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EFFECTIVENESS OF GREEN BETEL LEAF EXTRACT (*Piper betle*) FOR CONTROLLING SOYBEAN LEAF RUST DISEASES *Phakopsora pachyrhizi*

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ABSTRACT

This study aims to determine the effectiveness of betel leaf extract (Piper betle) on the control of leaf rust disease Phakopsora pachyrhizi soybean plants. The research was carried out by UPT Palawija Crops, Department of Agriculture of the Province of North Sumatra Tanjung Selamat, Deli Serdang with an altitude of ±25 meters above sea level with a flat topography. The research method used a non- factorial randomized block design consisting of 4 treatments and 3 replications. The treatments tested were K0 = control, K1 = 0.25% extract concentration, K2 = 0.50% extract concentration, K3 = 0.75% extract concentration. Parameters observed were the percentage of infected plants, disease intensity and seed weight of 100 grains. The results showed that the pesticide of betel leaf (Piper betle) had a significant effect in controlling leaf rust disease Phakopsora pachyrhizi. The treatment was in K3 (0.75% extract) with a percentage of 2.1% being attacked. Compared to treatment K0 (Control) the percentage of infection was 6.9%, K1 (Extract 0.25%) percentage was attacked by 5.7%, and K2 (Extract 0.50%) the percentage was 3.2%. The conclusion of this study Betel leaf vegetable pesticides (Piper betle) are effective in controlling leaf rust disease Phakopsora pachyrhizi and can suppress the intensity of P. pachyrhizi attacks on soybean plants so that growth is not disturbed. Betel leaf extract (P. betle)) which was tested had a significant effect on controlling leaf rust (P. pachyrhizi) on soybeans (Glycine max. L) in K3 treatment with the percentage of infected plants being 2.1%.

Keywords: Soybean Plants, Vegetable Pesticides, Betel Leaf Extract.

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INTRODUCTION

Disturbance due to attack by plant-disturbing organisms (OPT) will always occur during the growth and development of soybean plants in the field. This is an obstacle causing the decline in the quality and quantity of soybean crop production. One of the pests that is an important disease in soybean cultivation is soybean leaf rust, namely Phakopsora pachyrhizi. Disease disorders in soybean have been considered important since the emergence of a great leaf rust disease in 1962 (Somaatmadja dkk, 1985).

Rust disease caused by the fungus P. pachyrhizi is an important disease in soybean plants. Rust disease can reduce yields because the leaves that are attacked will experience early leaf fall which will result in reduced seed weight and number of pods which varies between 10-90%, depending on the phase of plant development, environment and soybean variety. (Sinclair, 1999).

Rust disease is caused by the fungus P. pachyrhizi which develops rapidly in moist air and its spores are easily carried by the wind so that the disease quickly spreads to soybean plantations, the spread of the disease can also be through rainwater splashing on the soil surface. Control measures carried out by farmers by spraying chemical pesticides but have not provided satisfactory results, are expensive and pollute the environment, so an environmentally friendly control alternative is needed, namely by using biopesticides (Hanudin *et al*., 2013).

Problems in control so far only rely on use of chemical pesticides, while the impact of pesticides can harm the environment, society and livestock. The use of synthetic pesticides is reported to leave toxins in the soil for many years after use, thereby reducing the carrying capacity of the land due to a decrease in the population of microorganisms that decompose organic matter that live in the soil. This condition is exacerbated by the increasing resistance of plant pests due to the excessive use of insecticides. Thus, farmers are forced to increase the doses of insecticides that are applied thereby increasing exposure to insecticide residues on the bodies of farmers and consumers (Yanti, *et al*., 2000).

To overcome these problems, it is necessary to make improvements to the method of cultivating plants so that they are more environmentally sound by paying attention to and utilizing the abundant biological resources in nature. Thus slowly a sustainable ecological balance will be created. Furthermore, farmers and entrepreneurs are expected to be able to develop pesticides that are environmentally friendly, among others by utilizing plant secondary compounds as active pesticide ingredients. Pesticides with active ingredients derived from plants are known as botanical pesticides (Yanti, *et al*., 2000).

Vegetable materials have enormous potential, especially in Indonesia which is rich in plant diversity. Some of these plant species have chemical compounds such as essential oils and act as bactericidal and fungicide. Betel leaf essential oil contains eugenol which is a derivative of phenolic compounds so that the substance has the power to kill bacteria (Lestari, 2006).

One of the plant materials suspected to contain anti-bacterial and anti-fungal compounds is betel leaf. Betel leaves contain essential oils, which consist of 82.8%

phenolic compounds, and only 18.2% are non-phenolic compounds. Many essential oils are contained in betel leaves which are composed of several chemical components which are classified as phenolic compounds and compounds other than phenol. The phenolic compounds that make up the betel leaf essential oil consist of two phenolic components, namely the betel phenol isomer of kavikol and eugenol with various combinations of phenols such as the content of these essential oil compounds in the form of betlephenol, eugenol, cavibetol, carvacrol which functions to suppress fungal activity (Dharma, 1985).

METHOD

The research was carried out by UPT Palawija Crops of the Tanjung Selamat Agriculture Service, North Sumatra Province, Deli Serdang, at an altitude of ±25 (masl). This research starts from January to May 2020.

This study used a non-factorial randomized block design (RBD) consisting of 4 treatment levels: K0 = without extraction (control), K1 = 0.25% extract concentration (2.5 ml extract + 997.5 ml water), K2 = 0.50% extract concentration (5 ml extract + 995 ml water), K3 = 0.75% extract concentration (7.5 ml extract + 992.5 ml water).

The data in the study were obtained by direct observation (observation) of the symptoms that occurred in each treatment and repetition. To determine the effect of the concentration of botanical pesticides, the data obtained was analyzed using the Analysis of variance (ANOVA) which was tested at a significant level of 5%, if there was a significant effect it was continued with the Duncans's Multiple Range Test (DMRT) test.

RESULTS AND DISCUSSION

1. Percentage of Affected Plants **(%)**

Observational data and results of statistical analysis of the percentage of diseased plants showed that green betel leaf extract (*P. betle* L) had a significant effect on the percentage of infected plants at 54 HST and 75 DAP, but had no significant effect at 47 DAP and 61 DAP. The results of the average percentage of infected plants are presented in Table 1.

Table 1. Average Percentage of Affected Plants (%)

Treatment	observation time			
	47 DAP	54 DAP	61 DAP	68 DAP
K0 (control)	5,8 a	7,8 a	8,2 a	6,9 a
K1 (0,25%)	4,3 a	5,5 ab	6,7 a	5,7 a
K2 (0,50%)	2,9 a	4,1 bc	4,1 a	3,2 b
K3 (0,75%)	2,2 a	2,5 c	2,5 a	2,1 b

Note: Numbers followed by unequal letters in the same treatment column and row are not significantly different at the 5% level based on the DMRT test.

From Table 1. At 47 DAP and 61 DAP it was found that the application of betel leaf extract had no significant effect on the percentage of infected plants, the highest percentage of diseased plants was in the K0 treatment (5.8% and 8.2%) then the K1 treatment (4.3% and 6.7%), K2 treatment (2.9% and 4.1%) and K3 treatment (2.2% and 2.5%).

At 54 DAP observations showed that the application of betel leaf extract had a significant effect on the percentage of infected plants. The highest percentage of infected plants was observed at 54 DAP, namely the K0 treatment (7.8%) of the affected plants. The smallest percentage of infected plants was in the K3 treatment (2.5%).

At 68 DAP observations showed that the application of betel leaf extract had a significant effect on the percentage of infected plants. The highest percentage of infected plants was in the K0 treatment (6.9%) of the affected plants. The smallest percentage of infected plants was in the K3 treatment (2.1%).

The results showed the differences in each treatment on the percentage of plants affected by leaf rust disease. Increasing the concentration of green betel leaf extract by 0.75% resulted in the smallest percentage of infected plants, namely 2.1%. The higher the concentration of green betel leaf extract given, the fewer soybean plants are affected by disease, this is presumably due to the essential oil content of betel leaf which has germ-killing, antioxidant and fungicide and anti-fungal powers (Susilo, 2016).

2. Intensity Of Disease (%)

Observation data on the intensity of leaf damage at observation 47 to 75 days after planting (DAP) and statistical analysis showed that administration of green betel leaf extract (*Piper betle* L) had a significant effect on disease intensity at age 47 and 75 DAP but had no significant effect at age 54, 61, and 68 DAP. The average disease intensity results for each observation are presented in Table 2.

Table 2. Average Intensity of Disease (%)

Treatment	observation time				
	47 DAP	54 DAP	61 DAP	68 DAP	75 DAP
K0 (control)	8,07 a	8,13 a	6,49 a	15,87 a	15,87 a
K1 (0,25%)	6,67 ab	6,22 a	5,67 a	9,93 a	10,91 b
K2 (0,50%)	6,27 bc	5,07 a	5,27 a	8,81 a	10,64 b
K3 (0,75%)	4,87 c	4,22 a	4,36 a	5,48 a	9,93 b

Note: Numbers followed by unequal letters in the same treatment column and row are not significantly different at the 5% level based on the DMRT test.

From Table 2. it can be seen that the application of several concentrations of green betel leaf extract with acetone solvent has an effect on the intensity of the disease. At the age of 47 DAP the highest disease intensity was found in treatment K0 (8.07%) which was significantly different from treatment K1 (6.67%) which was significantly different from treatment K2 (6.27%) and K3 (4.87%). K1 was not significantly different from K2 but significantly different from K3, K3 was significantly different from K2. From the results of the research at 47 HST it can be explained that the higher the concentration of green betel extract applied the less intensity of leaf rust disease, this is probably due to the impact of the activity of the active ingredients in green betel leaf extract which can inhibit the development of leaf rust disease.

At observations 54 and 61 DAP it can be seen that there was a decrease in disease intensity and an increase occurred at 68 HST observations and showed results that were not significantly different in each treatment. Of the three observation times, the highest disease intensity was found in treatment K0 (8.13%, 6.49% and 15.87%) then treatment K1 (6.22%, 5.67% and 9.93%) then K2 treatment (5.07%, 5.27% and 8.81%) and K3 treatment (4.22%, 4.36% and 5.48%), no there was a significant difference in each treatment allegedly due to evaporation and leaching of the active ingredients by rainwater during implementation and after application of green betel leaf extract.

The decrease in active ingredients can be caused by several factors, including during the application process the solvent will continue to experience cycles of evaporation and condensation, at a certain point an equilibrium will be reached where the solute diffusion rate from the solid surface to the solvent will be equal to the solute diffusion rate from the solvent to the solvent. solids or saturation occurs so that the solvent that is evaporated is no longer pure and causes the active substance to be applied to be also evaporated so that this causes the content of the active substance to decrease or even disappear (Siswarni, 2016).

At 75 DAP observations, an increase in disease intensity was seen in plants that were not given green betel leaf extract (control) vegetable pesticides and was significantly different from other treatments, with the higher the concentration given the lower the disease intensity. This is presumably because the concentration of green betel leaf extract given contains antifungal compounds, this condition causes higher inhibition of the growth of leaf rust disease.

The eugenol content in the betel plant is more than 42 percent. Eugenol is a compound that can inhibit the growth of fungi and can even kill the growth of fungal colonies (Wijayakusuma 1992).

3. Seed Weight 100 Grain (G)

Observational data and results of statistical analysis of seed weight of 100 soybean plants showed that administration of green betel leaf extract (*Piper betle* L) had no significant effect on seed weight of 100 soybean plants. The results of the average seed weight of 100 soybean plants can be seen in Table 3.

Table 3. Average Seed Weight 100 Grain (g).

Treatment	Seed Weight 100 Grain (g)
K0 (control)	14,43 a
K1 (0,25%)	14,82 a
K2 (0,25%)	14,83 a
K3 (0,75%)	15,04 a

Note: Numbers followed by the same letters in the same column and treatment are not significantly different at the 5% level based on the DMRT test

From Table 3. it can be seen that administration of green betel leaf extract had no significant effect on seed weight of 100 grains, with the heaviest seed weight being in treatment K3 (15.04 g) followed by treatment K2 (14.83 g), K1 (14.82 g) and K0 treatment (14.43 g).

When viewed from the response of green betel leaf extract to the weight of 100 seeds, the results showed that the results were not significantly different between one treatment and another. This situation is caused by the size of the seeds in soybean plants which are influenced by plant genetic factors so that the same variety will produce almost the same weight of 100 seeds. Kamil (1996) states that the size of the seeds formed in a plant is influenced by the genetic nature of the plant itself. Furthermore Suprapto (2002) stated that the size of soybean plant seeds depends on the ability of the plants themselves to translocate assimilate in the seeds and these properties are more controlled by genetic factors. Simanjuntak (1983) states that seed weight and seed shape are strongly influenced by certain genes present in plants

CONCLUSION

1. Application of plant-based pesticides from betel leaf extract (*P. betle*) is effective in controlling leaf rust disease and can reduce the intensity of disease attacks on soybean plants. The betel leaf extract tested had a significant effect on controlling leaf rust disease in soybean plants.
2. The best concentration was in the K3 treatment (0.75%) which resulted in a percentage of infected plants of only 2.1%, significantly different from the K0 treatment of 6.9% and suppressing disease intensity by 9.93%, significantly different from the K0 treatment of 15. 87%.

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