BUD-ROT DISEASE ON PB 121 COCONUT AT BANGUN PURBA PTP VI, NORTH SUMATRA

J. Brahmana and Azis Kelana [1]

SUMMARY

Three-year observations made upto 1987 on coconut hybrid PB121 (Malayan Yellow Dwarf x West Affican Tall) planted at the Bangun Purba PTP VI Estate, North Sumatra in 1977 revealed a 9.5 percent infestation by bud-rot disease. Bud-rot is disastrous since it kills the only growing point of the plant, and until today no remedy has been found out other than uprooting and destroying the diseased palms. Exast cause of but-rot is not known, eventhough the fungus *Phytophthora palmivora* is associated with the affected palms. This disease is noticed exclusively on mature palms, older than four years, and is found to spread blockwise.

INTRODUCTION

The North Sumatra Bangun Purba Estate is planted with coccia and a number of coconut varieties and strains. Hybrid coconuts (PB/121) planted in 1977 were attacked by bud-rot which killed 1984, and upto March 1987 (3-year period) the disease has spread to other blocks. The current percentage incidence of the disease in the area under reference is 9.5. Bud-rot is a common disease of coconut palm in tropical countries such as the Philippines, India, Sri Lanka, Malaysia, West Africa and other Asian and Pacific countries (2.4).

According to Reyne (1948), bud-rot disease originated from Tropical America. In the district of Laronie (Suriname), 24,707 coconut palms showing bud-rot were felled during 1918-1942. A similar step was taken by the Philippines in 1918 when 12,813 trees were. cut down. In other countries, the disease epidemiology was reported differently. In Malaysia, it is the PB 121 hybrid and the Malaysian Dwarf which are susceptible, the disease attacking mostly the seedlings and immature plants. According to Quilleec & Renard (1984), in West Affica, bud-rot disease usually attacks 5-6 years old West Affican Talls as well as hybrids of dwarf x tall (4). In India and Sri Lanka, it attacks mature palms, while in Indonesia it attacks, indiscriminately. According to the Directorate General of Estates (Indonesia), bud-rot disease is round in all kinds of coconut plants (1). Darwis (1985) stated that in North Sulawesi, bud-rot attacks all kinds of mature coconut, the Nias and Malaysian dwarfs, the PB-121 hybrid being more susceptible (3).

Based on observational findings at Bangun Purba Estate, while bud-rot attacks all kinds of coconuts, the maximum percentages of affected palms were found with PB 121 hybrids (5 -3 5%). The cause of this disease is suspected to be *Phytophtho*ra palmivora, which attacks only mature palms (± four years old), and the disease speads mostly blockwise.

RESEARCH METHOD

Our research on bud-rot disease was directed mainly to determine the cause and the nature of epiderniology.

The Cause of Bud-rot

In searching for the pathogen, decaying tissues of diseased plant material were isolated using PDA media (Potato Dextrose Agar) and the V-8 Juice Agar media.

[1] Coconut Research Centre, North Sumatra, Indonesia.

Epidemiology

In order to find out possible relationship between disease incidence and rainfall, nutrients, age of plants, and varieties, monthly observations were made during three successive years according to the following method

- Observations On coconut hybrids were recorded in blocks 3 (7 ha) and 4 (14 ha), to find out if there was a correlation between rainfall and the pattern of spreading of the disease;

- Experiments on adaptability of various coconut varieties were conducted in Blocks B-BP-01 (9.6 ha) and B-BP-02 (4.0 ha) to test any varietal resistance to the disease;

- A fertilizer experiment involving several nutrients was conducted in block A-BP-01 (10.8 ha) to find out if the disease responded to any of the fertilizers.

RESULTS AND DISCUSSION

Disease Symptoms

The morphological and anatomical symtoms of bud-rot disease arc as follows :

- **Morphological Symptoms**

The initial symptoms are : wilting of young leaves before the unfolding of the leaflet (as of lack of water), followed by snapping of the leaf and drying out. At this time one or two underlying leaves will also show wilting signs. Drying out will continue until most of the leaves (8-10 leaves) are dry and broken, usually 4-6 months after the initial symptom appeared.Other leaves which arei older will stay green and fresh while their nuts may achieve maturity. After eight to ten months all that rernains will be a stump, as seen in Figs l and 2.

- **Anatomical symptoms**

The diseased plant is sliced vertically, starting from the growing point until the healthy tissue of the leaf is found for anatomical investigation. Around the spear there appears white mucus which has a bad smell (specific of bacterial action). Below the exudation, a block of necrotic tissue ernitting an acid smell would be seen. At the lower part of the healthy frond (the edge between diseased and healthy frond) brownish black necrotic tissue having an acid smelt is normally found. (see Figs. 3 & 4). The symptoms of bud-rot disease, in West Africa reported by QUILLER (1984) is substantially similar to the disease symptoms found at Bangun Purba. The difference is that in West Africa the initial symptoms starts on the first leaf (No. 1), while at Bangun Purba it is on the young, partially opened leaf. In Sri Lanka, India (8) and Central Indonesia (North Sulawesi), the disease symptoms are similar, however with a difference with regard to the incubation period. This may be caused by different environmental. factors (in climate, soil and maintenance), or host plant varieties, and possible by fungus (WALKER, 1969).

Cause of the Disease

At the initial stage, tissue of the diseased PB 121 coconut hybrid was isolated in PDA medium and V-8 Juice agar. The isolation allowed identification of microorganism, e.g. Fusa*rium sp, Botryodiplodia sp, Pestalotia sp,* bacteria and *Phytophthora sp.* The development of *Phytophthora sp* from mycelium to oospores is presented in Fig. 5 and 6.

Fig 1. Broken and wilting spear.

Fig 2. Although several fronds are broken, fruits countinue to develop.

Fig 3. Necrosis at the base of frond.

Fig. 4. Horizontal cut shows light brown small necrosis under rotten tissue.

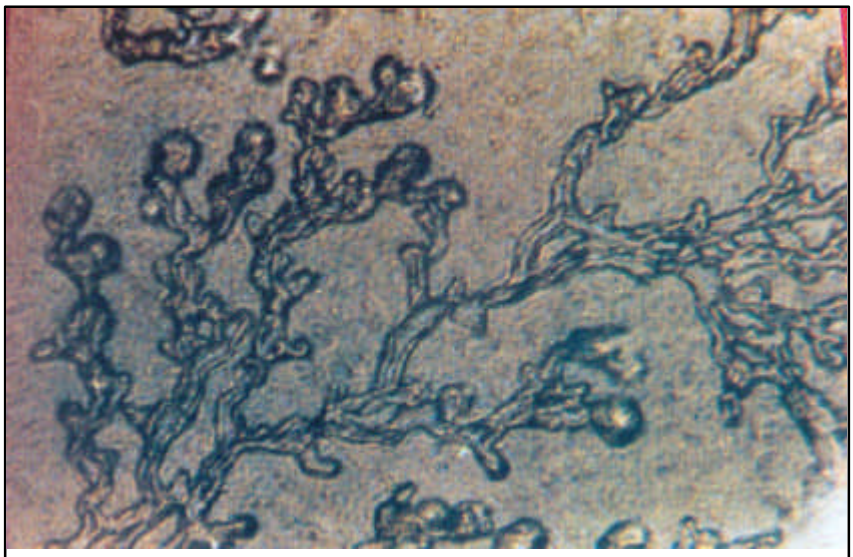


Figure 5. Sporangiopore on mycellium terminal

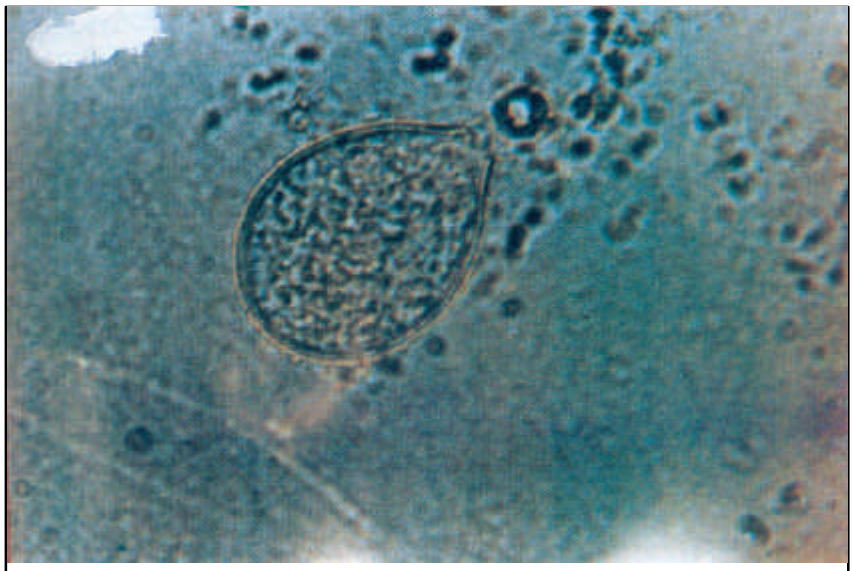


Figure 6. Sporangiums is broken and released zoospores.

Based on the findings of STAMPS (l986), it was inferred that the fungus responsible is *Phytophthora palmivora*. From the isolation and disease symptoms, the fungus *Phytophthora palmivora* appeared to be the causal agent. This pathogen is also mentioned as the cause of bud-rot in India (8) and in Indonesia by the Directorate General of Estates (1). Some experts, however, believe that the disease is caused by other pathogens for instance, QUILLEC (l984) stated that the cause of the disease was *Phytophthora heveae* (4), whereas in North Sulawesi this was caused by *Phythophthora nicotianae (3).* During the dry season this pathogen can survive in the soil for 15 months and in the decayed trunk for ± 5 months (9).

Rainfall and Disease Incidence

There was no distinct rainy season at Bangun Purba estate during the period 1977 to 1986. The rate of disease incidence which increased during rainfall from 1983 to 1986 is presented in (Annex. 1).

The graph shows that the highest rate disease incidence did not coincide with the highest rate of rainfall but occurred only few months following the wet months. The correlation between rainfall and the incidence of the disease is given in Table 1.

Table l - Correlation of Rainfall and Bud Rot

No.	Duration after rainfall (in months)	Rainfall coffelation with Bud rot
1.	4	0.04
2.	5	0.13
3.	6	0.02
4.	7	0.02

The above coffelation table indicates that the highest disease incidence was observed 5 months after the month of heaviest rainfall (200 mm). This analysis suggests that probably the incubation period is 5 months.

Also in the regions with distinct dry and wet seasons, e.g. West Affica and North Sulawesi, the incidence of the disease is closely connected with the rainfall. During wet months a low water deficit, the number of bud-rot affected plants increases (3.4).

Resistance of some Coconut Varieties.

Based on observations during one year, some varieties resistant to bud-rot, are presented in Table 2.

Table 2 - Percentage of Bud-rot disease incidence on various coconut varieties.

Plot	Plant		Affected palms	
	Variety	Number	Number	%
B-RB-01	Bali Tall	320	4	1.23
	CRD x WAT	320	14	4.38
	EGD x WAT	320	25	7.87
	PYD x WAT	320	4	1.23
	RLT x WAT	320	5	1.56
	MRD x WAT	320	20	6.25
Sub-Total		**1,920**	**72**	**3.75**
B-RB-02	MYD x WAT	120	24	20.00
	MRD x WAT	120	44	36.67
	MYD x WAT	120	43	35.83
Sub-Total		**360**	**111**	**80.83**
Total		**2,280**	**183**	**8.03**

Note :
1. MRD = Malaysia Red Dwarf
2. MYD = Malaysia Yellowish Dwarf
3. CRD = Cameroon Red Pwarf
4. EGD = Equalorial Guinea Green Dwarf
5. PYT = Polynesia Tall
6. RLT = Rennel Tall
7. WAT = West Africa Tall

The data in table 2 reveal that variety with dwarf mother tress (both yellow and red) are sensitive to bud-rot disease. More resistant are the tall varieties and tall x tall hybrids (affected rate 1.56%) According to TEY (1978) in Malaysia, the dwarf coconut and the PB 121 hybrid are susceptible to bud-rod (7).

Darwis (1985), too concluded that the PB 121 hybrid, Nias dwarf and Malaysia dwarf as susceptible to bud-rot (4). Based on observations and the above information, it can be concluded that the Malaysia dwarf coconuts used as parent trees for the PB 121 hybrid coconut are susceptible to bud-rot. The susceptibility of the PB 121 hybrid is supposedly inherited from the Malaysia Yellow Dwarf.

Age of Plants

In Bangun Purba, mature coconut hybrids attacked by budrot are presented in Table 3.

Table 3. Percentage, of Bud-Rot disease on different ages of mature hybrid coconut plants

No.	Planting year	Plant status	Number trees	Affected Trees	
				Number	%
1.	1977	MA	6,800	348	5.09
2.	1980	MA	48,000	20	0.42
3.	1982	MA	48,000	4	0.88
4.	1984	IM	48,000	0	0.00
5.	1986	IM	48,000	0	0.19
	Total		**198,800**	**372**	**0.19**

Note: MA = Mature
IM = Inimature

These observations indicate that only mature palms (older than 4 years) were affected. The older the plants, the higher the affected percentage. However, in Malaysia the trees affected were seedlings and immature plants (7), while in West Affica they were the plants between 5 to 6 years old (4).

Effect of Nutrients

The PB 121 coconut hybrid used for fertilizer experiments was also affected by bud-rot. The disease affected percentage in each treatment is presented in Table 4.

Table 4. indicates that palms under Mg level 2 treatment (22 palms) suffered least whereas those under P level l treatment (69 palms) suffemd most. However the disease relationship with nutritions is not very clear, although it may be assumed that K treatment can increase plant resistance to the disease. Sixty-four control trees were affected while out of level paims only 46 palms were affected.

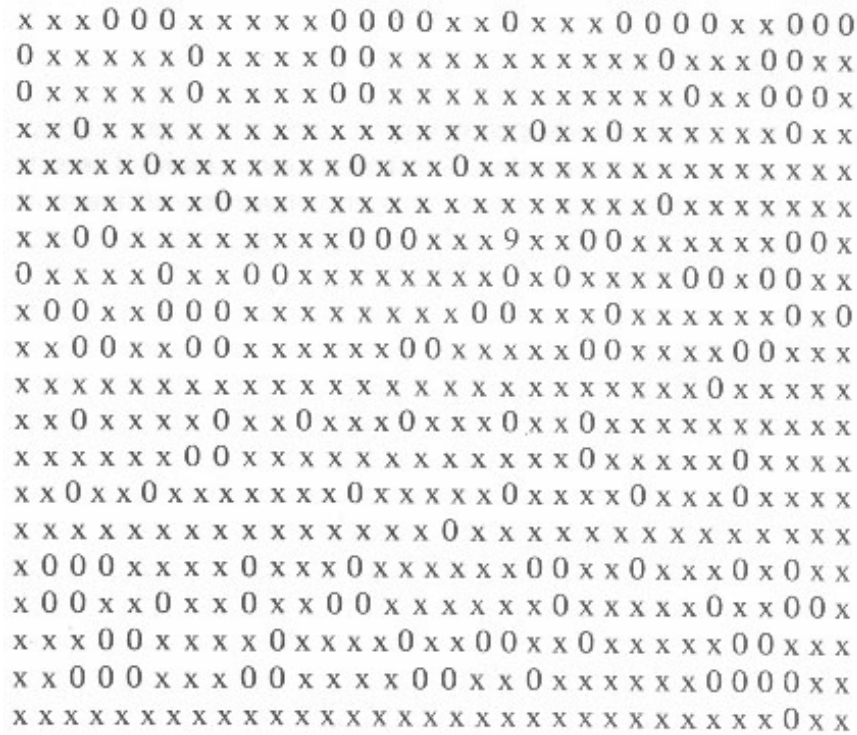
Table 4 - Number of Bud-Rot affected trees at nutrition level.

No.	Nutrient		Number of Trees
	Kind	Level	
1.	N	0	26
		1	50
		2	33
			109
2.	P	0	25
		1	69
		2	54
			148
3.	Mg	0	38
		1	46
		2	22
			106

Remark: Dosage and interval of nutrient is presented in Annex 2.

Disease Incidence

Bud-rot incidence at three years after the first infestation is presented in the diagram below :



Note : 0 = diseased palms
x = healthy palms

It could be inferred from the above that disease incidence may be observed in patches, although in some places there is no fixed pattem. Spreading of the disease depends on the weather factor. According to WALKER (1969), *Phytophthora* spores/oospores are dispersed by wind, rainfall, insects, and will develop quickly under high humidity conditions.

CONCLUSION

l . Bud-rot infestation is a common disease of coconut palms in tropical regions, causing drying and breaking of leaves (l - 15 leaves). Drying of the leaf starts at the growing point whereas other leaves remain fresh and nuts on the palm survive until maturity. This disease kills the growing point.

2. Bud-rot disease on PB 121 hybrid coconut is possibly caused by the fungus *phytophthora palmivora.* This fungus attacks bearing palms (of ± 4 years old). The attack generally is being observed in patches.

3. The highest attack percentage of bud-rot is not during the months of high rainfall but five months later. There is no obvious relationship with nutrient elements, although there may be a possibility that application of potash can increase plant resistance.

4. Hybrid PB 121 coconuts are rather susceptible to the disease in comparison to Bali talls or tall x tall hybrids. The PB 121 coconut susceptibility is probably inherited from its parent material the Malaysia Yellow Dwarf.

5. Research on bud-rot disease needs to be continued until the cause and epiderniology of the disease are clearly determined and until an efficient control method is devised.

SUGGESTIONS

1. It is advised to cut down bud-rot affected coconut palms and burn or discard them far away from the plantation area.

2. For replanting in areas with high rainfall (1,800 mm/years), use of coconut varieties which are, resistant to bud-rot and possess high vield potential are suggested.

3. PB 121 coconut hybrids planted in regions with heavy rainfall should be subjected to intensive care, especially with regard to the following practices, viz :

   - prevention of attack by Oryctes sp,

   - prevention of wetness through proper drainage systems.

REFERENCES

1. Anonymous. 1983. Petunjuk Pengenalan dan pengendalian Penyakit-penyakit Penting Tanaman Kelapa. Departemen Pertanian Direktorat Jenderal Perkebunan. 20 - 21.

2. Child R. 1974. Coconuts, 2nd edition. Longmans, Green and Co., London. 213-1215.

3. Darwis S. N. 1985. Tanaman Kelapa dan Lingkungan Pertumbuhan. No. 5/VII/1985. Departemen Pertanian Badan Penelitian Kelapa Menado.

4. Quillec G, J. L. Renard and H. Ghesquirre. 1984. *Phytophthora hevea* of coconut. Role in Bud rot and nutfall. Oleagineux 39 (10). 438-485.

5. Reyne. A. 1948. Kelapa. Diterjemahkan dari Bahasa Belanda oleh Prof. Dr. Ir. Haryono Semangun dan A. Azis Lohiya. LPP Yogyakarta. 144-147.

6. Stamps. D.J. 1985. Commonwealth Mycological Institute Identification Services Ferry Lane, Kew. Surrey TW 93 AF, UK. England.

7. Tey, C.C. and E. Chan. 1978. Disease of Coconut Palms in Peninsular Malaysia. International Conference on Cocoa and Coconuts, 1987 13 - 15.

8. Thampan P. K. 1982. Handbook on Coconut Palm. Oxford & IBH Publishing Co. New Delhi. 178.

9. Walker John Charles. 1957. Plant Pathology. Mc. Graw-Hill Book Company - Inc. New York. Toronto. London. 170 -180.