Patogenity Test of Two Isolates of *Ganoderma* on Sengon Seedlings

Elis N. Herliyana [a,*], Irfan K. Putra [a], Darmono Taniwiryono [b], Hayati Minarsih [b]

[a] *Department of Silviculture, Faculty of Forestry, Bogor Agricultural University, Bogor, Indonesia*
[b] *Indonesian Biotechnology Research Institute for Estate Crops (IBRIEC), Bogor, Indonesia*
** Corresponding author: Department of Silviculture, Faculty of Forestry, Bogor Agricultural University, Kampus IPB Darmaga Bogor (16680), Indonesia*
Fax 0251626806,
elisherliana@yahoo.com; elishe@ipb.ac.id

Abstract

Sengon tree (*Paraserianthes falcataria* (L.) Nielsen) currently becomes a major forest tree species widely planted by smallholders in Indonesia. Sengon often used by farmers as component planted in agroforestry system as well as shade trees planted in between other crops such as coffee and cacao. *Ganoderma* infection causebasal stem rot disease which is becoming more prevalent and causing significant loss in sengon tree and other estate crops. This research is based on the attack of *Ganoderma* tothe shade tree, sengon. Therefore, it is important to do a specific research on the process of the inoculation of *Ganoderma* to prevent such attack. The aim of this research is to understand the effect of the inoculation to the sengon seedlings. There are two majors in the research i.e. non inoculation and inoculation treatments. Each treatment consisted of three observation blocks that are considered equal and each block consisted of four plants (the sengon seedlings age were one and a half months) as replicates. The non inoculation treatments were all combinations of root and foodbase treatments. Foodbase treatment itself is divided into two i.e. the sengon wood piece with varying size (3, 4, and 5 cm diameters) and PDA (Potato Dextrose Agar) without inoculation of *Ganoderma* spp. from Ciamis area/region (isolates of *Ganoderma* from lamtoro) and isolates of *Ganoderma* from sengon plants) derived from the collection of Forest Pathology Laboratory and will be called SP1 and SP2. The result showed that the control has a better average growth compared to the inoculation treatment. The f pathogenity test shows that *Ganoderma* SP2 has more pathogenic than *Ganoderma* SP1. the heights of seedlings that were inoculated with *Ganoderma* SP2 are I lower than the heights of seedlingss that were inoculated with *Ganoderma* SP1. Root treatments application showed that both controls and treatments blocks have better growth from sengon seedlings using root cutting treatment. The effect on the growth of sengon seedlings showed that inoculated seedlings in the wood with 3 centimeters diameter as a foodbase inhibit both their height and leaves growth compared to the seedlings with 4 centimeters or 5 centimeters diameter of wood of the same foodbase.

*Keywords: foodbase, Ganoderma, sengon (*P. falcataria*), Basal stem rot.*

Introduction

Sengon tree (*Paraserianthes falcataria* (L.) Nielsen) currently becomes a major forest tree species widely planted by smallholders in Indonesia. In Java, there is a total area of 400.000 ha of community forest dominated by sengon from which 895.000 m3 wood are produced annually. The wood of this quick growing tree is processed further by paper industries to become pulp or sawed by lumber industries as a raw material for soft wood board. Sengon often used by farmers as component planted in agroforestry system as well as shade trees planted in between other crops such as coffee, cacao and banana. *Ganoderma* infection is becoming more prevalent and causing significant loss in sengon tree in Indonesia. Once the tree is infected by this cosmopolitan fungal pathogen, sooner or later its base will become totally rotten leading to the tree dead. The disease incidence ranges from 3% to 26%. One hundred percent disease incidence has been reported to occur in the second generation of replanting.

This basal stem rot disease spread amongst trees primarily through roots contact. The fungus has rigid fruiting bodies plate (conk), with or without stem, the top surface often looks shiny waxy brown to dark brown in color, the bottom surface looks porous creamy white in color.

Theyoften found attached to the base of the rotten tissues near soil surface. Basidiospores produced from pores at bottom surface plays in important roles in the disease spread from the infected tree to the fresh cut of the stumps. The disease symptoms look similar with those caused by heavy water stress displaying weak pale to yellowish in color of the tree canopy which is unrecoverable and leading to leaf dryness. The disease is difficult to be controlled, because when the symptom is observed, the infected tree is usually cannot be saved anymore by any control means. Turner (1981) in Zakaria *et al*. (2004) reported that at least there are 15 species of *Ganoderma* in various places in the world, which caused basal stem rot disease.

Ganoderma is a fungus causing basal stem rot disease that usually attacks the roots of the host range. This fungus attacks is commonly found in various types Leguminoceae (Henessy and Daly 2007), Palmae (Turner 1981 in Zakaria *et al*. 2005), Rubiaceae (Hindayana *et al*. 2002). The authors also found *Ganoderma* that attack the ebony tree (Ebenaceae). This research is based on the attack of *Ganoderma* to ashade tree, sengon. Therefore, it is important to do a specific research on the process of the inoculation of *Ganoderma* to prevent such attack. The aim of this research is to understand how the effect of the inoculation to the sengon seedlings to find the control technique.

Methodology

This research was conducted from October 2009 - March 2010. This research was held in a greenhouse of Department of Silviculture and Forest Disease Laboratory of the Department of Silviculture, Bogor Agricultural University.

Preparation of Equipment and Materials Research

The study was started by the preparation of sterile soil and foodbase that include a piece of wood with diameter 3, 4 and 5cm and foodbase a PDA (Potato Dextrose Agar). The supply of sterile soil was done by autoclaving of soil mixed media and charcoal husk compost with the ratio of 2:1:1. Autoclaving was done by the time adjacent to weaning so that the soil conditions results in steaming plastic bags are not contaminated. The PDA foodbase was prepared in two ways that are not inoculated or inoculated.

PDAs which were not inoculated by *Ganoderma,* was prepared simply by making sterile PDA medium which is then placed in polybags at weaning. The preparation of PDA inoculated media by *Ganoderma* was done in conjunction with the preparation of pieces of wood that also were infected with fungus. Isolates of *Ganoderma* have been cultured in a sterile culture into sterile jars containing both types of foodbase. Maturity level of culture can be seen quite well from the morphology of the fungus and spread on a PDA or timber in the jar. The uninoculated pieces, supplies quite done with skinning sengon logs that had previously been cut with a length of 5cm and various diameters i.e. 3, 4 and 5 cm. The pieces of wood were then boiled in a pan for a few hours before sterilized in an autoclave.

Weaning and Maintenance

Weaning were performed in the afternoon to prevent the death of seedlings due to the stress. Weaning also performed each treatment to be easy in the preparation plant. After that, sengon seeds will be slightly softened, about one or two days prior to adapt from the stress.

Providing treatment

There are two majors in the research i.e. non inoculation and inoculation treatments. Each treatment consisted of three observation blocks that are considered equal and each block consisted of four plants (the sengon seeds age were one and a half months) as replicates. The non inoculation treatments were all combinations of root and foodbase treatments. Foodbase treatment itself is divided into two i.e. the sengon wood pieces with varying size (3, 4, and 5 cm diameters) and PDA without inoculation of *Ganoderma* from Ciamis area/region (isolates of *Ganoderma* from lamtoro) and isolates of *Ganoderma* from sengon plants) derived from the collection of Forest Pathology Laboratory and will be called SP1 and SP2. The total of treatments are 10. Inoculation treatments were a combination of various treatments of root and foodbase which has inoculated with *Ganoderma*. Types of *Ganoderma* were also included in a combination. The total number of inoculation is 15 treats. Types of *Ganoderma* were also included in a combination. Total for this inoculation tratement is 30 treatments.

Observation of the Treatment and Data Collection

The observation of the treatment was carried out daily with the parameters of the number of young leaves and seeds of high accretion sengon. Data were collected on a tall sheet and analyzed using SPSS. At the end of the study, the root shoot ratio data was taken to see the most balanced growth among the treatments.

Data was taken on the inoculated sengon with *Ganoderma*, Determination of the presence or absence of fruiting body of *Ganoderma* was documented. The seeds which were harvested and cleaned were then grouped by the type of treatment and then the roots were separated from the shoots (stems). Part of the seed that is classified as part of the plant roots are located just below the former location of the branch or branches from the first base.

After the separation of shoots and roots, the weight of each seedling roots and stems were measured to determine the fresh weight of roots and shoots of seedlings. After the fresh weight measurements, parts of seeds were wrapped in a paper and dried in the oven for 24 hours at 110^0 C. The second measurement was done for both roots and shoots of each seedling to calculate the dry weight of roots and shoots.

Data Analysis

The experimental design was used complete randomized design based on the assumption that the research conducted on a homogeneous condition. Homogeneity test is based on experiments which only require element differentiation of treatment given. The calculation is performed with use of SPSS, while Duncan's test was used for further testing.

Results and Discussion

In general, the result of control treatments measurement has a better growth compared to the inoculation treatment. This result can be seen on the accretion parameter of heights and number of leaves. It is possible to do the observation on the treatment of the inoculation with the negative growth tendencies. The height measurement seed, according to the regulation of The Minister of Forestry no.3 in 2004, is the height measurement from the base of the plant seed to the top growing spot using centimeter unit. From that definition, if the growing point is dead, then the growing spot underneath can replace it, so the height will be reduced.

The pathogenicity test shows that *Ganoderma* SP2 has more pathogenic than *Ganoderma* SP1. This result can be seen on the heights of seeds that were inoculated with *Ganoderma* SP2 are lesser than the heights of seeds that were inoculated with *Ganoderma* SP1.

The root treatment application shows that both controls and treatments blocks have a better growth than sengon seedlings using root cutting treatment. This result corresponds with Deselina works (1999), where root cutting will produce more vigor seeds and stronger roots. This positive result of root cutting application in inoculation treatment, reveals that infection rate of *Ganoderma* is lower than the healing process as the effect of the cutting.

The effect on the size of sengon seedlings showed that inoculated seedlings in the wood with 3 centimeters diameter as a foodbase hampered both their height and leaves growth compared to the seedlings with 4 centimeters or 5 centimeters diameter in the same foodbase. This result indicates that wood pieces with 3 centimeters diameter as a foodbase, is more optimal in spreading *Ganoderma* than the 4 or 5 centimeters.

Application of foodbase type differentiation in sengon seedlings showed that wet foodbases such as PDA is easier than dry foodbases such as wood pieces, in transmitting *Ganoderma* into plant's roots. This can be seen from the calculation where the inoculated sengon seedlings with the wet foodbase such as PDA, has a higher disruption than the dry one. These results occurred in height parameter. Root sprout ratio measurement in this research shows an effect of the *Ganoderma* infection on the plant. General calculation of root sprout ratio will generally support the result using SPSS. Root cutting treatments on seedling growth sengon resulted in high seedling leaves and seedling growth better than the group without cutting the roots of sengon seedlings (Figure 1 and 2).

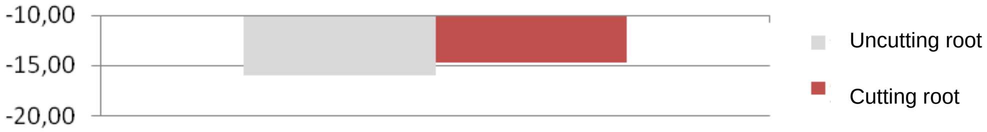

Figure 1 Comparison of the rate of increase in the child leaves the root treatment. Grey block shows the uncutting roots and red block shows the cutting roots.

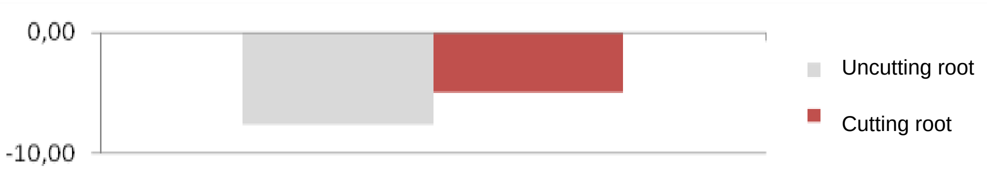

Figure 2 Comparison of the high rough at the rate of root treatment. Grey block shows the uncutting roots and red block shows the cutting roots.

Conclusion

The control treatments shows better growth compared to the inoculation treatments. Inoculation treatments at high pathogenicity on seedlings derived from *Ganoderma* sengon sp2. These were shown by the magnitude inhibition. These obtained from the average growth of the inoculated seedlings sengon with parameters of the number of leaves and seedlings height. Observations showed that sengon seedling growth better by cutting the roots treatments, both in the controls and inoculation treatments.

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