

INFESTATION OF MAJOR PESTS AND DISEASES ON VARIOUS CASSAVA CLONES IN LAMPUNG-INDONESIA

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ABSTRACT

Infestation of major pests and diseases on various cassava clones in Lampung-Indonesia. Lampung Province is one of cassava producers in Indonesia which contributes more than 30% to the total national cassava production. However, the infestation of pests and diseases can limit cassava production in the field. The objective of this research was to observe the infestation level of major plant pests and diseases of cassava in Lampung. A survey was conducted in August 2016 in several locations of cassava fields owned by farmers and experimental plots in the area of Faculty of Agriculture, University of Lampung. The results showed that cassava mealybug (*Phenacoccus manihoti*), papaya mealybug (*Paracoccus marginatus*) and red mite (*Tetranychus urticae*) infested at cassava clones in Lampung. The infestation of red mite tended to be higher than that of mealybugs. The cassava brown leaf spot disease that infested in mild to moderate severity was found on all cassava clones, while viral disease with prevalence of 78% was only found on Duwet 1 clone in experimental plot.

Key words: cassava, leaf spot diseases, mealybugs, red mite

INTRODUCTION

Lampung Province contributes more than 30% to national cassava production in Indonesia. In 2013, the total production of cassava in Indonesia was around 23 million ton with 1 million ha of planting area, while the total production and planting area of cassava in Lampung were 8 million ton and 0.3 million ha, respectively (BPS, 2014). Indonesian Government encourages expansion of cassava plantation later, because the area of this crop tends to decline (Kementerian Pertanian, 2016).

The expansion of cassava cropping systems are usually followed by an increase in pests and diseases problem. According to Bellotti (2002), there were around nine pest species infested cassava in Asia, including spider mite, mealybugs, whitefly, scale insect, fruit fly, grubs, termites, and stem borer. They were considered as serious problem in many cassava producing countries. Abaca *et al.* (2014) reported that green mite, mosaic wilt and cassava wilt bacteria were the main pests and diseases in Northwest of Uganda. The green mite infestation reached 37–100%. In Ivory Coast, the mites is also reported capable to spread in a very wide area

every year (Yaninek *et al.*, 1989). Other pest such as whitefly (*Bemisia tabaci*) is reported as a vector of mosaic geminivirus disease on cassava that causes crop yield loss of more than 1.5 million USD in Africa (Ewusie *et al.*, 2010).

Spider mites and mealybugs are also reported as the major pest of cassava in Indonesia. According to Kalshoven (1981), the spider mite species attacking cassava in Indonesia was *Tetranychus bimaculatus* (synonym: *T. urticae*), while Astuti (2014) also found that *T. kanzawai* can reduce 95% of cassava production in West Java. Papaya mealybug and cassava mealybug are two important species attacking cassava in Indonesia. Muniappan *et al.* (2009) described that cassava mealybug (*Phenacoccus manihoti*) was a very destructive pest. Cassava mealybug and papaya mealybug (*Paracoccus marginatus*) were exotic pests that have been entering Indonesia since 2007 (Wardani, 2015). Infestation of the two mealybug species on young crops of cassava caused bunchy top symptoms, stunting, followed by dropping leaves and reduced 40–50% of production. Based on CLIMAX model, Parsa *et al.* (2012) predicted that cassava mealybug (*P. manihoti*) risk is most acute in the southern end of Karnataka in

India, the eastern end of the Ninh Thuan Province in Vietnam, and in most of West Timor in Indonesia, because of climate suitability.

There are many clones of cassava cultivated by farmer in Lampung, but the two most dominant clones were UJ-3 and UJ-5. The characteristic of the clones was high production and high starch content within tubers. Infestation of pests and diseases can limit the production of cassava in Lampung, but information about the pests and disease infestation is still lacking. The objective of this research was to observe the infestation level of major pests such as mealybug, red mite and major diseases especially leaf spot disease on cassava from several cassava fields in Lampung-Indonesia.

MATERIALS AND METHODS

Research Site. Sampling of pests and diseases were conducted from May to August 2016 on two types of cassava field, the first was owned by farmers and the second was cassava plot in Experimental Station of Faculty of Agriculture, University of Lampung. The cassava fields was distributed in several locations, i.e. Bandar Lampung, South Lampung, and East Lampung Districts. At least 20 clones of cassava were planted in the experimental plots. Samples were processed in the Laboratory of Plant Pests and Diseases, University of Lampung-Indonesia.

Two ha of cassava plantation area was selected as sampling site for each location. Within a sampling site, 10 subsample rows in 3-row intervals were taken systematically across the field diagonal. One subsample row consisted of 10 plants. The prevalence of mealybug, spider mites and brown leaf spot disease were documented in each subsample. The disease severity was grouped into four categories, i.e. healthy, mild,

moderate and severe, respectively. The pest infestation and disease incidence were measured by the following formula:

$$\text{Pest infestation} = \frac{\text{number of infested plants}}{\text{total number of plants observed}} \times 100\%$$

$$\text{Disease incidence} = \frac{\text{number of diseased plants}}{\text{total number of plants observed}} \times 100\%$$

Mealybug and spider mite population were measured from the leaves of five cassava plants that were taken randomly. From each plant sample, six leaves were taken respectively from the lower and middle part of plant. The pests on the leaves were counted using a hand-tally counter under a stereo binocular microscope (LEICA EZ4HD) in laboratory. The counting unit is the basal area of cassava leaf within 2 cm radius (leaf base).

RESULTS AND DISCUSSION

The major pests found infesting cassava in Lampung were red spider mite (*Tetranychus* spp., Acarina: Tetranychidae), and two species of mealybugs: the cassava mealybug (*Phenacoccus manihoti* Matile-Ferrero, Hemiptera: Pseudococcidae) and the papaya mealybug (*Paracoccus marginatus* Williams and Granada de Willink, Hemiptera: Pseudococcidae). The major disease was the brown cassava leaf spot caused by fungi *Cercospora henningsii*. Figure 1 shows that the pests infesting cassava plants in all locations surveyed. The infestation of red mite tended to be higher than that of mealybugs in all locations, except in Sukarame area. The infestation of mealybugs in NTF-1 area and NTF-2 area tended to be lower than in other

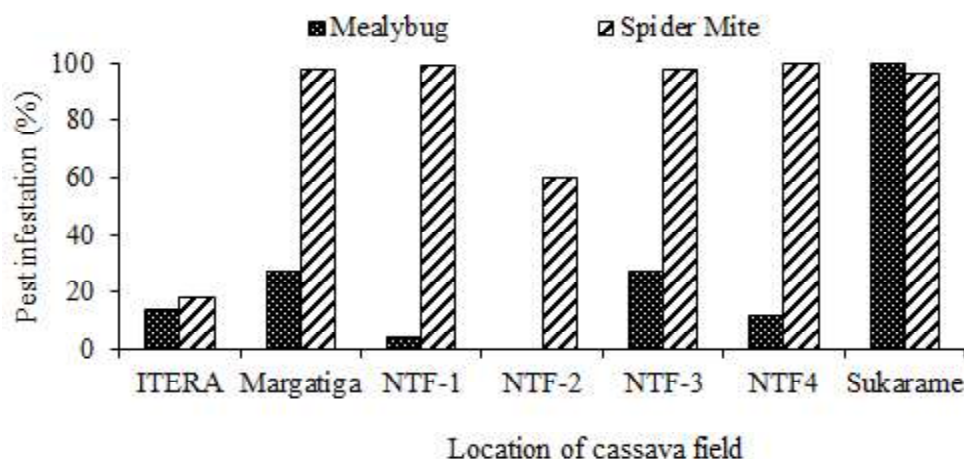


Figure 1. The prevalence of spider mite and mealybug infestation on several cassava field in Lampung, Indonesia.

locations. The brown leaf spot disease was found in all surveyed locations with disease severity from mild to severe, while the moderate to severe category occurred on cassava in NTF-1 area and NTF-3 area. The mild category of diseases occurred in the other locations (Figure 2).

Based on leaf position, the mealybugs preferred to attack on both the lower and middle leaves, while red spider mite preferred to attack on the middle leaves. The population of mealybugs on the lower versus middle leaves was not different, but the population of red mite was higher on the middle leaves (Figure 3).

Pest population and disease prevalence on various cassava clones were depicted in Table 1. In general, the population density of spider mites and mealybugs on

various cassava clones was low. The highest mealybug population that reached nine individuals per leaf base was found on clone UJ3 (1), while the pest population on the other 19 clones were around two or less individuals per leaf base. The spider mite population on these various clones was also low. The population mean of the pests on four cassava clones, namely Baris 14, Baris 17, Gajah and SL 75 were 2 individuals per leaf base and tended to be higher than that on the other 16 clones. The lower population of mealybugs and red mite in this study may due to climate condition was not vavorable to the pest. Observation of pest was conducted at May, when season was rainy. The severity of the brown leaf spot disease on all cassava clones were mild to moderate, but the disease prevalence was

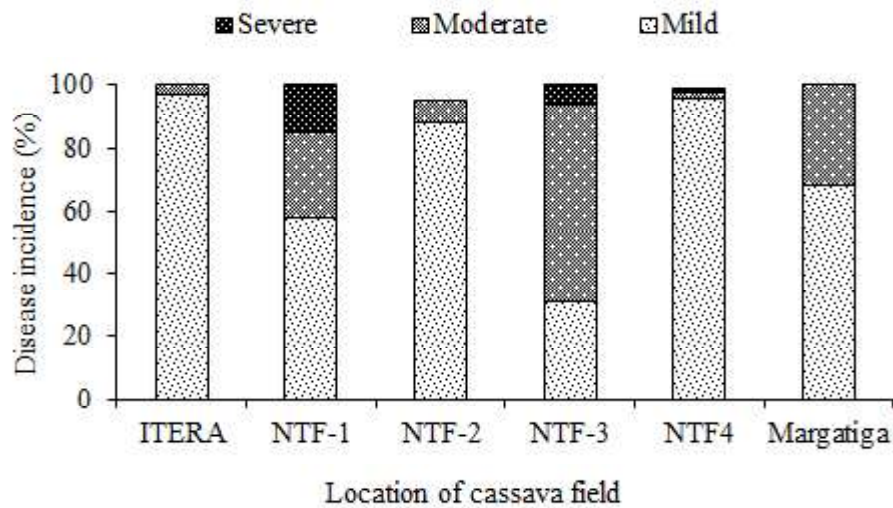


Figure 2. Brown leaf spot prevalence in several cassava fields in Lampung, Indonesia.

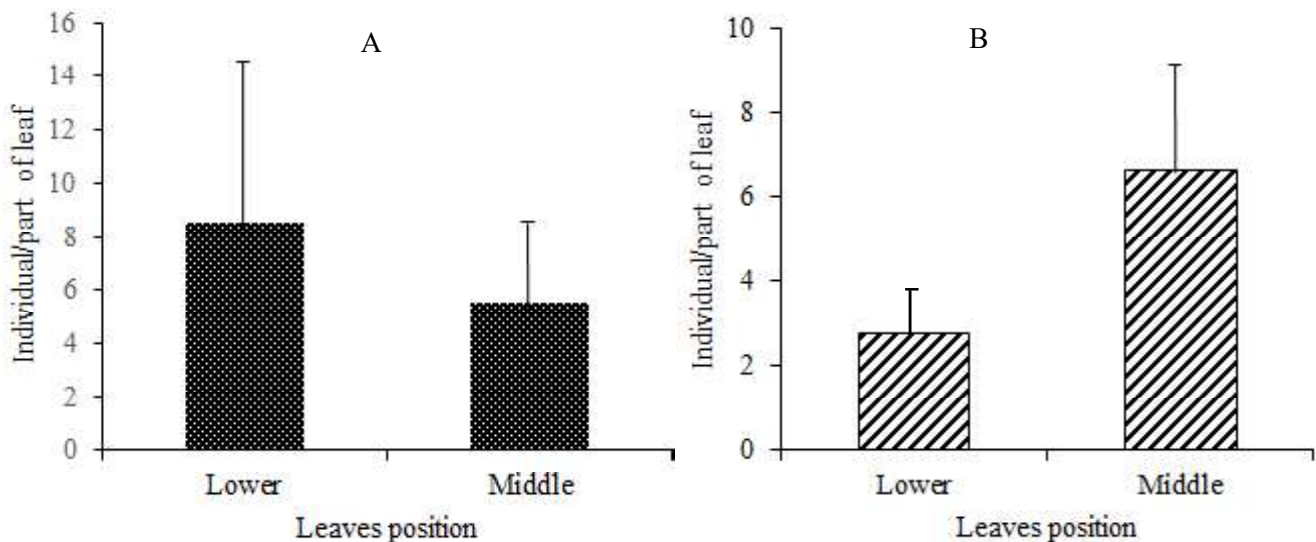


Figure 3. Population density of pest on lower and middle cassava leaves. (A) Mealybug, (B) Mite.

high. Most clones showed 100% disease prevalence and on the rest ranged 40–80% prevalence. Two clones, namely SL75 and T45 showed 100 and 66% prevalence with moderate severity, respectively, while clones Cimanggu Pekalongan, Adira 4 Baturaja, CMM 97-(17), UJ5 22-11-2014, 17, UJ3(1), Baris 14, Gajah, and Baris 17 showed 100% prevalence with mild disease severity. The rest of the clones showed mild and moderate severity. Viral disease on cassava with dwarf, small leaves and curly symptoms were found on several clones, namely T45, UJ5 22-11-2014, UJ3(1), Baris 14, UJ4 Masgar, MU III, Baris 20, and Duwet 1. The disease prevalence on Baris 20 and Duwet 1 clones was more than 70%.

Mealybugs, red mite and brown leaf spot were found to infest all observed cassava clones in Lampung, Indonesia. The mealybugs often found were cassava mealybug (*Phenacoccus manihoti*) and papaya mealybug (*Paracoccus marginatus*), while the red mite was *Tetranychus urticae*. This data indicated that the two species of mealybugs and the red mite were the

major pests of cassava in Indonesia especially in Lampung Province. The cassava mealybug infested cassava plants in West Java, Indonesia since 2007 (Wardani, 2015). Muniappan *et al.* (2009), also reported that *P. manihoti* was a new invasive species attacking cassava in Indonesia. Sartiami *et al.* (2014) reported that the mealybugs were also found in Malaysia. Yonow *et al.* (2017) indicated that *P. manihoti* have been spreading to Indonesia. The polyphagia of papaya mealybug was the first record in Indonesia in 2008 (Muniappan *et al.*, 2008). Papaya mealybugs attacked 32 plant genera including papaya and cassava which was in severe category (Susilo *et al.*, 2009). The attacks of *Phenacoccus manihoti* and *Paracoccus marginatus* in cassava are usually undistinguishable, so farmers assume that the two mealybugs are the same species.

The finding of this research indicated that the major pests of cassava in Indonesia especially in Lampung are comparable with cassava pests in Africa and other regions. According to Abaca *et al.* (2014),

Table 1. Population density of pests and diseases prevalence on several cassava clones surveyed in Lampung-Indonesia

Cassava clones	Spider mites	Mealybugs	Brown leaf spot disease			Viral disease
			Mild	Moderate	Severe	
			Indiv/leaf part		%	
GM 1	0.50	0.20	80.00	20.00	0.00	0.00
Cimanggu Pekalongan	1.17	0.11	85.71	0.00	0.00	0.00
SL 75	2.00	0.44	0.00	100.00	0.00	0.00
Adira 4 Baturaja	0.72	0.56	100.00	0.00	0.00	0.00
UJ5	1.42	0.88	75.00	25.00	0.00	0.00
UJ3	0.50	0.39	33.33	66.67	0.00	0.00
BL2	0.54	2.08	80.00	20.00	0.00	0.00
CMM 97- (17)	0.40	0.90	100.00	0.00	0.00	0.00
T45	1.33	1.42	0.00	66.67	0.00	33.33
UJ5 22-11-2014	0.83	1.42	75.00	0.00	0.00	25.00
17	1.17	1.10	100.00	0.00	0.00	0.00
UJ3 (1)	0.53	8.83	100.00	0.00	0.00	50.00
Baris 14	1.69	0.28	75.00	0.00	0.00	25.00
Gajah	1.54	0.04	100.00	0.00	0.00	0.00
UJ3 Masgar	0.31	1.92	44.44	11.11	0.00	44.44
Baris 17	1.88	2.71	100.00	0.00	0.00	0.00
Cimanggu	0.10	2.03	87.50	12.50	0.00	0.00
MU III	0.07	2.27	80.00	20.00	0.00	60.00
Baris 20	0.23	1.40	42.86	57.14	0.00	71.43
Duwet 1	0.13	1.70	77.78	22.22	0.00	77.78

the main pests of cassava in Africa were cassava mealybug (*P. manihoti*), African root scale insect (*Stictococcus vayssierei*) and cassava green mite (*Mononychelus tanajoa*). Bellotii (2002) also described nine species of pests that attack cassava in Asia, including mite, mealybugs, whitefly, fruit fly, grubs, termite, and stem borer. The other pests as mentioned by Bellotii (2002), are considered to be a minor pest of cassava in Lampung, so they were not recorded in this study.

Mealybugs and red spider mites were found in all cassava locations observed in Lampung, including in the experimental plot of Faculty of Agriculture, University of Lampung in Natar area (Figure 1, and Table 1). The data indicated that mealybugs and red mites spread in almost all locations in Lampung. Even though mealybugs and mites were unable to move for long distance, the pest was able to disperse by wind and plant material transportation from island to island. Yaninek *et al.* (1989) reported that green mite was able to spread 600 km per year in Ivory Coast. The papaya mealybug (*P. marginatus*) was firstly reported in Bogor- West Java in 2008, then it was found in Lampung in 2009 infesting many plants species including cassava (Susilo *et al.*, 2009).

The prevalence of mealybug and red spider mite were high in all locations and clones (Figure 1), but their population number were low (Table 1). This result was consistent with Indiati (2012) that reported all early maturing cassava clones attacked by red mite were high in the prevalence but low in population number, so there were not effects on production. In addition, mealybug attacked at all leaves position, but spider mite attacked at the middle old leaves. Wardani (2015) described that bunchy top or stunning symptoms of cassava were caused by cassava mealybugs, and the pest attack on young plant will reduce 40–50% of production.

Brown leaf spot (*Cercospora henningsii*) disease was found infesting all cassava plants while mosaic virus disease was also found in small Experimental Plot of Faculty of Agriculture, University of Lampung in Natar, Lampung. The result of this study was different from previous reports of cassava diseases in Indonesia and other countries. Sundari (2010) reported that cassava diseases in Indonesia were mostly caused by bacteria and fungi. Abaca *et al.* (2014) reported that cassava in Africa was attacked by four diseases, namely, cassava mosaic diseases (CMD), cassava brown streak disease (CBSD), cassava bacterial blight (CBB) caused by *Xanthomonas axonopodis* pv. *manihotis* while cassava anthracnose caused by *Colletotrichum gloeosporioides* (CA). The differences in finding of

the diseases in this study with the previous report may be cause of the differences of clone of cassava or climate condition between Indonesia and Africa.

Brown leaf spot and mosaic virus diseases were found in this observation. The brown leaf spot disease was found in all locations of cassava fields (Figure 2) and cassava clones (Table 1). Batino *et al.* (2007) also reported that brown leaf spot incidence were high (ranged 68–100%) in all cassava growing areas. That mosaic virus disease was only found in Experimental Plot in Natar area indicated that this disease did not widespread yet in Lampung. According to Ewusie *et al.* (2010), mosaic virus disease of cassava in Africa was transmitted by whitefly (*Bemisia tabaci*). In this study, the vector that transmitted the viral-disease was still not clear because no whitefly found in this study. In our opinion the mealybug associated with the cassava plants can act as a vector transmitted of the mosaic virus.

CONCLUSION

The pests of cassava plants in Lampung were dominated by cassava mealybug (*P. manihoti*), papaya mealybug (*P. marginatus*) and red spider mite (*T. urticae*). The pests infested in almost all cassava clones in various locations surveyed in Lampung, Indonesia. The prevalence of red mite infestation that reached 100% in five locations tended to be higher than that of mealybugs that around 5–30% in the five locations. The cassava diseases found were brown leaf spot and mosaic virus disease. Brown leaf spot infestation in mild and moderate severity was found on all cassava clones and locations, while the viral disease with prevalence of 78% was only found on clone Duwet 1 in the experimental plot. It still needs a further study to find out whether the environmental factors and agronomic practices influence the cassava pests and diseases infestation in Lampung.

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