DISEASE PATHOGENS OF DRAGON FRUITS (*Hylocereus* sp.) IN SUKAMADE, BANYUWANGI DISTRICT EAST JAVA INDONESIA

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ABSTRACT

Dragon fruits or pitaya's (*Hylocereus* sp) are the non-indigenous plants. It could be attacked by indigenous pathogen were carried by stem callus or/and attacked by native pathogens where it has developed. In Sukamade, the pitaya's planted by intensive lightning-monoculture system on large area. It has reported has damaged due to plant disease. The research aims to detect and identification of disease pathogens on Sukomade pitaya's, Banyuwangi. It has conducted by several steps: symptoms sample picking, agar plate isolation, morphological and biochemical test identification and postulate Koch procedure. The result showed it was attacked by several pathogens. Generally, the Sukomade pitayas attacked by scab disease, dry rot, stem yellowing, wet rot, and anthracnose. That disease can attack the stem and fruits either, but the wet rot and yellowing neither, it has only found on the stem of Sukomade pitaya's. Based on identification procedure, scab disease caused by *Fusarium* sp., the dry root by *Fusarium oxysporum*, the stem yellowing by nutrient deficiency, the wet rot disease by *Pectobacterium carotovorum* and the anthracnose by *Colletotrichum* spp.

Keywords: *Colletotrichum* spp., , *Fusarium* sp., Identification, Pitaya, Symptoms

A. INTRODUCTION

Dragon fruit or pitaya (*Hylocereus* sp. (Haw.) Britton & Rose) is one of the fruit plants whose widely cultivated in Indonesia. It's Introduced to Indonesian country in the early 21 century's and introduced by cutting stem seeds. It classified into the cactus plant and came from Mexico and another country in Central of American Continent (Crane dan Balerdi, 2005) also from the South American continent (Merten 2003). The dragon fruit is grown in the subtropical and tropical countries and is typically available all year round. Dragon fruit is beautiful because of its exotic appearance. The pulp is juicy and contains numerous small black seeds. It is also considered as a potential source of micronutrients and antioxidants (Ariffin *et al*., 2009). Dragon fruit is classified as a non-climacteric fruit (Kishore 2016). The ripening mechanism of it based on the absence of ethylene burst during fruit ripening which corresponds to the inability to synthesize ethylene autocatalytically (Périn *et al*., 2002).

Pitaya was originally regarded as an ornamental plant and has already been known for quite some time by the people of Taiwan, Vietnam, and Thailand. In this subfamily, there are several genera, with the dragon fruit belonging to the genus of Hylocereus. This genus comprises about 16 species (Soeparjono 2015). Significant varieties that are widely cultivated are the white pitayas, red pitayas, super red pitayas and yellow pitayas. Nowadays, pitayas demand is increasing years by years. Its became the important crops based on its function and properties. The primary function of pitayas are medicinal properties and soon. It's used as fresh fruits on by developing to another form.

The dragon fruit production has become as fresh fruits sources, it can as farmers income and employment local farmers. It could be an asset on the backyard to the large-scale plantations. The large-scale cultivation of dragon fruits in Indonesia has two major cultivation methods, the general cultivation, and intensive lightning cultivation methods. However, both are a monoculture system. The intensive lightning method is one of the cultivation methods by using LED lamp to boost the production of the fruit. It used to substitute the sunlight at night or cloudy time.

As a non-indigenous plant, the dragon fruits could be attacked by indigenous pathogen were carried by stem callus or/and attacked by native pathogens where it has developed. In Sukamade, the pitaya's planted by the intensive lightning-monoculture system. It planted in a large area, more than 10 ha per area, some of them occupy the citrus cultivation area. It's reported has damaged due to plant disease. The disease on the Sukamade pitayas is hard to distinguish for detection only from each symptom. The research aims to detect and identification of disease pathogens on Sukomade's Pitaya, Banyuwangi.

B. MATERIALS and METHODS

Location and sample collection.The sample of diseased dragon fruits was taken from the Sukamade village, Banyuwangi district east java, Indonesia. It is taken from the intensive lightning cultivation area. Diseased plant sample collected by direct flesh cutting of pitaya stems and fruits. It's transferred to the laboratories of Plant Protection Department, the University of Jember with the cool dried condition within 10^oC of temperature. It's based on qualitative type.

Pathogens Isolation. The dragon fruits pathogen isolated by direct assay method. The diseased stem and fruits cut off into small part (1 mm^2). Each cutting part was the diseased part and the healthy

part. After that, each part sterilizes by surface sterilization methods were wash into ethanol for 30' and reply three times than was into sterile water for one minute and dried on the sterile tissue. The sterilize tissue of dragon fruits inoculated into several media on Petri dish. The agar media like PDA and MEA with antibiotics for the fungal plant pathogen inoculation. The agar media like KB, NA, and YPGA used for bacterial plant pathogens inoculation. The media for fungal pathogen isolation then incubates for seven days in the room temperature (± 25^{o}C) but neither for bacterial media. The media for bacterial isolation incubates for two until three days on room temperature.
Isolation methods for the virus were different from other, viruses isolated by SAP methods. The stem or rind of dragon fruits with yellowing symptom mashed with the mortar into the fine-grained shape until the sap of dragon fruits gone out. The pH buffer standard added into sap. Its smeared into a fresh piece of healthy stem of dragon fruits and incubates until 7 days after inoculation.

Pathogens Identification. Each pathogen group have different identification technique. Morphology assessment of spore/conidia and hypha used for fungal pathogen identification. Size and shape of spore/conidia and hyphae measured by Image Raster 3.0 software with 40x magnification. For identify bacterial pathogens, the biochemical identification protocol used, it based on Schaad *et al*. (2001). Several biochemical and physiological test used in respectively i.e. Gram test, Catalase test, Oxidative - Fermentative Test, Starch test (Lelliot dan Stead, 1987), Indole Produces test, Nitrate reduction test (Klement, 1983), Production of levant sucrose test (Kerr, 1980; Fahy dan Hayward, 1983), Potato rot test (Lelliot dan Stead, 1987) and Hypersensitive reaction test (Klement, 1983) respectively.

Postulate Koch. The last assessment of isolation and identification of dragon fruits pathogen are postulated, Koch. It used to prove the identification result. It conducted by two different methods, differently by pathogens type. The colony attachment procedure used for the fungal pathogen. It attaches into the fruit or stems that have been previously injured by the sterile cutter. It then closed by wet sterile cotton. The injection of bacterial suspension used for bacterial pathogens. One mL of the bacterial colony with a minimum density on 10^{4} CFU/mL. The inoculant then incubated for five to seven days until the disease symptoms develop.

C. RESULTS AND DISCUSSION

One of the central planting areas of Pitaya in East Java, Indonesia is in Banyuwangi District. The specific location in Banyuwangi district for pitayas planting area is in Sukomade-Pesanggaran Village, Pesangaran Sub District. Most of them cultivated by intensification cultivation. Its planted with adding the artificial light for bost the production of the fruit. It is activated at night or in cloudy condition (figure 1).

Figure 1. Pittaya planting location, red dots (A) and pitayas intensification cultivation by lighting cultivation (b). Figure photo by google maps and Jawapos groups

The pitaya has been developed as favorite fruits on over the decades. As for favorite fruits, it planted area are increasing year by year. The intensification pitaya has to be done to increase the pitaya production. One of them is with artificial light cultivation. Reported it had had a positive and negative impact. Based on Jiang *et al* (2016), the positive impact of the light induction or night breaking treatment (NB) has induced the pitaya to generate the flowering bud in offseason or winter season.

Based on the direct observation on the Sukamade cultivation area, the negative impact on the artificial light cultivation is plant disease epidemic. The plant pest and disease attack have been a resultant following that fact. The disease in that cultivation technique became a complex disease. Its has been attacking by several pathogens at the same time. Moreover, the disease symptom on each observation site looks similar to each disease (Table 1).

Table 1. The similarity of common disease in Sukamade pitaya

Site Location	Expected disease	Symptoms	Similarity (%)
Site one	Soft Rot	Rooten in the old branch, Chlorosis or yellowing, abscission and wilt	90 ± 2.3
	Scab	Necrotic, Scab in all branch and main branch, and fruits, yellowing in the branch	76 ± 1,1
	Rot	Chlorosis or yellowing, rotten in all part	84 ± 4.3
	Antachnose	Yellowing, pitting in the branch and fruits	90 ± 2.1
Site two	Soft Rot	Roten in the main branch Chlorosis or yellowing, abscission and wilt	92 ± 1.2
	Scab	Necrotic, Scab in all branch and main branch, and fruits, yellowing in the branch	80 ± 1.2
	Rot	Chlorosis or yellowing, rotten in all part	93 ± 1.4
	Yellowing	Yellowing, pitting in the branch and fruits	98 ± 3.2

* The similarity result count by several students and farmers respondent on the field observation

The disease symptoms in that area can only be distinguished when the disease attack occurs on the new plant or in the initial disease attack stage (Figure 1). The yellowing, rotten, abscision and pitting have been significant symptoms in the massive disease attack. The pest and disease problem can solve by pest and disease management. The wisely management conducted based on the accurate result of plant pest and pathogen identification.

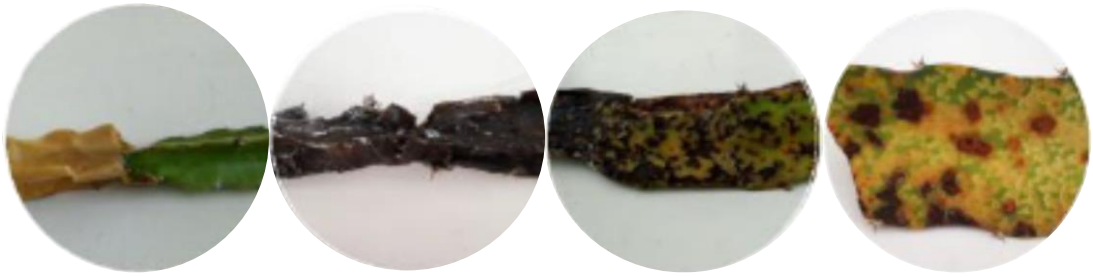

Figure 1. Common Disease symptoms on Sukomade pitaya's

Based on the identification result, several pathogens are known and identified in both sites. Generally, the Sukomade pitayas attacked by scab, rot, stem yellowing, wet rot, and anthracnose disease. That disease can attack the stem and fruits either, but the wet rot and yellowing neither, it has only found on the stem of Sukomade pitaya's. Based on identification procedure, scab disease caused by *Fusarium* sp., the dry root by *Fusarium oxysporum*, the stem yellowing by nutrient deficiency, the wet rot disease by *Pectobacterium carotovorum* and the anthracnose by *Colletotrichum* spp (Table 2)

Table 2. The identified pathogen and their clarification procedure

Symptoms	Location	Identified Pathogen	Clarification procedure
Soft Rot	Branch	*Pectobacterium carotovorum*	Potato root Test, Biochemical and physical test, postulate Koch
Scab	Branch	*Fusarium sp*	Morphological Identification and postulate Koch
Rot	Branch/Stem	*Fusarium oxysporum* / Nutrient deficiency	Morphological Identification and postulate Koch and Nutrient test
Antachnose	Branch	*Colletotrichum spp*	Morphological Identification and postulate Koch and Nutrient test

Based on Ping-lin *et al*.(2017) the anthracnose disease of pitaya has found in several countries. Can be caused by three species of Colletotrichum, like *C. gloeosporoides, C. truntacum* and *C. boninense*. All of them caused the anthracnose disease either in stem or fruits. Morphological characteristics of *C. gloeosporioides* colony in PDA was characterized as whitish to

grayish with blackish or orange masses of conidia in concentric rings.

Scab and rot disease confirmed caused by Fusarium. Several species fusarium was known as stem disease of pitaya on another country. Based on Hawa *et al* (2017) *Fusarium fujikuroi* was recovered from stem rot lesion in Malaysia. On other country based on Rita *et al*. (2013) *Fusarium solani* recorded was attacked the pitaya plant in Bali Indonesia.

The interesting result found on the identified bacterial pathogen. Based on Mashayit *et al* (2009) the *Pectobacterium carotovorum* reported attacked on other cacti species not on pitaya directly, the bacterial soft rot disease has been reported on graft-cactus (*Chamaecereus silvestrii*) in Korea.

D. CONCLUSION

The intensification pitaya with artificial light has to be done to increase the pitaya production. Unfortunately it has negative impact on the plant healthy. One of the impacts makes the distinguish disease symptoms. The disease symptoms look similar in field observation. The identification result of disease pathogen in Sukamade field was little different with other, *Pectobacterium carotovorum*and *Fusarium oxysporum* found as new pathogen in pitaya plant.

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