BIODIVERSITY OF BACTERIAL COMMUNITIES IN SUPPRESSIVE AND CONDUSIVE LANDS FOR FUSARIUM BASAL ROT ON GARLIC

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ABSTRACT

Since 2000 farmers in Tawangmangu have been faced with reducing the productivity of garlic land area (the generative land). The generative land was caused by decreasing the soil fertility which leading for increasing the intensity of basal rot by *Fusarium oxysprorum* f. sp. *cepae*. One of the important factors determining the productivity and the suppresiveness of land area is biological activity of beneficial microbiota in soil. The purpose of the present research was to elucidate the relationship between bacterial diversity with the suppressiveness of soil in the productive land toward garlic basal rot in Tawangmangu, Karanganyar. Then, the results would be used to design the strategy for application as the basic conservation of the degenerative land for improving the garlic productivity. Characterization of bacterial diversity was conducted by cultivation methods on the general and selective media for bacteria. Cultivation methods indicated that population density and biodiversity of bacteria communities were tended to be higher in the suppressive land than in the condusive land.

Key words: bacterial diversity, condusive land, Fusarium basal rot, garlic, suppresive land

INTRODUCTION

Fusarium oxysporum f. sp. *cepae* has been one of the major adverse andthreateningdisease on garlic land inTawangmangu, Karanganyar,Central Java, Indonesia. Since 2000 the Fusarium basal rot on garlic has been found ranging from low incidence to 60 % bulb loss Degenerating of the garlic land plantation was basically caused by developing of the incidence of Fusarium basal rot disease and decreasing soil biological fertility. Although the degenerative - condusive lands are continuously developed, actually in the field it is still found the productive – suppressive lands for garlic. The biodiversity of microbiota inhabiting in the productive – suppressive land is considered as an important key to determine the soil health for land productivity and land suppressiveness. The structure of microbial diversity in the productive-suppressive land can be identified and used as an conservasion model for shifting the diversity to be relatively closed to the structure as found in the productive-suppressive lands. The purpose of the present research was to elucidate the relationship between bacterial diversity with the suppressiveness of soil in the productive land toward garlic basal rot in Tawangmangu, Karanganyar.

MATERIALS AND METHODS

Rhizosphere of garlic were taken as samples from healthy plants and infected plants from generative – condusive land in Gondosuli (7° 39' 59,6"LS and 111° 9' 41,8" BT, 1507 mdpl) and from productive – suppressive land in Pancot (7° 39' 25,4"LS and 111° 8' 31,9" BT, 1218 mdpl), in Tawangmangu, Karanganyar, Central Java, Indonesia. Samples were taken several times on days 0, 20, 40, 60, 80, 100 and 120 after planting, with three replications at every time of sampling.

Bacterial communities were isolated from the rhizosphere of garlic by using cultivation method with a general medium and several selective media for bacteria. Serial of dilution series using the rhizosphere of garlic were applied to media of Nutrient Agar for isolating of general bacteria, Pikovskaya's medium for phosphate solubilizing bacteria, Yeast Extract Mannitol Agar for *Rhizobium* strains, Jensen's medium for *Azotobacter* strains, and Starch Casein Agar for Actinobacteria. Characterization of bacterial diversity was conducted based on a variety of morphological colonies of bacteria growing on each medium.

RESULTS AND DISCUSSION

The population density and diversity of bacterial communities from the generative-condusive land in Gondosuli and the productive – suppressive land in Pancot showed the same patterns, increase gradually along the growth of garlic plants until 80 days after planting and then decrease until the harvest time (120 days). This finding indicated that there was some correlation between the growth phase of garlic plant with the bacterial communities in the rhizosphere.

On the day 80, the diversity of general bacteria, phosphate solubilizing bacteria, *Rhizobium strains*, and actinobacteria isolated from produktive suppresive land were higher than those isolated from generative condusive land. The exception was showed by *Azotobacter* strains that grew more diverse on day 80 in the degenerative condusive land than in the productive suppressive land.

The population density and diversity of bacterial communities isolated from rhizosphere of healthy plants were higher than those from rhizosphere infected plants of garlic.

CONCLUSIONS

Bacterial communities showed the higher population density and diversity: (1) in the productive suppresive land than in the generative condusive land of garlic plantation, and (2) in the rhizosphere of healthy plants than in the rhizosphere of infected plants. The findings indicated that bacterial communities in the rhizosphere of garlic plants might play roles as antagonistic microorganisms either by direct or indirect effects to the disease of Fusarium basal rot on garlic.

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