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Involvement Of Insects In The Transmission Of Banana Blood Disease

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Abstract: Blood Diseases bananas in North Minahasa Regency, North Sulawesi, Indonesia caused by Ralstonia solanacearum phylotype IV has existed for decades, but over the past few decades there has been no data on insect visitors banana flower which acts as a carrier of this pathogen. This study aims to determine the insects visitors banana flower can be a vector of R. solanacearum phylotype IV and the number of propagules of these bacteria carried by these insects. In every garden selected by purposive sampling of five to seven flowering tree, then flower-visiting insects were captured using a modified insect net. Insects were sorted according to species and counted the number of each species. Five individuals of each species of insects were placed in pots. Isolation of Ralstonia solanacearum phylotype IV using spread-plate method, then colony forming units (CFU) of virulent R. solanacearum filotipe IV per milliliter was calculated. Oscinella sp was an insect species most committed feeding on banana cv. kepok inflorescence (42.39 individuals), followed by A. melifera (1.47 individuals), Formicidae (0.65 individual), Blaberidae (0.55 individual), and Chelisoches morio (0.39 individual). Oscinella sp. brought 17636.39 to 75533.33 CFU / ml R. solanacearum phylotype IV, Aphis melifera 23500.00 to 26100.00 CFU / ml, Blaberidae 10300.00 to 23690.00 CFU / ml, Formicidae 3600.00 to 8000.00 CFU / ml, and C. morio 340.00 to 8000.00 CFU / ml.

Index Terms - North Minahasa, North Sulawesi, R. solanacearum phylotype IV, colony forming units, Oscinella sp., Aphis melifera, Blaberidae, Formicidae, Chelisoches morio

I. INTRODUCTION

North Minahasa regency, North Sulawesi, located at 01 ° 17 '15' - 01 ° 53 '18.5 "N and 124 ° 43' 51 '- 125 ° 10' 33.7 'E. Total area of North Minahasa Regency is 1059.244 km^2 that is divided into 10 districts and 128 villages.. The average daily temperature varies from 25.4 ° - 27.8 ° C Most of the regions of this district (42.71%) had a flat to gently sloping topography [1]. Climate type is type A (wet climate), with a dry season usually takes place in May to October, and the rainy season in November to April [2].

One of the main limiting factor of banana cultivation in North Minahasa Regency is attack blood disease pathogen, *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* filotipe IV [3]. This disease was first discovered in the island Selayar 1910 [4]. Report in 2009 stating that the disease has spread in 13 provinces [5]. *R. solanacearum* greatly limit the production of bananas, especially banana cultivar kepok. The damage caused by this pathogen is absolute, meaning that if the infected plants in the vegetative and generative phase (infected through flowers) then the plants will die.

According to [6] blood disease epidemics can occur due to the availability of susceptible host (banana cv. kepok) continuously, the land has been infected with *R. solanacearum*, there are *insect-borne* (spread of pathogens within a short distance or remote), and pathogens can be carried by a machete or other cutting tools.

R. solanacearum in living plant tissue does not produce resistant cells to drought and their chances to survive in the ooze that attach to the body of insects [6]. In Uganda, the insects that act as a *carrier* of bacteria causing wilt of banana is Plebeinadenoiti (Apidae), another apidae species (not identified), species of (Chloropidae, Drosophilidae, and *Apis mellifera* (Apidae) [7].

Research reports on insects as vectors of *R.* new *solanacearum* conducted in Lampung and Java. In Lampung, this bacterium carried by members of the family Chloropidae, Drosophilidae, Flatypezidae, Culicidae, Museidae, Antomyiidae and Sareopangidae (Diptera); Colephoridae (Lepidoptera), Blattidae (Blattaria) and Apidae (Hymenoptera) [8]. According to [9] insect flower visitors that members of Drosopholilidae capable of carrying pathogens through the mouth. In West Sumatra, *Trigona* spp. (Hymenoptera: Apidae) and *Drosophila* sp. (Diptera: Drosophilidae potential as vectors *of R. solanacearum* phylotype IV [10]. North Sulawesi have been no reports of research on insects as *carriers R. Solanacearum,* and also the diversity and abundance of species of banana flower-visiting insects.

The purpose of this study was to determine the insects visitors banana flower can be a vector *R. solanacearum* phylotype IV and the number of propagules of these bacteria carried by these insects.

II. MATERIALS and METHODS

2.1 Time and Place of Research

This study was conducted from May to September 2013. Sampling banana orchards kepok generative phase is done in Wori District (Tiwoho, Wori and Kulu Villages), District Talawaan (Village Warisa, Patokaan and Tumbuhon Villages) and in the District of East Likupang (Village Palaes, Maliambao and Serey Villages). These district is production centers of banana cv. kepok in North Minahasa Regency. Identification of insects is done in the Lab of Plant Pests and Entomology, Faculty of Agriculture, The University of Sam Ratulangi, and the isolation and counting the number of CFU / ml of *R. solanacearum* phylotype IV conducted at the Lab of Microbiology and Plant Pathology, Faculty of Agriculture, The University of Sam Ratulangi.

2.2 Research Procedure

Each district selected three villages (areas), and each village selected three gardens. Areas sampled in Wori District is Tiwoho, Wori and Kulu; The District of East Likupang is Palaes, Maliambao and Serey. Selection of sampling gardens using purposive sampling method, and criteria for the garden namely at least 0.5 ha either maintained or wild.

To determine the insects carrier *R. solanacearum* and how much inoculum were brought, the insects were collected with an insect net. The insects were caught collected at the end of the net and put in *killing bottle* with ethyl chloroform vapor for 1 minute to kill insects. Then. insects placed on a paper and sort by species and counted the number of each species. Each group was placed in small bottles / pot contains 70% alcohol and brought to the Lab of Plant Pests and Entomology, Faculty of Agriculture, The University of Sam Ratulangi to be identified by Team Identification of Insects. Each banana farm was choosen 5-7 inflorescences either healthy or infected. Spread-plate method was used to isolate *R. solanacearum* phylotype IV. One milliliter of suspension from each insect species was sudpended into 9 ml sterile water in a test tube. Suspension was diluted 100 times. Then, 0.5 ml suspension was taken from each dilution using a cicropipette and was plated using the spread-plate method to NA+TZC. These plates, after being wrapped with plastic in inverted position, were incubated at room temperature for 2 - 3 days. Futhermore, colony forming units (CFU) of virulent *R. solanacearum* phylotype IV were calculated by using colony counter [11].

III. RESULTS AND DISCUSSION

3.1 Species Diversity and Density of Banana Flower-Visiting Insect

Average diversity and banana cv. kepok inforescence-visiting insects kepok presented in Figure 3.1. *Oscinella* sp. an insect species most committed feeding on banana inflorescence (42.39 individuals), followed by *A. melifera* (1.47 individuals), *Formicidae* (0.65 individual), *Blaberidae* (0.55 individual), and *C. morio* (0.39 individual).

Interesting phenomenon insects visitors banana cv. kepok inflorescence is relatively very much *Oscinella* sp. who perform feeding on banana flower compared to other insect species. The results of research in Indonesia on insects banana flower visitors [8, 9, 10] did not find *Oscinella* sp. as banana flower-visiting insects. Reports on Diptera: Chloropidae as banana flower visitors proposed by [7]. They argued that the number of individuals of Chloridae in Uganda who do feeding on a banana inflorescence ranged from 2.6 to 11.8 individuals. According to [12] the members of which are nectarophagous Chloropidae rare, but some members have a significant role as pollinators.

Chloripidae is a family of flies that are commonly known as fly grass (grass) [13]. Some species of the genus *Oscinella* like *O. pusila* Meigen and *O. frit* Linnaeus adults perform additional feeding on pollen and nectar of wild herbs. Stage larvae of these flies act as pests in wheat, barley, oats, rye, corn and wild grass [14]. Farmers in North Minahasa cultivate banana cv. kepok in small gardens. In general environments around the banana plantations were fallow gardens fallow for several years so it were grown by various species of weeds, shrubs and trees. Grass weed species most commonly found is *Imperata cylindrica* Linnaeus. Around the banana cv. kepok gardens also cultivated crops form family Poaceae (grass) such as maize *(Zea mays* Linnaeus), and rice *(Oryza sativa* Linaeus). Possibly because so many herbs as host of *Oscinella* sp. around banana plantations so that the population is very high.

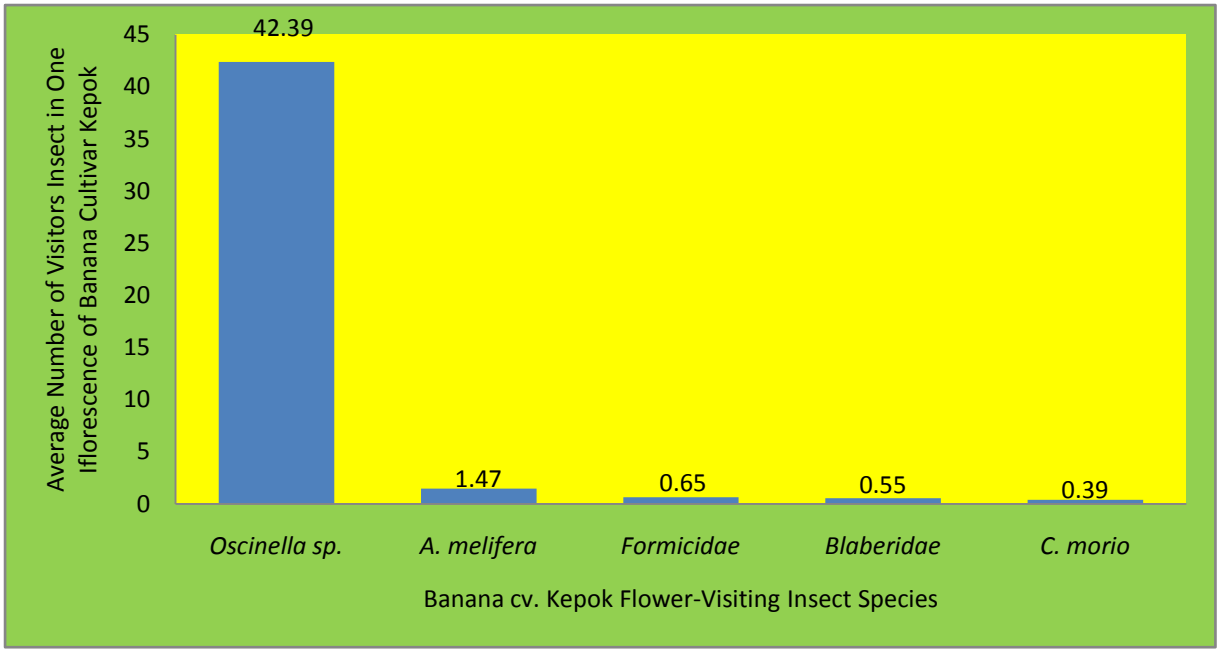

FIGURE 3.1 DIVERSITY AND INSECT POPULATION DENSITY Kepok Banana inflorescence VISITORS IN NORTH MINAHASA

3.2 Population Density of *R. solanacearum* Phylotype IV on Banana Inflorescence-Visiting Insects

All species of insect visitors on banana inflorescence infected or healthy in banana plantations were proved to carry propagules *of R. solanacearum* phylotype IV with a certain amount. *Oscinella* sp. brought *R. solanacearum* phylotype IV 17636.39 to 75533.33 CFU / ml, *A. melifera* 23500.00 to 26100.00 CFU / ml, *Blaberidae* 10300.00 to 23690.00 CFU / ml, *Formicidae* 3600.00 to 8000.00 CFU / ml, and *C. morio* From 340.00 to 8000.00 CFU / ml.

R. solanacearum does not produce cells that are resistant to drought and their chances to survive in the *ooze* that attach to the body of insects [6]. In Uganda, an insect which acts as a carrier *R. solanacearum* is *Plebeinadenoiti* (Apidae), another apidae species (not identified), species of chloropidae, Drosophilidae, and *Apis melifera* (apidae) [7].

Research reports on insects as vectors of R. solanacearum new in Indonesia conducted in Lampung, Java and West Sumatra. According to [8] The bacteria in Lampung carried by members and relatives Cloropidae, Drosophilidae, Flatypezidae, Culicidae, Muscidae, Antomyiidae and Sarcopangidae (Diptera); Coleophoridae (Lepidoptera), Blattidae (Blattaria) and Apidae (Hymenoptera). Flower-visiting insects, members of Drosopholilidae able to bring these pathogens through the mouth [9]. The results of the study [10] showed that *R. solanacearum* filotipe IV can be found on the outside and inside the body of the insect visitors banana flower blood sick. Insect species carrier *R. solanacearum* filotipe IV is *Trigona* spp, *Oecophylla smaragdina, Erionota Thrax, Nezara viridula, Apis cerana, Apis dorsata* and *Drosophila* sp.

Most of the banana cv. kepok plantation garden generative pase in North Minahasa have symptomatic bacterial wilt. According Buddenhagen (pers. comm. 2006) that the losses due to the attack *of R. solanacearum* carried by insects is the greatest cause direct attack banana fruit cultivation land although not infected with this soil-borne bacterium.

IV. CONCLUSION

All of the banana cv. kepok flower-visiting insects in North Minahasa Regency serves as a carrier *R. solanacearum* phylotype IV. The highest population density of banana cv. kepok inflorescence-visiting insects was *Oscinella* sp. (42.39 individuals) followed by *A. melifera* (1.47 individuals), Formicidae (0.65 individual), Blaberidae (0.55 individuals and *Chelisoches* sp. (0.39 individuals). Population density of *Oscinella* sp. relatively very high may be associated with the availability of host plants such as grass and other vegetation around the banana plantations.

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