FOLIAR DISEASES OF TARO IN THE WAHGI VALLEY OF THE WESTERN HIGHLANDS PROVINCE OF PAPUA NEW GUINEA

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ABSTRACT

*Foliar diseases of taro (*Colocasia esculenta *(L.) Schott) in three areas of the Wahgi Valley in the Western Highlands of Papua New Guinea was investigated. Alomae Bobone Virus Complex (ABVC), Ghost Spot (*Cladosporium colocasiae *Saw.) and Dasheen Mosaic Virus (DMV) diseases were detected at all sites. ABVC and Ghost Spot affected between 70 - 100% of varieties. Taro Leaf Blight (*Phytophthora colocasiae *Rac.) disease was not found at any of the sites.*

Keywords: Foliar diseases, Colocasia esculenta, *Wahgi Valley*

INTRODUCTION

Taro (*Colocasia esculenta* (L.) Schott.), an important staple tuber crop in many parts of Papua New Guinea, has declined in production (Bourke 1982). Factors such as soil fertility decline, pests, diseases and the growing of other higher yielding tuber crops have contributed to the decline of taro production. Nevertheless taro is currently one of the most expensive tuber crop in Papua New Guinea. Diseases could be contributing to the decline in production as has occurred in other taro growing areas. The foliar diseases that are considered to be economically important are: Taro Leaf Blight (TLB), Alomae Bobone Virus Complex (ABVC), Dasheen Mosaic Virus (DMV), Ghost Spot and some others. A survey was done in the Wahgi Valley during the first week of April 1996 to observe the status of these diseases in randomly selected gardens. Information gathered may caution and guide farmers, extension workers and researchers when transferring taro germplasm from one region to another.

MATERIALS AND METHODS

Location

The Wahgi Valley is located in the Western Highlands Province. The Valley floor is found at 1400 to 1800 metres altitude. The sites visited were Domil, Kopolong and Barawahgi. The former two sites are at 1500 to 1600 m and the latter at about 1450 m a.s.l.. Three gardens were randomly selected in each village. Sizes of gardens at Kopolong and Domil were in the range of 6 - 7 m^2 whereas Barawahgi was about 4 - 5 m^2. Other crops such as banana (*Musa* cvs.), sugarcane (*Saccharum officinarum* L.), saiyor (*Rungia klossii* S. Moore), sweet potato (*Ipomoea batatas* (L.) Lam.) and highlands pitpit (*Setaria palmifolia* (Koenig) Stapf) were being grown among taro. Disease incidence and severity assessment were made and the different varieties grown were recorded. The gardens selected had taro of about four to five months old.

Disease Assessment

The disease incidence (DI) and severity on individual plants were visually assessed. Symptoms descriptions of ABVC and DMV used by Jackson (1978), Zettler and Jackson (1979) and Shaw *et al.* (1979) were used to visually assess the two parameters. A key and formula modified from Anon. (1947) was used to calculate the two parameters. For disease incidence calculations, the number of plants affected was expressed as a percentage over the total of each variety. The formula used is:

$$DI = \frac{(\text{Total number of plants - Non diseased plants})}{\text{Total number of plants}} \times 100$$

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To quantify the intensity of disease presence on the plants, half of all the varieties grown were assessed. The surface area affected and types of symptoms shown were assessed for individual leaves. Scores of 1, 2 and 3 were given for less, moderate and severe symptoms respectively. The sum of the scores over total number of leaves multiplied by 3 expressed as a percentage is the severity of the disease of that variety. The formula is:

$$DS = \frac{\text{Sum of all scores} \times 100}{\text{Total number of leaves} \times 3}$$

Disease severity (DS) of ABVC and DMV was calculated using the above formula but scores given were based on types and stages of development of symptoms expressed. Mild, moderate and severe symptoms of leaf crinkling, mottling, puckering, rolling, stunting etc. were given scores of 1, 2 and 3 with signs +, ++ and +++ respectively. The disease rating legend is given in Appendix 1.

RESULTS

Taro Leaf Blight disease caused by the fungus *Phytophthora colocasiae* Rac. was not detected at the sites visited although the disease was reported to be present in the area (Kokoa 1991). Ghost spot caused by *Cladosporium colocasiae* Saw. affected all

Table 1. **Taro Leaf Diseases Incidence and Severity at the three locations**

Location	Taro variety number	Diseases							
		TLB		Ghost Spot		ABVC		DMV	
		DI	DS	DI	DS	DI	DS	DI	DS
Kopolong	1p	0	0	30	+	100	+		
	2	0	0	100	++	80	++		
	3d	0	0	80	++	100	+		
	4	0	0	-	-	20	+		
	5t	0	0	80	+	100	++	20	+
Domil	1p	0	0	10	+	100	+		
	2	0	0	-	-	-	-		
	3d	0	0	100	++	100	++		
	4	0	0	60	+	100	++		
	5	0	0	-	-	60	+		
	6	0	0	100	++	100	+		
	7	0	0	100	+	60	+		
	8	0	0	-	-	-	-		
	9t	0	0	100	++	100	++	50	++
Barawahgi	1t	0	0	100	++	100	++		
	2d	0	0	100	+	100	+		
	3	0	0	100	+	100	+		

Note: **a/ Letters after taro variety number indicate the same variety at different locations.**
b/ DI = disease incidence expressed as a percentage
c/ DS = disease severity
+ = mildly affected,
++ = moderately affected
+++ = severely affected. ***(See appendix 1)***

the varieties at Barawahgi and more than 70% of varieties at Kopolong and Domil. Older leaves were more vulnerable to this disease, especially those of the green pigmented varieties.

Dasheen Mosaic Virus (DMV) disease was observed at Kopolong and Domil on the same variety. The symptoms observed at the former location was only main vein chlorosis with feathery pattern of mosaic on some of the lateral veins. Symptoms at the Domil location were moderately severe showing leaf curling with distorted chlorotic feathery pattern of mosaic, crinkling and puckering. The pattern seemed to be coupled with ABVC.

Alomae Bobone Virus Complex (ABVC) disease incidence was about 78% at Domil and 100% at Kopolong and Barawahgi. Two dark purple pigmented varieties grown at the former location showed no visible symptoms of ABVC on any plant. Apart from those two varieties, most characteristic symptoms of ABVC viz., mid leaf crinkles, leaf puckering, severe leaf crinkle and thickening of lateral veins, were seen on all varieties grown at the three sites. The most severe symptoms of ABVC such as leaf rolling, enlarged stunted outgrowth of leaf petiole, severe stunting of youngest leaf with rolled up lamina and death were not observed.

The intensity of ABVC disease symptoms was much higher in the commonly grown taro varieties.

DISCUSSION

A high incidence of ABVC and Ghost spot was recorded at all three sites. Only one taro variety showed symptoms of DMV at two locations. Taro leaf blight was not detected at any of the sites although the disease was recorded at Kuk Agriculture Research Station at an altitude of 1590 m above sea level in 1986 (Kokoa 1991). The higher altitude of above 1400 m and lower day and night humidity could be possible reasons for the absence of the disease. Ghost spot (*Cladosporium colocasiae* Saw.) was reported to be endemic in the country (Shaw 1984; Muthappa 1987; Kokoa 1991).

ABVC disease is likely to be the most serious at these sites in the near future as common varieties are substantially affected. The higher intensity of ABVC symptoms expressed on the commonly grown taro varieties could be due to the viruses build up over time. The disease is presently seen to be the most serious after Taro leaf blight in the wet lowlands of the country but may become important. Varieties that showed no or little symptoms should be collected and used in breeding for ABVC tolerance.

Ghost spot showed similar patterns at the sites but is of less significance as it only affects older leaves. The effect of the disease on the performance and yield of taro is, however, unknown.

Generally ABVC and Ghost spot incidence and severity were similar at the three sites. It shows that the diseases' intensity and development is similar throughout the Waghi valley.

Farmers in the area should be encouraged to use suckers as planting material in new gardens to reduce virus spread by planting material. Fungicidal control on Ghost spot is uneconomical as the disease does not cause appreciable losses (Trujillo 1967).

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Appendix 1

	Disease Rating Scale	
Diseases	**Score**	**Sign**
Ghost Spot *Cladosporium colocasiae*		
1 - 20 % of leaf area affected	1	+
21 - 50 % of leaf area affected	2	++
> 50 % of leaf area affected	3	+++
Alomae Bobone Virus Complex (ABVC)		
Localised mild symptoms of leaf crinkling, puckering and rolling.	1	+
Moderate symptoms of leaf crinkling associated with thickening of lateral veins, puckering and vein rolling, clearing etc.	2	++
Both the above with severe stunting and out-growth of petiole and stunting of youngest leaf with rolled up lamina and death eventually.	3	+++
Dasheen Mosaic Virus (DMV)		
Mild localised mosaic symptoms	1	+
Moderate symptoms covering nearly half of the leaf.	2	++
Severe mosaic and distortion symptoms affecting the entire leaf.	3	+++