

Incidence of *Phytophthora* Fruit Rot on Four Durian Cultivars in Davao City, Philippines

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Abstract

A two-year study was conducted in a farm in Davao City, Philippines, to investigate the incidence of *Phytophthora* fruit rot on four commercial durian (*Durio zibethinus* Murr.) cultivars previously laboratory-tested for their reaction to the disease using isolates of the pathogen, *Phytophthora palmivora* Butler. In year 1, disease incidence was highest on cultivars Alcon Fancy and Arancillo at 10.7% and 9.9%, respectively. Lesser infection was observed on cultivar Puyat (0.5%) and no infection was recorded for cultivar Seri Kembangan. The same trend was obtained in year 2, further confirming previous laboratory infection test results. Incidence on Alcon Fancy was 47.3%, followed by Arancillo (25.92%), Puyat (12.6%), and Seri Kembangan (2.1%). In monetary terms, the year 1 total of 545 infected fruits is equivalent to a potential income loss of PhP27,250.00, with PhP2900.00, PhP2697.00 and PhP204.38, respectively, coming from the three cultivars. In year 2, the total of 1233 total infected fruits translates to a potential income loss of PhP49,320.00. To this figure, Alcon Fancy cultivar with the highest infection (47.3%) contributed PhP21,873.34, followed by Arancillo (25.9%) with PhP15,967.35. Puyat at 12.9% infection shared about PhP11,925.00 and Seri Kembangan at 2.1% added an equivalent of PhP1294.65. Result of the study indicate that more disease management interventions will have to be exerted for the more susceptible but more commercially preferred cultivars. Several fruit nursery operators in Davao City expressed that propagating Alcon Fancy and Arancillo seedlings is no longer profitable since knowledgeable farmers do not patronize them anymore, citing high susceptibility to *Phytophthora* diseases as the primary reason.

Keywords: disease spread; durian; *Phytophthora palmivora*; symptoms; yield loss

Abbreviations:

DMRT – Duncan’s multiple range test

DNCRDC – Davao National Crop Research and Development Council

PAGASA – Philippine Atmospheric, Geophysical and Astronomical Services Administration

PCA–DRC – Philippine Coconut Authority–Davao Research Center

SMIARC – Southern Mindanao Integrated Agricultural Research Center

Introduction

In the Philippines, Southern Mindanao ranks first in area planted to durian (*Durio zibethinus* Murr.) with 5546 ha (53%) (Durian Technical Committee, 2000) and concentrated mostly in Davao City. For now, the country’s production is still limited to domestic consumption. Metro Manila is the biggest commercial destination, followed by Cebu. As domestic demand for durian increased, the area planted to the crop has also been steadily increasing over the years. Consequently, the surfacing of new durian cultivars has likewise ensued in response to consumer preferences. Among the cultivars that may be seen in commercial fruit stalls in Davao City include Puyat, Arancillo, Alcon Fancy, and Seri Kembangan.

Amid these developments, plant pests and diseases remain to be a serious concern of durian farmers. High on the list of these problems is durian fruit rot caused by the pathogen *Phytophthora palmivora* Butler (Lim, 1990). The disease sets in on the fruit surface as a small brown fleck, rapidly advancing as a lesion radially and into the tissues in a few days (Figure 1). Eventually, the fruit drops prematurely (Figure 2), unfit for market consumption (Lim, 1990).

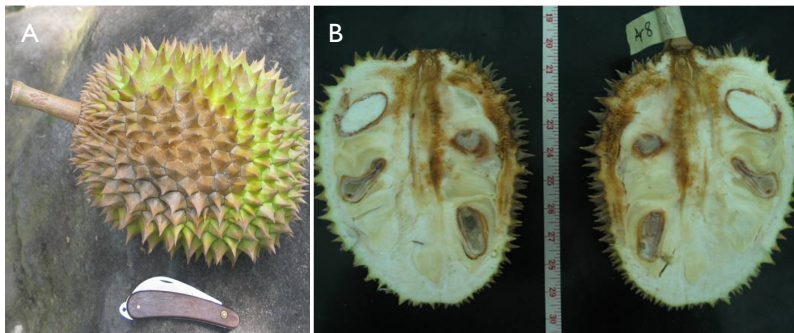


Figure 1. (a) A *Phytophthora* fruit rot–infected durian; (b) a dissected fruit showing extent of rot of internal tissues and aril

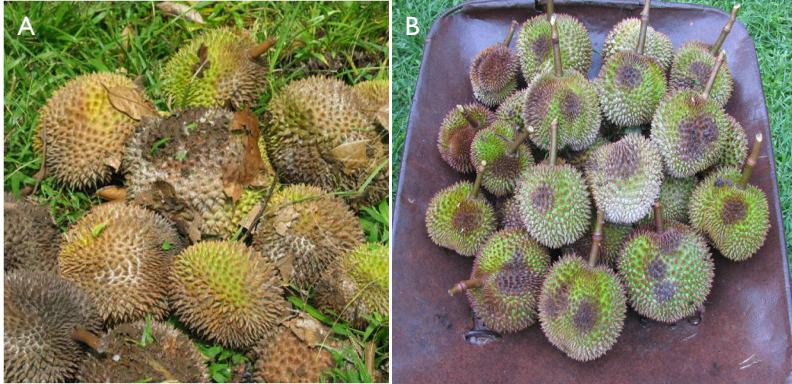


Figure 2. *Phytophthora* fruit rot–infected durian: (a) prematurely fallen; (b) harvested in order to dispose off and prevent disease spread

Under field conditions, it was observed that incidence of fruit rot was more prevalent on some durian cultivars than others. Many durian nursery operators have, in fact, ceased production of planting materials of the Arancillo and Alcon Fancy cultivars, which were perceived to be highly susceptible to *Phytophthora* disease, in favor of other cultivars believed to be less susceptible. Infection tests conducted under laboratory conditions by Abad and Suib (2007) revealed that fruit rot developed readily and faster on Arancillo and Alcon Fancy cultivars than on Puyat and Seri Kembangan cultivars. In view thereof, a follow-up study was conducted to ascertain if natural incidences of fruit rot under field conditions would support the laboratory findings. This paper presents the result of a two-year observation of fruit rot incidences in a farm in Davao City, Philippines.

Materials and Methods

The work was conducted in Alcon Farm, Los Amigos, Davao City, Philippines (Figure 3), a 2.8-ha area with 140 bearing durian trees of various cultivars, which include Alcon Fancy, Arancillo, Puyat, and Seri Kembangan (Table 1). Monitoring of fruit rot incidence on each durian tree was conducted periodically (daily most of the time) during the fruiting season for two years (2006 and 2007). Facilitated by a hand-held tally counter, data gathered were (1) total fruit count when the fruits were about fist-size and (2) number of rot-infected fruits. Disease severity is based on the ratings used by the Southern Mindanao Integrated Agricultural Research Center (SMIARC), Region 11, Davao City (Table 2). The number of infected fruits is used to compute for the

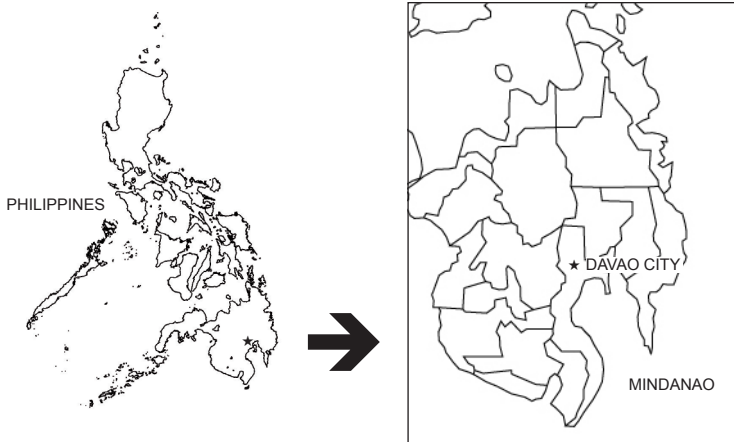


Figure 3. Map showing the location of Davao City, Philippines

Table 1. Fruit characteristics of 4 commercial durian cultivars

Cultivar	Fruit characteristics	No. of trees
Alcon Fancy	Round, weighing about 1–2 kg; flesh is canary yellow, sweet, and has slightly bitter taste and mild aroma; 34% edible portion	40
Arancillo	Ovoid, weighing about 1–3 kg; flesh is mimosa yellow, firm, sweet and creamy, and has a mild aroma; 38% edible portion	29
Puyat	Big and cylindrical, weighing about 3–4 kg; flesh is chrome yellow, firm, sweet, soft, buttery, and has a mild aroma; 40% edible portion	37
Seri Kembangan	Ovoid, medium to large; flesh is light yellow	7
Total		113

Source: DIS Techno-guide Series no. 03-05.2003. Davao National Crop Research and Development Council (DNCRDC) Information Service, Bago Oshiro, Mintal, Tugbok District, Davao City, Philippines

Table 2. Cultivar susceptibility scale

Degree of infection	Rating
1%–10%	Low
11%–20%	Medium
21% and above	High

Source: Adapted from the Southern Mindanao Integrated Agricultural Research Center (SMIARC), Region 11, Davao City, Philippines

economic loss, assuming that a fruit weighs 2 kg (except for the small-sized Alcon Fancy and big-sized Puyat fruits, which were placed at 1.5 kg and 3 kg per fruit, respectively) at the prevailing farm gate price.

Results and Discussion

During the period, the incidence of fruit rot was consistently higher on Alcon Fancy and Arancillo than on Puyat and Seri Kembangan (Table 3), concurring with the laboratory findings of Abad and Suib (2007) (Table 4). Overall, the higher incidence of fruit rot in year 2 compared to year 1 may be attributed to several factors such as rainfall (Portales, 2004; Nanthachai, 1994), humidity (Drenth and Guest, 2004; McMahon and Purwantara, 2004), temperature (Ko, 1993), pathogen inoculum potential (Agrios, 1997), and ubiquity of biological disease transmitting agents, among other things.

Table 3. Incidence of fruit rot (%) on 4 durian cultivars

Cultivar	Year 1 (n = 545)	Year 2 (n = 1233)
Alcon Fancy	10.7 ^b (Medium)	47.3 ^b (High)
Arancillo	9.9 ^b (Low)	25.9 ^{ab} (High)
Puyat	0.5 ^a (Low)	12.6 ^a (Medium)
Seri Kembangan	0.0 ^a	2.1 ^a (Low)

Note: Means with the same letter superscripts are not significantly different at 5% level using DMRT.

Table 4. Susceptibility of six cultivars to *Phytophthora* fruit rot infection under laboratory conditions

Cultivar	Susceptibility rating	Description
Alcon Fancy	4.8 ^a	High
Arancillo	3.3 ^{ab}	High
Native	2.8 ^b	Medium
Puyat	1.3 ^c	Low
Seri Kembangan Original	1.2 ^c	Low
Seri Kembangan F2	4.5 ^a	High

Source: Abad and Suib (2007)

Note: Means with the same letter superscripts are not significantly different at 5% level using DMRT.

In this study though, precipitation during the fruiting seasons of years 1 and 2 was high but did not differ much in volume. There were more rainy days in the latter (Table 5), and rain splashes can greatly aid in dispersal of the pathogen (Ko, 1993). However, it can only be conjectured that the higher frequency of precipitation equally afforded higher frequency for spores of the pathogen to be transmitted by rain splashes to fruits or trees nearby. Rats and ants (Figure 3) are also construed to play a role in disease transmission as they were commonly observed on durian trees and fruits. It is surmised that they help spread the disease with their movement from tree to tree or from fruit to fruit, carrying some pathogen propagules on their bodies. With rats, insects, and other organisms that cause wound or scratches on fruits, the disease spread

Table 5. Rainfall data during the fruiting seasons of 2006 and 2007

2006			2007		
Month	Rainfall (mm)	No. of rainy days	Month	Rainfall (mm)	No. of rainy days
July	254.3	12	June	438.4	25
August	428.1	18	July	251.9	21
September	249.2	17	August	392.7	19
October	288.5	14	September	172.7	20
November	201.3	13	October	306.9	18

Source: Lifted from Cruz (2008). Data originally from the Agromet Station of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) located in the Philippine Coconut Authority–Davao Research Center (PCA–DRC).

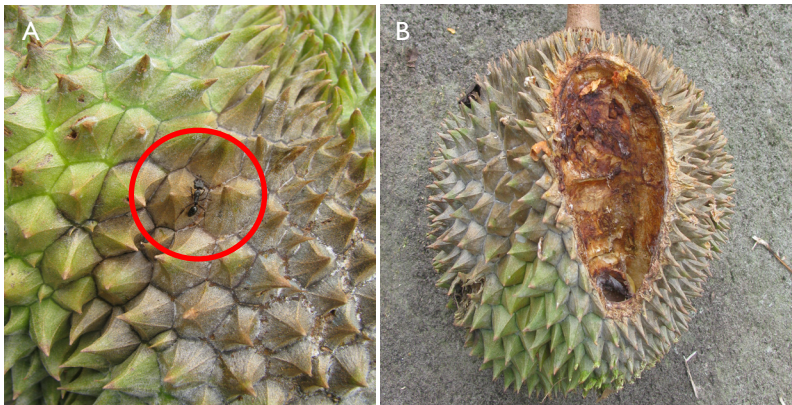


Figure 3. Possible biological agents of *Phytophthora* disease spread: (a) a species of ant (encircled) on durian fruit; (b) rat-gnawed durian fruit infected with *Phytophthora*

would be more facilitated as exposed tissues provide convenient ingress of the pathogen (Abad and Suib, 2007; O’Gara et al., 2004). Therefore, in line with disease management, cuts and bruises should be avoided on fruits whether in the farm or during postharvest situations.

Economic Implication

The actual sales from durian fruits reckoned from about 40 bearing trees in Alcon Farm for the harvest season (July to October) of 2007 is presented (Table 6). From the table, calculations show the weight of each fruit at 2 kg and an average price of PhP25 per kg. The weight figure is a conventional average, except for the small-sized Alcon Fancy, which may be more easily placed at a conservative weight of 1.5 kg per fruit.

In year 1, the total fruit rot infection in the farm reached 545 fruits (13.36%). This is equivalent to PhP27,250 potential income loss due to the disease, with Alcon Fancy at 10.7% (58 fruits; PhP2900) and Arancillo at 9.9% (54 fruits; PhP2697) taking the top spots. In year 2, 1233 fruits were infected. This translates to a potential income loss of PhP49,320. To this figure, PhP21,873.34 is attributed to Alcon Fancy cultivar, which has the highest infection at 47.3% (583 fruits), while PhP15,967.35 is attributed to Arancillo cultivar at 25.9% infection (319 fruits). Puyat at 12.9% (159 fruits) shared about PhP11,925.00 while Seri Kembangan, with the least infection at 2.1% (26 fruits), added PhP1294.65. The two-year observation suggests that more disease management efforts will have to be exerted in the case of Alcon Fancy and Arancillo cultivars in order to prevent huge losses.

Several durian nursery operators that we have interviewed stated that Alcon Fancy and Arancillo cultivars are popular among local consumers because of their excellent taste. However, they have ceased propagating seedlings of these cultivars since knowledgeable farmers do not patronize them anymore in view of their high susceptibility to fruit rot. In addition, many farmers have lost interest in planting these cultivars because of their perceived proneness to *Phytophthora* attack on the stem (Figure 4), which can be lethal when not checked on time (Yaacob and Subhadrabandhu, 1995). Puyat and other cultivars believed to be less susceptible to *Phytophthora* diseases are preferred.

Table 6. Actual sales from durian fruits of Alcon Farm in Los Amigos, Davao City, Philippines, 26 July–02 October 2007

Number of fruits	Weight (kg)	Amount (PhP)	Computed weight/fruit (kg)	Computed price/kg (PhP)
2067	4047.55	101,149.50	1.958	24.99

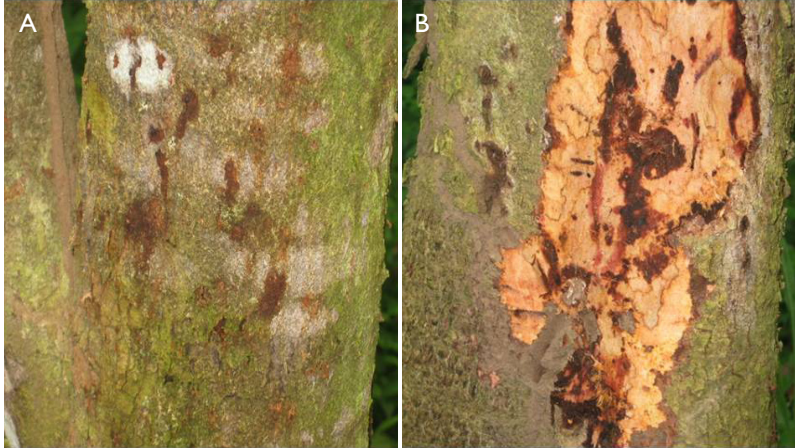


Figure 4. *Phytophthora* stem canker: (a) external symptoms; (b) partly debarked to show extent of rotting of internal tissues

Conclusion

The study has confirmed the high susceptibility of Alcon Fancy and Arancillo to *Phytophthora* fruit rot and the considerable economic losses that the disease can cause on these two cultivars. It is apparent that these cultivars demand extra attention in farm management to deal with disease incidence. Breeding for disease resistance on top of maintaining superior agronomic attributes is also worth undertaking in the area of research and development.

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