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

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ABSTRACT

Lampung Province is one of cassava producers in Indonesia. Many cassava clones are cultivated in this area, contributing to more than thirty percent of total national cassava production. Cassava is also an important cash crop in Lampung. However, the infestation of pests and diseases can limit cassava production in the field. These infestations may vary from clone to clone. The objective of this research was to document the infestation level of major plant pests including mealy bugs, red mite, and leaf spot disease on various clones from some locations of cassava fields in Lampung. A survey was conducted on August 2016 in cassava fields belong to farmers in several locations in East Lampung (NTF, Margatiga), Bandar Lampung (Sukarama), and South Lampung (ITERA) as well as field experimental plots belong to Faculty of Agriculture, University of Lampung at Natar. The results showed that cassava mealybug (Phenacoccus manihoti), papaya mealy bugs (Paracoccus marginatusi) and red mite (Tetranychus urticae) have infested almost all cassava clones in surveyed locations. The prevalence of red mite infestation tended to be higher than that of mealy bugs. Cassava diseases found were brown leaf spot and virus mosaic. Brown leaf spot infested cassava clones in mild to moderate severity found on all cassava clones and locations, while viral disease with prevalence of 78% was only found on Duwet 1 clone in field experimental plot.

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Keywords: mealybugs, red mite, brown leaf spot, cassava clones
INTRODUCTION

Cassava (*Manihot esculenta* Cranz.) is a perennial woody shrub with an edible root, which grows in tropical and subtropical areas of the world, including Indonesia. In Indonesia, cassava is not only used as food materials but also as feedstuffs and used as raw materials on various industry. Cassava is rich in carbohydrates, calcium, vitamins B and C, and essential minerals. However, nutrient composition differs according to variety and age of the harvested crop, and soil conditions, climate, and other environmental factors during cultivation. Cassava has also been developed as the source of alternative energy to substitute fossil oil. Therefore, the demand of cassava tends to increase every year. Departemen Pertanian (2015) reported that cassava was exported to many other countries such as Taiwan, UK, Australia, and Philippines as fresh products as well as processed products.

Lampung province is one of cassava producer in Indonesia. This province, contribute more than 30.11% to national production. The total Indonesian cassava production in 2013 was 23,824,008 ton and the planting area was 1,061,254 ha. The total production and planting area of cassava in Lampung were 8,237,627 ton and 314,607 ha respectively (BPS, 2014). Cassava planting area growth in Indonesia tends to decline, but their productivity increase. Indonesian government encouraged increasing of national cassava production by expansion of planting area (Departmen Pertanian, 2015).

Commonly, the expansion of cassava planting area can raise pest and diseases risk. According to Bellotti (2002), around 9 pest species infested cassava in Asia, including mite, mealy bugs, white fly, scale fruit fly, grubs, and termite and stem borer. Abaca *et al.* (2014) list pests and diseases on cassava in Africa including *cassava mosaic disease* (CMD) that was transmitted by white fly (*Bemisia tabaci*), *cassava brown streak virus diseases* (CBSVD), cassava bacterial blight (CBB: *Xanthomonas axonopodis pv manihotis*), cassava anthractnose (CA: *Colletotrichum gloeosporioides*), Cassava mealybug (CM: *Phenacoccus manihoti*), African root scale insect (*Stictococcus vayssierei*), green mite (CGM: *Mononychelus tanajoa*) and nematodes mainly root knot nematodes (*Meloidogyne* spp.)

Many pest and diseases was raise to serious problem in many country of cassava producer. Abaca *et al.* (2014) reported that green mite; mosaic wilt and cassava wilt bacteria were the main pest and diseases in Northwest of Uganda. Infestation of green mite in this region reached 37 – 100 percent. Other important pest in this regions was white fly (*Bemisia tabaci*), it was a vector of mosaic Gemini virus disease on cassava, that was reported result
crop lost more than 1.5 million USD in Africa (Ewusie et al., 2010). The green mite was capable to spread in very wide area every year in Ivory Coast (Yaninec et al., 1989).

The major pest of cassava in Indonesia consisted of mite, mealy bugs, and grubs. Red mite (Tetranychus bimaculatus) synonym T. urticae have been reported attacking cassava for several years ago in Indonesia (Kalshoven, 1981), but Astuti (2014) found T. kanzawai attacked cassava in West Java caused of 95% production lost. According to Muniapen et al., (2009) cassava mealybug (Phenacoccus manihoti) was also others important and very destructive pest.

Mealy bugs were the main pest of cassava in West Java. Wardani (2015) reported that cassava mealy bug was exotic pests and as a main pest of cassava since 2007 in West Java. Other species attacked cassava was papaya mealy bug (Paracoccus marginatus). Mealy bugs infestation on young crops caused the bunchy top symptoms, stunting followed by dropping leaves and reduced a production around 40-50%.

Plant breeding was conducted to improve quality and yield of cassava production. The effort was done to find out an ideal cassava clones. Widodo and Puspodarsono (1990) described that prime cassava clones are characterized by: capable to produce more than 35 ton/ha of tuber with cyanide content less than 25%, response to fertilizer external inputs, resistant to plant pests and diseases and with no branching plants. Although, there are many cassava clones cultivated by farmer in Lampung Province, the popular clones are UJ-3 and UJ-5. These clones produced tubers that contain highstarch (Sholihin, 2013). More than thousand clones were planted for selection study in Experiment Plot of Faulty of Agriculture, Lampung University. The crops may infested by vary pest and disease severity.

The resistance to plant pests and diseases was important aspect of cassava breeding, in addition to high quantity and quality of production. It is still limited information of pest and disease infestation on various cassava clones in Lampung. Severity level of pests and diseases infestation can express of crops resistance. Lower severity indicates higher resistance to pest and disease, vice-verse. The objectives of this study were to observe the infestation level of major pests including mealy bugs and red mite and leaf spot disease on various clones from several locations of cassava fields in Lampung.
MATERIALS AND METHODS

Sampling of pest and diseases were conducted on two type of cassava field, first was cassava field belong to farmer and the second was cassava plot in Experimental Station of Faculty of Agriculture University of Lampung, in Natar. The cassava field belong to farmer distribute to several location, in Bandar Lampung and East Lampung District. Two major cassava clone i.e. UJ5 and UJ3 were dominated the cassava belong to farmer. Many clones were grow in experimental plots. Description of sampling site and cassava clones was described in Table 1. Laboratory processes was done in Plant Pest and Diseases Laboratory of Lampung University, Indonesia. Sampling of cassava pest and diseases was done on May to August 2016.

Sampling of pests and diseases were done in every clones of cassava. Around 2 ha of cassava field was assigned as sampling site. Within sampling site, 10 rows subsamples each contain 10 plant were taken in interval 3 rows systematically across diagonal of field. Pest and disease prevalence was counted in each subsample and the disease severity was grouped into healthy leaf, mild disease, moderate disease and severe disease respectively. The prevalence of pest or disease were count for present or absent of mealy bug and mite infestation or brown leaf spot caused by fungi.

Table 1. Locations, clones and age of cassava object of sampling of pest and disease

<table>
<thead>
<tr>
<th>No.</th>
<th>Locations</th>
<th>Number of Clones</th>
<th>Crops Age (MAP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sukaram, Bandar Lampung</td>
<td>1 (Adira-1)</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>ITERA, South Lampung</td>
<td>1 (UJ5)</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>NTF-1, East Lampung</td>
<td>1 (UJ5)</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>NTF-2, East Lampung</td>
<td>1 (UJ5)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>NTF-3, East Lampung</td>
<td>1 (UJ5)</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>NTF-4 East Lampung</td>
<td>1 (UJ3)</td>
<td>1.5</td>
</tr>
<tr>
<td>7</td>
<td>Plot H Expt, Natar, South Lampung</td>
<td>21 clones</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Five infested plant by mealy bug and mite were taken randomly as sub-subsample, to count pest population. From sub-subsamples infested plant, three lower and three middle cassava
leaves were taken randomly as leaf sample and then bring to laboratory for pest population counting.

There were many plots of cassava crops with various ages in Experimental Plot Field of Agriculture Faculty. Each plot contained 21 rows; one row contained 10 individual plants of one clone. Observation of pest and disease infestation was conducted on this experimental plot field. Prevalence of mealy bugs and mite infestation and brown leaf spot disease were measure for all plant in every row. Three pest infested of plant were taken randomly as sub-samples, and then from every sub-samples of plant, 3 lower leaves and 3 middle leaves respectively were taken from sub-sample for mealy bugs and mite population counting. In laboratory, mealy bugs and mite were count under stereo microscope with 40 times magnification from lower leaves surface in a round of base stake part of cassava leaf sheet.

The variable observed in this research was absolute infestation of mealy bugs and mite and brown leaf spot disease incidence. The absolute pest infestation was measured by formulae as below:

\[
\text{Absolute pest infestation or disease incident} = \frac{\text{number of infested plant}}{\text{total number of plant observed}} \times 100\%
\]

RESULTS AND DISCUSSIONS

Results

The major pest that infested cassava crops in Lampung were red spider mite (Tetranychus spp., Acarina: Tetranychidae), mealybugs including cassava mealybugs (Phenacoccus manihoti Matile-Ferrero, Hemiptera: Pseudococcidae) and papaya mealybug (Paracoccus marginatus Williams and Granada de Willink, Hemiptera: Pseudococcidae). While the major disease that infested cassava in Lampung was brown cassava leaf spot disease caused of fungi Cercospora henningsii. Figure 1 indicated that the pests were found in almost all of locations surveyed, and infestation was low in ITERA. Except of cassava in Sukarame, the prevalence of infestation of red mite tended to be higher than that of mealy bugs in all locations. In NTF-1 and NTF-2, the infestation of mealy bugs was low.
Figure 1. Pest infestation on several location of farmer cassava field in Lampung

Disease infestation was found in all location, almost all crops were infested with the severity a range from severe to mild. The moderate to severe infestation of disease occurred on cassava located in NTF-1 and NTF-3, the most of mild infestation category occurred in others location (Figure 2). on locations other than NTF-1 and NTF-3, the infestation of disease was mild?

The pest including red mite and mealy bugs infested all cassava clones observed in Lampung. Prevalence of red mites tended to higher than mealy bugs in all clones except of Adira-1 clone. Compared to other clones, prevalence of red mites infestation on UJ5, around 70%, tends to lower than the prevalence on three others clones, Adira-1, UJ3, and Medan (100%). The prevalence of red mite infestation tend to higher than prevalence of mealybugs infestation on all cassava clones, except on Adira-1 (Figure 3).
Figure 2. Disease infestation on several location of cassava farmer field in Lampung

Figure 3. Pest infestation on several clones of cassava belongs to farmer in Lampung

The population of red mite and mealy bugs on lower and middle cassava leaves of several cassava clones was described on Table 2. Generally, population of mealy bugs was low on all cassava clones except of Adira-1. The population of mealy bugs on Adira-1 in Sukarame were range of 23.7 - 55.5 individual per part of leaves and tend to be higher than the population on other clones that were range of 0.0 – 1.5 individual per part of leaves. The
population of red mite pest on UJ5 in NTF-2 were range from 4.2 – 14.5 individual per leaf parts tend to be higher than that pest population on others clones.

**Table 2.** Mean and standard deviation of population of mealy bug and mite on several location of cassava field in Lampung

<table>
<thead>
<tr>
<th>Location (Clone)</th>
<th>Mealybug</th>
<th></th>
<th></th>
<th>Mite</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LL Mean</td>
<td>Std</td>
<td>Mean</td>
<td>Std</td>
<td>Mean</td>
<td>Std</td>
</tr>
<tr>
<td>Sukarame (Adira-1)</td>
<td>55.3</td>
<td>26.7</td>
<td>23.7</td>
<td>14.5</td>
<td>2.8</td>
<td>5.0</td>
</tr>
<tr>
<td>ITERA (UJ5)</td>
<td>1.5</td>
<td>1.45</td>
<td>0.7</td>
<td>0.7</td>
<td>2.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Margatiga (Medan)</td>
<td>0.5</td>
<td>1.19</td>
<td>0.0</td>
<td>0.0</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>NTF-1 (UJ5)</td>
<td>0.2</td>
<td>0.45</td>
<td>0.3</td>
<td>0.6</td>
<td>2.5</td>
<td>1.6</td>
</tr>
<tr>
<td>NTF-2 (UJ5)</td>
<td>0.3</td>
<td>0.43</td>
<td>0.1</td>
<td>0.3</td>
<td>4.2</td>
<td>3.1</td>
</tr>
<tr>
<td>NTF-3 (UJ5)</td>
<td>1.0</td>
<td>0.67</td>
<td>1.1</td>
<td>1.5</td>
<td>2.3</td>
<td>1.5</td>
</tr>
<tr>
<td>NTF-4 (UJ3)</td>
<td>0.7</td>
<td>1.15</td>
<td>11.1</td>
<td>12.4</td>
<td>2.5</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Based on the population of pest on different leaves position, mode of mealy bugs infestation were different from red mite, the mealy bugs were prefer to attack lower leaves while red mite was prefer on middle leaves. The population of mealy bugs on lower of leaves was higher than on middle one. In contrast, the population of red mite was higher on middle than lower of leaves (Figure 4).

![Graph](image)

**Figure 4.** Population of mealy bug and mite on lower and middle cassava leaves

The population of mealy bug on several cassava clones of field Experimental Plot of Faculty of Agriculture, University of Lampung in Natar was low. The higher population of
this pest was found on UJ3 (1) clones reached 9 individual per a part of leaves, while that population on 19 others clones were less than 2 individual per a part of leaves (Figure 5).

![Graph showing mealybug population on various cassava clones.]

**Figure 5.** Population of mealybug on several clones of cassava in experimental plots in Natar

The red mite population on several clones in Experimental Plot of Agriculture Faculty, Lampung University, Natar also low. The mean of red mite population on four cassava clones namely Baris 14, Baris 17, Gajah and SL 75 were 2 individual per a part of leaves and tend to higher than that population on 16 others clones (Figure 6).
**Figure 6.** Population of mite on several cassava clones in experimental plots in Natar

The brown leaf spot disease infested all cassava clones in Field Experimental Plot of Faculty of Agriculture, University of Lampung in Natar. Disease severity was mild up to moderate categories. Many clones have 100% of disease prevalence and others clones were range of 40-80%. Two clones namely SL75 and T45 have 100% and 60% disease severity moderate respectively, while Pekalongan, 4 Baturaja, MG 97 (17), UJ5 22-11-2014, 17, UJ3(1), Baris 14, Gajah, and Baris 17 have 100% disease severity in mild category. Others clones have disease severity in mild and moderate categories. No severe disease category was found in this experimental plot (Figure 7).

**Figure 7.** Disease incidence on several clones of cassava in experimental plots in Natar
In addition to fungal diseases, the cassava in Experimental Plot of Faculty of Agriculture, University of Lampung in Natar was also infested by viral disease. Viral disease on cassava showed dwarf, small leaves and curly symptoms. Many clones of cassava namely T45, UJ5 22-11-2014, UJ3(1), Baris 14, UJ4 Masgar, MU III, Baris 20, and Duwet 1 were also showed the symptoms of viral disease. The clones Baris 20 and Duwet 1 have more than 70% prevalence of that viral disease (Table 3).

**Table 3.** Viral disease incidence on several clones of cassava in Natar experimental plots

<table>
<thead>
<tr>
<th>Clones</th>
<th>Viral disease incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T45</td>
<td>33</td>
</tr>
<tr>
<td>UJ5 22-11-2014</td>
<td>25</td>
</tr>
<tr>
<td>UJ3 (1)</td>
<td>50</td>
</tr>
<tr>
<td>Baris 14</td>
<td>25</td>
</tr>
<tr>
<td>UJ3 Masgar</td>
<td>44</td>
</tr>
<tr>
<td>MU III</td>
<td>60</td>
</tr>
<tr>
<td>Baris 20</td>
<td>71</td>
</tr>
<tr>
<td>Duwet 1</td>
<td>78</td>
</tr>
</tbody>
</table>

**Discussions**

Most of cassava farmers in Lampung cultivated their field with cassava UJ5 and UJ3 clones, and few of them planted cassava Adira-1 and Medan clones. Although local government has released at least nine (9) clones of cassava clones (Suhartina, 2005), most of the cassava farmers in Lampung preferred in cultivating UJ5 and UJ3 cassava clones. Those two clones of cassava can be observed on many locations in East Lampung, i.e. NTF area. The UJ5 and UJ3 cassava clones become favourite may because those clones have a high yield. For example, UJ5 produce 25-28 ton/ha, and UJ3 produce 23 – 35 ton/ha tuber (Suhartini, 2005). According to Sholihin (2013), cassava farmers cultivated clones of UJ5 and UJ5 because of their high content of starch.

Pests mainly mealy bugs and red mite and disease especially brown leaf spot infested all of cassava crops observed in Lampung. The major pests of cassava in Lampung were cassava mealybugs (*Phenacoccus manihoti*) and papaya mealybug (*Paracoccus marginatus*) and red mite (*Tetranychus urticae*). Wardani (2015) described that the cassava mealybugs infested cassava in West Java, and farmer notes that the pest have been attacked cassava since year of 2007 ago. According to Muniapan *et al.* (2009), *P. manihoti* was new
invasive species attacked cassava in Indonesia. Meanwhile, the polyphagia papaya mealybug was reported to attack around 31 genera of plant out of papaya, including cassava which is in severe category (Susilo et al., 2010). The attack along P. manihoti to P. marginatus in cassava crops in the field unrecognized, so farmers generally assume that they were the same pest. The major pest of cassava in Lampung was different with cassava pest in Africa. According to Abaca et al. (2014) the main pest of cassava in Africa were cassava mealybug (P. manihoti), African root scale insect (Stictococcus vayssierei) and cassava green mite (Mononychelus tanajoa). Bolleti (2002) described that 9 species of pest attacked cassava in Asia, including mite, mealybugs, whitefly, scale fruit fly, grubs, termite, and stem borer. The others pest as mention of Bolleti (2002), may a minor pest of cassava in Lampung, so they were not recorded in this study.

Brown leaf spot (Cercospora henningsii) disease was found infested cassava, almost all cassava crops belong to farmer were infested by that fungal disease in Lampung. Mosaic virus disease also found in small plot of Experimental Plot of Faculty of Agriculture, University of Lampung in Natar. The result of this study not consistent with Sundari (2010), that report cassava diseases in Indonesia were cause of bacteria and fungi. The number cassava diseases species that were recorded in this study was lower than the number of cassava diseases species in Africa. Abaca et al. (2014) reported that cassava in Africa was infested by five species, namely, cassava mosaic diseases (CMD) brown streak virus disease (CBSD), cassava bacterial blight (CBB) cause of Xanthomonas axonopodis pv manihotis and cassava anthracnose cause of Colletotrichum gloeosporioides (CA). The mosaic virus recorded in this survey is sill need to advance study to identify the vector transmits the virus.

Mealy bugs and red mite were found in all observed of cassava location in Lampung, including of field experimental plot of Faculty of Agriculture, University of Lampung in Natar (Figure 1, 5, and 6). The data indicated that mealy bugs and red mite spreading in almost all location in Lampung. Even though mealy bugs and mite unable to move to long distance alone, the pest able to move for long distance by win and plant material transportation. Yaninec et al. (1986) reported that green mite able to spread 600 km per year in Code Ivory. Papaya mealy bug (P. marginatus) was first reported in Bogor East Java in 2008, the mealy bug has been found in Lampung in 2009, infested many plants species (Susilo et al., 2010).
Prevalence of mealy bug and mite infestation were high in all location and clones (Figure 1), but their population were low (Table 2). The high prevalence of the pest infestation on various cassava clones and crop location may because of more of plants observed were old (Table 1). This result was consistent with Indiati (2012) reports, that all of early maturing cassava clones attacked by red mite. The high prevalence of the pest infestation may not impact of cassava production seriously, because their populations were low. In additions, mealybug also more common on lower old leaves and mite at middle old leaves. The stunting or bunchy top symptom and leaf fall of cassava occurred and followed by reducing 40-50% of production, when cassava mealy bugs attacked young cassava (Wardani, 2005).

Brown leaf spot and mosaic virus diseases were found in this observation . The brown leaf spot disease was dominant in both of cassava belong to farmer and cassava in experimental plots (Figure 2 and 7). The high prevalence of this disease may because most of crops observed ages was 7-8 month after planting, more infestation occurred on older crops. This data not consistent with Batino et al. (2007) which were reported that brown leaf spot incident not related with crop age. The disease have negative correlated to crop system and vegetation type. Mosaic virus disease only found in small of Experimental Plot in Natar, indicated that this disease not spreading yet in Lampung. It is still not clear, the vector transmitted the disease. According to Ewusie et al., (2010), Gemini mosaic virus disease of cassava was transmitted by white fly (Bemisia tabaci) in Africa. In this study, the virus disease may carried with stem of planted material, because there was no white fly observed.

The pest of cassava crops in Lampung were dominated by cassava mealybug (Phenacoccus manihoti), papaya mealybug (Paracoccus marginatus) and red mite (Tetranychus urticae). Those pest infested on almost all cassava clones in surveyed locations. The prevalence of red mite infestation tends to higher than mealybugs. The cassava diseases found were brown leaf spot and mosaic virus disease. Brown leaf spot infested in mild and moderate severity found on all cassava clones and locations, while virus disease with prevalence 78% only found on clone of Duwet 1 in field experimental plot. It is still need to advanced study to find out whatever of environmental factors and agronomic practiced influence the cassava pests and diseases infestation in Lampung.

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