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Research Article

EVALUATION OF BIOCONTROL AGENTS AGAINST FOOT ROT OF FINGER MILLET CAUSED BY *SCLEROTIUM ROLFSII*, UNDER *IN VITRO* CONDITIONS

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ABSTRACT
Finger millet is one of the important millet crops widely cultivated across India. Although, it is found to be a hardy crop, it is also affected by many diseases, among them foot rot caused by *Sclerotium rolfsii* has been an increasing problem. So, a total of 5 bioagents were screened *in-vitro* against *Sclerotium rolfsii* causing foot of ragi. Among the bioagents *Trichoderma harzianum* – 2 isolate was found to be effective than other biogents.

Key Words: *Sclerotium rolfsii, Fungicides, Finger Millet, Foot Rot, Bioagents*

INTRODUCTION
Finger millet [*Eleusine coracana* (L.) Gaertn.,] is an important staple food in India, Nepal and eastern Africa especially among tribal belts. It is commonly referred to as Ragi, Chodi, Bird's foot, Nagli, Mandua in different regions of the country. It belongs to the family Poaceae. Ragi is nutritionally rich with high quality protein, plenty of minerals, dietary fiber, and phytochemicals and is having 8-10 times more calcium than rice and wheat and is recommended for diabetes and other life style diseases. It has a slightly higher water requirement than pearl millet and is typically grown on higher latitudes up to 2000 meters above sea level. They are grown on soils which are typically too poor to support any other crop. It is subsistence and food security crop that is especially important for its nutritive and cultural value, and also commands higher market prices. Further, it can be stored safely for many years without insect damage. This is particularly vulnerable in drought-prone areas where harvests frequently fail. The wide adaptability of the crop could be attributed to its C_4 nature. Finger millet farmers face numerous challenges, including labour, credit, marketing, weeds, pests and diseases. Despite these challenges, finger millet is still widely used as valued and new food products such as porridge, bread, malt, fodder, feed, food for babies and convalescents have industrial potential. With more research and an enabling policy environment, the crop has great potential for expansion.

Although, it is found to be a hardy crop, it is also affected by many diseases, among them foot rot caused by *Sclerotium rolfsii* has been an increasing problem especially in irrigated and heavy rainfall area (Nagaraja and Reddy, 2009). The disease has been reported to cause more than 50 per cent yield loss (Batsa and Tamang, 1983). *Sclerotium rolfsii* Sacc. is a well known and most destructive soil borne fungus initially described by Rolfs (1892) on tomato. The *Sclerotium rolfsii* is widely distributed and causes severe damage to more than 500 crops (Aycock, 1966). Although there are several other *Sclerotium* producing fungi, the fungus characterized by small tan to dark-brown or black spherical sclerotia with internally differentiated rind, cortex, and medulla were placed in the form genus *Sclerotium* (Punja and Rahe, 1992). *Sclerotium rolfsii* Sacc. is predominantly distributed throughout tropical and subtropical regions where, the temperature reaches higher levels during the rainy season. This pathogen causes a variety of symptoms on different hosts like collar rot in chickpea, southern blight of sugar beet, foot rot of finger millet, leaf spot in *Lotus meliloti,* bud rot of *Colocasia variagata and* fruit rot in *Citrullus vulgaris* etc. Consequently the diseases caused by this fungus are more serious in tropical and subtropical regions than in temperate regions and this pathogen is of major importance throughout the world.

MATERIALS AND METHODS

Isolation of the Fungus

The part of foot region showing typical symptoms of foot rot disease of finger millet was used for isolating the causal fungus adopting the standard tissue isolation. Later, the bit of fungal growth was transferred to potato dextrose agar (PDA) slants for purification and maintenance of the culture. The pathogenicity is also confirmed by proving Koch's postulates.

Evaluation of Bio-Agents

In vitro evaluation was carried out with five biogents *viz., Trichoderma harzianum* - 1, *Trichoderma harzianum* – 2, *Trichoderma viride, Pseudomonas fluorescens* and *Bacillus subtilis* (Cultures provided by Biocontrol lab FTS, Vizianagaram and native isolates) by dual culture technique for their antagonistic effect against *Sclerotium rolfsii* under *in-vitro* conditions. For this study both bioagents and test fungus were cultured on potato dextrose agar in order to get fresh and active growth of fungus.

Dual Culture Technique

Twenty ml of sterilized and cooled potato dextrose agar was poured into sterile Petri plates and allowed to solidify. For evaluation of fungal biocontrol agents, mycelial discs of test fungus were inoculated at one end of the Petri plate and antagonistic fungus was placed opposite to it on the other end. In case of evaluation of bacterial antagonist, the bacterium was streaked one day earlier at one end of the Petri plate to the middle of the Petri plate and the test fungus placed at the other end. The plates were incubated at 27±1°C and zone of inhibition was recorded by measuring the clear distance between the margin of the test fungus and antagonistic organism. The colony diameter of pathogen in control plate was also recorded. The per cent inhibition of growth of the pathogen was calculated by using the formula suggested by Vincent (1947).

$$I = \frac{C - T}{C} \times 100$$

Where,
I = per cent inhibition
C = growth in control
T = growth in treatment

RESULTS AND DISCUSSION

Evaluation of Bioagents

The antagonistic microorganism's *viz., Trichoderma harzianum* - 1, *Trichoderma harzianum* – 2, *Trichoderma viride*, *Pseudomonas fluorescens* and *Bacillus subtilis* were evaluated by dual culture technique for their antagonistic effect against *Sclerotium rolfsii* under *in-vitro* conditions. Inhibition zone in mm was recorded and the per cent inhibition was calculated.

Table 1: Antagonistic effect of different bioagents against *Sclerotium rolfsii*

Sl. No.	Bioagents	Per cent inhibition of mycelial growth	
		7 days	**14 days**
1	*Trichoderma harzianum* - 2	62.87	82.11
2	*Trichoderma harzianum* - 1	57.34	57.34
3	*Trichoderma viride*	58.78	58.78
4	*Pseudomonas fluorescens*	0.00	0.00
5	*Bacillus subtilis*	0.00	0.00
6	control	0.00	0.00
	SEm±	**1.81**	**1.57**
	C.D at 1%	**4.03**	**3.15**
	CV %	**7.60**	**3.90**

At 7 days after inoculation maximum inhibition of mycelial growth (61.88%) was noticed in *Trichoderma harzianum* - 2, which was followed by *Trichoderma viride* (57.77%) and *Trichoderma harzianum* - 2 (56.33%). *Pseudomonas fluorescens* and *Bacillus subtilis* did not show any inhibition of mycelial growth of *Sclerotium rolfsii* as the pathogen grew over the bioagents (Table 1).

At 14 days after inoculation all the isolates does not show any variation in increasing the inhibition percentage except *Trichoderma harzianum* - 2 which continued its growth on the pathogen and inhibited up to 81.11% growth. However, the bacterial antagonist doesn't show any inhibition of the mycelial growth of *Sclerotium rolfsii* even after 14 days of inoculation. These results were in accordance with the results of Bari *et al.,* (2000); Kulkarni (2007) and Basamma (2008).

Conclusion

Among the bioagents, *Trichoderma harzianum-2* isolate showed maximum inhibition of *Sclerotium rolfsii.* However these fungicides and bioagents may be tested under field conditions for confirming the efficacy.

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