Agriculture

The Diversity of Leaf-Sucking Insect on Potato Leafandit's Potential as Aninsect Vector Diseaseon Granola-L (G3) Varieties in Sembalun, East Lombok

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Abstract

This study aims to determine the type and potential of pests on potato crops and to determine the intensity of virus attacks PLRV (Potato Leaf Roll Virus), PVY (Potato Virus Y), PVX (Potato Virus X) and also the presence of insects as a virus vector on the production of potato seeds on class (G3) Granola-L varieties in Sembalun East Lombok. Descriptive method was used in this research. The results showed four types of leaf-sucking insect associated with potato crops such as *Aphids* spp., *Bemisiatabaci*, *Thrips palmi* Karny and *Tetranychus* spp. The highest population and intensity of pest attack is at age 77 dap equal to 5921.5 with the attack intensity equal to 60.16%, the dominance of leaf-sucking insect is *Aphids* spp., equal to 49% with abundance equal to 19,79%. The positive results of ELISA showed that potato leaf samples at age 10 WAP (Week After Planting) positively contained virus with the seed plot in the north (plot III) and ELISA was further performed on border plant samples related to whether border plants were the right plants for limiting plants or not, positive results were also shown by the positive leaf samples of cassava plants that contained viruses. The virus that was detected in the G3 potato seed production field is transmitted by the vector insects, as the plant was attacked at the age of 5-6 WAP, if the plant virus is carried by the seed, then the early symptoms of the plant at 2-4 WAP (Week After Planting) will appear and will react positively when continued with ELISA. Potato virus vectors that have the potential to spread and transmit the virus consist of four major pests of potato plants such as Aphids (*Myzuspersicae*), Trips (*Trips palmi*),Mite (*Tetranychus* sp) and The silver leaf fly (*Bemisiatabaci*).

Keywords : Leaf sucking insects pest, virus deseases, potato seed

1. Introduction

The productivity of potatoes in Indonesia in 2009 was 16.51 ton/ha and decreased to 15.95 ton/ha in 2010 (BPS, 2011). In 2013 the productivity of potatoes decreased again to 16.02 ton/ha and in 2014 reached 17.67 ton/ha (BPS and Directorate General of Horticulture). Potato productivity in Indonesia is below the Europe that reach 25 tons/ha (The International Potato Center, 2008). The low productivity of potatoes in Indonesia can be caused by several factors, including pests and plant diseases and problems during the seed production process. West Nusa Tenggara Province is an agrarian area with the potential to develop various agricultural commodities. In addition to food crops such as rice, corn, soybean, potato which is one of horticultural commodities is also very potential developed in Indonesia especially type of Granola-L which is widely grown by farmer.

One of the prerequisites for seeding potatois the quality of related seeds. The attack of plant disturbing organisms (the existence of pests) greatly affects the quality of the seeds produced in which one of the basic requirements for grade (G3) seed is the minimum maximum intensity of bacteria attack 1.0% virus 0,5% rotten leaves 10% and NSK 0 % (SNI Potato, 2004).

According to Widjaja (1996) there are several pests associated with potato plants that are (*aphids* spp.), The silve leaf fly (*Bemisiatabaci*), *Thrips palmi* Karny., Green leafhoppers (*Empoasca* spp.,), Cotton buds and potato tubers (*Phthorimaeaoperculella*, *Symmetrischemaplaesiosema*, *Teciasolanivora*, and *Scrobipalpulaabsoluta*), caterpillars (*Agrotis* spp.,), Dog fleas (*Epitrix* spp.,) And mites (*Tetranychus* spp.,). According to CIP-

Balista in Srie (2006) there are 72 types of pests that are inventoried in potato plants including 4 types of pathogens, 13 species of pathogenic fungi, 15 types of viruses, 1 type of mycoplasma, 8 types of diseases and 31 species of pests.

2. Materials and Method

2.1 Place and Time of research

This research was conducted at highland of ± 1000-1100asl that located in Sembalun, East Lombok and confirmed the presence of virus by ELISA method (PVY Pathoscreen® kit Alkaline Phosphatase Agdia Incorporated, Indiana, USA) was conducted at Biotechnology and Bioscience Laboratory Faculty of Agriculture University of Mataram. This study began on May to August 2015.

3. Materials and Tools

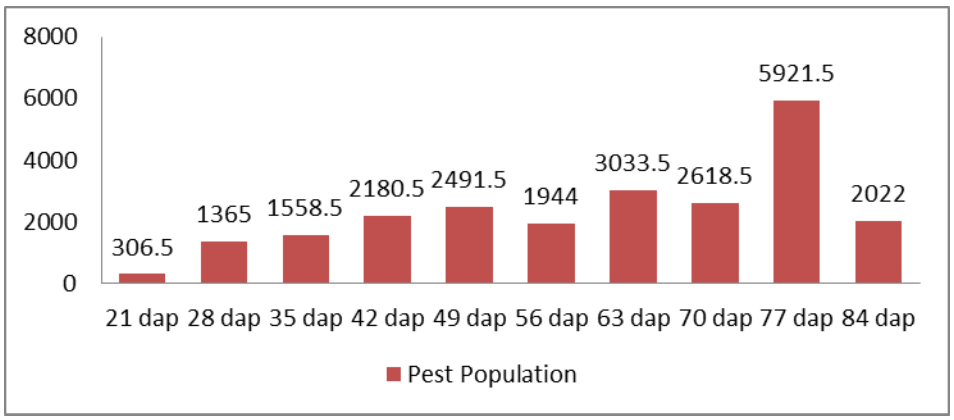
The materials used in this study are potato seeds granola (G2) varieties obtained from Faculty of Agriculture, water, detergent, Phonska fertilizer, SP-36,TSP, ZA, KNO3, petroganik. The insecticides used were Decis, Ludo,Rampage, Suprmek, while the fungicides used were Cabrio top, Antracol, Metazeb, systemic fungicide were Revuz and Zampro, primary antibodies, secondary antibodies, PNP substrate tablets, PNPbuffer substrate, positive control (PVY) extraction of low-fat milk powder, phosphatebuffer saline, buffer extract for protein, water.

The tools used in this research are digital camera, mortar and pastel, sterile knife, micro pipette, micro pipette tip, eppendorf tube, air tight container, petri dish, thermohigrometer, ELISA plate, and sticky traps.

Figure 4.2. Average population of leaf-sucking insect pests at potato crops in Sembalun Highland, East Lombok during Observation

3.1 Data Analysis

Data analysis was performed to find out the functional relationship between leaf-sucking insect populations with the intensity of attack (level of damage) caused. So the method used for analysis were regression analysis and Qualitative Descriptive Analysis.



4. Results and Discuussion

4.1 Population of leaf-sucking insect pest

Based on the results of the study, insect population at the beginning of observation at age 21 dap of 306.5, increase constantly until the observation at age 49 dap for 2491.5. However, on observations of 56-70 dap the insect populations tend to fluctuate or unstable. Population of insect pest at age 56 dap by 1944, age 63 dap are 3033.5, age 70 dap are 2618.5. On the next observations, the population increased very high at age 77 dap of 5921.5 and the observation age 84 dap pest populations decreased again by 2022 (Figure 4.2).

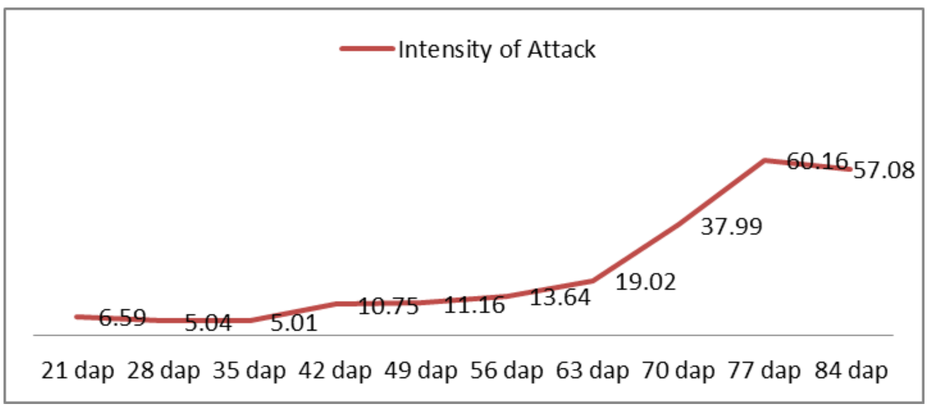
This is presumably because when the crop at age 21-49 dap, the availability of food for the pests in abundance so that will be followed by the increasing of pest populations. In addition, appropriate environmental conditions will affect the growth and development of the pests. According to Sunjaya in Yulianti (2005) temperature is one important factor and influential for the life of insects that affect the activity and the development of insects. The average temperature during the observation ranges from 20-29^oC and the humidity ranges from 53-92%. The conditions of temperature and humidity during observation are suitable with the growth and development of the pests. According Susniahti (2005) the appropriate temperature range for the growth of pest populations is from 15 to 33^oC. The growth of insect pest populations will decrease in temperature of 14^oC and 41^oC.

However, when the crops at age 56-84 dap, the insect populations tend not to be constant, due to the role of natural enemies of the pests. In addition to the high amount of food, insect populations are also controlled by several other components including abiotic and biotic factors. biotic factors used in decreasing the population of insect is predators that can affect the growth and development of the insect.Susniahti (2005) said, the number of pest populations are influenced by several factors such as biological factors that are biological agents and physical factor such as food, temperature and humidity.The availability of food in abundant circumstances will support the growth of insect populations. The decrease of insect population is also due to the catalytic and mortality (Susniahti, 2005). During the observation there are 3 species of biological agents that are predators of the leaf-sucking insect such as *Coccinellatransversalis*F., *Menochilussexmaculatus*and*Paederusfuscipes.*

4.2 Intensity of leaf-sucking insect attack

Intensity observation of pest-sucking insect attack was conducted when the crop was 21 dap. In the first observation, at age 21 dap on the damage of leaf-sucking insect, the leafcould be seen with the low intensity of attack at 6.59%. The next observation at age 28-35 dap, the intensity of the attack decrease to 5.04-5.01% from the previous observations. at age 42-77 dap the intensity of the attack increase from 10.25-60.16%. The intensity of attack decreased to 57.08% at age 84 dap, (Figure 4.6).

Figure 4.6. Average population and intensity of leaf-sucking attack on potatoes during observation.



The low intensity of attacks, especially at age 28-35 dap, is thought to be due to the occurrence of mortality and the impact of biotic factor in the ecosystem i.e. biological agents (predators) and environmental conditions that are not suitable for the growth of insect. If the environmentdidn't supportfor the development of insect it will affect the behaviour of insect, especially the way in finding food.

At age 42-77 dap, the intensity of attack continued to increase and age 84 dap the intensity of the attack decreased to 57.08% (Figure 4.6). Besides to the abiotic and biotic factors, human actions in cultivation techniques is one of the components that is not less important that affect the existence of damage plants. During the observation, farmers often use insectides unwisely with the same type continuously, with a wrong dosage and irregular application time.

The intensity of leaf-sucking insect attack on potato crop is high categorized because of the intensity of attack ranged from 5.01-60.16%, so it is necessary to control the attack of leaf-sucking insect. According to Hidayat in Dafrinal (2007) if the attack of pest hasreduced the quality and production of plants by 45-60% then the pest has passed the threshold of control.

4.3 The relationship between the intensity of the attack with the number of leaf-sucking insectpopulations

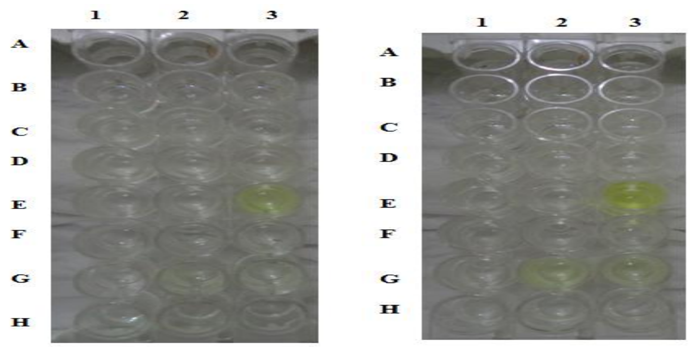
Regression analysis was used to test whether there is a relationship between intensity of attack (Y) with population number (X). The result of the analysis shows that the equation of regression line Y= -0.7 + 0.00993 x indicates that the relation between population size and intensity of pest-sucking insect attack is significant. This means that the addition of 1 leaf-sucking insectcan result in damage of 0.00993%. This indicates that the greater the number of pest populations, usually followed by the extent of damage (intensity of attack).

4.4 The domination and abundance of leaf-sucking insect pests

Based on the observation, the highest to the lowest insect dominance were *Aphids* spp., 49%, *Thrips palmi* Karny 39%, *Bemisiatabaci* 9% and *Tetranychus* spp., 3%. Figure 4.4 shows the abundance of leaf-sucking insect that are *Aphids* spp., 19,79%, *Thrips palmi* Karny 15,54%, *Bemisiatabaci* 3,62% and *Tetranychus* spp. of 1.04% respectively.

Figure 4.4. leaf-sucking insect domination at potato crops in East Lombok Sembalun during observation

Aphids spp., is a pest that can easily adapt to its place of life. During observation the existence of *Aphids* spp., hasbeen seen since the beginning of observation than other pests (Figure 4.5). In addition, the body size of *Aphids* spp., which is larger than the other 3 pests that is ± 1.8-2.3 makes *Aphids* spp., easier in obtaining food and breeding places. *Aphids* spp., also known to be resistant to several types of insecticides, so the existence is not easy to removed (Dafrinal, 2007).

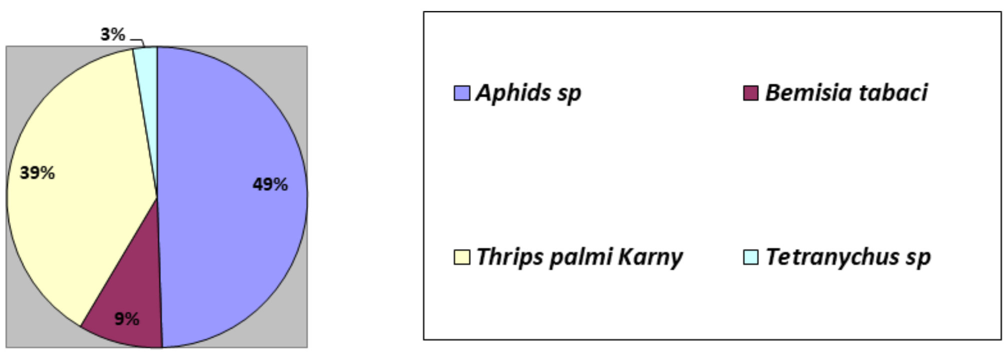


4.5 Detection of disease using ELISA

The symptoms of potato virus (1) PLRV virus (potato leaf roll virus) (2) PVX (potato virus X), (3) PVY (potato virus Y). ELISA (Enzym Linked Immunosorbent Assay) was conducted for some of the virus symptoms above. The result of the test is presented in Figure 4.1.2:

Figure 4.1.2. Result of potato virus test using ELISA (Enzym Linked Immunosorbent Assay) 15 minutes and 30 minutes after incubation

Description: (A1): Potato leaf samples 2 wap plot I, (A2): Potato leaf sample 2 wap plot II, (A3): potato leaf sample 2 wap III, (B1): Sample of potato leaf 4 wap plot I, (B2):Potato leaf sample 4 wap II, (B3): potato leaf sample 4 wap plot III, (C1): potato leaf sample 6 wap plot I, (C2): potato leaf sample 6 wap plot II, (C3): potato leaf sample 6 wap plot III, (D1): potato leaf sample 8 wap plot I, (D2): potato leaf



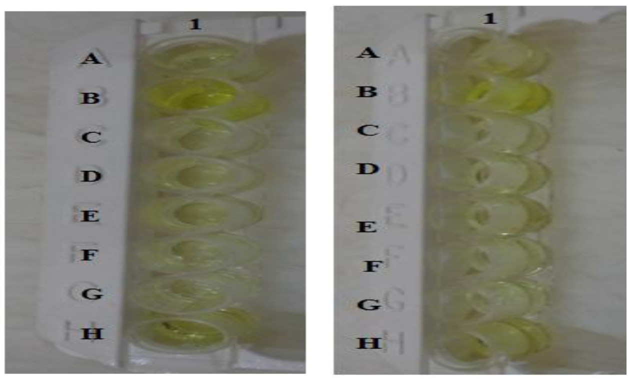
sample 8 wap plot II, (D3): potato leaf sample 8 wap plot III, (E1): potato leaf sample 10 wap plot I, (E2): potato leaf sample 10 wap plot II, (E3): potato leaf sample 10 wap plot III, (F1): border crop of corn samples, (F2): border cassava plant sample, (F3): border peanut plant sample, (G1): border carrot plant sample, (G2): positive control, (G3): positive control, (H1): border pumpkin sample, (H2): negative control, (H3): negative control.

Based on the intensity of virus attack on G3 potato crop in Sembalun and the result of virus testing with ELISA, the virus found in G3 potato crop at age 10 mstwas caused by virus vector insect. Virus vector insect that have been found on the G3 potato field in Sembalun are Aphids (*Myzuspersicae*), The silver leaf fly (*Bemisiatabaci*), Trips (*Trips palmi*) and Mite (*Tetranychus* sp). These insects carried the virus on potato crop because the virus detected at age 10 wap in the potato crops, but if the virus was carried by the seed, then the initial symptoms of growth could be seen and if the virus tested with ELISA then the initial week of planting will be positive contain virus, but after it was proved by ELISA only at the age of 10 wap that positively contains the virus, while the plate hole that contains the sample of the previous weeks is still clear. Virus vector insects that potentially transmit the virus to potato plants are presented in Figure 4.1.3 Virus vector insects found in G3 potato plants in Sembalun are able to spread and transmit the virus, so that in potato G3 is positive to contain the virus at the age of 10 wap and in the plot number III potato planting in sembalun. Insect vector of G3 potato virus virus was observed on every observation week, its population always increase from the beginning of planting until the harvest day

From the several types of border plants found in the area, can be the host of potato plant virus vector insects, because of some of these insects are polifag. The host of this viral vector can be a source of virus transmission in potato plants, to prove the presence of virus in border plants that could potentially be a source of virus that will be transmitted to potato plants, then the virus tested by ELISA in this border plant, the result of virus ELISA on plant border is presented in Figure 4.1.5 below:

Figure 4.1.4 Results of viral ELISA on border plants around G3 potato planting land in Sembalun 15 and 30 minutes after incubation

Description (A1) Negative control, (B1) positive control, (C1) carrot leaf sample, (D1) leaf sample of western flowering plant, (E1) leaf sample of eastern pumpkin plant, (F1) , (G1) sample of maize plant leaves, (H1) cassava leaf sample



Other factors that can also affect the population of virus vector insects is the existence of a type of plant solanaceae, because some types of virus vector insects in potato plant like the type of plant solanaceae as its host. The following table presents a solanaceae plant on the G3 potato plant in Sembalun.

Table 4.1.5. Solanaceae plants that are located on the potatoes field in G3 Sembalun

No	Types of plants	The age of potato plant	Age of other solanaceae plant
1	Chili	2 wap	Before harvest
2	Tomato	2 wap	Befre harvest
3	Ciplukan	2 wap	2 weeks
4	Potato	2-8 wap	2 Month

Some of the solanaceaespecies plantabove can potentially be as the host of insects from virus vector that cause viruses in potato plants. Other solanaceaespecies are plants that are often used as host by virus vector insects, because some insects are found to be polyphag insects, therefore on a field needs to be isolated from the plant solanaceae so as not to be a source of infection, especially in potato plants.

5 Conclusion and Recommendation

Conclusion

Based on the results and discussion in this study can be summed up things as follows:

1. There are 4 types of leaf-sucking insect associated with potato plants i.e. *Aphids* spp., *Bemisiatabaci*, *Thrips palmi Karny* and *Tetranychus* spp.
2. Population and intensity of the highest pest attacks that is at age 77 hst for 5921,5 with the intensity of the attack of 60.16%
3. The dominance of leaf-sucking insect is Aphids spp., by 49% with an abundance of 19.79%
4. Testing of virus symptoms in potato plants was conducted since the age of 2-10 mst, positive results of PVY virus is shown in the sample at age10 mst.
5. Viruses in potato plants are not carried by seeds, but are transmitted by viral vector insects.
6. The source of virus infection is not from solanaceae plants such as chili, tomato, etc., but from cassava plants (*Euphorbiaceae*).
7. ELISA method also proves that in positive cassava plants contain the PVY virus.
8. Transmission of the virus is done by aphids (*Myzuspersicae*), kebul (*Bemisiatabaci*), trips (*Trips palmi*), and mites (*Tetranychus* sp).

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