Screening of Cowpea Varieties for Resistance to Brown Blotch Fungal Disease

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Abstract

Seventy-one cowpea varieties were screened in the field out of which nine resistant varieties were selected and these were further evaluated for resistance to cowpea brown blotch disease caused by Collectorichnm capsici under artificial inoculation. The results showed that the cowpea variety IT95k-193-12 appeared to be the most resistant to brown blotch disease. Artificial inoculation seemed to be more effective in identifying resistant genotypes as most of the cowpea varieties with moderate resistance in the field were highly susceptible under artificial inoculation.

Keywords: Artificial inoculation, brown blotch, cowpea, disease, resistance.

Introduction

Diseases caused by fungal pathogens constitute over 75% of plant diseases and they limit our ability to produce food in sufficient quantity and acceptable quality to satisfy a rapidly expanding world population (Hewitt, 1998). Cowpea is susceptible to a range of these pathogens which are important in all the agro-ecological zones of Nigeria. Some of the prevailing fungal diseases in the forest agro-ecological zone of southwestern Nigeria are brown blotch, cercospora leaf spot, choanephora pod rot and sclerotium stem rot. The most important among these diseases are brown blotch and *cercopora* leaf spots.

Over 90% of brown blotch disease of cowpea is induced by *Colletotrichum capsici* (Syd.) Butler and Bisby (Emechebe, 1981; Emechebe and Lagoke 2002). The disease is of great importance in co\vpea production due to the fact that all the above ground plant parts could be infected. Common symptoms of the disease include seedling damping off, stem or branches girdling flowers abortion, immature pods mummifying and pods and leaves showing lesions. The pathogen is seed-born (Emechebe, 1981). It survives the dry season in seed and infected crop or any plant debris (Okpala, 1981) Secondary infection is disseminated by rain splash, wind driven rain and air currents (Alabi and Emechebe, 1992) Infected plants produce tiny and wrinkled seeds that are unmarketable. There is also reduction in stand establishment from 88% for healthy seeds to 24% for seeds infected by *C. capsici* (Emechebe), 1981).

Table 1. Seed yields and reactions of five selected cowpca varieties to brown blotch disease in 1999 and 2000 cropping seasons.

Cowpea Varieties	Yield (g/plant)		Disease Incidence		Disease Severity	
	1999	2000	1999	2000	1999	2000
IT82E- 18	10.1	38.3	12.2	0.0	2.5	1.0
IFE-98-12	3.5	0.0	4.4	0.0	2.0	1.0
Ife-brown	7.3	4.8	18.9	0.0	3.0	1.0
IT95K-1384	4.1	13.1	9.1	23.1	2.0	3.0
IT95K-193-12	0.0	4.5	10.3	0.0	2.5	1.0

Extracted from Ajibade and Amusa (2001)

In view of the importance of brown blotch disease in cowpea production, there is a need to screen and identify resistant varieties for recommendation to farmers and incorporation into breeding programmes.

Material and Methods

Based on the result of field screening conducted in 1999 and 2000, five varieties with low disease severity and incidence in the field (Ajibade and Amusa, 2001) were selected for evaluation under artificial inoculation in the screen-house. The reactions of these selected five varieties to natural infestation of brown blotch disease and their seed yields are presented in Table 1. In addition, four germplasm accessions were added to the experimental materials making nine, since none of the cowpea varieties screened in the field was totally free of symptoms of brown blotch disease (Ajibade and Amusa, 2001). The four additional accessions were TVu 16467, TVu 1977 TVu 13674 and TVu 14195, collected from the Genetic Resources Unit of International Institute of Tropical Agriculture (IITA).

Isolation of fungi and artificial inoculation: Infected leaves, pods and seeds from infected field were collected and kept at 10°C. These were later surface sterilized with 1% NaOCl for 5mins and rinsed in three changes of sterile distilled water. The plant parts were cut into small pieces and were then plated separately on solidified chloraphenicol modified (60mg/ml) Potato Dextrose Agar (PDA) plates.

Table 2. Mean square values for the severity and incidence of brown blotch disease on nine cowpca varieties under artificial inoculation.

Source of Variation	df	Severity	Incidence
Season	1	10.67**	13699.2**
Varieties	8	2.04**	2922.0**
Season x Varieties	8	0.92**	606.2**
Error	36	0.06	210.96

*, ** Significant at 0.05 and 0.01 probability levels respectively.

The plates were incubated at 28± 2°C and the resultant fungi growing from the plant parts were sub-cultured for identification and pathogen)city tests. The nine cowpea varieties were planted in pots filled with sterilized soils. The pots were arranged in a randomized complete block design in three replicates. Each replication consisted of six pots with 2 plants per pot. The varieties were inoculated with spore suspensions of *Colletotrichum capsici* adjusted by haemocytometer to concentrations $3.6x10^6$ spore/ml distilled water two and six weeks after planting. A week after inoculation, the cowpea varieties were assessed for the incidence and severity of disease. The incidence of the disease on each cowpea variety was assessed by counting the number of plants showing symptoms of the disease and expressed as percentages. Disease severity score used was based on scale of 1-5 and described as follows; 1= no symptom, 2=mild symptoms confined either to the stem or to the base and tip of the peduncle, 3= stems, leaf veins and pods with moderate blotching but without distortion, 4- heavy blotching of pods with some distortion and 5= severe pod damage. The screening was conducted twice in 2002 (early season, April - July and late season, August- October, 2002). The data collected for the two seasons were subjected to the analysis of variance and means separated using Duncan Multiple Range Test at 5% probability level.

Results And Discussion

The results of the cowpea reactions inoculated with spores of *Colletotrichum capsici* are shown in Tables 2 and 3. The season and the cowpea varieties planted significantly influenced both the severity and incidence of the disease with significant season x variety interaction (Table 2). Disease severity ranged between 1.5 - 4.0 and 1.5-3.0

Table 3: Reactions of the nine cowpea varieties to the severity ami incidence of brown blotch disease under artiilcial inoculation.

Cowpea varieties	Severity		Incidence (%)	
	Early season	Late season	Early season	Late season
IT95K-1384	3.5^{b}	2.0^{b}	80.72^{3}	66.67^{a}
TVu 16467	3.0^{c}	2.0^{b}	53.64^{b}	31.25^{bcd}
TVu 1977	3.0^{c}	1.5^{c}	8206^{a}	21.65^{cd}
Ifc brown	4.0^{a}	2.0^{b}	91.50^{a}	49.38^{abc}
IT95K-193-12	1.5^{e}	1.5^{c}	3.85^{c}	5.88^{d}
TVu 13674	2.0^{d}	2.0^{b}	46.65^{b}	10.72^{d}
Ife-98-12	3.0^{c}	2.0^{b}	66.65^{ab}	41.25^{abc}
TVu 14195	3.0^{c}	2.0^{b}	80.77^{a}	22.53^{cd}
IT82E-18	3.5^{b}	3.0^{a}	83.75^{a}	53.56^{ab}

Values along a column with the same superscript(s) are not significantly different (P> 0.05).

for early and late seasons respectively. Also, the incidence of the disease varied from 3.85 - 91.50 and 5.88 - 66.67% respectively. The cowpea variety IT95K-193-12 was the most resistant among all the varieties evaluated, it was however low yielding (Tables 1 and 3). The highest yielding variety, IT82E-18 with low disease incidence and severity in the field was found to be highly susceptible under artificial inoculation (Tables 1 and 3). This could be as a result of low inoculum load of the target fungi in the field. This calls for the recombination of the two varieties (IT95K-193-12 and IT82E-18) for further improvement. The identification of source of resistance to brown blotch disease is of great importance in cowpea production, as the disease is wide spread and up to 75% crop loss have been reported under protracted wet field conditions in all the ecological zones where cowpea is cultivated in Nigeria (Alabi, 1994).

Many of the cowpea varieties that seemed to be moderately resistant to brown blotch disease in the field were highly susceptible in the screen-house (Tables 1 and 3). Screening with artificial inoculation appears to be more reliable and cheaper in identifying resistant genotypes. Field screening however, affords the opportunity of observing the crops in their natural environment. The identified resistant variety (IT95k-193-12) would be incorporated into the breeding programme for further improvement.

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