

Occurrence of Root and Stem Rot of Durian in Mon State and its Control by Trunk Injection with Phosphorous Acid

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ABSTRACT

Durian (*Durio Zibethinus* Murr) orchards in Thahton, Pauung, Mudon and Thanphyuzayat Townships. Mon State, were visited during 2000-2001. Root and stem rot disease caused by *Phytophthora palmivora* was found to be serious and widespread in those durian growing areas. Disease incidence ranged from 16% to 100%. The investigation was undertaken at Kangalay orchard (Mudon Township) and Kyonka orchard (Paung Township), Myanmar Agriculture Service, to evaluate the effect of trunk injection of Phosphorous acid and some chemical application in controlling of root and stem rot of durian. Effective control of the disease on 4-year-old durian trees was achieved by injecting 20% Phosphorous acid twice a year. Phosphorous acid injection in combination with Ridomil 25 WP bark paint and Ridomil 5G soil treatment was also found to be effective.

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INTRODUCTION

Root and stem rot of durian tree (*Durio zibethnus Murr*) caused by *Phytophthora palmivora* is a serious and widespread disease in all durian producing areas in wets Malaysia (Huan, 1971); Thailand (Disthaporn et al., 1996) and Vietnam (Anon., 2000). Patch canker of durian trees was first reported by Thompson (1934). Affected trees show symptoms of bark decay, gummosis on the collars and stems, die-back of branches, root rot and finally death of the trees. In addition to losses of mature trees in durian orchards, the disease becomes increasing important on seedlings and budded plants in nurseries (Huan, 1971).

Some workers recommended chemical control such as trunk injection with Phosphorous acid (Disthaporn et. al., 1996) and Q-RIAN (Anon., 1996), soil drench (Chan and Lim, 1987) and trunk paint (Disthaporn et. al., 1996) with Ridomil (metalaxyl). The scientists from Australia, Thailand and Vietnam currently worked to develop integrated management strategies for the control of *Phytophthora* diseases of durian (Anon., 2000)

Now-a-days root and stem rot has become widespread and major important disease of durian in Myanmar. To suppress the incidence of the disease, it is required to find out the strategies which are applicable for the growers. Systematic study on *Phytophthora* diseases of durian, however, was limited. The experiments were, thus, conducted with the following objectives: (i) to survey the occurrence of root and stem rot disease of durian in Thahton, Paung, Mudon and Thanphyuzayat Townships, Mon State, and (ii) to evaluate the effect of trunk injection of Phosphorous acid and application of some chemicals in the controlling of root and stem rot of durian.

MATERIAL AND METHODS

Occurrence of *Phytophthora* Root and Stem Rot of Durian

A group consisted of the teaching staff from Department of Plant Pathology, Yezin Agricultural University, extension staff from Plant Protection Division and Horticultural Crops Extension Division, Myanma Agriculture Service, Yangon Head Quarter and Mon State paid field visit to the durian orchards in Thahton, Paung, Mudon and Thanphyuzayat townships in March and July 2000, and May 2001. The symptoms of root and stem rot of durian were systematically studied and recorded.

Discussion on the disease and its control were held between the group members and durian growers. Phosphorous acid injection into the trunk of infected plants was also demonstrated. Disease incidence of *Phytophthora* root and stem rot of durian was based on the data collected from the growers.

Effect of Chemical Application in Controlling of *Phytophthora* Root and Stem Rot of Durian

Experiment 1 (Kangalay Orchard, MAS, Mudon Township)

About 20- year-old durian trees which were serverly infected with root and stem rot caused by *P. palmivora* were used in this study. The experiment consisted of 4 treatments with 3 single-tree replicates. The treatments were as follow.

1. Phosphorous acid trunk injection + Q-RIAN trunk injection + Ridomil 5 G soil treatment,
2. Phosphorous acid trunk injection + Q-RIAN trunk injection + Ridomil 25 WP bark paint,
3. Phosphorous acid trunk injection + Q-RIAN trunk injection + Ridomil 5G soil treatment + Ridomil 25 WP bark paint,
4. Untreated tree.

Ridomil 5G (metalaxyl 5%) was applied twice to the soil surface at the rate of 20 g/m². Ridomil 25 WP (metalaxyl 25%) at the rate of 2% a.i. was applied as bark paint. Ten ml of Q-RIAN which is a new type of plant growth and disease resistant regulator was injected into the trunk of the durian trees. Twenty per cent Phosphorous acid was injected into the trunk in March and July, 2000. Before injection, Phosphorous acid was adjusted to pH 6 with potassium hydroxide to obtain monohydrogen dipotassium phosphite (K₂HPO₃). The injection rate was 15 ml of the solution per diameter of tree canopy. Number of the required holes to inject depend on the size of the tree canopy.

The hole 5 mm in diameter was drilled about 20 cm from the ground and 25 mm depth at a slight downward angle into the trunk of the infected tree. The plastic connector piece (plastic needle-head of the disposable needle) was inserted tightly into the hole without leaking. The piece was filled with the solution by means of a needle and syringe.

A modified 25 ml disposable plastic syringe was used as injection device. Rubber ring which looked like elastic piece of catapult was attached to the nipple of the syringe (Plate 1). The syringe was then filled with 15 ml of the solution. The nipple of the syringe was inserted into the plastic connector piece fitted in the trunk. The end of the rubber ring was pulled back and hung at the end of the plunger so that the solution remained under pressure. The fluid was forced into the trunk by strength of rubber ring (Plate 2). When all the solution was infected into the trunk, the syringe and connector piece were withdrawn and then the hole was plugged with beeswax.

Disease severity was visually estimated 14 months after application. Each tree was assessed for vigour on an arbitrary scale of 1-5 where 1 is a healthy tree and 5 is a dead one.

Experiment II (Kyonka Orchard, MAS, Paung Township)

Four-year-old infected durian trees were used in this experiment. There were 4 single-tree replicates of each treatment. The treatments tested in this study were (1) trunk injection with 20% Phosphorous acid, (2) the trunk injection in combination with Ridomil 5G soil treatment and Ridomil 25 WP trunk paint, and (3) untreated tree. The procedure and rate of each chemical application were similar to those practiced in Experiment 1.

Disease assessment was done at 3 months after the first time of trunk injection and 11 months after second trunk injection. Disease severity was determined based on the extent of girdling of lesions. Scoring scale used in the experiment was as follow:

0 = no lesion; 1 = 10% of trunk circumference girdled; 2 = 11-25%; 3 = 26-50%; 4 = 51-75% and 5 = 76-100%

RESULTS

Symptoms of Phytophthora Root and Stem Rot of Durian

The symptom was found at any side of the bush, any branch or tree depending on infection. Early symptom was observed on the leaves of the infected trees. Leaf surface was not shining and gradually turned to pale yellow and finally feel off. Infected barks on the branches and trunk became brownish dark in colour with water-soaked appearance. Cortical tissue turned reddish brown or dark brown in colour compared with the normal light brown colour of healthy issue. The bark tissue eventually died and dried out. As lesion expanded, trunk or branches were girdled, and defoliation and die-back of branches occurred until eventually the tree was dead. Affected roots were discolored, decayed and easily torn off when the severely infected trees were dug up.

Occurrence of Phytophthora Root and Stem Rot of Durian

Disease incidence ranged from 16% to 100% and 20% to 100% respectively in Mudon township and Kyonka village (Paung township). A durian orchard in Weyet village (Thanphyuzayat township) and another one in Kyawktan village (Thahton township) showed 80% and 100% disease incidence respectively (Table-1).

Effect of Chemical Application in Controlling of Phytophthora Root and Stem Rot of Durian

Experiment I (Kangalay Orchard, MAS, Mudon Township)

Arbitrary scales of all chemical treated trees were less than those of untreated ones. Over a period of 14 months after treatment, all untreated plants were dead. However, the treated trees that were initially severe showed to a certain extent of recovery (Table-2).

Experiment II (Kyonka Orchard, MAS, Paung Township)

Disease severity decreased in all chemical treated trees when compared with those in untreated ones. The treatments showed not much effect at 3 months after first time of Phosphorous acid trunk injection but the condition of the trees were dramatically improved at 11 months after second injection. However, 3 untreated trees among 4 were dead.

There was no difference in disease severity between Phosphorous acid injected trees, and the injected trees in combination with Ridomil 5G soil-treated and Ridomil 25 WP bark painted ones. The results showed that Phosphorous acid injected alone may be equivalent in efficacy to the application of Ridomil

soil treatment and bark paint in combination with Phosphorous acid injection. The evidence, therefore, suggested that Phosphorous trunk injection alone was more economical in controlling of root and stem rot disease of durian.

DISCUSSION

According to the field survey data, Phytophthora root and stem rot of durian seemed to be serious and widespread in Mon State. The occurrence of the disease was also informed from various durian growing areas in Myanmar. The disease symptoms were observed on different ages of durian trees including seedlings and old ones. However, Phytophthora fruit rot has not been noticed. Rooten fruit caused by *P. palmivora* was reported in Thailand (Disthaporn et al., 1996).

The results from the experiment conducted in Kangalay Orchard on severely affected old trees were inconsistent. It might probably be due to the complicated effect of wood borer attacked disease infection. Therefore, combined use of such chemical application could not be recommended from this experiment. Nevertheless, such treatments were effective in controlling of root and stem rot of durian tree.

Various workers reported the effect of such chemical to control Phytophthora diseases of durian. Q-RIAN improved and promoted vigorous plant growth of durian to withstand disease infection particularly patch canker (Anon., 1996). Disthaporn et. al., (1996) recommended Phosphorous acid trunk injection to control root and stem rot of durian in Thailand. Ridomil applied as a soil drench (Chan and Lim, 1987) and a bark paint (Disthaporn et. al., 1966) was also effective in controlling of the disease.

In the trial carried out in yonka Orchard on 4-year-old trees, trunk injection with phosphorous acid was as effective as that treatment combined

with Ridomil soil treatment and bark paint. The fungicide Fosetyl-A1 (aluminum tris-0-ethyl phosphate), under the trade name of Aliette which is degraded to phosphorous acid in plant tissue, has high efficacy against several diseases caused by *Phytophthora* species (Coffey and Bower, 1984). The diseases controlled by Forestyl-A1 were avocado root rot caused by *P.cinnamomi* (Davas et. al., 1984), black stripe of rubber caused by *P.palmivora* (Tan., 1990), Phytophthora foot and root of citrus caused by *P.citrophthora* (Schwinn, 1983), and root and stem rot of durian (Disthaporn et. al., 1996).

In the present study, effective control of root and stem rot of durian was achieved by injecting small quantities of Phosphorous acid into the trunk of the infected tree. Therefore, it could be concluded that trunk injection by Phosphorous acid was efficient and economical for combating Phytophthora root and stem rot disease of durian. Continued investigation of Phosphorous acid trunk injection should be carried out in large scale to enhance the current effects towards minimizing the serious disease problems and increase durian production in Myanmar.

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Table 1. Occurrence of root and stem rot of durian at different location in Mon State

Location / Owner	Disease incidence (%)
Mudon Township	
1. U Chit Than	100
2. U Tun Kyaine	55
3. Dr. Tin Shwe	48
4. U San Myint	38
5. U Khin Maung Thein	34
6. U San Tin	29
7. U Ohn Phay	18
8. U Mine	18
9. U Nyi Tin	16
Paung Township	
1. U Shwe Mann	100
2. U Kyi Lwin	100
3. U Kyi War	91
4. U Ant Ku	90
5. U Kyaw Khe	63
6. U Pawk Kyone	60
7. U Aung Kyi	46
8. U Kyaing	35
9. U Htan Poe	20
Weyet Village (Thanphyuzayat Township)	
1. U Kyi Tun	80
Kyawktan Village (Thahton Township)	
1. U Tin Hlaing	100

Table 2. Effect of combined use of chemical application in controlling of root and stem rot of durian (Kangalay Orchard)

Treatment	Scoring Scale
Phosphorous acid + Q-RAIN + Ridomil soil treatment	1.0 *
Phosphorous acid + Q-RAIN + Ridomil trunk treatment	2.3
Phosphorous acid + Q-RAIN + Ridomil soil treatment + Ridomil trunk paint	4.0
Untreated control	5.0

* 1 = healthy and 5 = death

Table 3. Effect of phosphorous acid alone and combination of phosphorous acid and Ridomil

Treatment	Scoring Scale	
	3 m after 1st injection	11 m after 2nd injection
1. H ₃ PO ₃ trunk injection	3	0 *
2. H ₃ PO ₃ trunk injection + Ridomil soil treatment + Ridomil bark paint	3	0
3. Untreated control	4	5

*0 = no lesion ; 1 = 10% ring barked; 2 = 11-25%; 3 = 26-50%; 4 = 51-75%, and 5 = 56-100%

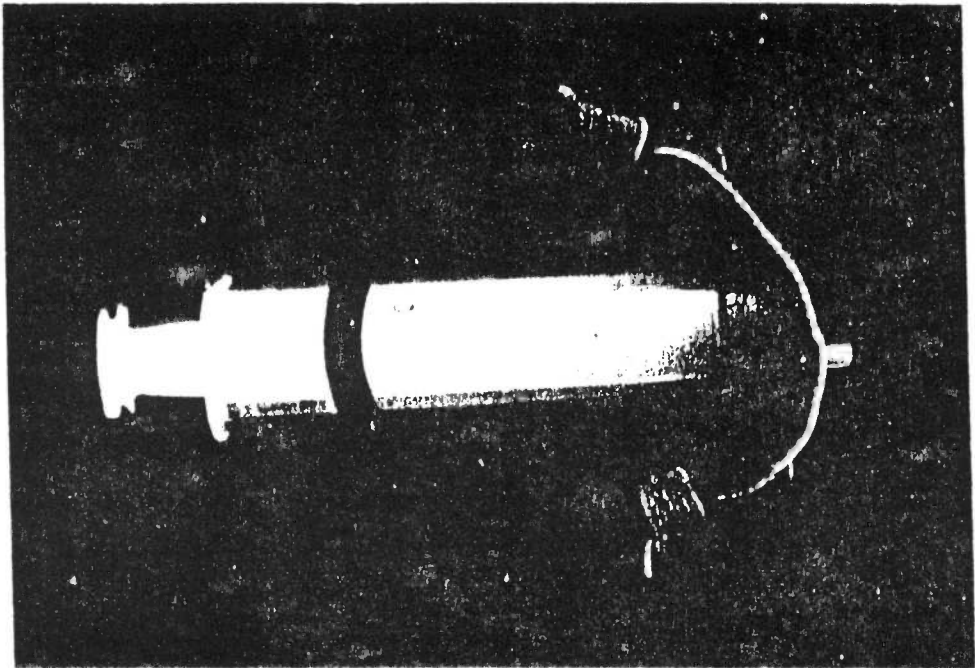


Plate 1. Modified disposable plastic syringe used as trunk injection device



Plate 2. Injection of Phosphorous acid in the trunk of the infected durian tree using modified syringe