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Agarwood (*Aquilaria malaccencis*) Health at Nursery

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ABSTRACT

Gaharu (*Aquilaria malaccencis*) is a tree species included in Thymelleaceae family, Agarwood can grow in lowland as well as mountains, up to 750 m above sea level. The average temperature required is 32 ° C and the average humidity is 70%, with annual rainfall of about 2000 mm. This plant produces a resin powder which has a distinctive aroma fragrance infected due to fungal diseases (fungi) that enter through the trunk wound. The objective of this study is to identify the characteristics of attack which causes damage to the agarwood plant seedlings (*Aquilaria malaccencis*) and to elucidate the intensity of pests and diseases on agarwood plant seedling (*Aquilaria malaccencis*). By using code of *Environmental Monitoring and Assessment Program* (EMAP) which had been modified so that it was obtained the damage cause, damaged parts of plants, the type and the level of severity of damage suffered by the plant. Based on the results, data showed that the biggest cause of the damage suffered by the agarwood plant was a disease characterized by symptoms on the leaves where the damage type was in the form of leaf discoloration with the level of severity of 20-29%. The intensity of damage was 44. 66%, damage due to pest was 8%, and damage due to illness was 32%.

Keywords: Plant Health, Agarwood, Resin, Disease

INTRODUCTION

G*aharu* (*Aquilaria malaccencis*) is a tree species included in Thymelleaceae family, Agarwood can grow in lowland as well as mountains, up to 750 m above sea level. The average temperature required is 32 ° C and the average humidity is 70%, with annual rainfall of about 2000 mm. This plant produces a resin powder which has a distinctive aroma fragrance infected due to fungal diseases (fungi) that enter through the trunk wound. Some types of Agarwood plant known among others are *Aquilaria malaccensis*, *A. filaria*, *A. hirta*, *A. agalloccha*, and *A. macrophylum*. Of the potential plant species, *Aquilaria malaccensis* is the most valuable Agarwood economics view.

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Fig. 1. *Aquilaria malaccensis*

Agarwood plant (*Aquilaria malaccencis*) is healthy if it is not impaired by a factor or cause to intervene against the activity of cells or organs of normal plants, the deviations and adverse effects on the plants. Unhealthy plant is when this plant has a bad growth, has no straight stems, has pale yellowish leaves and has been attacked by pests and diseases (Forestry Minister Regulation No. P.03 / MENHUT-V / 2004). From some of these factors it is very important to know the health condition of the plants at seedling stage in order to reduce the failure of Agarwood (*Aquilaria malaccencis*) when planted in the field.

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The objective of this study is to identify the characteristics of attack which causes damage to the Agarwood plant seedlings (*Aquilaria malaccencis*) and to elucidate the intensity of pests and diseases on Agarwood seedling (*Aquilaria malaccencis*).

MATERIAL AND METHOD

Location and Time

This study was carried out in Balai PerbenihanTanaman Hutan (BPTH); Research Institute for Forest Crop, Banjarbaru, South Kalimantan, while the study period was approximately3 months.

Material and Equipment

Materials used were 150 Agarwood seeds (generative*)*, 3 months old. The tools used in this research were stationeries, a location map, a calculator to calculate, a camera as a tool for documentation, a *tallysheet*, a luv, a *soil pH tester*, and a hygrometer.

Work Procedures

a. Seed Sampling, Sampling used *simple random sampling*.
b. Observation and Data Collection were done by observing the seedling, one by one; they included the symptom, damage cause, damage type, and attack intensity.
c. Observation results were checked off with coding from EMAP (modification) where then processed based on the damage cause consisted of 11 codes (Table 1), damage parts of plants consisted of 6 codes (Table 2), damage type consisted of 12 codes (Table 3), and level of severity consisted of 8 codes (Table 4).
d. From the code checking result then the data were processed in the form of tables
e. Furthermore, these data are presented in the form of tables.

Based on the observation, the characteristics of healthy seedlings are: (1) there is not any sign of pests and diseases whether on leaves, trunks, branches, and roots; (2) normal growth; (3) The leaves have fresh color or there is no discoloration either on the leaves, trunks, branches, and roots. This is in accordance with the Regulation of the Minister of Forestry Number P.03 / MENHUT-V / 2004 Part Five on Implementation Guidelines for Performance Assessment of National Movement Implementation for Forest and Land Rehabilitation, it is declared that healthy plants are when the plants have good growth (leaves and trunks are fresh), straight trunk, dense crown, and they are not attacked by pests and diseases.

Assessment criteria of seedlings health associated with signs of damage by pests or diseases that exist in the seedlings, based on Muhtadin (2005), he stated that the criteria for a healthy plant is that there is not attack symptoms on leaves, but the number of affected leaves and the width of attack is very small compared with the total number of leaves.

Table 1. Causes of damage

Code	Specification
001	Dead
100	Insect
210	Wound
200	Disease
300	Fire
400	Animal
500	Weather
600	Plant Competition
700	Human Activity
800	Unknown Cause
999	Besides the Existing Criteria

Table 2. Parts of damaged plant

Code	Specification
0	No Damage
4	Under Trunk
5	Top Trunk
6	Branch
7	Shoot
8	Leaf

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Table 3. Type of damage

Code	Specification
01	Cancer
02	Conk, fruiting bodies, and other indicator of advanced
03	Open wounds
04	Resinosis or gummosis
11	Broken bole on roots
12	Water Bud
21	Dead Shoot
22	Fracture And Dead
23	Excessive branching or brooms
24	Damaged Leaf
25	Discoloration of foliage
31	Other Damages

Table 4. Level of Severity

Code	Specification
2	20-29%
3	30-39%
4	40-49%
5	50-59%
6	60-69%
7	70-79%
8	80-89%
9	90-99%

Furthermore,the intensity of attacks (IS) were calculated to determine how much the attack by pests and diseases. Intensity of attack were calculated by using the following formula:

a. The intensity of overall attack = $\frac{\text{number of sick seedlings}}{\text{number of seedlings which are studied}} \text{ X } 100\%$

b. The intensity of pests = $\frac{\text{number of seedlings exposed to pests}}{\text{number of seedlings which are studied}} \text{ X } 100\%$

c. The intensity of disease = $\frac{\text{number of seedlings infected by disease}}{\text{number of seedlings which are studied}} \text{ X } 100\%$

RESULT AND DISCUSSION

Fig. 2. Cause of damage by disease

Pracaya (2009), revealed the turn of initially bright green leaves to yellow, and dim green or pale green is called chlorosis. Discoloration (chlorosis) is caused by a damaged or malfunctioning chlorophyll or green substance. Pracaya has also stated the biggest attack of agarwood seedlings is a disease due to abiotic factors characterized by symptoms of chlorosis, which is caused by a deficiency of nutrients N and leaf spot disease. Causes of damage of agarwood seedlings in present study can be seen on Table 5.

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Table 5. Data from causing damage to seedlings of Agarwoods

No	Causes of Damage	Code	Number of attacked (seedling)	%
1	Dead	001	4	2.66
2	Insect	100	12	8.00
3	Wound	210	-	-
4	Disease	200	48	32.00
5	Fire	300	-	-
6	Animal	400	-	
7	Weather	500	-	-
8	Plant Competition	600	8	5.33
9	Human Activity	700	-	-
10	Unknown Cause	800	-	-
11	Besides the Existing Criteria	999	-	-

Table 5 showed that the most dominant cause of damage to Agarwood seedlings is a disease due to abiotic factors and leaf spot disease (32%), Insects that attacked were grasshoppers, spiders, and snails.

Fig. 3. Cause of damage by pest

Untung, (1993) adds that the populations of insect pests that damage does not arise by itself, but it is the result of interaction between the population with various elements and factors in the environment, as well as the actions taken by the human who comes from the pest environment.

The types of causes of damage, from observation to the type of causes of damage can be seen in Table 6 .

Table 6 showed that the most dominant type of damage was change the color of the leaves to yellow (21.33%). for the two other damages are leaf spot and dwarf (the highest size is 26cm, while dwarf is just 10,5cm). Plant parts damaged by insect or disease can be seen in Table 6.

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Table 6. Result Data of the type of damage to Agarwood seedlings

No	Type of damage	Code	Number of attacked (seedling)	%
1	Cancer	01	-	-
2	Mushroom Fruit Grows	02	-	-
3	Wound	03	2	1.33
4	Gemosis	04	-	-
5	Trunk or Root Fractures	11	-	-
6	Water Bud	12	-	-
7	Dead Shoot	21	-	-
8	Fracture And Dead	22	-	-
9	Excessive Water Bud	23	-	-
10	Damaged Leaf	24	9	6.00
11	Leaf Discoloration	25	32	21.33
12	Other Damages	31	25	16.66

Table 7. Parts of damaged Agarwood seedlings

No	Parts of damaged Agarwood seedlings	EMAP Coding	Number of attacked (seedlings)	%
1	Under Trunk	4	8	5.33
2	Top Trunk	5	6	4.00
3	Branch	6	-	-
4	Shoot	7	-	-
5	Leaf	8	64	42.66

Table 7 showed that the dominant part of the seedlings attacked was leaves 42.66% which marked by a change in leaf color, leaf curling caused by spiders, damaged leaves which are edible by locust and also leaf spot. This is consistent with the statement of Sumardi (2004), which revealed that in general part of the entire seedling is a food favored by a variety of insects because parts of it are still young and tender. Level of severity can be seen in Table 8.

Table 8. The result data of level of severity

No	Level of Severity	EMAP Code	Number of attacked (seedlings)	%
1	20-29%	2	38	25.33
2	30-39%	3	9	6.00
3	40-49%	4	8	5.33
4	50-59%	5	10	6.66
5	60-69%	6	-	-
6	70-79%	7	-	-
7	80-89%	8	-	-
8	90-99%	9	2	1.33

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Table 8 showed that the level of the most dominant offensive damage of 20% -29% was as much as 25.33%. One of the factors that support healthy plant produces is healthy seedlings that are planted. The healthy seedlings are based on Indonesian National Standard (SNI) 01-5006.1-2006 about Quality of seedlings where the fresh seedlings are not attacked by pests or diseases and or no signs of nutrient deficiencies. Techniques to obtain the healthy seedlings can be done in several ways;some of them are tissue culture, the treatment to the seeds chemically and the treatment to seeds with microorganisms.

The intensity of the pests and diseases attacks of Agarwood seedlings is summarized in Table 9.

From table 9 it is clear that most of agarwood seedlings were healthy (52.55%) (compared to unhealthy ones, 44.66%).

Table 9. Number of living Agarwood seedlings

No.	Identification	Number of Seedlings	%
1	Number of healthy seedlings	79	52.55
2	Number of unhealthy seedlings	67	44.66
3	Number of dead seedlings	4	2.66
4	Number of seedlings which are studied	150	100.00

Table 10. Data of observation result and percentage calculation of the living Agarwood seedlings

No	Type of Seedlings	Number of seedlings which are studied	Number of living seedlings	Life Percentage
1	Agarwood	150	146	97.33%

Percentage of life of the seedlings (i.e., 97.33%) indicates that the agarwood seedlings in the nursery were very good (as judged by Sindusuwarsono (1981) and Mahurung (2006): ercentage of life range between 91% -100% is classified as very good; 76% -90% is classified as good; 55% -57% is classified as moderate, and <55% is classified as less good). The good percentage of life of agarwood seedlings is also supported by the maintenance activities during the observation that is watering which was done once in a day adjusted to the weather along with cleaning the weeds that surround the observed seedlings.

The intensity of the overall attack

$$= \frac{\text{number of sick seedlings}}{\text{number of seedlings which are studied}} \text{ x } 100\%$$

$$= \frac{67}{150} \text{ x } 100\% = 44.66\%$$

The intensity of pest attack

$$= \frac{\text{number of sick seedlings exposed to pests}}{\text{number of seedlings which are studied}} \text{ x } 100\%$$

$$= \frac{12}{150} \text{ x } 100\% = 8\%$$

The intensity of the disease attack

$$= \frac{\text{number of sick seedlings infected by diseases}}{\text{number of seedlings which are studied}} \text{ x } 100\%$$

$$= \frac{48}{150} \text{ x } 100\% = 32\%$$

From the calculation ofthe intensity of the attack (IS) indicates that the overall intensity of the attack was 44.66%. The intensity of the attack by disease was 32% , while intensity of attack by pest was 8%. Judging from the intensity of the attack, the intensity of attack by disease was greater than the intensity of attack by pest.

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CONCLUSIONS

The most dominant cause of the damage is a disease as much as 32% of the total of 150 seedlings. The intensity of attack by pest was 8%.The dominant type of damage was leaves discoloration which is characterized by leaves turn yellow (21.33% of the total of 150 seedlings).

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