RESISTANCE OF COLOCASIA ESCULENTA *TO LEAF BLIGHT CAUSED BY* PHYTOPHTHORA COLOCASIAE.

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ABSTRACT.

Trials conducted at Keravat from 1960 *to* 1965 *showed that seven selected taro clones were weakly to moderately resistant to* Phytophthora *leaf blight. Production of suckers, normally very variable between clones, considerably affected results.*

INTRODUCTION.

INOCULATIONS in Hawaii (Anon. 1938) showed that none of the 45 varieties of taro (*Colocasia esculenta*) tested was resistant to leaf blight (*Phytophthora colocasiae* Racib.). Parris (1941) tested 32 varieties in Hawaii and found none resistant.

Deshmukh and Chhibber (1960) found an Indian variety of *C. antiquorum* on which there was reduced sporulation on black, presumably hypersensitive, lesions caused by *P. colocasiae.* Paharia and Mathur (1964) conducted a laboratory test on leaf discs from 20 Indian selections of *C. antiquorum* and found only one immune from leaf blight. The significance of neither this immunity nor the partial resistance of several other clones (varieties) mentioned in this paper has been stated.

For some years *Phytophthora* leaf blight of taro (*C. esculenta*) has caused occasional concern in parts of the Territory of Papua and New Guinea. Seven clones comparatively free of the disease were collected from food gardens on Buka Island, Bougainville District by Mr. J. C. Lamrock. Trials were conducted to estimate the level of resistance in these selections and, if possible, make suitable varieties available for distribution.

All taro clones tested were collected from village gardens and can therefore be classed as acceptable from a culinary angle. However, taste tests were conducted to check the suitability of the selections.

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METHODS.

The first trial was conducted by Dr. R. J. van Velsen, at Keravat. Setts of each selection were planted in June, 1959, in single rows, alternating with rows of a clone, designated Local Taro, commonly grown near Keravat and often moderately or severely blighted. The plants were naturally infected with *P. colocasiae* and records of infection were taken in March, 1960. Counts were made on ten plants of each selection and on 20 of the Local Taro. Taste tests were conducted on tubers roasted over an open fire with Nakanai labourers doing the judging.

The second trial, conducted by the author, was planned similarly to the first, replacing the Local Taro with agronomic selections not selected for freedom from leaf blight. The area was planted in January, 1963, spray-inoculated with a suspension of sporangia in June and records taken in July, 1963. Flavour tests were made on boiled tubers in November.

The third trial was a randomized block experiment, blocks I and II of which were planted in November, 1964, and blocks III, IV, V and VI in February, 1965. Each block consisted of two sections of 100 plants each. Each section contained four plots of four plants each with double rows of Local Taro between and around each plot. The plants were unified as much as possible by periodic pruning, leaving one sett in each plant. No permanent labels were used, thereby eliminating any possible bias during recording. Blocks I and II were inoculated in January, 1965 ; the remainder were naturally infected from these. Records were taken in

May, 1965, and March, 1966, of number of lesions on each leaf. Pruning and weeding were not supervised from June, 1965, to March, 1966.

RESULTS.

The results for all trials are shown in *Table* 1. Significance, denoted by letters a, b, etc., was calculated using a 2 x 2 contingency test, exemplified in the Appendix. Only the results of the third trial at the first reading are relatively unbiased by the growth habit of the plants ; these show only one clone, Seeru-Lemankoa, with significantly more blight-free leaves than the Local Taro. Seeru-Lemankoa may be classed as moderately resistant ; the remaining clones, all having less blight than unselected material in all trials, as weakly resistant.

An analysis of variance of mean numbers of uninfected leaves per plant (= sett) at the first reading in the third trial proved insignificant at the 5 per cent. level.

Tests conducted at the completion of the first trial showed favourable taste in selections Seeru-Iltopan, Hububin-Lontis and the Local Taro. Tests after the second trial showed best taste in (in decreasing order of suitability) :—

Remat A (variety not selected for blight resistance) ;

Seeru-Lemankoa ;

Seeru-Tahai Tahai ;

Seeru-Iltopan ; and

Hububin-Lontis.

DISCUSSION.

Assessment of disease.

Mean numbers of lesions per leaf were difficult to analyse. Within a sett the youngest leaf usually had few or no lesions and the number of lesions was greater on successively older leaves. The oldest living leaves were often a mass of lesions (*Plate* I), impossible to count ; it was difficult to judge whether some nearly moribund leaves should have been included in the assessments. For this reason, the simple record of presence or absence of lesions on a leaf was considered in the main analysis. There was no difference between any of the varieties in the colour, size and shape of lesions on which to base an assessment.

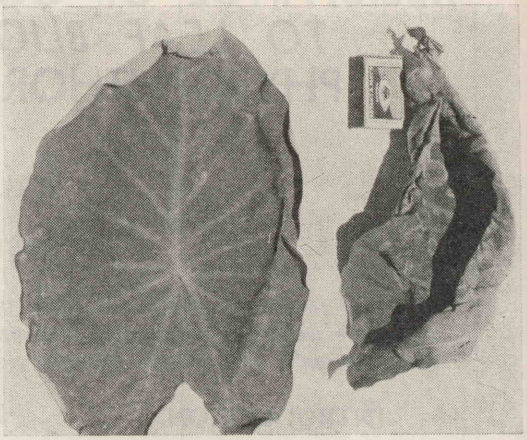

Plate I.—Leaves of *Colocasia esculenta* with six (left) and many (right) blight lesions respectively caused by *Phytophthora colocasiae.* The lesions are indicated in the inset by shaded areas.

Suckering.

Unpruned plants of clones selected for resistance very frequently produced more suckers than the unselected ones (unpublished results) and frequently more leaves (see *Table* 1 except for the third trial, first reading). This led to a higher turnover of leaves and consequently at any time, the plants with greater leaf numbers had relatively more young ones. For example, at the time of reading the second trial, Kaf Kaf 1, unselected, had 265 leaves on 60 setts while Seeru-Iltopan, selected, had 245 leaves on 86 setts. The mean numbers of uninfected leaves per sett were 1.30 and 1.48 respectively, much closer figures than the percentage infected of total leaves.

From one trial to the next some clones produced consistently high or low numbers of suckers but others, notably Seeru-Tandeki and Seeru-Tahai Tahai, fluctuated considerably. Pruning had little residual effect as can be seen in *Table* 1, third trial, second reading, where numbers of leaves per plant are much higher than they were nine months previously.

The results in unpruned taros were therefore biased against Seeru-Lemankoa and the unselected taros which generally produced few suckers.

Table 1.—Assessment of Leaf Blight of Taro at Keravat.

CLONE (For blight-free selections the name of the village from which they were selected follows the native name for the morphological type.)	NUMBERS OF LEAVES RECORDED (WITH NUMBERS OF PLANTS IN PARENTHESIS)											
	1st TRIAL *			2nd TRIAL			3rd TRIAL FIRST READING			3rd TRIAL SECOND READING		
	I	U	% I / I + U	I	U	% I / I + U	I	U	% I / I + U	I	U	% I / I + U
Seeru-Iltopan	78	399 (10)	16.4 b †	118	127 (16)	48.2 a	34	48 (24)	41.5 ab	18	124 (11)	12.7 ab
Seeru-Lemankoa	45	199 (10)	18.4 bc	27	30 (8)	47.4 ab	34	56 (24)	37.8 a	19	190 (20)	9.1 a
Seeru-Tandeki	74	420 (10)	15.0 b	90	77 (13)	53.9 ab	20	21 (12)	48.8 ab	1	42 (10)	2.3 a
Pi-Tahai Tahai	52	295 (10)	15.0 ab	158	142 (16)	52.7 ab	40	49 (24)	44.9 ab	27	232 (18)	10.4 ab
Hububin-Lontis	46	135 (10)	25.4 c	207	149 (15)	58.1 cb	45	46 (24)	49.5 ab	5	66 (8)	7.0 a
Seeru-Tohatsi	91	472 (10)	16.2 b	175	127 (16)	57.9 cb	38	47 (24)	44.7 ab	9	98 (12)	8.4 a
Seeru-Tahai Tahai	67	603 (10)	10.0 a	89	41 (16)	68.5 cd	48	42 (24)	53.3 ab	47	172 (17)	21.5 cb
Local Taro	112	150 (20)	42.7				42	32 (22)	56.8 b	16	35 (10)	31.4 c
K. Taro 9				130	18 (16)	87.8 e						
Kaf Kaf 10				122	24 (12)	83.6 ed						
Ramat A				157	63 (16)	71.4 d						
Kaf Kaf 1				187	78 (16)	70.6 d						

* Results due to R. J. Van Velsen ; analysis by the author.

† Results associated with the same letter do not differ significantly from one another at the 1 per cent. level.

I = number of leaves infected. U = number of leaves uninfected.

Palatability.

Although there were differences between clones in palatability of the cooked tubers, they were originally selected from native gardens and probably have acceptable flavours.

Yield.

No yield records were made since tubers often failed to mature, mainly due to grub (Scarabidae) invasion.

Identity of varieties.

Three of the clones, Seeru-Lemankoa, Seeru-Tahai Tahai and Local Taro were identified at the Division of Botany, Department of Forests, Lae as belonging to the species *Colocasia esculenta* (L) Schott. Flowers and seeds of the remainder have not been collected but it may be assumed, meanwhile, that all of the clones are *C. esculenta.*

CONCLUSION.

None of the taros selected for low incidence of *P. colocasiae* infection in the field proved immune when grown with susceptible taros in the field at Keravat, New Britain. One clone, Seeru-Lemankoa, may be considered moderately resistant as a result of these tests, the remainder weakly resistant. All clones may be considered to have an acceptable taste.

Growth habit had a marked effect on incidence and must be controlled for comparable results between clones.

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Appendix.

CALCULATION OF SIGNIFICANCE OF RESULTS.

The results for Seeru-Tandeki and Local Taro in the first trial are used to show how the significance in the table was calculated by the 2 x 2 contingency test as follows :—

	Infected.	Uninfected.	Total for variety.
Seeru-Tandeki	74	420	494
Local Taro	112	150	262
Class Total	186	570	756

$$x^2 = \frac{((150 \times 74) - (112 \times 420))^2 \times 756}{186 \times 570 \times 494 \times 262}$$

$$= 71.2$$

A value of x^2 of 3.85 is significant at the 5 per cent. level,

6.64 is significant at the 1 per cent. level,

and 10.9 is significant at the 0.1 per cent. level.

Therefore, 71.2 is significant at a level less than 0.1 per cent.