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SYMPTOMS OF TARO LEAF BLIGHT DISEASE (*PHYTOPHTHORA COLOCASIAE*) AND RELATIONSHIP WITH YIELD COMPONENTS IN BIAK, IRIAN JAYA

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ABSTRACT

Phytophthora colocasiae *can cause leaf blight and rot on taro flower, petiole, stem base and corm. Significant symptoms of the leaf blight and corm decay are always found on the same plant. Intensity of the disease on monoculture cropping systems is higher than on mixed cropping systems. Leaf blight disease intensity showed a linear relationship with yield components. An increase in intensity of disease is followed by the reduction of the corm weight per crop.*

INTRODUCTION

There are about 31 species of plant pathogens causing disease on taro crops (Anonymous, 1982). A very important one is *Phytophthora colocasiae* Rac. causing leaf blight disease.

Even though Indonesia does not have clear and accurate data on the disease, it is known that leaf blight occurs in all taro growing areas. In recent years two epidemics have taken place in Irian Jaya. The first epidemic to be reported occurred in Ayamaru and vicinity in 1975, and the second was in Biak Island in 1981. Since then, the disease is reported to be widespread over all taro growing areas in Irian Jaya.

The loss in yield at the time of the Biak epidemic reached 80% and even without epidemic yield loss can reach 15-45%. The disease also affects the quality of corm since the infected corm is bloated, produces much secretion, and causes itching when eaten.

Field evidence has indicated that the disease intensity varied from time to time, and from one location to another. Disease fluctuation could be caused by the variation in cultural practice, including time of planting, cultivar selection, and the surrounding environment (Fry, 1982). The taro cropping system in Irian Jaya is usually monocultural and taro is grown year round. Size of gardens ranges between 0.2-0.5 ha, with irregular plant spacing of 40-60 cm. In several places farmers grow taro in a mixture with crops such as banana, cocoyam, cassava, sweet potato and sugarcane.

The objectives of this research were; (1) to study the intensity of taro leaf blight disease in monoculture and mixed cropping systems, (2) to study the relationship between taro leaf blight intensity and yield components such as corm weight per plant, corm length, corm diameter, and number of suckers.

MATERIALS AND METHODS

Observations were made at 26 sites in local farmers' taro gardens in the southern, northern and eastern parts of Biak Island, Irian Jaya. The gardens included monoculture taro gardens and 16 mixed gardens in which taro was the main crop.

Sample plots of size 6 x 4 m^2 were randomly selected from six months old gardens. Replication was three times for each observed site. Five sample plants were observed in each plot. Recorded data included disease symptoms, intensity of leaf blight, weight of corm per crop, length of corm, corm diameter, and number of suckers.

Leaf blight disease observation was based on criteria proposed by Gollifer & Brown (1974) and the following formula was used for calculating the intensity of disease;

$$IP = \frac{n \times v}{Z \times N} \times 100$$

where : IP = disease intensity
n = number of crop samples having certain scale value
v = scale value of crop sample (the scale used is necessary if work is to be repeated)
Z = the highest scale value
N = total number of observed plants in sampled plots.

Relationship between disease intensity and yield components was analysed by using multiple regression and simple correlation analysis.

RESULTS AND DISCUSSION

The disease symptoms

The result of the observations conducted at several sites in taro growing areas in the southern, northern and eastern part of the Biak Island revealed that disease symptoms found in all sites were alike. First symptoms of the taro leaf blight disease caused by *Phytophthora colocasiae* were purple-brown spots on the upper part of the leaf and wet symptoms on the underside. The spots could occur on the middle or on the margin of the leaf.

Spots were circular and regularly increased in diameter. Spot development, however, was obstructed when reaching the main vein and, as a result, spots in this situation extended alongside the main vein. Infected leaf surface increased if several spots unified. A specific characteristic of the disease was the occurrence of yellow to red liquid drops on the middle of the spot in the morning, but when dry, the liquid became solid and brown in color. The spots were sometimes circled by purple to yellow rings.

The leaf symptoms may be accompanied by rot of the petiole, base of the stem and flower. This has not been previously reported in Irian Jaya, but has been reported in the Philippines (Gomez, 1925), and India (Bulter & Kukkarni cited by Gollifer *et al.*, 1980).

Soft rot was noticed on the corm in particular taro crops in this study. Rot started on the base of corm, and could make the corm totally infected. The infected corm was white, gray, or blackish brown in color. The same color symptom has been reported by Gollifer *et al.* (1980) and Ooka (1983). The leaf blight disease and corm rot do not always appear on the same plant.

Relationship of disease intensity and yield components

Average disease intensities (IP180) ± standard deviation, in monoculture and mixed cropping systems at six months after planting were 40.83 ± 8.65 and 26.63 ± 8.36, respectively. Multiple regression analysis showed that there was a significant linear relationship between IP180 and yield components. Regression models for monoculture and mixed cropping systems are as follows

$$Y_M = 40.698 - 0.449^{**}BU + 0.073\ PU + 1.572\ DU + 0.250\ JA$$
$$(r = 0.956^{**};\ r^2 = 0.91)$$

$$Y_C = 43.586 - 0.046^{**}BU + 1.219^{*}PU + 0.233DU - 2.590\ JA$$
$$(r = 0.969^{**};\ r^2 = 0.94)$$

**Significant at 0.01; *Significant at 0.05;

Where: Y_M= Disease intensity in monoculture system
Y_C= Disease intensity in mixed cropping system
BU= Corm weight
PU= Corm length
DU= Corm diameter
JA= Number of suckers

A great contribution to IP180 came from the weight of corm per crop which had partial correlation coefficient of 0.838 for monoculture and 0.903 for mixed cropping systems (Table 1). The partial correlation coefficient of mixed cropping system is not significant.

Results of simple matrix correlation analysis among observed components are presented in Table 2. By ignoring other yield components it seems that the increase in disease intensity is followed by significant decrease in corm weight per crop (Figure 1), whereas there is no significant decrease in corm size or sucker number.

Table 1. Partial correlation coefficient between IP 180 and yield components.

Yield components	Monoculture	Mixed
Corm weight per crop	0.838**	0.903**
Corm length	0.002	0.403
Corm diameter	0.254	0.022
Number of suckers	0.001	0.215

**Significant at 0.05

CONCLUSION

Leaf blight caused by *Phytophthora colocasiae* Rac. is an important disease of taro. In addition to leaf blight the pathogen can also cause rot symptom on petiole, flower, stem base and corm. All symptoms are not always found on the same plant.

Disease intensity is higher in monoculture cropping that in mixed cropping systems.

Intensity of leaf blight disease showed a linear relationship to yield components. The increase of disease intensity was followed by decrease in corm weight. Corm size and number of sucker were unaffected.

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Table 2. Correlation between IP, corm weight unit area (BU), the length of corm (PU), corm diameter (DU), and number of suckers (JA) in monocculture (above the diagonal) and mixed cropping systems (below the diagonal).

Observed components	IP	BU	PU	DU	JA
IP	-	-0.938**	-0.581*	-0.325	-0.151
BU	-0.914**	-	0.983**	0.389	0.025
PU	-0.534	0.731*	-	0.329	0.016
DU	-0.073	0.364	0.703	-	0.040
JA	0.355	-0.312	-0.297	0.099	-

*Significant at 0.05; **Significant at 0.01

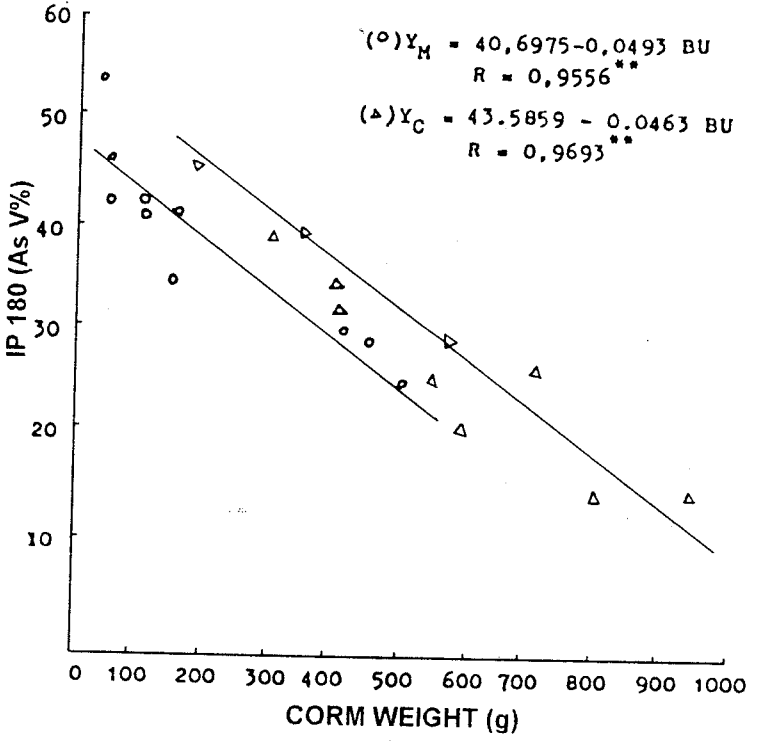

Figure 1. Regression of IP on corm weight per crop. Circles - monoculture, triangles - mixed cropping.

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