual / leaf, it is clear that ability control experience Still weak.



Figure 2.
Source: Dirgayana (2025)

The implications are the need strategy conservation enemy experience through provision refugia plants, reduction insecticide synthetic, and even introduction additional predator *C. montrouzieri*. Burgio *et al.* (2025) suggest area -wide predator augmentation to stabilize population pests in the field wide. Meanwhile, integration with specific parasitoids like *Anagyrus lopezi* who has success in Africa can also be considered (Parsa *et al.*, 2012; Neuenschwander, 2001).

5. CONCLUSION

Existence population *P. marginatus* in the Village Sekaan, Kintamani, included high and potential harm production cassava. The predator *C. montrouzieri* is present but in limited numbers, so that contribution experience still not enough significant. Difference microclimate between location cause variation population *P. marginatus* and the predator *Cryptolaemus montrouzieri*. Although Thus, the existence of natural predators like *C. montrouzieri* potential pressing population pests in the field with intervention pesticide low.

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