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Xylem Limited Bacteria (XLB) Clove Disease Control Technology through Utilization of Endophytic Bacteria

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ABSTRACT

Xylem Limited Bacterium (XLB) disease (*Ralstonia syzygii*) is the most seriuos disease on clove plant. Biological control using endophytic bacteria (*Bacillus sp*. Bc25 and fluorescent pseudomonad Pf22) is expected to control clove XLB disease.The research aim to get *Bacillus sp*. Bc25 and fluorescent pseudomonad Pf22 product are effective to control XLB disease on clove plant. The study of *Bacillus sp*. Bc25 and Fluorescent pseudomonad Pf22 was done in watering on clove plant field were infected by XLB disease in Solok West Sumatera on January to December 2017.The study used a randomized block design (RBD) with four replications. The parameters observed were the disease attack level and plant growth.The study study results showed that *Bacillus sp*. Bc25 and fluorescent pseudomonad Pf 22 separately and combination of them can control XLB disease and increase clove growth. *Bacillus sp.* Bc25 and fluorescent pseudomonad Pf22 cThe combination treatment demonstrate as the best treatment to control XLB disease by disease intensity suppressing from 86.80% to 20.59%, increasing the disease inhibition from 0,0 % to 66,21 % control capabilities and promote the best clove plants growth by intensity suppressing of XLB disease from 86.80% to 20.59% byand increasing the clove plants growth from the stem circle 20.00 cm to 46.00 cm. Combination product of biological agents *Bacillus sp.* Bc25 and fluorescent pseudomonad Pf22 can be developed to control XLB diseases and increase clove plant growth.

INTRODUCTION

Clove (*Syzygium aromaticum* L. Merril et Perry) is a type of industrial plant commodity which is classified as high demand for spices, medicines, parfum and eugenol sources, both domestically and abroad. Domestic clove production is currently very low. One of the low causes is a disturbance of Plant Disturbing Organisms (PDO). The main PDO in clove plants is Xylem Limited Bacteria

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(XLB) caused by *Ralstonia syzygii* which many attacks clove plants (52%). At the heavy attacks level can destroy clove plantations in the production center area. It is spread very quickly and reduce production quite high, especially in clove production centers in Sumatera and Java (Rahayu and Yuniarti, 2014).

MATERIALS AND METHODS

To find out the problem, a survey was conducted on clove plantations infected with XLB disease in Solok Regency, West Sumatra. Location selected based on the development and level of disease attack, that is disease intensity more than 75%.

The intensity of the disease is calculated using the following formula:

$$\text{Disease Intensity} = \frac{\sum(n \times v)}{Z\ N} \times 100\ \%$$

Where n, v, N and Z are number of symptomatic plants of each score, disease symptom score value, number of plants observed, and highest disease symptom score, respectively. The scores are:

0 (healthy) =All leaves are healthy
1 (mild)) = 1 - 10 % withered leaves
2 (medium) = >10 – 30% withered leaves
3 (weight) = > 30% withered leaves

RESULTS AND DISCUSSION

a. DiseaseDevelopment

Clove plants that are treated with endophytic bacterial in clove plantation that have been infected with Xylem Limited Bacterium (XLB) disease, show that biological agents have the ability to suppress the development of clove XLB disease. Thisclearly shows that endophytic bacterial agents *Bacillussp* Bc25 and Fluorescent pseudomonad Pf22 eitherseparatelyor in combination can suppressthedevelopment of clove XLB disease from 86.80% (withoutthe*Bacillussp* Bc25 and Fluorescent pseudomonad Pf22) to 20.59 – 36.20% (with *Bacillussp* Bc25 and fluorescent pseudomonad Pf22) (Table 1).

b.Plant growth

Based on plant stem growth, where cloves treated with biological agents of endophytic bacteria *Bacillus sp* Bc25 and Fluorescent pseudomonad Pf 22 showed better growth with stem circles 30.50 - 46.00 cm compared to cloves not treated with biological agents (control) with circle stem 20.40 cm (Table 2).

Table 1. Disease intensity and inhibition percentage of clove XLB disease (%) in clove plantation treated with *Bacillus sp.* Bc25 and Fluorescent pseudomonad Pf22 by watering in endemic areas of clove XLB disease 180 days after application

Treat-ment	Disease intensity (%)	Disease inhibition (%)
B	36.20 bc	50.6
P	28.08 b	58.72
BP	20.59 a	66.21
C	86.80 d	00.00

Note: B = *Bacillus sp* Bc25; P = Fluorescent pseudomonad Pf22; BP = Combination of *Bacillus sp* Bc25 and Fluorescent pseudomonadPf22; C = Control (without endophytic bacteria). The numbers followed by the same letter were not significantly different according to the 5% DNMRT test.

CONCLUSION

Clove plants treated with endophytic bacteria *Bacillus sp.* Bc25 and Fluorescent pseudomonad Pf 22 can control XLB disease and increase clove growth in endemic areas of clove XLB Disease. Clove plants treated with a combination of *Bacillus sp*Bc25 and

Table 2. Growth conditions of clove plants after application with Biological AgentsWatering *Bacillus sp* Bc25 and fluorescent pseudomonad Pf22 in the area XLB clove endemic disease 60 days after application.

Treatment	Stem circle(cm)
B	30.50 b
P	37.25 b
BP	46.00 c
C	20.40 a

Note: B = *Bacillus sp* Bc25; P = Fluorescent pseudomonad Pf22; BP = Combination of *Bacillus sp* Bc25 and Fluorescent pseudomonadPf22; C = Control (without endophytic bacteria). The numbers followed by the same letter were not significantly different according to the 5% DNMRT test.

Fluorescent pseudomonad Pf22 showed the best control ability of XLB disease and increased growth of cloveplants compared to *Bacillus spBc25* and Fluorescent pseudomonad Pf22 separately. It is recommended to develop technology to use a combination of endophytic *Bacillus sp.* Bc25 and Fluorescent pseudomonad Pf22 products that are stable, effective and efficient in controlling XLB disease and increasing clove growth.

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