ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFS 2025; 7(12): xx-xx
www.agriculturaljournals.com
Received: 12-08-2025
Accepted: 14-09-2025

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Evaluation of cowpea varieties/genotypes against root rot incited by *Rhizoctonia bataticola*

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DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i12c.1046

Abstract
Cowpea [*Vigna unguiculata* (L.) Walp] (diploid, 2n=22) is an annual legume crop. Cowpea is a member of family *Fabaceae.* Cowpea is attacked by viruses, bacteria and fungi which causes many diseases. Root rot caused by *Rhizoctonia bataticola* (Taub.) Butler [*Macrophomina phaseolina* (Tassi.) Goid] is considered as one of the most serious diseases of cowpea. The characteristic symptom of root rot is leaf yellowing, followed by defoliation within two to three days. The infected stems and leaves become dry, brittle and straw colored. The plants show wilting and necrosis symptoms resulting from the pathogen's vascular bundles blockage and secretion of toxic substances. Fifteen varieties/genotypes of cowpea received from RARI, Durgapura were evaluated against root rot under field condition during *kharif* 2023. The screening and varieties/genotypes were maintained under field condition with Randomized Block Design (RBD) and observations were recorded in which None of these were found immune or resistant to root rot. CSP 23-10, CPP 22-18, CPP 22-9, CPP 22-8 were observed susceptible, CPP 22-10, CPP 23-4, CPP 22-21, CPP 22-20, CPP 22-3 were found moderately susceptible, CPP 22-5, CPP 22-11, CPP 22-15, CPP 22-12, CPP 22-2, CPP 22-13 were observed moderately resistant and local cultivar (Check) were found highly susceptible.

Keywords: Screening, Root Rot, *Rhizoctonia bataticola*

Introduction
Cowpea [*Vigna unguiculata* (L.) Walp] (diploid, 2n=22) is an annual legume crop. It is also known as lobia, southern pea, black eye pea, crowder pea, barbati, china pea, cowgram etc. Cowpea is a member of family *Fabaceae*. It is also known as "poor man's meat" due to it's high nutritional value and early maturity. Cowpea is a multipurpose crop which is used as pulse, vegetable, forage, fodder, green manure and generally grown as an intercrop with millets such as sorghum for either human or livestock consumption. Cowpea is a significant legume and hay crop in many tropical and subtropical region [4] and an important component of cropping system grown as catch crop, mulch crop, intercrop, mixed crop and green manure crop. Cowpea is a self-pollinated crop and has nitrogen fixation ability which improve soil fertility and consequently helps to increase the yield of cereals when grown in rotation. It is an annual herb with strong principal root and spreading lateral roots in surface soil. The roots have large number of nodules with *Bradyrhizobiuim* sp which is the symbiotic nodular bacteria that fixes the atmospheric nitrogen. Cowpea is attacked by viruses, bacteria and fungi which causes many diseases [3]. Root rot caused by *Rhizoctonia bataticola* (Taub.) Butler [*Macrophomina phaseolina* (Tassi.) Goid] is considered as one of the most serious diseases of cowpea. *Rhizoctonia bataticola* [*Macrophomina phaseolina*) (Tassi.) Goid] fungus is mainly a soil borne in nature with wide range of host and it can survive under the soil as saprophyte up to 15 years. The fungus causes high yield losses in the pulses, oilseeds and vegetable crops and produces different symptoms like root rot, charcoal rot, stem and root rot, seedling blight and ashy stem blight. The fungus is a facultative parasite capable of living saprophytically on dead organic tissue, mostly on many of its natural hosts producing microsclerotia, which produces pycnidia. When atmospheric temperature is above 30 °C and the pycnidiospores remain viable for over a year since the fungus attack wide range of plant species [1]. The severity of *Rhizoctonia bataticola* depends on the population of sclerotia present in the soil. Microsclerotia produce germ tube and penetrate through natural openings in vascular tissues colonization take place [2].

The most characteristic symptom of root rot was yellowing of the leaves and within two of three days these leaves may drop off. The plant may show wilt within a week and necrotic symptoms due to blockage of vascular bundles with microsclerotia and secretion of toxic substances [6]. The dark lesions may be seen on the bark at ground level. If the plants are pulled out from the soil and examined the plant, the basal stem and main roots show the symptoms of root rot. In advanced stage sclerotial bodies which is scattered may be seen on the affected tissues [7].

Management of root rot caused by *Rhizoctonia bataticola* (*Macrophomina phaseolina*) is challenging due to the pathogen's polyphagous nature and ability to survive in the soil through its resting structures. Fungicides are expensive and harmful to the environment, making them a less desirable control option. Host plant resistance is a more economical and environmentally friendly approach to the management of root rot. Management strategies of this disease include, Varietal screening which is the systematic process of evaluating different crop varieties/ genotypes to identify those that possess a superior level of resistance or tolerance to a specific plant disease or pathogen. It is a foundational and highly sustainable component of modern plant disease management, particularly within an Integrated Pest Management (IPM) framework. Ecofriendly approaches to suppressing and destroying of disease.

Material Method

Screening of varieties/genotypes against root rot of cowpea

Fifteen varieties/genotypes of cowpea received from RARI, Durgapura were evaluated against root rot under field condition during *kharif* 2023. Inoculum multiplied on sorghum medium was applied in the field. Inoculum were added before sowing. The screening and varieties/genotypes were maintained under field condition with Randomized Block Design (RBD) and observations were recorded. On the basis of disease incidence and varieties/genotypes were categorized according to their reaction against the disease as per criterion.

Table 1: Disease rating scale given by Gireesha *et al*, 2023

Category	Per cent disease incidence
Immune	0 %
Resistant	0.1-10%
Moderately resistant	10.1-20%
Moderately susceptible	20.1-30%
Susceptible	More than 30%

The following varieties/genotypes were used against root rot of cowpea CSP 23-15, CPP 22-18, CPP 22-9, CPP 22-10, CPP 23-4, CPP 22-5, CPP 22-11, CPP 22-15, CPP 22-21, CPP 22-20, CPP 22-12, CPP 22-2, CPP 22-13, CPP 22-8, CPP 22-3. The disease incidence of root rot was recorded for each cultivar/ germplasm lines.

Percent disease incidence (PDI) was recorded by using the formula given by Wheeler (1969)

$$\text{Percent disease incidence (PDI)} = \frac{\text{No. of infected plants}}{\text{Total no. of plants}} \times 100$$

Result

Screening of varieties/genotypes against root rot of cowpea

An experiment was conducted under field conditions to find out the resistance varieties/genotypes against *Rhizoctonia bataticola* (*Macrophomina phaseolina*). Observation was recorded after 50 days after sowing on the basis of disease incidence and varieties/ genotypes were categorized according to their reaction against the root rot disease as per criterion

Table 2: Disease rating scale given by Gireesha *et al.*, 2023

Category	Per cent disease incidence
Immune	0 %
Resistant	0.1-10%
Moderately resistant	10.1-20%
Moderately susceptible	20.1-30%
Susceptible	More than 30%

Fifteen varieties/genotypes were screened under artificial conditions. None of these were found immune or resistant to root rot. CSP 23-10, CPP 22-18, CPP 22-9, CPP 22-8 were observed susceptible, CPP 22-10, CPP 23-4, CPP 22-21, CPP 22-20, CPP 22-3 were found moderately susceptible, CPP 22-5, CPP 22-11, CPP 22-15, CPP 22-12, CPP 22-2, CPP 22-13 were observed moderately resistant and local cultivar (Check) were found highly susceptible. On the basis of rating scale varieties/genotypes categorized as susceptible, moderately susceptible, moderately resistant (Table 2)

Table 3: Screening of varieties/genotypes against root rot of cowpea

S. No.	Name of varieties/ genotypes	Percent Disease incidence*	Reaction of varieties/ genotypes
1	CSP 23-10	34.60 (36.00)	S
2	CPP 22-18	36.53 (37.16)	S
3	CPP 22-9	31.83 (34.32)	S
4	CPP 22-10	24.30 (29.49)	MS
5	CPP 23-4	23.43 (28.92)	MS
6	CPP 22-5	18.33 (25.32)	MR
7	CPP 22-11	16.86 (24.21)	MR
8	CPP 22-15	15.73 (23.35)	MR
9	CPP 22-21	26.90 (31.21)	MS
10	CPP 22-20	23.13 (28.72)	MS
11	CPP 22-12	13.36 (21.39)	MR
12	CPP 22-2	13.63 (21.65)	MR
13	CPP 22-13	14.70 (22.45)	MR
14	CPP 22-8	38.63 (38.41)	S
15	CPP 22-3	27.13 (31.32)	MS
16	Control	51.60 (45.90)	
	S.Em±	0.97	
	CD (p=0.05)	2.83	

*Average of three replications

Figures given in parentheses are angular transformed values

Where, R- resistant, MR- Moderately resistant, MS- Moderately susceptible, S- Susceptible, HS- highly susceptible

Table 4: Reaction of varieties/ genotypes to root rot of cowpea

Reaction	Per cent disease incidence	No. of varieties/ genotypes	varieties/ genotypes
Resistant	0.1-10	0	-
Moderately Resistant	10.1-20	6	CPP 22-5, CPP 22-11, CPP 22-15, CPP 22-12, CPP 22-2, CPP 22-13
Moderately susceptible	20.1-30	5	, CPP 22-10, CPP 23-4, CPP 22-21, CPP 22-20, CPP 22-3
Susceptible	More than 30	4	CSP 23-10, CPP 22-18, CPP 22-9, CPP 22-8

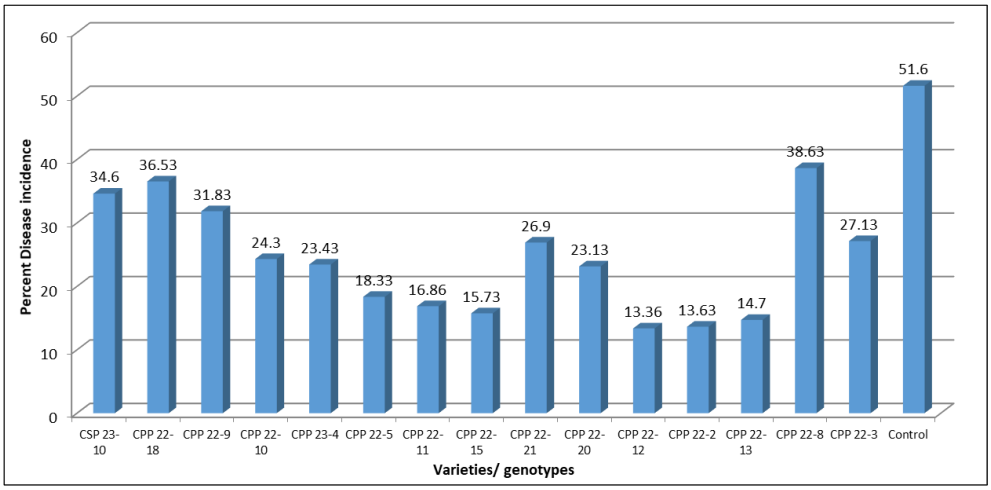

Fig 1: Screening of varieties/genotypes against root rot of cowpea

Discussion

Fifteen varieties/genotypes were screened against *Rhizoctonia bataticola* under field conditions. None of cultivars found immune or resistant to root rot of cowpea. Among fifteen varieties/genotypes CPP 22-5, CPP 22-11, CPP 22-15, CPP 22-12, CPP 22-2, CPP 22-13 were observed moderately resistant, CPP 22-10, CPP 23-4, CPP 22-21, CPP 22-20, CPP 22-3 were found moderately susceptible and CSP 23-10, CPP 22-18, CPP 22-9, CPP 22-8 were found susceptible.

Conclusion

Fifteen varieties/genotypes were screened against *Rhizoctonia bataticola* under artificial conditions. None of cultivars found immune or resistant to root rot of cowpea while others were moderately susceptible, moderately resistant to susceptible.

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