

REACTION OF CASSAVA PLANTS TO BROWN LEAF SPOT INFECTION

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ABSTRACT

PRC 24 cassava plants inoculated with *Cercospora henningsii* at 8 weeks after planting manifested the earliest symptom and defoliation. Initial symptoms of cassava brown leaf spot disease are light green, round lesions about 3.5 mm in diameter which later turn greenish brown. These lesions then coalesce and result in blighting and subsequent defoliation. Out of the 98 cassava accessions tested for susceptibility to the disease, 28 accessions were rated to be resistant with total lesion area ranging from 0 to 0.5 cm².

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KEY WORDS: Cassava. Varietal resistance. *Cercospora henningsii*. Brown leaf spot disease. Susceptibility.

INTRODUCTION

Cassava brown leaf spot disease (caused by *Cercospora henningsii*) was considered of minor importance when it was first reported in the

Philippines (Reinking, 1918). Recently, it has become one of the most common root crop diseases in the country and is predicted to assume an economic impact especially with the increasing cultivation

of cassava for animal and human consumption. Since the development of the disease is usually favored by high temperature, the occurrence of cassava brown leaf spot disease is widespread during hot months in the Philippines. The disease is also considered an important destructive malady in Panama (Toller et al., 1959) and Colombia (Castaño, 1969).

Studies on the control of the disease received little attention since the damage that is inflicted often appears negligible. Nevertheless, control of cassava brown leaf spot disease is necessary in cases of severe infection. An effective method of control is the planting of resistant cassava varieties.

This study presents the susceptibility of PRC 24 (cv. Golden Yellow) cassava at different ages and the reaction of cassava varieties/accessions to the disease.

MATERIALS AND METHODS

Effect of Plant Age

Stems of PRC 24 (cv. Golden Yellow) cassava were cut into 30-cm long seed pieces and two seed pieces were planted in 30-cm diameter clay pots filled with sterile soil. One set of test plants was inoculated with *C. henningsii* at the same time but at different ages and planted at 2-week intervals. Another set was inoculated at different times and planted simultaneously.

The completely randomized design (CRD) with 10 treatments and four replications was followed in

setting up the experiment. A total of 4 trials was conducted. Each trial consisted of 40 pots with 2 plants per pot. The plants were subjected to natural infection following the schedule listed below.

- T2 = Plants inoculated 2 weeks after planting (WAP)
- T4 = Plants inoculated 4 WAP
- T6 = Plants inoculated 6 WAP
- T8 = Plants inoculated 8 WAP
- T10 = Plants inoculated 10 WAP
- T12 = Plants inoculated 12 WAP
- T14 = Plants inoculated 14 WAP
- T16 = Plants inoculated 16 WAP
- T18 = Plants inoculated 18 WAP
- T20 = Plants inoculated 20 WAP

The test plants were exposed to natural infection at different stages of growth and observed daily for symptoms of the disease.

Screening for Resistance. - Different cassava accessions were randomly planted in rows of 10 hills and bordered with PRC 24. When they were about 6-8 months old, 10 leaves were sampled per accession to determine the average number and area of lesions.

A rating scale was devised to assess the susceptibility or resistance of the different cassava accessions based on the total area of the lesions (TAL) in sq cm which was obtained by multiplying the average number of lesions with average lesion area in 10 leaf samples per accession. The cassava accessions were rated resistant (0-5 TAL), moderately resistant (5.1-10 TAL), moderately susceptible (10.1-15 TAL) and susceptible (> 15 TAL).

RESULTS AND DISCUSSION*Disease Development*

At about 25 days after natural infection (i.e. test plants were placed in between infected cassava plants in the field), light green round lesions were found on both middle and lower parts of mature leaves. The lesions, about 3-5 mm in diameter,

were visible on both surfaces of the leaf although these were more prominent on the upper surface. Four to 5 days later, the light green lesions turned greenish brown to brown reaching their maximum size of 7 mm at this stage (Fig. 1A). Coalition of adjacent lesions was observed at 4 to 7 days after their appearance (Fig. 1B). In some instances, coalesced lesions com-

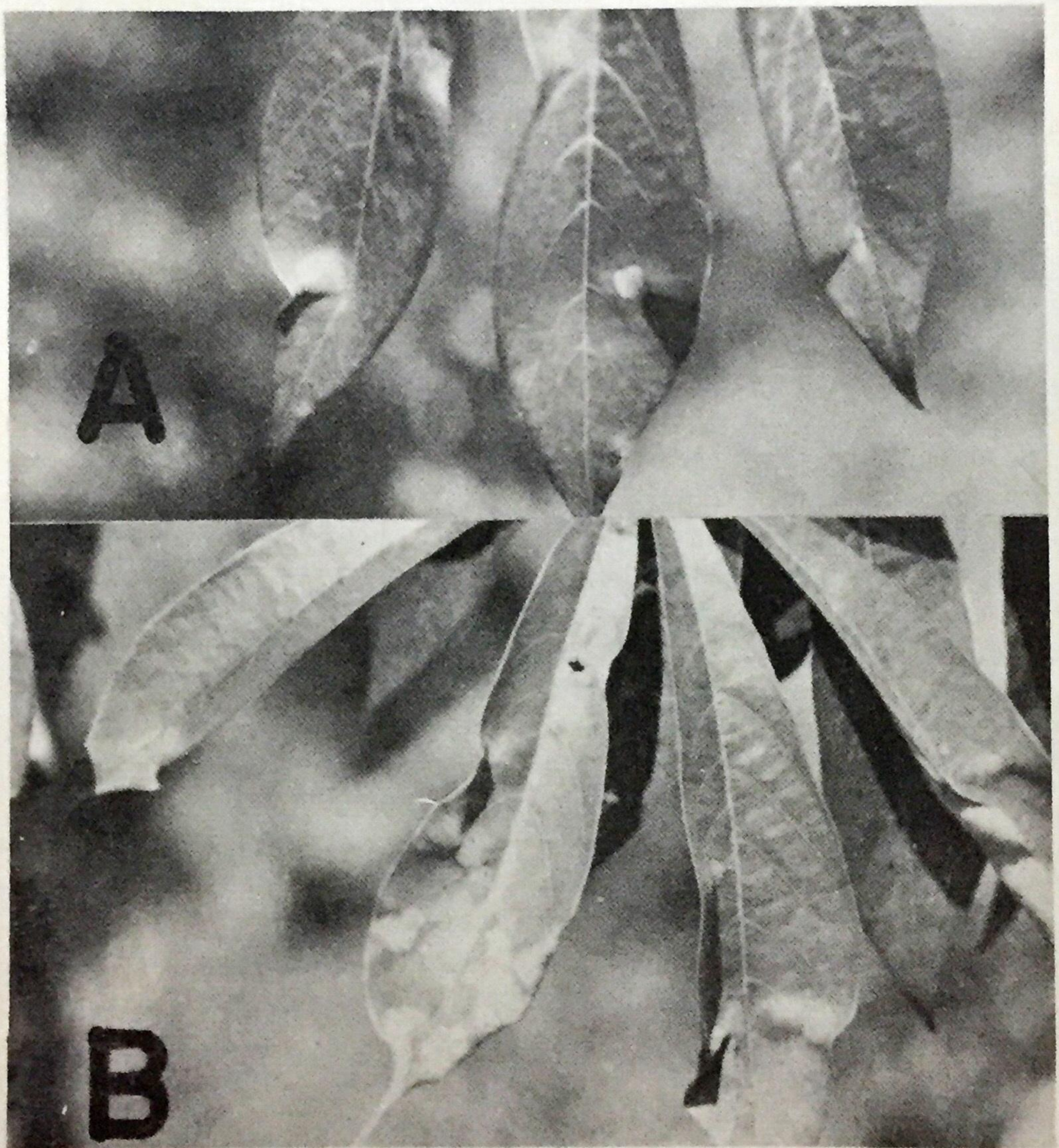


Figure 1. Cassava leaf showing distinct circular, greenish-brown lesions of cassava brown leaf spot disease 25-30 days after inoculation (A) and coalition of adjacent lesions 4-7 days after their appearance (B).

bined with one another. Hence, a total of 10-15 or more lesions could sometimes be found in a coalesced lesion. This type of coalition resulted in blighting and subsequent defoliation.

Reaction of Test Plants to Natural Infection

Table 1 shows the number of days from natural inoculation with *Cercospora henningsii* to appearance of symptoms and defoliation. Plants inoculated at 8 weeks after planting (T8) exhibited symptoms of the disease and defoliation ahead of all the other treatments. It took a longer time for plants younger than those in T8 to show symptoms of the disease and defoliation despite the former's younger age. This could be attributed to the observation that under field conditions, *C. henningsii* infected only the fully mature leaves. In contrast, plants older than plants in T8 which had more mature leaves failed to show early symptom and defoliation. Apparently, plants exposed to natural inoculum 8 weeks after planting were most susceptible to infection under field conditions. The failure of the plants younger and older than 8 weeks to exhibit early symptom could probably be attributed to inhibitory components in the said plants which hindered the successful establishment of the fungus.

Number of Lesions per Leaf

Plants inoculated at 8 weeks after planting had the highest num-

ber of lesions per leaf (Table 1). Plants inoculated earlier or later than 8 weeks had significantly less lesions per leaf. However, the number of lesions per leaf in plants inoculated later than 8 weeks was significantly higher than those inoculated earlier than 8 weeks. Infection was most severe in 8-week old cassava plants which further indicates that this stage is most susceptible to brown leaf spot infection.

Size of Lesion

Plants inoculated at 8 weeks after planting had the biggest lesion (Table 1). On the other hand, plants inoculated earlier or later than 8 weeks after planting had significantly smaller lesions. However, size of lesions in older plants was significantly smaller compared to those in younger ones. Many disease pathogens prefer younger plants for the development of a disease, hence plants younger than 8 weeks were expected to have larger lesions. However, this was not shown by the results of this study. This could probably be explained by the ability of the younger tissues to recover faster because of rapid cell division. In addition, younger leaves probably contain more inhibitory substances which prevented rapid development of the disease. In support of the given reasons, Ciferri (1953) reported that under natural conditions, younger (not fully developed) leaves were very resistant or immune to circular leaf spot of cassava. He further revealed that solutions of untreated anthocyan from young

Table 1. Summary table on the effect of *Cercospora henningsii* infection on PRC 24 cassava cultivar at different ages.¹

Plant Age (weeks)	Number of Days		Lesions in the Leaf			
	Symptom Appearance	Defolia- tion	Number per Leaf ²	Size ³ (mm)	Coalition %	Defoliation %
2	26.5a	50.5a	14.38i	5.01de	3.70h	7.00d
4	25.5ab	49.5ab	18.40h	5.63bc	8.60de	11.33bc
6	24.5bc	49.5ab	21.95f	5.66b	9.75bc	14.35b
8	23.5c	36.0d	32.55a	6.15a	12.68a	18.30a
10	25.0abc	44.0c	25.23b	5.26de	10.35b	13.20bc
12	25.5ab	47.0b	24.83bc	5.03de	10.06b	12.80bc
14	26.0ab	49.0ab	23.50d	5.02de	8.73cd	12.02bc
16	25.0abc	49.0ab	23.60d	4.99de	7.58ef	11.17c
18	25.5ab	48.5ab	22.98de	4.99de	6.91fg	11.05c
20	25.5ab	49.5ab	21.82fg	4.86e	6.33g	10.50c
Average	25.25	47.25	22.93	5.26	8.47	12.90

¹In a column, treatment means followed by a common letter are not significantly different at 5% level based on DMRT.

²Based on 20 leaves/trial

³Based on all lesions in sample leaves

leaves inhibited germination of conidia.

Plants older than 8 weeks, which showed smaller lesions than the 8-week old plants, probably developed resistance as they matured.

Percentage Coalition of Lesions

Plants younger or older than 8 weeks had significantly lower percentage coalition of lesions than 8-week old plants (Table 1). However, percentage coalition in plants younger than 8 weeks was generally significantly lower than those in the older plants. Coalition of lesions occurred at 4 to 7 days after the initial appearance of symptom. Coalesced lesions, usually composed of 2 or more lesions, resulted in blighting of leaves and subsequent defoliation. This again suggests that younger leaves probably contain inhibitors of fungal germination which cause a lower degree of infection resulting to small-sized and lesser lesions.

Percentage Defoliation

Highest percentage defoliation was obtained in plants inoculated at 8 weeks after planting (Table 1). Plants younger or older than 8-week old plants had significantly lower percentage defoliation than 8-week old plants. Furthermore, 2-week old plants exhibited the lowest percentage defoliation. This suggests that defoliation was enhanced in plants inoculated at 8 weeks after planting but not at earlier or later stages.

The results obtained in this study suggest that plants inoculated at 8

weeks after planting were most susceptible to cassava brown leaf spot infection. It was further observed that the pathogen preferred the middle leaves of cassava plants. In this regard, Chevaugeron (1956 as cited by Lozano and Booth, 1976) demonstrated that infection commonly occurred in old leaves. However in some varieties like PRC 24, younger leaves were sometimes infected. It is probable that the middle leaves provide the conditions favorable for the growth of the pathogen.

Screening for Disease Resistance

The results obtained using PRC 24 (Table 1) show that the optimum period to inoculate plants would be at 8 weeks after planting. This might be adopted for preliminary screening of a large batch of cassava crosses or accessions. However, under field conditions the cassava brown leaf spot disease generally becomes more severe when the cassava crop is already more than 5 months old. Hence, the cassava plants were rated for disease resistance between 6-8 months after field planting.

A total of 98 cassava accessions was studied for their susceptibility to cassava brown leaf spot disease in the field. Based on the total area of lesions (TAL), 28 accessions were resistant with 0-5 TAL while 16 accessions were susceptible with more than 15 TAL (Table 2). With this information, development of hybrids resistant to the cassava brown leaf spot disease can be initiated.

Table 2. Reaction of different cassava accessions after natural infection with *Cerospora henningsii*.

Resistant (0-5 TAL)							
Acc. ¹	TAL ²	Acc.	TAL	Acc.	TAL	Acc.	TAL
20	0	82	1.7	1515	0	237	0
23	0	86	4.3	164	0	243	0
30	4.1	88	4.7	182	0	BPI-6	0
41	0	102	0	194	0	C-CS 166	0
52	0	117	0	216	0	C-CS 192	0
73	0	120	5.0	217	3.5	C-CS 487	0
81	0	131	3.5	221	0	C-CS 1984	0
Moderately Resistant (5.1-10 TAL)							
Acc.	TAL	Acc.	TAL	Acc.	TAL	Acc.	TAL
1	7.2	28	7.4	109	6.7	152	6.3
4	6.3	36	7.1	111	9.7	158	7.5
5	8.0	43	9.0	121	9.0	168	8.3
6	8.0	47	8.3	123	7.3	177	6.9
9	5.4	49	9.1	124	7.3	210	9.5
10	8.2	98	5.4	129	9.4	C-CS 179	7.6
11	7.5	100	5.7	138	7.8		
17	8.0	108	5.4				
Moderately Susceptible (10.1-15 TAL)							
Acc.	TAL	Acc.	TAL	Acc.	TAL	Acc.	TAL
3	10.5	46	13.6	107	10.3	174	11.1
9	12.1	48	13.0	110	10.4	184	10.7
13	13.2	79	13.5	112	14.5	218	13.8
21	14.6	84	11.9	114	12.3	220	13.0
32	13.6	103	13.3	119	12.4	232	12.0
35	14.5	104	13.0	126	12.0	C-CS 156	13.3
						C-CS 184	11.1
Susceptible (> 15 TAL)							
Acc.	TAL	Acc.	TAL	Acc.	TAL	Acc.	TAL
2	16.6	33	16.2	50	15.5	96	15.1
12	22.9	34	16.8	66	20.0	106	17.6
19	16.3	38	16.8	71	25.0	125	16.5
29	17.3	39	20.0	72	28.0	166	20.0

¹ Accession number in PRCRTC cassava germplasm collection

² TAL - Total area of lesions (cm²) obtained by multiplying the average number of lesions with average lesion area in 10 leaf samples per accession.

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