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*by* Surya Sila, A.I. Abadi, G. Mudjiono, And Tutung Hadi Astono

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## Banana Bunchy Top Virus (BBTV) on wild banana species in Kutai Kartanegara Regency

Surya Sila<sup>1,2\*</sup>, Abdul Latief Abadi<sup>3</sup>, Gatot Mudjiono<sup>3</sup>, Tutung Hadi Astono<sup>3</sup>

<sup>1</sup> Doctoral Program of the Faculty of Agriculture, Agricultural Sciences, Universitas Brawijaya, Malang, INDONESIA

<sup>2</sup> Pest and Disease Study Program, Faculty of Agriculture Universitas Mulawarman, Samarinda, INDONESIA

<sup>3</sup> Department of Pests and Diseases, Faculty of Agriculture, Universitas Brawijaya, Malang, INDONESIA

\*Corresponding author: Surya Sila

### Abstract

The dwarf banana disease has been detected and causes losses in the banana plantation situated in Kutai Kartanegara Regency. This disease was also observed in wild banana species that grow close to kepok banana. The purpose of this study was to observe the symptoms and determine the causes of wild banana dwarf disease. Observation methods to calculate the incidence of the disease are carried using census method by calculating the number of diseased and healthy plants. DAS ELISA method was utilized, to determine the causes of wild banana dwarf disease. Dwarf disease symptom in wild bananas inhibit banana growth. It is visible in the form of shrunk, erect, and stiff leaves. Leaves accumulate on the top of branch. The leaves edges turned yellow, gradually becoming blackish brown due to necrosis. The bottom of the leaf facing the sun, the lamina near the leaf stalk exhibits dark green vein resembling the letter "J". The ailed banana root is not well developed and the tree quickly dies. The incidence of the wild banana dwarf disease is 18.4% and kepok banana is 0.9%. There are indications that wild bananas are more susceptible to dwarf disease. Two observations were made in the location. It exhibited that the number of diseased forest bananas grew more widespread. The decline in the growth of wild bananas due to dwarf disease is significant. Decreasing growth in plant height, canopy, leaf width and length of wild banana leaves are 77%; 71.6%; 89.5% and 82% respectively. The results of the DAS ELISA test on diseased wild bananas exhibited positive BBTV with an absorbance value of 2.086 nm (K+ = 1.267 nm and K- = 0.118 nm).

**Keywords:** wild bananas, plant diseases, plant viruses, BBTV and DAS ELISA

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### INTRODUCTION

Bananas, including horticultural crops, are a type of tropical fruit that is familiar to the world community, especially in Indonesia. Besides being delicious, bananas also have many benefits. Complete nutritional content is very good for health.

The pests and diseases that often attack banana plants are a virus called Bunchy Top Virus (BBTV) (Jekayinoluwa et al., 2020; Krishnan et al., 2020). Symptoms that arise are banana plants will experience growth problems, namely stunting or stunted and unable to produce fruit.

Banana dwarf disease is a disease important in banana plants in Indonesia. This disease was first reported to be spread in Java and Bali. It was further reported that currently it is spread across seven provinces in Indonesia, namely Riau, West Sumatra, Lampung, West Java, Central Java, Yogyakarta and Bali (Nurhadi & Setyobudi, 2000).

Mauli banana contracting dwarf disease has been found in seven of eighteen districts in Kutai Kartanegara

Regency. Research by Ni, Irwansyah & Sofian (2019) reports that character of attack BBTV is generally in the assessment score 3 with the characteristics: (1) the edge of the leaf is quite severe yellowing, (2) the existence of leaf narrowing or twisting (3) the occurrence of distortion, dwarf and necrosis (4) found more than four infected banana stems in a clump

Dwarf disease is caused by Banana Bunchy Top Virus (BBTV) which has infected several varieties of known and wild banana species (Sila, et al., 2018; Baldodiya et al., 2019; Ji et al., 2019; Kakati et al., 2019; Debbarma et al., 2019; Wirya et al., 2019). BBTV is transmitted by banana aphids, *Pentalonia nigronervosa Coquerel*, which is widespread, especially when transporting banana seeds (Furuya et al., 2006)

Wild banana species are found in Kutai Kartanegara District. These wild bananas are native to Indonesia. In

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accordance with the opinion of Simmonds and Shepherd (1955), bananas originated in the Malay Peninsula, Indonesia, Philippines and New Guinea regions. Based on Australian Regulatory Technology data (2008), out of 50 known banana species, most of these species are in the Indonesian archipelago.

Wild banana species as native plants are very susceptible to outside invasive species. This is evident on wild bananas in Tenggaraong Seberang District. Two observations conducted on-site revealed the dwarf disease number and extent of the attacks.

The study aimed to determine the causes of wild banana dwarf disease, disease symptoms, and the influence of disease on the growth of wild bananas.

## RESEARCH METHOD

The location of wild banana observation was on the roadside of Samarinda - Tenggaraong axis road, Tenggaraong Seberang District at 0o 25' 31" S and 117o 5' 8" E.

Observation of the incidence of wild banana dwarf disease was carried out using census method. The researchers count the number of diseased wild banana divided by the number of healthy bananas and multiplied by 100%.

$$K = \frac{a}{b} \times 100\%$$

Description:

K = disease incidence (%)

a = total diseased banana tree

b = total healthy banana tree

DAS (Double Antibody Sandwich) ELISA method is used to detect the causes of wild banana dwarf disease. BBTv antibodies and buffers were taken from www.agdia.com. BBTv antibodies were prepared by adding 1x carbonate coating buffer solution at a ratio of 1: 100. 100 µl of antibody solution was inserted into a microplate well and was incubated for 4 hours at room temperature. After incubation, the microplate was emptied and washed 4 times using PBST. The microplate was dried by patting it on towel paper. Test sample 1 g was added 10 ml of GEB buffer which was crushed until smooth. The microplate well was filled with 100 µl of the sample, 1x of GEB solution, negative control, and positive control according to the test layout. Incubation was done overnight. The microplate was washed 4 times using PBST solution. Dissolved the conjugate in 1x EC1 buffer with a ratio of 1: 100. 100 µl solution was added to each test well then incubated at room temperature for 2 hours, and wash microplate 8 times. NP solution was prepared by inserting 1 PNP tablet (5 mg) in 5 ml PNP buffer with a ratio (1: 1). The microplate was filled with 100 µl PNP buffer and incubated at room temperature for 30-60 minutes.



Fig. 1. The wild banana growing in open areas



Fig. 2. Wild bananas, fruit (2a) and seeds produced (2b)

Observations were made on color changes and readings at ELISA reader at a wavelength of 405 nm.

## FINDINGS AND DISCUSSION

Wild bananas grow freely in nature in open areas (Fig. 1). Wild bananas have not been managed by the community, because the fruit produced is small, has seeds and the taste is not sweet. Bananas are usually eaten by birds, which at the same time spread them (Fig. 2). Wild bananas have pseudostems that can reach > 7 m and dense growth between plant. The potential of wild bananas as a source of germplasm is very important for the development of bananas in the future.

Wild bananas contract dwarf disease as the plants grow close up to ± 4m with banana kepok, which first shows dwarf disease symptoms. According to Orum, et al., (2001), the virus spread spatial pattern of infected





**Fig. 3.** The wild banana community which was attacked by BBTV



**Fig. 5.** Comparison of healthy wild banana leaves (5a) and dwarf wild banana trees (5b)



**Fig. 4.** The symptoms of the dwarf disease on wild banana and pseudo-stem growth conditions of the healthy banana (behind)

aphid from one plant to another is at a distance of 3-5 plants.

The calculation result of the wild banana dwarf disease incidence were 18.4% and kepok banana was 0.9%. This indicates that wild bananas are more sensitive to attacks.

The symptoms of the dwarf disease on wild bananas is similar to the symptoms of Mauli banana and Susu banana dwarf disease symptom (Sila, et al., 2018). Wild bananas are short and possess small, stiff, and erect leaves (Magee, 1927; Nelson, 2004; Lobo et al., 2020). Banana leaves are gathered in the upper part of the plant (Magee, 1927; The College of Tropical Agriculture & Human Resources, 1997). Leaf edges turned yellow and gradually experience necrosis into blackish brown color (Elayabalan, Subramaniam, and Selvarajan, 2015)

(Figs. 3 and 4). At the bottom of the leaf around the lamina area and midrib possess dark green colored vein which forms a "J" line (Nelson, 2004; Ranasingh. 2007). The infection of wild bananas in Kutai Kartanegara Regency, according to the opinion of researchers who specifically observe invasive species from the International Union for the Conservation of Nature (IUCN), stated that banana dwarf disease was caused by the Banana Bunchy Top Virus (BBTV). It is included as one of 100 world invasive alien species (Lowe et al., 2000).

Measurement of growth between healthy and dwarf wild bananas exhibited that dwarf disease can reduce growth parameters such as 77% plant height, 89.5% leaf width, 82% leaf length, 70.7% stem diameter, and 71.6 % crop canopy (Table 1).

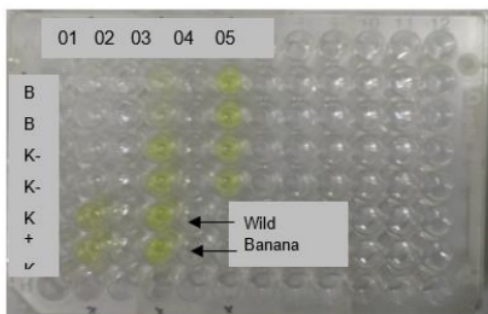
The comparison between the length of a healthy wild banana leaf and the height of a dwarf wild banana plant has a significant difference. Wild diseased bananas withered and decayed therefore it is prone to fall (Fig. 5).

The DAS ELISA test carried out on wild dwarf banana samples is positive as exhibited Banana Bunchy Top Virus (BBTV). Light yellow color changes (Fig. 6) and absorbance values in wild dwarf bananas were 2,086 nm (K + = 1,267 nm and K- = 0,118 nm). According to Prakash et al. (2010), DAS-ELISA and PCR methods are very efficient to diagnose viruses in the body of insects and plants.

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**Table 1.** Diseased wild banana plants growthdecrease measurement compared with healthy banana plant

No.	Parameter	Mean (cm)		Growth Decrease (%)
		Healthy	Diseased	
1.	Plant height	736	171,2	77,0
2.	Leaf width	76	8	89,5
3.	Leaf length	383	68,8	82,0
4.	Canopy	211	60	71,6
5.	Stalk diameter	19,1	5,6	70,7
6.	Leafstalk diameter	3,4	1,1	67,7
7.	Total leaf	10	8,6	14



**Fig. 6.** Light yellow changes occur in wild bananas that show dwarf disease symptoms

### CONCLUSION AND SUGGESTION

Based on the DAS ELISA test, light yellow discoloration and absorbance values of 2,086 nm occur. It can be concluded that wild bananas exhibiting dwarf symptoms are caused by Banana Bunchy Top Virus (BBTV). Wild bananas are more susceptible to BBTV, as evidenced by the disease incidence value of 18.4%. It is greater than the incidence of disease in Kepok banana which is only 0.9%.

Wild banana is a source of germplasm for future development. Therefore conservation and control against dwarf disease symptom is very crucial.

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