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**3rd INTERNATIONAL CONFER-
ENCE ON SECURITY IN FOOD,
RENEWABLE RESOURCES, AND
NATURAL MEDICINES 2019
(SFRN 2019)**



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INDONESIA



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QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF SUSTAINABLE DE- VELOPMENTS GOALS (SDGS)

September 25-26, 2019



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The Diversity of flower-visiting insects (*Musa paradisiaca*) and the Potential as a Spreading Agent *Ralstonia syzygii* subsp. *celebesensis* on Barangan Banana, in North Sumatera, Indonesia

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Abstract: *Ralstonia syzygii* subsp. *celebesensis* is a wilting bacterial pathogen, which is the main limiting factor of banana production in Indonesia, especially in Barangan plants in North Sumatra. The purpose of this study is to obtain data on insect diversity and its potential as a dispersing agent for *R. syzygii* subsp. *celebesensis*. This research was conducted with a purposive sampling method in the planting of banana farmer groups in Telaga Sari Village, Tanjung Morawa District, Deli Serdang Regency. The type of banana that was observed was the type of Barangan banana that was flowering. The insect sampling method used a sticky trap method and a sweeping net every two days for one month — identification of insects to species level. Isolation and identification /characterization of bacteria from vector to the Barangan flower were carried out using Triphenyl Tetrazolium Chloride (TTC) medium. Observation parameters are population density (K), Relative density (KR), and Relative Frequency (FR), isolation of bacteria from the body of insects of flower visitors. There are three orders of insects that visit the banana flower every day with a very high abundance. Among the orders, Diptera, Lepidoptera, and Hymenoptera, and there are unknown types of insects. Respectively 57% (*Drosophyla* sp), 31% (*Bractocera* sp), 7% (sp-1), 3% (sp-2) 2%, (*Erionota thrax*), and 0% (*Aphis dorsata*). Propagule *R. syzygii* subsp *celebensis* was found on the outer surface and inside of the insects' vector to the Barangan banana flower in Telaga Sari Village, Tanjung Morawa District, Deli Serdang Regency.

Keywords: flower visitor insects, *Erionota thrax*, Barangan banana, *Ralstonia syzygii* subsp. *celebesensis*, imago

INTRODUCTION

Blood Disease bacterium in Indonesia is caused by *Ralstonia syzygii* subsp. *celebesensis* (Safni.I *et al* 2018) is a group of banana pathogens that can cause creasing the banana's production around 20-100%. This pathogen can attack almost all types of bananas. The development and spread of this disease are very fast, according to the geographical spread of this disease in Sumatra, ranging from 189-203 km year⁻¹ (Setyobudi L and Hermanto C, 1999) and in Indonesia around 100 km year⁻¹ (Supriadi. 2005). The role of insects causes the rapid spread of blood diseases. According to Mairawita *et al* (2012) is the spread of blood disease in banana

plantations in West Sumatra was transmitted by *Trigona minangkabau*. Propagule BDB can be isolated from the body of *imago T.minangkabau*, larvae, pupae, eggs, pollen, and nectar. *Imago T.minangkabau* visits are found higher in flowers. Kepok banana plants infected with BDB compared to the flowers of healthy Kepok plants.

One of the causes of the rapid distribution of blood diseases is the role of insects. Insect transmission will determine the rapid spread of illness in banana plantations in Indonesia (INIBAP. 1995).

Barangan banana is a type of local Medan banana that can also be attacked by BDB in addition to the fungus of *Fusarium solanacearum f sp.cubense*. In the planting of Barangan bananas in the field can be found both pathogens and *Erionata thrax* pests simultaneously. In the beginning, the development of BDB in the area of the banana garden area was low. It was around 5% of the population of banana cultivated by Tanjung Morawa Women's Farmer Group. Within the next six months, the percentage of BDB's attacks had reached 20%. The attacks spread be faster because Barangan bananas planted by the Women Farmers group are not bruised, and male flowers are not cut. In the banana planting area, the group also detected the attack of leaf roller pests caused by high amounts of *Erionata thrax*. The group must be aware of the presence of *E.thrax*. It is suspected that the spread of BDB will be faster in the planting area because the *E.thrax* imago or banana flower visitor insect can be a very potential BDB infectious agent.

Information about the diversity of insects of visitors to Barangan banana flower and its role as a BDB infectious agent is still limited, so research on the variety of banana visitor insects and its role as a BDB contagious agent is considered necessary.

METHODOLOGY

Methods

Determination of the study location uses a purposive sampling method based on the biggest Barangan plantations in women farmer groups in Telaga Sari Village, Tanjung Morawa District, Deli Serdang Regency, North Sumatra Province. The researchers carried out the study between July to September 2018.

Insect Collection and Identification of Visitors of Barangan Banana Flower

The sampling of insect visitors to the Barangan banana flower was taken from plants infected with Blood disease bacterium (BDB) using the sticky trap method. The researchers coated the trap with a yellow wrap hung near the banana flower and the technique of direct capture using a net (sweeping net). Intake is carried out at 07.00 - 18.00 WIB every two days at intervals per 2 hours for 30 days (Yuniana, B. 2002).

The collection of insects was conducted from male flowers and female flowers. The insects obtained are put into a poison bottle containing chloroform flour for 1 minute to loosen the insects. Each insect for each species was put into each container containing sterile aqua dest (for bacterial isolation). The other amount is put into a bottle containing alcohol for the identification and characterization of insects.

Insect Identification

Researchers carried out insect identification at the level of the order, family, and genus using reference books (Inoue. T et al, 1990),(Inoue. T, 1985),(Nakane. T, 1955),(Sakagami.S.F et al, 1990).

Isolation and Identification of *R. syzygii subsp celebensis* from the outside of the body phase of the insect visiting Barangan flower

BDB isolation and identification are carried out to ensure that the bacteria are isolated from all kinds of visiting insects. Flower trapped barriers bring BDB disease-causing blood in banana plants. BDB pure cultured used as a source of inoculums for pathogenicity tests and morphological characterization of the properties (including shape, size, shape edging, color and shape of the surface) and physiological (Gram reaction tests, pectinase enzyme tests, *pathogenicity* tests, and hypersensitivity reactions).

Observation

Population density of Barangan flower-visiting insect

The insect density is calculated based on the number of insects caught in each healthy flower and diseased plants.

BDB population

Klement formula (Klement Z. et al 1990) was used to calculate the BDB population on sick Barangan from outside body insect visiting flower in individual, where: $JB = Ax B$; JB = number of bacteria, A = Number of colonies of bacteria, B = the dilution factor.

DISCUSSION

Diversity of flower visitor insects

There are three orders of insects that are associated with the Barangan banana flower infected by BDB in the plantations of women farmer groups in Telaga Sari Village, Tanjung Morawa District, Deli Serdang Regency, North Sumatra Province. The order is Hymenoptera (Aphidae family), Lepidoptera (Hesperidae), Diptera (Drosophilidae, and Tephritidae).

The types of insect visitors for banana plant flowers, are *Aphis dorsata*, *A. mellifera* (Aphidae), *Drosophila* sp (Drosophilidae), *Erionatha thrax* (Hesperidae) and *Bractocera* sp (Tephritidae). The diversity of insects in Barangan infected with *R.syzygii subsp celebensis* in the banana plantations of the Tanjung Morawa Women's group was dominated by the Diptera (95.13%) followed by the Lepidoptera (4.84%) and Hymenoptera (0.015%) (Table 1).

Table 1. Abundance of Barangan visiting flower insect in Barangan woman farmer groups in Telaga Sari Village, Tanjung Morawa District, Deli Serdang Regency, North Sumatra Province.

Ordo/ Famili	Tanjung Morawa Womans Barangan plantation					Analysis		
	Interval/ time (Wib)				Total	Composition		
Species	7-9	10-12	13-15	16-18		K*	KR	FR
	Individual /observations					%	%	
Diptera/ Tephritidae								
<i>Bractocera sp</i>	2865	1859	992	375	6091	304.55	0.3097	1
sp-1	530	554	229	94	1407	70.35	0.0715	1
<i>Drosophila sp</i>	5474	3146	1853	740	11213	560.65	0.5701	1
Lepidoptera/ Hesperidae								
<i>Erionata thrax L.</i>	277	30	8	37	352	17.6	0.0178	1
sp-2	162	179	159	101	601	30.5	0.0305	1
Hymenoptera/ Apidae								
<i>Aphis dorsata</i>	1	2			3	0.15	0.0001	0.1
Total	9309	5770	3241	1347	19667			

K * = Population density, KR = Relative density, FR = Relative Frequency. sp = unknown insect species

The highest visit of insects on banana flower infected with BDB was found in the morning at 07.00-09.00 WIB (47.33%). Following the visit at 10.00-12.00 WIB (29.33%), 13.00-15.00 WIB (16.47%), and 16.00-18.00 WIB time by 6.84%. The high number of insect visits in the morning is thought to be related to the condition of morning temperatures around 25⁰C, high humidity, and low sunlight intensity. According to (Morse R and Hooper T. 1985) whether or not the worker insects visit food sources is determined by many factors including the distance of the nest to the food source, the number of flowers, weather conditions, the number of pollinators who visit the food source and the type of plants to be visited.

In addition to the state of food sources, differences in height and time of observation will affect the type and population of insects found at the observation site. It relates to differences in physical, biotic, and available food sources. Physical factors include temperature, humidity, light intensity, rainfall, and wind speed. In the environment, these elements work together to influence various insect activities (Tarumingkeng, R.C. 1994).

BDB density and Character

In general, bacterial colonies transmitted by insects have a high virulence rate in banana plants. There are two types of typical bacterial colonies of *R. syzygii* subsp *celebensis*, namely: colony 1, has a bright red color, size 0.5-10 mm, convex and fluidal. Colony 2, pink, curved and fluidal colonies with or without the center of the

pink, irregular formation, colonies measuring 0.5 - 10 mm (Figure 1). Colony 2 has a high virulence in the Kepok banana plant. According to (Tarumingkeng, R.C. 1994), the size and color of bacterial colonies are closely related to pathogenic strains where virulent strains usually have a younger colony color.

Table 2. The density of BDB colonies and types of bacterial colonies isolated from the body surface of sick visitors of Barangan flowers

<i>Insect</i>	Typical colony BDB		Total
	colony 1	colony 2	
<i>Bractocera sp</i>	11	40	59
sp-1	84	121	257
<i>Drosophila sp</i>	26	47	94
<i>Erionata thrax L.</i>	85	163	284
sp-2	68	89	186
<i>Aphis dorsata</i>	78	193	316



Fig 1. Bacterial colony from outside the body insect from Barangan flower sick with (a) or without a pink center formation (b)

CONCLUSION

The Barangan banana plantations attacked by BDB in the group found a diversity of flower visitor insects. There are three orders of Diptera, Lepidoptera, and Hymenoptera, which were struck by BDB. The group found a variety of flower visitor insects. There are three orders of Diptera, Lepidoptera, and Hymenoptera. Diptera Order dominates insect diversity (95.13%), followed by Lepidoptera (4.84%) and Hymenoptera (0.015%). All flower-visiting insects are detected carrying bacterial propagules of high blood-borne bacterial disease in banana plants

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