Incidence of stem canker on Sarawak local durians

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Abstract

This paper provides a summary of work on an integrated management of durian stem canker conducted from 1990 to 2012 at Stesen Pertanian Kabuloh. The implementation of IPM had effectively minimise the severity and spread of the disease. Of the 34 local varieties monitored, DS64 was found to be significantly tolerance against stem canker

Keywords: Canker, Phytophthora palmivora*, Sarawak local durians, IPM*

Introduction

Durian or known as a king of fruit is one of the most popular fruit and widely planted in Malaysia. Even though it is one of the most highly-priced fruit in the Northern Region of Sarawak, it is still very much sought after especially among visitors from the neighbouring country, Brunei. The durian lovers are willing to pay high because of the uniqueness taste of the fruit. Today, many durian farms are planted with varieties such D99, D24, MDUR88 and MDUR78. Those are the varieties introduced by MARDI (Malaysian Agricultural Research Institute). In Malaysia, generally, most of the durian planted in mixed orchard or 'dusun' as the local people called it, are based on their own accession or from friends.

Canker disease, caused by *Phytophthora palmivora* is known to significantly destruct durian plantings. Symptoms include initial leaf-yellowing and leaf loss from the top of the canopy, with further loss of leaves occurring through the canopy at varying rates. New shoots may appear following initial severe defoliation, but further development and growth is unusual. Tree death generally occurs in 4–12 months from the initial onset of symptoms. In general observation, the disease is easily detected from the wet lesions on the bark of the trees. The lesions are purplish black in colour in contrast to the creamy colour of the healthy tissue and sometimes produce slimy fluid. The symptoms are very obvious during wet season.

Phytophthora can also affect the quality of durian fruits. Depending on weather and other microclimatic conditions, 30% of the fruits produced from the diseased tree may be also affected (Lee B.S., 1992). Other than durians planted in the farms, the disease is also frequently reported in durian nurseries.

Commercial varieties of durian especially those recommended by MARDI such as MDUR78, MDUR79 and MDUR88 were found to be least susceptible to the disease. Our Sarawak local varieties are claimed to be more tolerant to *Phythopthora* stem canker.

However, there was no record on the tolerance level of this disease on our local durians. Therefore, this paper reports on the level of tolerance of Sarawak local durian varieties planted at Stesen Pertanian Kabuloh. It also summarises the station's practice in effectively managed the disease.

Materials and Methods

Thirty Sarawak local varieties of *Durio zibethinus* were planted in October 1987 at a planting distance of 12 x 12 meter and varieties were arranged in a Completely Randomized Block Design (CRBD) with three replicates. These varieties were collected from all over Sarawak and selected based on their fruit quality. A standard application of fertiliser and other normal agronomic practises was applied in this plot. For the severity and incidence, all trees were monitored and recorded for stem canker symptoms. As D24 is generally known to be susceptible to canker (Lee, 1999), this variety was also planted as a check for incidence of the disease. The varieties and total number of the durian planted in the plot are as in Table 1.

	Varieties		**Varieties**
1.	D2S	18.	DS 25
2.	D16	19	DS 27
3.	D24	20.	DS 29
4.	D24S	21.	DS 34
5.	D96	22.	DS 37
6.	D102	23.	DS 39
7.	DS1	24.	DS 40
8.	DS2	25.	DS 42
9.	DS4	26.	DS 47
10.	DS5	27.	DS 52
11.	DS7	28.	DS 56
12.	DS10	29.	DS 57
13.	DS11	30.	DS 59
14.	DS16	31.	DS 60
15.	DS17	32.	DS 61
16.	DS19	33.	DS 63
17.	DS20	34.	DS 64

Table 1: Durian varieties planted in 1987

After eight years planting, some trees were observed infected with canker. Affected trees exhibited symptoms of stem and root necrosis, gummosis, branch dieback, similar to plants affected by *Phytophthora* diseases. Samples were brought back to ARC Plant Pathology laboratory for isolation of the organism. Through Phytophthora Selective Medium, the organism was identified as *Phytophthora palmivora*. Once the causal organism of the disease had been identified, treatments to the affected trees were started

immediately by metalaxyl (Ridomil Plus®) painting. Prior to treatment, the surface of the bark was scraped.

In 1998, all trees were subjected to trunk injection of Phosphorous acid once a year. The treatment was applied before the onset of flowers to ensure that the trees are 'healthy' enough to be subjected to wounds. Trunk injection involved drilling a hole 6.5 mm in diameter and 40 mm deep with a sharp drill, about 50 cm from the base of the trunk. The injection rate utilised was four 20 mL Chemjet® syringes of Foli-R-Phos® 200, which is equivalent to 16 g a.i. of phosphonate. Injections were administered in the early morning. The drilling holes were then covered with plasticine to avoid being infected by stem borers.

Over the years, some trees succumb and some of the varieties also showed some tolerance to the disease. Each individual tree was monitored, starting in 1996 for the presence of canker. Infected barks were collected and measured its disease severity.

The disease severity was measured using the rate of canker severity (Anderson & Guest, 1990) by:

0 – no canker

1 – canker , 100 cm2

2 – canker > 100 cm but < 70% of girdling of the main trunk

3 – canker > 70% girdling of main trunk / almost dead owing to canker

Trees with scales 2 and 3 were specifically monitored and further assessed for their canker progress. Percentage of 0 to 100 was given to these trees; 0 for trees exhibiting canker symptom but did not progress further and 100 was given to trees died due to canker.

Data obtained from the experiment was compared and analysed using Duncan Multiple Range Test (DMRT), GENSTAT for windows, 11th edition (Lawes Agricultural Trust, Rothamsted, England).

Results and discussions

Isolation from the first sampling in 1997 indicated that *P. palmivora* is the causal organism for the disease. After nine years of planting, symptoms of canker was first observed on several trees, with D16 has the highest incidence, followed by DS20, DS4, DS52, DS40 and DS25. By March 1997, 72% of the trees were affected, 21% were dead, 29% were in the scale of 2 and 3, and 22% were observed to have the initial symptom of canker (Annual Report 1997). A severe haze problem occur throughout Sarawak in 1997 has further intensify the incidence of disease. The long drought makes the trees weaker and hence could not recover well after application of metalaxyl. Due to this, we lost our collection of D16 (Figure 1). With an exception of DS64 and DS10, all the other clones showed symptoms of canker, with DS59, DS5, DS47 and D102 has the most severe incidence.

Painting with metalaxyl on the affected area on the durian trunks did not effectively control the spread of *Phytophthora*. Metalaxyl has xylem-translocated compound with an upward movement in plants in the transpiration stream (Darvas *et al*., 1984). When applied to the tree trunk, it is not transported to the affected root area and thus, could not control the infection of *Phytophthora* at root levels. Metalaxyl can be effective only when used as a soil drench. However, this application method is found to be wasteful and not environmentally friendly. Furthermore, soil microorganisms can degrade the chemical and as such, the persistence and effectiveness of metalaxyl is reduced (Guest *et al.* 1995). Resistance has also developed to it among populations of *Phytophthora*, particularly *P. infestans* (Cohen and Coffey 1986).

As the plot is meant for varietal evaluation, it was crucial to save the durian collections. Therefore, chemical control by metalaxyl was replaced by posphorus acid in early 1997. Initially, root feeding was tried on all tress with canker symptoms. Method of application was done according to Wong M.H. (2004). However, due to the very slow uptake of the fluid, this method was replaced by trunk injection. By this method, the chemicals were forced into the trees, minimising wastage and environmental contamination, and achieving maximum persistence (Darvas *et al*., 1984). Phosphorous acid, unlike metalaxyl, did not develop resistant isolates of *Phytophthora* even after more than 20 years of use (Andre & Guest, 2004).

One year after the application of phosphorous acid, the spread of canker was observed to be minimal. However, D24, DS96, DS4, DS10, DS11, DS27, DS34, DS37, DS39 and DS61 still showed high severity of canker and another variety; DS102 was lost. The concentration of phosphorous acid, at this time, has shown that the amount used to control canker was sufficient to halt the development of stem canker.

The progress of canker after several years of phosphorous acid application was observed to be slow but another two varieties were destroyed due to this disease in 2000; D24S and DS59 (Figure 1). Because of this, the station introduced an integrated approach of managing stem canker, starting in early 2001. A restricted access to the area was imposed; only the AA-in-charge (Agriculture Assistant) and several research workers are allowed to the area. All workers including the research officers were provided with different colour of long boots when working in the trial plots. All the agriculture tools used were also separated from the general pool of tools. When necessary, all materials brought in or out from the plot were treated with Chlorox®. The workers were explained on the importance of each procedure and they were also trained to recognise disease problems in durian trees.

Of all the 34 varieties planted, DS64 showed a significant tolerance to the disease as compared to the other clones (Table 2). Even though, symptoms of stem canker were detected on several of the trees of this clone, the symptoms did not seem to affect the growth and performance of the trees. However, there could be a different response of this clone to stem canker if it is evaluated elsewhere. In addition to differences in pathogen populations, we also have to consider differences in environmental conditions and soil types which occur at a local level and may have a significant influence on the expression of resistance in the durian varieties.

D24, a susceptible variety of durian to canker was found to be significantly better than DS5, DS39, DS27, DS61, DS96, DS59, DS102 and DS16 (Table 2).

	Variety	Progress of canker (%)		Variety	Progress of canker (%)
1.	DS64	0.00 *a*	18.	D24	52.14 *i-k*
2.	DS19	14.57 *b*	19.	DS37	53.79 *i-l*
3.	DS63	14.57 *b*	20.	DS1	54.93 *j-m*
4.	DS29	28.29 *c*	21.	DS4	54.93 *j-m*
5.	DS57	33.43 *cd*	22.	DS16	55.00 *j-m*
6.	DS2	34.29 *cd*	23.	DS34	55.00 *j-m*
7.	DS25	36.07 *c-e*	24.	DS47	57.43 *j-m*
8.	DS11	39.29 *d-f*	25.	DS42	60.71 *k-n*
9.	DS7	39.29 *d-g*	26.	DS5	62.71 *l-n*
10.	DS60	41.64 *d-h*	27.	DS39	62.86 *l-n*
11.	DS17	41.71 *d-h*	28.	DS27	64.07 *mn*
12.	D2S	44.64 *e-i*	29.	DS61	67.64 *no*
13.	DS40	44.64 *e-i*	30.	D96	74.57 *op*
14.	DS10	49.07 *f-j*	31.	D24S	80.36 *pq*
15.	DS56	50.00 *h-j*	32.	DS59	82.07 *pq*
16.	DS52	50.36 *h-j*	33.	D102	84.57 *q*
17.	DS20	51.14 *h-k*	34.	D16	89.29 *q*

Average of 14 replications. Mean separation by DMRT at 5% level

Table 2: The progress of canker for each variety

After the implementation of an integrated management of canker, the disease seemed to be effectively managed. In order to limit the risks associated with the spread of this disease, we had use a combination approach. By inspecting individual trees for the symptoms of stem canker and provide an immediate control to the affected trees, did limit the severity of disease. Routine maintenance such as weeding were done carefully so as not to injure the trees. The health of trees was also maintained by fertilising possibly very closed to the schedule with organic manures. The most essential component approach, however, was by introducing a strict hygiene measures in the plot. If implemented rigorously and consistently, it can significantly reduce disease pressure in durian orchards. Nevertheless, all these measures would not be achievable to reduce the loss due to *Phythophthora* if the orchard supervisors and workers were not knowledgeable and experienced. Therefore, trainings and updating the workers are crucial.

Similar integrated approach of canker management can be promoted to our durian growers. The growers initially need to be trained to recognise the problem and how the disease can be controlled. Chemicals should be used as the last option and in some cases, hygiene may be all that is required to manage diseases.

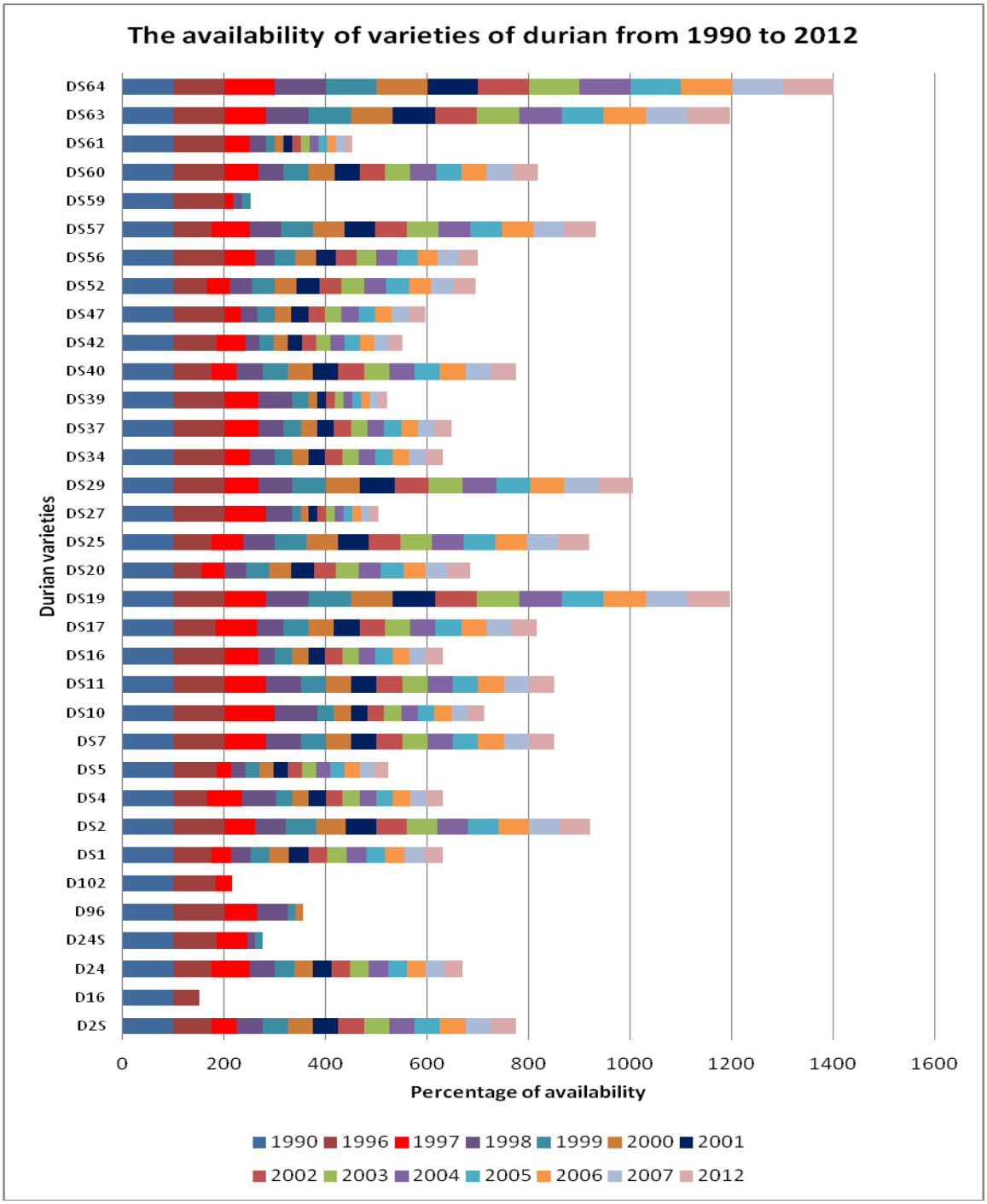

Figure 1: The availability of varieties of durian from 1990 to 2012

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References

Anderson, R.D. and Guest, D.I. (1990). The control of black pod, canker and seedling blight of cocoa, caused by *Phytophthora palmivora*, with potassium phosphonate. *Australian Plant Pathology*, 19, 127-129.

Annual Report Research Division (1997). Department of Agriculture Sarawak, p 69.

Cohen, Y. and Coffey, M.D. (1986). Systemic fungicides and the control of Oomycetes. *Annual Review of Phytopathology*, 24, 311-338.

Darvas, J.M., Toerien, J.C. and Milne, D.C. (1984). Control of avocado root rot by trunk injection with fosetyl-Al. *Plant Disease*, 68, 691–693.

Drenth, A. and Guest, D.I. (2004). Principles of *Phytophthora* disease management. In: Diversity and management of *Phytophthora* in Southeast Asia. Edited by ACIAR Monograph, 154-160.

Lee Boun Siew (1994). Integrated control of *Phytophthora* stem canker of durian. In: Mohamad, O., Zainal Abidin, M. and Mohd Shamsudin, O., eds. *Recent Developments in Durian Cultivation*. Proceedings of the durian seminar held in Ipoh June 1992, 81-87.

Lee Boun Siew (1999). Biological approaches for controlling *Phytophthora* root and trunk rot of durian. Paper presented at National Horticulture Conference, 16–17 November 1999, Kuala Lumpur

Wong Mee-Hua (2004). Root infusion of phosphorous acid for the control of *Phytophthora* foot rot in black pepper (*Piper nigrum* L.). In: Diversity and management of *Phytophthora* in Southeast Asia. Edited by ACIAR Monograph, 154-160.