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TYPES OF INSECTS ASSOCIATED WITH POTATO PLANTS (*SOLANUM TUBEROSUM* L.) AND THE INCIDENCE OF THE DISEASE IN MODOINDING, NORTH SULAWESI, INDONESIA

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Abstract

The study was conducted in Modoinding District in the villages of Palelon, Makaaroyen and Linelean. The purpose of this study was to determine the types of pests and diseases and their populations. Insect sampling using the diagonal slice method where in each plot there are 5 subplots, 4 at the end and 1 in the middle, each subplot is 4m x 2m wide. Samples were collected by sweeping using 10 nets of insect swings. Insect samples were anesthetized with ethyl acetate and put in bottles containing alcohol and labeled. Samples are taken to the laboratory to identify and calculate the population. Insect sampling was carried out at the age of the plant 14, 28, 42, 56, 70, 84 days after planting. Plant disease sampling also used diagonal slice method, each subplot was 2m x 2m with 22 plants per subplot. Sampling of plants affected by disease is carried out on plants aged 35, 42, 49 days after. Found as many as 27 types of identified insects known as pests, predators and parasitoids. The dominant insects found and the population average is Empoasca sp. 49 individual, Lygus sp. 16.44 individual, Leptorna sp. 15.89 individual, Acrididae 11.44 individual, Nezara sp. 11.22 individual, Epilachna sp. 10.89 individual, Bactrocera sp. 10.78 individual, Phthorimaea sp 10.17 individual. Identified plant diseases are dry spots Alternaria solani, fusarium wilt Fusarium oxysporum and Ralstonia solanacearu. The incidence of the disease found is not too significant where the numbers are relatively small. Bacterial wilt disease was found as much as 7.5%, fusarium wilt 4.54% and dry spots 3.61%.

Key words: *insects, identification, pests, diseases, predators, parasitoids*

INTRODUCTION

Modoinding District is located in the highlands of North Sulawesi about 1600m above sea level. This region is well-known as a center for food crops in North Sulawesi. One of its superior products is potatoes. Potatoes, *Solanum tuberosum L.*, is one of the important food plants as a source of vegetable carbohydrates, proteins, minerals and vitamins (Sembel, 2014) [12]. Potatoes are also an important source of carbohydrates for animals including various types of fitopagous insects. Therefore many types of pest insects are known to attack potato plants (Kalshoven, 1981; Lumowa, 2010; Kandowangko and Ratulangi, 2012) [1, 3, 4, 5]. Potato plants have 266 pests and diseases derived from 23 viruses, 38 fungi, 6 bacteria, 2 mycoplasmas, 1 viroid, 68 nematodes and 128 insects (Sastrahidayat, 2011) [10]. Potatoes are often susceptible to pathogen infections. Lateblight caused by *Phytophthor infestans* is reported as the main disease affecting potato plants in Indonesia. This pathogen causes blotches and rot on plant tissue that is infected and results in yield losses of between 10-100% depending on the level of infestation, season, height, and potato varieties (Nathasia et al., 2014) [6].

MATERIALS AND METHODS

Insect sampling

Sampling as shown in Figure 1. Each sub plot is 4x2 meters in size. Insect sweeping is done 10 times a double swing each subplot. Sampling is done every 2 weeks on the day 14, 28, 42, 56, 70, 84 days after the planting or 6 times for each plot. Insects captured were

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identified using the Kalshoven (1981), Johnson *et al*. (2005) [3, 2] and the amount is calculated.

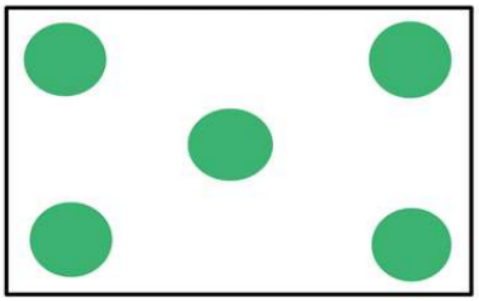

Fig. 1. Layout of sampling diagonally
Source: Own results in the laboratory.

Sampling of plants affected by disease

Sampling of plants affected by disease using the diagonal slice method. In each subplot, a distance of 2m x 2m containing 22 plants or 110 plots per plant. Sampling was carried out on days 35, 42, 49 days. Plants that experience symptoms of illness are collected and taken for identification. Then the sample is isolated where each Petri dish is given 0.5 mm / 0.5 cc specimen from a 10-4 test tube, then labelled and placed on a culture rack. Observations were made on each petri dish by looking at the morphology in accordance with the characteristics of the disease, then a subculture process was carried out to obtain pure culture.

Pathogens that grow on the second day after isolation in subcultures to obtain pure culture. The method used is the diagonal (*zigzag*) slice method on other NA media. Media that have been overgrown by bacteria are taken using a sterilized needle, then a diagonal line (*zigzag*) is made on the NA media and placed on a culture rack.

RESULTS AND DISCUSSIONS

Associated Insects

27 species of insects was found (Table 1). Many species are known to be the main pests of potato plants, but some of them are known as predators and parasitoids.

Table 1. Insect types and insect population averages in every village

No.	Insect types			Insect population average per villages			Averages
	Order	Family	Genus	Makaaroyen	Palelon	Linelean	
1	Hemiptera	Cicadellidae	Empoasca sp.	57.67	46.33	43.00	49.00
2	Orthoptera	Acrididae		16.50	11.17	6.67	11.44
3	Coleoptera	Tenebrionidae	Alphitobius sp.	7.50	5.67	7.00	6.72
4	Coleoptera	Coccinellidae	Epilachna sp.	12.67	9.83	10.17	10.89
5	Hemiptera	Miridae	Lygus sp.	15.50	19.33	14.50	16.44
6	Coleoptera	Carabidae		0.83	1.50	0.50	0.94
7	Coleoptera	Cerambycidae		0.83	0.50	0.00	0.44
8	Coleoptera	Chrysomelidae	Chaetocnema sp	1.00	3.67	4.50	3.06
9	Hemiptera	Miridae	Leptopterna sp.	16.00	15.17	16.50	15.89
10	Dermaptera	Forficulidae	Forficula sp.	0.33	0.83	0.50	0.56
11	Coleoptera	Curfculinonidae	Graphognatus sp.	0.50	0.00	0.67	0.39
12	Diptera	Tephritidae	Bactrocera sp.	13.00	10.00	9.33	10.78
13	Hemiptera	Pentatomidae	Nezara sp.	12.83	9.67	11.17	11.22
14	Diptera	Tephritidae	Peronyma sp.	7.17	10.00	9.50	8.89
15	Hemiptera	Pentatomidae	Scotinophora sp.	5.33	6.67	6.67	6.22
16	Diptera	Chloropidae		12.50	10.50	7.00	10.00
17	Coleoptera	Scarabaeidae		2.83	1.17	0.50	1.50
18	Lepidoptera	Gelechiidae	Phthorimaea operculella	11.67	9.67	9.17	10.17
19	Coleoptera	Coccinellidae	Stethorus sp.	3.67	3.50	4.00	3.72
20	Diptera	Agromizydae	Liriomyza sp.	8.67	6.17	5.83	6.89
21	Diptera	Dolichoppodidae	Dolichopus sp.	5.17	5.67	4.00	4.95
22	Hymenoptera	Formicidae	Dolichoderus sp	7.00	4.67	6.17	5.94
23	Hymenoptera	Ichneumonidae	Eriborus sp.	2.00	1.00	1.83	1.61
24	Coleoptera	Coccinellidae	Hyperaspis sp.	1.33	3.00	4.50	2.94
25	Hymenoptera	Sphecidae	Pemphredon sp.	0.83	0.67	0.83	0.78
26	Diptera	Syrpidae		1.50	0.00	0.33	0.61
27	Araneae			3.83	0.83	2.50	2.39
Sum				224.83	196.33	184.83	202.00

Source: Own results in the laboratory.

The largest insect population is in the village of Makaaroyen 224.83 individuals, Palelon villages 196.33 individuals, and Lineleyan villages 184.83 individuals.

In this study, many secondary pests are found, which are not the main pests, because their population are small. These pests are from other plants. But, the main pest population found in this study decreased, for example *Empoasca sp*. According to Bororing (2015) [1], *Empoasca sp*. was found an average of 109.03 individuals, but now *Empoasca sp*. found, only 49 individuals.

Insect population known as predators and parasitoids are small in number, compared to pest insect population. The emergence of secondary pests, the small number of natural enemies, and the decline in the number of primary pest populations may be due to the intensive administration of pesticides.

In controlling pest populations, farmers overcome it by administering chemical insecticides intensively.

However, excessive use of insecticides can cause environmental pollution, the occurrence of pest resistance, the emergence of secondary pests, pest resurgence and killing of natural enemies (Redcliffe et al, 2009; Sosromarsono, 1989; Parella, 1987; Settle, *et al*., 1986) [9,14, 8, 13]. In this study, five dominant insects were found namely *Empoasca sp., Lygus sp., Leptopterna sp., Acrididae sp., and Nezara sp*.; but *Empoasca sp*. is the most population. *Empoasca sp*. which is a type of planthopper pest is the main pest reported in Modoinding (Tomayahu, 2007; Bororing, 2015) [15, 1].

Table 2. Incidence of Potato Disease

Species	INCIDENCE of DISEASE (%)												AVG
	LINELEYAN				MAKAAROYEN				PALELON				
	I	II	III	AVG	I	II	III	AVG	I	II	III	AVG	
Alternaria solani	1.82%	2.73%	6.36%	3.33%	2.73%	4.55%	5.45%	3.89%	0.91%	2.73%	8.18%	3.61%	3.61%
Fusarium oxysporum	0.91%	2.73%	5.45%	2.78%	2.73%	5.45%	9.09%	5.28%	1.82%	4.55%	8.18%	5.56%	4.54%
Ralstonia solanacearum	4.55%	7.27%	16.36%	8.61%	1.82%	8.18%	13.64%	7.22%	2.73%	3.64%	15.45%	6.67%	7.50%

Source: Own results in the laboratory.

Disease

Observation results obtained 3 types of diseases identified are diseases originating from fungi namely *Alternaria solani* dry spots and fusarium wilt *Fusarium oxysporum* and derived from bacteria namely *Ralstonia solanacearum wilt*. The incidence of plant disease was found to be relatively small in number (Table 2).

The incidence of bacterial *Ralstonia solanacearum wilt*, 7.5%; *Fusarium oxysporum wilt* 4.54%; and *Alternaria solani* dry spot, 3.61%. In plants that have symptoms of dar4k patches on the potato leaves, indicates the plant has a disease of *Alternaria solani* dry spots (Semangun, 1989). While the plant were found to have symptoms of wilting, from the observation, showed that the plants were attacked by *Fusarium oxysporum wilt* and wilted bacteria *Ralstonia solanacearum*.

Symptoms caused by fusarium wilt disease, will clearing the leaves bones and leaf stalks. Furthermore, the leaves on the lower site, will turn yellow and then die (Miller, et al., 2006) [7]. While in p0lants that are attacked by bacterial wilt disease has symptoms of wilting leaves and yellowing quickly and then the stems will collapse (Semangun, 1989) [11].

CONCLUSIONS

Found as many as 27 types of insects in potato cultivation in Modoinding, both as pests and natural enemies (predators and parasitoids). There are 5 main pests namely *Empoasca sp., Lygus sp., Leptopterna sp., Acrididae, Nezara sp*. There were also 3 types of diseases, but the number was not significant, namely diseases originating from fungi namely *Alternaria solani* dry spots and fusarium wilt *Fusarium oxysporum* and from bacteria, namely wilted bacteria *Ralstonia solanacearum*. The incidence of bacterial wilt *Ralstonia solanacearum* 7.5%, *Fusarium wilt*

Fusarium oxysporum 4.54% and *Alternaria solani* dry spots 3.61%.

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