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THE EFFECT OF ANTAGONIST PLANTS IN SUPPLYING THE PROGRESS OF THE EVENT OF GANODERMA SP ROOT DISEASE

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Abstract

Activity Testing the Effect of Antagonist Plants in Suppressing the Development of Incidence of Root Rot Disease Ganoderma sp. aims to determine the effect of antagonist plants in suppressing the development of stem rot disease incidence of Ganoderma sp. in oil palm nurseries. The study used a randomized block design with 7 treatments, namely Ganoderma+ginger isolate, Ganoderma+turmeric isolate, Ganoderma+lemongrass isolate, Ganoderma+temulawak isolate, Ganoderma+garut isolate, Ganoderma isolate and control. Each treatment with 5 replications with 2 sample plants. The parameters observed were the development of disease incidence through symptoms, height and number of leaf midribs of oil palm seedlings. The data were analyzed using the SPSS program. The effect of the treatment was analyzed by using fingerprints. If there is a treatment that has a significant effect, further tests are carried out with Duncan's Multiple Distance Test (DMRT) with a level of : 0.05. Based on the test results, it was found that the incidence of Ganoderma stem rot disease was the fastest, highest and most developed in each observation, namely in the treatment using ginger and lemongrass antagonists. While the lowest incidence of disease was found in the treatment of arrowroot, turmeric and temulawak. These antagonist plants have exudate containing antibiotics that can inhibit the growth of the Ganoderma fungus. The development of oil palm seedling plant height is strongly influenced by the physical properties of the soil and the presence of Ganoderma pathogens. While the Ganoderma pathogen did not affect the development of the number of leaf midribs, but only caused changes in leaf color such as necrosis.

Keywords**: *Antagonistic plants, incidence of Ganoderma stem rot disease, plant height, number of leaf midribs.***

1. INTRODUCTION

Oil palm (Elaeis guineensis Jacq.) is currently one of the plantation crops that occupies an important position in the agricultural sector in general, and the plantation sector in particular. This is because of the many plants that produce oil or fat, oil palm produces the largest economic value per hectare in the world (Fauzi et al., 2012). Oil palm is a vegetable oil-producing plant that can be a mainstay in the future because of its various uses for human needs. In the midst of the global crisis that hit the world today, the palm oil industry continues to survive and make a major contribution to the country's economy. Palm oil has an important meaning for Indonesia's national development. In addition to creating job opportunities that lead to community welfare, it is also a source of foreign exchange.

The spread of oil palm plantations in Indonesia has now grown in 22 provinces (Ditjenbun, 2008). Seeing the importance of oil palm plantations in the present and in the future, and along with the increasing need of the world's population for palm oil, it is necessary to think about efforts to increase the quality and quantity of oil palm production appropriately so that the desired target can be achieved. One of them is pest and disease control (Ditjenbun, 2008).

Pests and diseases are one of the important factors that must be considered in oil palm cultivation. The consequences are very large, such as decreased production, even plant death. Pests and diseases can attack oil palm plants from nurseries to mature plants. Most of the pests that attack

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are insects (insects) and some are mammals. Meanwhile, diseases that attack oil palm are caused by microorganisms such as fungi, bacteria and viruses (Fauzi et al., 2012). One of the important diseases that attack oil palm plants from seedling to mature plants is stem rot disease or called Ganoderma. According to Susanto, (2012).

In general, the disease becomes more severe and the rate of infection accelerates. At present, it is widely reported that soils that are relatively poor in nutrients tend to be attacked by Ganoderma disease with a higher intensity. This is due to the abundance of substrate, namely the availability of oil palm plants and a very wide range of alternative hosts. Not only in mineral soils, in peat soils the development of this disease is also faster. The faster infection rate is thought to be due to the role of other mechanisms, namely its spread through basidiospores. In addition to Ganoderma disease, upper stem rot is also found in peatlands (Susanto, 2012). Susanto (2012) said that so far, no oil palms are resistant or immune to this disease. Nevertheless.

The control of stem rot disease (Ganoderma sp.) has been carried out both by prevention and treatment but has not been able to overcome the problem. Based on this, the Medan Plantation Seedling and Plant Protection Center is looking for an alternative control method that is cheaper, more practical, and easier to obtain, namely the use of antagonistic plants. Antagonistic plant is a plant from the natural environment that has the ability to suppress the development of stem rot disease. The antagonist plants used include arrowroot, ginger, lemongrass, turmeric and temulawak.

Previously, several antagonistic plant extracts had been tested to inhibit the growth of Ganoderma hyphae in the laboratory. The test results showed that of the five antagonist plant extracts, only the exudate of the lemongrass plant was able to inhibit the growth of the hyphae of Ganoderma sp. Furthermore, BBPPTP Medan wanted to know the effect of antagonistic plants in suppressing the incidence of Ganoderma stem rot disease in oil palm nurseries. Activity “Application of Study on Disease Control of Ganoderma sp. On Oil Palm Nursery Plants with Antagonist Plants” was carried out at UPPT Sibirubiru, Deli Serdang Regency.

2. IMPLEMENTATION METHOD

2.1 Implementation Time and Place

The activity of testing the effect of several antagonistic plants in suppressing the development of Ganoderma sp. The Oil Palm Seedling Plant was carried out from December 2016 to March 2017, in Sibiru-biru Regency, Kec. Deli Serdang, to be precise, at UPPT Sibiru-biru and the BBPPTP Medan Laboratory.

2.2 Materials and tools

The materials used in this study were soil, compost, plastic sheeting, palm fronds infected with Ganoderma fungus, antagonistic plants (such as ginger, turmeric, arrowroot, temulawak and lemongrass), polybags, transparent white plastic, PDA, aquades, alcohol and Bayclin. While the tools used include hoes, gloves, rulers, microscopes, cutters, petridishes, ose needles, and stationery.

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Figure 1. Antagonistic plant treatment

2.3 Implementation Method

The test used a Randomized Block Design with 7 (seven) treatments and 5 (five) replications. The treatments used in this test were Ganoderma + Ginger isolates, Ganoderma isolates + Turmeric isolates Ganoderma + Lemongrass, Ganoderma + Temulawak isolates, Ganoderma isolates + Garut, Ganoderma isolates and controls. Each replication in each treatment consisted of 2 (two) sample plants.

2.4 Implementation Stage

2.4.1 Ganoderma Inoculum Production

Ganoderma in the form of inoculum source was propagated on rubber wood substrate measuring 6 cm x 6 cm x 10 cm. The technique of using rubber wood as a source of Ganoderma inoculum is as follows. The pieces of rubber wood are cleaned with a shaving machine. Then washed with running water, boiled for 2 hours, then drained (dryed) until no water drips. Next, put in a polypropylene plastic or heat-resistant plastic with a size of 1 kg (15 cm x 25 cm). After that, 10 ml of liquid PDA media was poured into the plastic. The plastic mouth is given a poly vinyl chloride ring and covered with cotton. It was then sterilized in an autoclave at 1 atm for 60 minutes at 121°C. After cooling, they were transferred to laminar air flow for infestation with pure isolates of Ganoderma sp. who is 14 days old. Infestation of isolates was carried out on the right and left sides of the growing media in laminar air flow. Then put in the oven at a temperature of 27°C for 60 days to get the inoculum that is quite old.

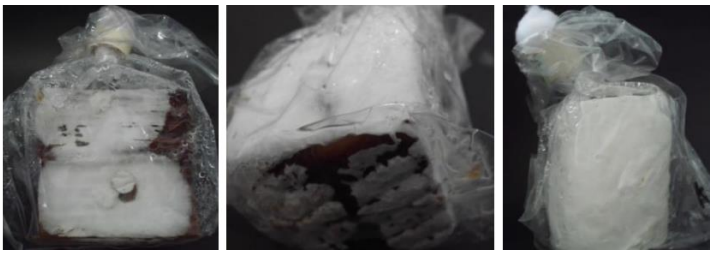

Figure 2. Inoculum Ganoderma sp. on rubber wood

2.4.2 Growing Medium and Treatment

The planting medium used is soil and compost that have been sterilized by drying in the sun. The drying process is carried out several times. After that, it is mixed and put into a 5 kg polybag. The sterilization process is carried out to remove contamination from pests and other diseases. While the treatments used as antagonist plants in suppressing the growth of Ganoderma fungi were ginger, lemongrass, turmeric, temulawak and arrowroot.

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Figure 3. Soil and compost are mixed and dried in the sun (soil sterilization)

2.4.3 Inoculation of Plant Seeds, Inoculum of Ganoderma and Antagonist Plants

The inoculation technique uses the sitting germinated seed method. One inoculum of Ganoderma in a rubber wood block aged 2-3 months was placed in a 5 kg polybag filled with soil and compost with a depth of 5 cm next to the planting point of oil palm seedlings. Next on the other side are planted 2 stems of antagonistic plants. Seedling maintenance consists of watering and sanitation. Fertilization during the study was omitted so as not to affect the rate of infection of Ganoderma.

Figure 4. Polybags containing oil palm seeds, palm fronds that have been attacked by Ganoderma and antagonistic plants

2.5 Observation Parameter

The observation parameter in this activity was to see whether planting antagonist plants (ginger, turmeric, lemongrass, temulawak and arrowroot) around oil palm nurseries that had been infected with Ganoderma fungus could reduce the incidence of the disease. The parameters observed were the number of leaf midribs (strands) and plant height (cm).

Figure 5. Trial Location

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2.5.1 Observation of the Occurrence of Root Rot Disease

Observation of the incidence of stem rot disease was carried out every 2 weeks. The development of the incidence of root rot disease was observed based on visual signs and symptoms. Symptoms of the disease in the form of yellowish green leaf color like necrosis, dry up and eventually the plant dies. While the sign of the disease is the appearance of Ganoderma fruiting bodies on the soil surface of oil palm nurseries. The incidence of Ganoderma disease is calculated by the formula:

$$\mathbf{KP} = \frac{\boldsymbol{a}}{\boldsymbol{a}+\boldsymbol{b}} \times \mathbf{100\%}$$

Information:

KP : Disease Incidence
a : number of diseased plants
b : number of healthy plants

At the end of the study, observations were made of root necrotic symptoms due to Ganoderma attack by dismantling oil palm seeds. Observations to ascertain the symptoms of stem rot on the surface of the growing medium.

2.5.2 Observation of Height and Number of Midrib/Leaves of Oil Palm Seeds

Observations on the height and number of midrib/leaves of oil palm seedlings were carried out to support data on the effect of Ganoderma stem rot incidence on oil palm seedlings. Plant height was measured from the soil surface to the tip of the highest leaf with observation intervals every 2 weeks. Meanwhile, the number of fronds is calculated from the lowest to the highest frond but which is already open.

Figure 6. Observation of nursery plant height

2.6 Data analysis

The incidence of root rot disease, plant height, number of leaf midribs and infection rate were analyzed by analysis of variance. In addition, further tests were also carried out using the Duncan Multiple Range Test at a level of 5%.

3. RESULTS AND DISCUSSION

3.1 Observation of the incidence of root rot disease

The development of the incidence of root rot disease was observed based on visual signs and symptoms. Symptoms of the disease in the form of yellowish green leaf color like necrosis, dry up and eventually the plant dies. While the sign of the disease is the appearance of Ganoderma fruiting

bodies on the soil surface of oil palm nurseries. Based on observations of the incidence of stem rot disease that has been carried out every 2 weeks for 4 months, the results obtained can be seen in Table 1.

Table 1. The development of disease incidence (%) of stem rot by Ganoderma sp. on various treatments

Perlakuan	Kejadian Penyakit (%) Pada Pengamatan (... MSI)							
	2	4	6	8	10	12	14	16
Garut	0	0	16,67	33,33	33,33	33,33	33,33	16,67
Jahe	33,33	66,67	66,67	66,67	66,67	83,33	100	100
Serai	16,67	33,33	50	50	66,67	66,67	83,33	83,33
Kunyit	0	0	33,33	16,67	16,67	33,33	33,33	33,33
Temulawak	0	16,67	16,67	16,67	16,67	16,67	16,67	16,67
Inokulum *Ganoderma*	0	0	33,33	50	50	50	50	50
Kontrol	0	0	0	33,33	33,33	83,33	83,33	83,33

Table 1 showed that each treatment experienced the development of Ganoderma stem rot disease incidence. However, the development was different, visual symptoms of stem rot disease appeared on observations I (2 MSI), II (4 MSI) III, (6 MSI) and even IV (8 MSI). Visual symptoms of stem rot disease can be seen from the change in leaf color to yellowish green like necrosis. In addition, the development can be seen from the appearance of Ganoderma fruiting bodies on the soil surface of oil palm nurseries.

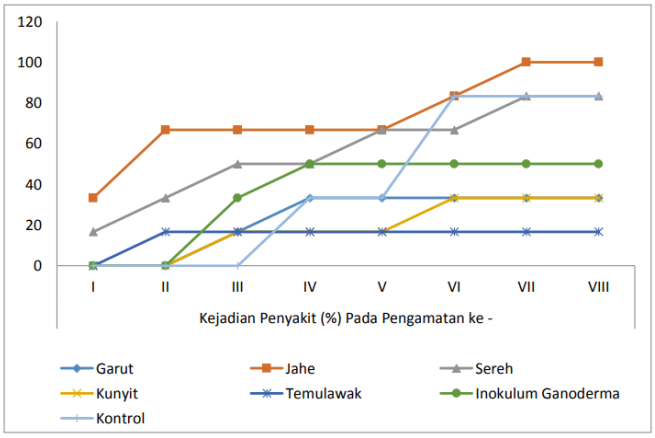

Figure 7. Diagram of disease incidence (%) of stem rot by Ganoderma sp. On various treatments

The incidence of root rot disease first appeared in the 2nd week, namely in the treatment of ginger and lemongrass antagonist plants, amounting to 33.33% and 16.67%, respectively. Antagonistic plants of temulawak showed disease incidence at the 4th week. At week 6, the highest incidence of disease was found in the ginger antagonist plant treatment, which was 66.67%. Followed by lemongrass treatment by 50%, turmeric 33.33% and arrowroot and temulawak by 16.67%. Disease incidence was growing in several treatments of antagonistic plants until 16 MSI was observed. Seen in antagonistic plants ginger and lemongrass. However, there are several antagonistic plant treatments where the percentage of disease incidence does not develop or remains, such as arrowroot, turmeric and temulawak. This shows that the exudate of the above antagonist plants can inhibit the growth of Ganoderma fungi.

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Figure 8. The development of disease incidence can be seen from the change in leaf color (necrosis) and the appearance of Ganoderma fruiting bodies on the soil surface of oil palm nurseries

The exudate may contain antibiotics as listed in Table 1. The volatiles contained in turmeric have been investigated and found to have antibiotic properties against the Ganoderma fungus. While temulawak has antibacterial properties and arrowroot has antidiarrheal properties. Situmorang, et al (2006) said that the presence of antibiotics released by antagonist plant roots into the soil was thought to be the main factor that played a role in the mechanism of the plant's antagonism against the Ganoderma fungus. The effectiveness of these antagonist plants in addition to quality also depends on the number of antibiotics produced in a certain period. This depends on the speed of growth, reproduction and survival of the antagonist plant. Antagonist plants needed to control white root fungal disease on rubber, according to Situmorang, et al (2006) are 3-4 trees around the root base of 3 months old rubber plants, 4-6 trees on healthy immature plants from sick plant neighbors or 8-10 trees planted around the root stump. It is suspected that the use of antagonistic plants can be tried to control Ganoderma stem rot disease.

The suppression of the incidence of Ganoderma stem rot disease will be maximized if the number of antagonist plants around oil palm nurseries is increased. For this reason, it is recommended that further testing try as many antagonistic plants as above in suppressing the incidence of Ganoderma stem rot disease. In the diagram, Figure 12, the control treatment without Ganoderma inoculum also shows that the oil palm seedling plant was attacked by the Ganoderma fungus. Attack symptoms appeared at 8 MSI and increased to 16 MSI. This is presumably because the surrounding plants have been attacked by stem rot disease and even show the appearance of fruit bodies. Just like the white root fungus, the fruiting body of the Ganoderma mushroom can spread disease through spores that fly or work in air born diseases. This is in accordance with what was stated by Paterson, (2007) in Risanda, (2008) where basidiospores have a significant effect on disease epidemiology, but do not increase disease incidence. Basidiospores are released and dispersed by the help of the wind. In addition to leaf discoloration or necrosis and the appearance of fruiting bodies, to ensure that the oil palm nursery is attacked by Ganoderma stem rot disease, the plants are removed from the soil in polybags.

Next, the plants were brought to the Medan BBPPTP Laboratory. Then the roots were cleaned, cut into pieces and planted on PDA media. After a few days, the spores grew and finally filled the PDA medium.

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Figure 9. Roots of oil palm seedlings that have been attacked by Ganoderma stem rot disease (antibacterial treatment of lemongrass)

3.2 Observation of Height and Number of Midrib/Leaves of Oil Palm Seeds

Observations of the height and number of midrib/leaves of oil palm seedlings were carried out to support data on the causes of Ganoderma stem rot incidence on oil palm seedlings. Plant height was measured from the soil surface to the tip of the highest leaf with observation intervals every 2 weeks. Meanwhile, the number of fronds is calculated from the lowest to the highest frond but which is already open. Data from observations on the height development of oil palm seedling plants infected with Ganoderma stem rot disease in all treatments can be seen in Table 2.

Table 2. Growth of plant height (cm) of oil palm nurseries infected with Ganoderma sp. on various treatments

Perlakuan	Pengamatan ke ... MSI (Minggu Setelah Inokulasi)							
	2	4	6 MSI	8 MSI	10 MSI	12 MSI	14 MSI	16 MSI
Garut	9,1	11,1	13,3	12,9	9,9	13,7	15,2	14,4
Jahe	8,4	9,9	12	11,8	11,2	13,8	15,4	16,1
Sereh	9,2	10,5	12,8	12,6	10,9	14,2	13,9	14,6
Kunyit	8,1	9,4	11,7	11,9	9,6	15,6	15,25	15,9
Temulawak	9,9	11,25	12,5	12,4	12,1	16,2	16,25	17,8
Inokulum *Ganoderma*	8,3	9,1	10,4	11,1	9,8	10,1	11,3	11,6
Kontrol	8,7	9,3	10,6	11,4	10,1	10,8	11,4	12

Table 2 showed that the height of oil palm seedlings was greatly suppressed by soil properties and the presence of Ganoderma pathogens. The decrease in plant height can be seen at the 10th MSI observation in each treatment. At the observation of 12 MSI and 14 MSI plant height increased. According to Susanto et al. (2013), the incidence of root rot in the treatment medium was strongly influenced by physical properties, soil pH and soil biology. Another determining factor is the fertility of the sandy soil. The higher the percentage of soil sand fraction will increase the incidence of root rot disease. Soil that is poor in nutrients will cause plants to decrease their resistance to pathogen infection. Low soil acidity can reduce the incidence of root rot disease. The biological nature of the soil or growing medium greatly influences the development of stem rot disease. Weak plants will be easily infected with pathogens.

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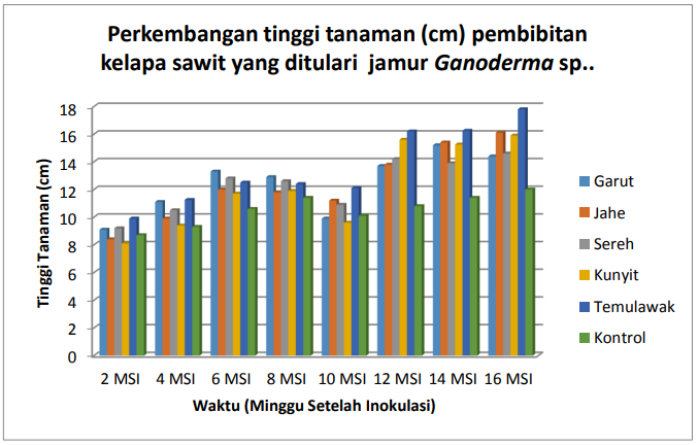

Figure 10. Plant height development diagram (cm) of oil palm nurseries infected with Ganoderma sp . fungus

Furthermore, the diagram Figure 15 shows the plant height decreased again at 16 MSI observations, namely the treatment of arrowroot antagonist plants. Meanwhile, in the treatment of antagonistic plants ginger, lemongrass, turmeric and temulawak, the plant height continued to increase. In addition to plant height data, data on the number of leaf midribs was also taken to support data on the high and low incidence of stem rot disease. For data on the results of observations on the development of the number of midribs/leaves (strands) of oil palm nurseries infected with Ganoderma stem rot disease in all treatments, it can be seen in Table 3.

Table 3. Development of the number of fronds/leaves (strands) of oil palm nurseries infected with fungi Ganoderma sp

Perlakuan	Pengamatan ke ... MSI (Minggu Setelah Inokulasi)							
	2 MSI	4 MSI	6 MSI	8 MSI	10 MSI	12 MSI	14 MSI	16 MSI
Garut	7	8,3	9,2	9,7	9	8,7	9,7	9,7
Jahe	7,5	9	10	10,2	9,2	10,2	10,7	11,3
Sereh	7,8	9	10	10,5	9	9,8	10,7	10,8
Kunyit	7,5	8	9,3	9,3	9,7	9,7	10,2	10,3
Temulawak	8,5	9,2	9,8	10,8	9,7	10,8	11,2	11,7
Inokulum *Ganoderma*	7,3	8,1	8,9	9,5	9,1	9,1	9,8	10,3
Kontrol	8,7	9	9,5	10,5	9,5	8,2	9,2	9

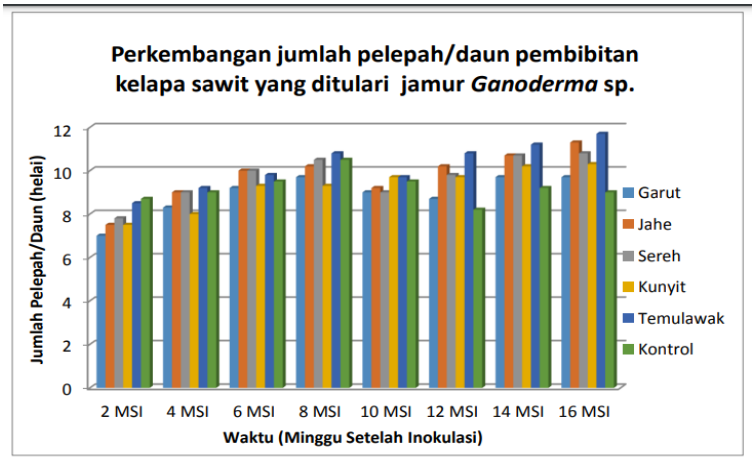

Figure 11. Diagram of the development of the number of fronds/leaves (strands) of oil palm nurseries infected with the fungus Ganoderma sp

Table 3showed that the number of leaf midribs increased from 2 MSI to 8 MSI observations in all treatments. However, at 10 MSI the number of leaf midribs decreased. Furthermore, at 16 MSI the number of leaves increased again in each treatment. This shows that the incidence of Ganoderma stem rot disease has no effect on the number of leaf midribs. Rather, it affects leaf discoloration or necrosis. As stated by Risanda (2008), one of the symptoms of Ganoderma stem rot attack is that the leaves experience discoloration or necrosis.

4. CONCLUSION

From the results of this study, several conclusions can be drawn, namely:

1. The incidence of Ganoderma stem rot disease most rapidly attacked oil palm nurseries treated with ginger and lemongrass antagonists.
2. The highest incidence of Ganoderma stem rot disease occurred in oil palm nurseries treated with ginger and lemongrass antagonists. Then followed by turmeric, arrowroot and ginger.
3. In the last 16 MSI observations, the incidence of Ganoderma stem rot disease developed in oil palm seedlings treated with ginger and lemongrass antagonists. However, in the arrowroot treatment, turmeric and temulawak did not.
4. Turmeric antagonist plants have exudates that contain antibiotics that can inhibit the growth of the Ganoderma fungus.
5. The development of oil palm seedling plant height is strongly influenced by the physical properties of the soil and the presence of Ganoderma pathogens.
6. While the Ganoderma pathogen did not affect the development of the number of leaf midribs, but the change in leaf color became necrotic.

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