



## REDUCED MORPHOLOGICAL ROOT FEATURES OF ANTHRACNOSE INFECTED COWPEAS (*Vigna unguiculata* (L) Walp)

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### ABSTRACT

In a green house experiment to determine the effects of anthracnose disease caused by *Colletotricum lindemuthianum* on cowpea, sterilized soils in planting pots were used for planting two susceptible cowpea varieties (Ife Brown and IT82-60). The seedlings were inoculated with the inoculum meal of the pathogen after 3 weeks of planting. The results obtained show that characteristic tan to brown anthracnose symptoms had appeared on the leaves of both varieties after 3 weeks of inoculation, while the roots of the infected cowpeas were observed to be morphologically different from the roots of the uninfected plants. Similarly, infected plants were smaller in size and there was a marked reduction in their yield IT82-60 (35%) versus Ife Brown (19%). The reduction of the plant structures and yield of the infected plants was suspected to have been as a result of the anthracnose disease.

Keywords: Anthracnose disease, *Colletotricum lindemuthianum*, cowpea

### INTRODUCTION

Anthrachnose disease of cowpea has long been known and reported in Nigeria. The causative organism was identified as *Colletotricum lindemuthianum* (Onesirosan and Baker, 1971). It affects the leaves, stems pods and even the seeds but its effect on the roots has not been commonly reported. The disease is known to reduce cowpea yields by as much as 50% in very susceptible varieties (Williams, 1974; Fakorede, 1976; Emechebe and Shoyinka, 1985). Anthracnose is a disease characterized by distinctive limited lesions on stem, leaf or fruit, often accompanied by dieback and usually caused by *Gleosporium* or *Colletotricum* imperfect fungi (Reinhold, 1990). Individual lesions of anthracnose are lenticular, sunken and tan to brown (Onesirosan and Bakar, 1971; 1971; Williams, 1975). All above ground parts may be infected (IITA, 1982; Lucas *et al.*, 1992) but rarely the roots (Lucas *et al.*, 1992). Butler and Jones (1961) reported that the roots are not affected and the foliage leaves may not be badly affected. The objective of this study was to determine the effects of anthracnose disease on cowpea plants and on their yields.

### MATERIALS AND METHODS

This work was carried out in the green house and laboratories of the Department of Crop Protection and Environmental Biology of the University of Ibadan, Ibadan, Nigeria in 1996.

#### Soil sterilization and planting of seeds

Topsoil was collected and sterilized at 15 psi (121°C for 15 min) and then filled into labeled planting pots. The

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cool (ca 23°C) soil were moistened with tap water till saturation, after which susceptible cowpea seeds (IT82<sup>F</sup>-60 and Ife Brown) obtained from the International Institute of Tropical Agriculture (I.I.T.A.), Ibadan, Nigeria were planted in the respective labeled pots at the rate of 3 seeds/pot. There were 3 replications. 100% germination was obtained and all seedlings were established. Upon steady growth, they were thinned to 2 plants/pot.

#### Inoculation of seedlings

At 22 days after planting (D.A.P) the seedlings were inoculated with the inoculum meal of *C. lindemuthianum* (also obtained from I.I.T.A; Ibadan, Nigeria) as described by Adebitan (1991) with a little modification.

The inoculum meal was prepared by adding 40 g of ground dry cowpea seeds of the respective varieties unto sporulated growth of the pathogen (*C. lindemuthianum*) cultured on PDA (Oxoid). Plants were inoculated by using sterile razor blade to wound about 1 cm diameter of the seedling stems following which 0.5 g of the inoculum meal (paste) was placed on the wound, taped with cellotape, and subsequently allowed to stand for 4 days at ambient temperature. A total of 12 plants were inoculated (2 plants/pot, 3 pots/variety). Total number of infected plants is shown (Table 1).

Three weeks after the inoculation when the disease symptoms were evident on the leaves, the plants were carefully thinned to a plant/pot under wet conditions of soil.

#### Harvesting and yield determination

Harvesting of Ife Brown started by the 8<sup>th</sup> week after planting (W.A.P) while that of IT82<sup>F</sup>-60 started by the 9<sup>th</sup> WAP. Ripened dried pods were frequently picked and put into separate labeled harvest bags. Pods were hand broken and seeds were collected and weighed.

## RESULTS AND DISCUSSION

#### Disease incidence

Disease symptoms began appearing as from the 14<sup>th</sup> day of inoculation. By the 3<sup>rd</sup> week after inoculation, 16.67% of the uninoculated and 66.67% of the inoculated IT82<sup>F</sup>-60 cowpea variety were infected. Also, 50% and 83% of the uninoculated and inoculated Ife Brown variety was respectively infected. This was determined by presence or absence of disease symptom and not degree of infection (Table 1).

Table 1. Percentage infection of cowpea seedlings after 21 days of inoculation

Treatment	Total plants (2/pot)	Number infected	Number uninfected	Percentage infected
IT82 <sup>F</sup> -60 Uninfected	6	1	5	16.67
IT82 <sup>F</sup> -60 Infected	6	4	2	66.67
Ife Brown Uninfected	6	3	3	50.00
Ife Brown Infected	6	5	1	83.33

#### Disease symptoms

The disease symptoms on the leaves are shown on Fig. 1. It is evident in this study that there was a marked reduction in the growth of the inoculated plants as compared with the uninoculated plants. This could be seen in terms of reduced plants height, leaf number as well as reduced size and number of pods (Fig. 2). This is attributable to anthracnose infection.

As shown in Figs. 3 and 4, a difference in length of the primary (tap) root in both treatments was observed, as well as the amount of both secondary and tertiary roots of both varieties. As observed, the uninfected plant roots had longer tap roots/more root hairs and even higher incidence of root nodules as against those of the infected plants.

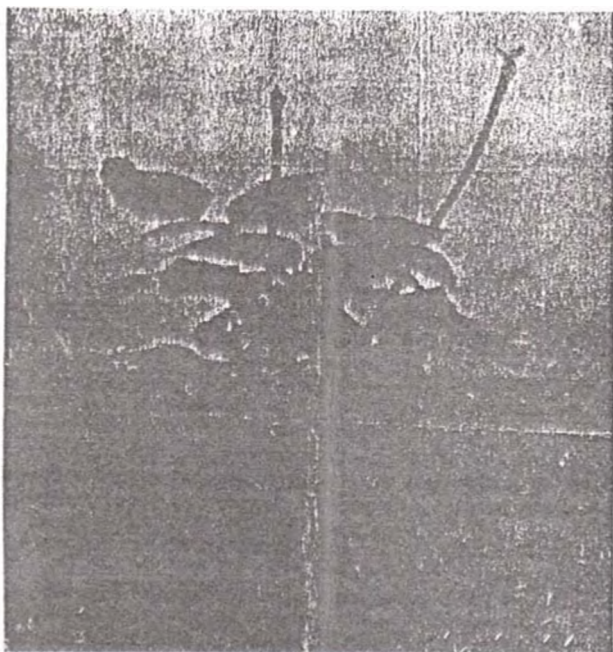


Fig. 1. Symptoms of anthracnose disease on leaves of cowpea

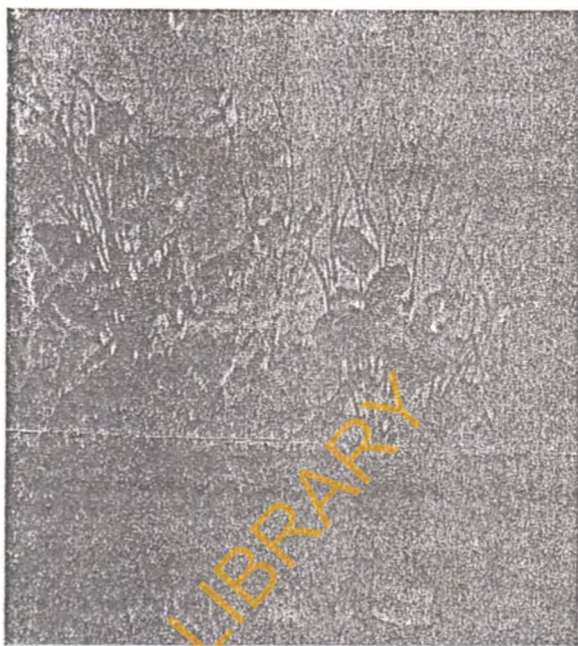


Fig. 2. Differences in plant sizes (height) between anthracnose infected (right) and uninfected (left) Ife Brown cowpeas



Fig. 3. Differences in root morphologies between anthracnose infected (right) and uninfected (left) Ife Brown cowpeas



Fig. 4. Differences in root morphologies between anthracnose infected (left) and uninfected (right) IT82E-60 cowpeas

*Effect of anthracnose on cowpea yield*

As shown in Table 2, a reduction in yield of the inoculated plants was observed. The inoculated plants (IT82E-60 and Ife Brown) had as much as 35% and 19% respective yield reductions as compared with the uninoculated. Yield reductions varying between 35% and 50% has earlier been reported (Williams, 1975; Fakorede,

1976; Emechebe and Shoyinka, 1985). Varietal susceptibility and severity of infection would determine yields of anthracnose-infected plants.

Table 2. Difference in yield between inoculated and uninoculated cowpea plants

Treatment	Grain yield/Plant (g)	
	IT82 <sup>F</sup> -60	Ife Brown
Uninoculated plants	10.10 ± 2.89	5.65 ± 1.14
Inoculated plants	6.56 ± 1.47	4.58 ± 0.48
% Difference in yield	35.05	18.94

Each data is the mean ± standard deviation of 3 determination (n=3)

Disease symptoms were seen on all above ground parts (but not very evident on the pods). This agrees with the reports of IITA (1982) and Lucas et al. (1992). Although no anthracnose symptoms were observed on the roots, the differences in the root morphologies in both treatments could be attributable to the effects of the disease on the inoculated plants. The absence of the tan to brown colour of anthracnose in the root structures (Figs. 3 and 4) should have been as a result of the natural brown colour of the plant root system, which could not contrast those of anthracnose. This observation is not in agreement with the reports of Butler and Jones (1961) and Lucas et al. (1992).

The reduced yields (Table 2) associated with the infected plants may have also resulted from reduced root structures for absorption of soil water and mineral salts for food manufacture (photosynthesis) in addition to reduced photosynthetic leaf surfaces (Fig. 1). The very low yield difference of 19% observed in the Ife Brown treatments resulted from the very high susceptibility of this variety to the disease (Table 1) as the uninoculated (control) plants were naturally infected which brought about a reduction in their yield. The observed root size reduction is believed to be one of the effects of anthracnose disease on cowpea.

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