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Vikash Kumar Yadav
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

VP Choudhary
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

SK Singh
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

Manish Kumar Maurya
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

SP Vishwakarma
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

Rajendra Prasad
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

Jaishraj Yadav
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

Akash Singh
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture and Technology, Kumargnaj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
SKS Rajpoot
Department of Entomology Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh, India

In vitro efficacy of botanicals against *Rhizoctonia solani* Kühn inciting sheath blight of rice

Vikash Kumar Yadav, VP Choudhary, SK Singh, Manish Kumar Maurya, SP Vishwakarma, Rajendra Prasad, Jaishraj Yadav and Akash Singh

Abstract
Among the fungal diseases, sheath blight, caused by multinucleate *Rhizoctonia solani* Kühn (teleomorph: *Thanatephorus cucumeris* Donk), a ubiquitous pathogen. It is an important fungal disease of rice ranking only after blast and often rivaling it. The potential losses due to sheath blight alone in India has been estimated up to 50.3 per cent. An attempt was made to investigate the antifungal efficacy of botanicals *viz*., neem (*Azadirachta indica*), tulsi (*Ocimum sanctum*), garlic (*Allium sativum*), onion (*Allium cepa*) and ginger (*Zingiber officinale*) *in vitro* by poison food techniqueat 5 and10 per cent concentrations. The bulb extract of garlic and ginger rhizome extract of ginger suppressed the mycelial growth (68.70 and 67.77 respectively) at 10% concentration followed by neem leaf extract (64.63%), bulb extract of onion (63.52%) and tulsi leaf extract (61.52%) at 8 days after inoculation.

Keywords: Lentil, fusarium, fungicides, evaluation, neem

1. Introduction
Rice (*Oryza sativa* L.) is the most important staple food crop and grown in India providing of 50 to 80 per cent of calorie requirement for more than 70 per cent of the Indian population. Globally, rice annual production of around 497.9 million tonnes with average productivity of 3.9 tonnes/ha (Anonymous, 2017) [2]. The annual production of rice in the country is around 103.36 million tones (Anonymous, 2019) [3] and the average productivity in the country across all the ecosystems is still around two tonnes/hectare of milled rice. In India, Uttar Pradesh ranks 3rd in the production of rice. The annual rice production is around 12 metric tonnes with the average productivity of about 2 tons/ha (Dwivedi, 2014) [5]. Rice cultivation is often subjected to several biotic stresses of which diseases like sheath blight, stem rot, blastand bacterial blight are the important ones (Kumar *et al.,* 2019) [9]. Rice sheath blight is an important soil borne fungal disease (*Rhizoctonia solani* Kuhn) causing up to 25% of yield losses (Zheng *et al.,* 2013) [23]. The disease was first reported from Japan in 1910 by Miyake, who named the causal organism *Sclerotiumirrular* (Miyake, 1910) [11]. Subsequently, in Sri Lanka, China and Philippines and pathogen was identified as *Rhizoctonia solani* (Park and Bertus, 1932; Wei, 1934; Reinking, 1918) [14, 21, 16]. In India, the first report of its occurrence was reported by Paracer and Chahal (1963) [15] from Gurudashpur, Punjab and later it was reported from Uttar Pradesh (Kohli, 1966) [8].
Presently, no strong genetic sources of resistance are reported against rice sheath blight disease. The rice sheath blight resistance among the cultivable varieties in India currently showed very susceptible to moderately resistant reaction (Kumar *et al.,* 2019) [9]. Therefore, integrated management of this disease below its economic threshold is important for increasing the production, productivity and quality of the produce. The use of botanicals in the management of rice sheath blight is gaining importance and different plant extracts are being used all over the world. Among them, neem formulations are very effective in controlling the sheath blight incidence as well as in increasing grain yields (Biswas, 2007) [4]. Tomato and escarole green manure were reported to suppressing the *R. solani* damping off on *Lepidium sativum* (Pane *et al.,* 2011) [12]. Plant extracts that can control the growth of *R. solani* are the extraction of garlic bulb with saponins, extraction of *Piceane Oveitchii* with four flavonoids (Song *et al.,* 2011) [18], cauliflower with caulilexins (Soledade *et al.,* 2006) [17], extraction of *Anemarrhenaas phodeloides* rhizomes with nyasol (Z)-1, 3-bis (4-hydroxyphenyl) 1.4-pentadiene (Park *et al.,* 2003) [13]. *Brassica juncea, B. napus,* and *Sinapis alba* which are added

to the soil can protect wheat from rot root of *R. solani* (Handiseni *et al.*, 2013) [13].
Hence, considering economic importance of the crop and the disease, the present investigation was undertaken to evaluate the efficacy of botanicals against *R. solani* and to find out the suitable management practice to mitigate the disease.

2. Materials and Methods

2.1 *In vitro* effect of botanicals on radial growth of *R. solani*

In vitro efficacy of five plants extract *viz*., Neem oil, garlic clove, onion bulb, Tulsi leaves and Ginger rhizome by poison food technique at 5 and 10 per cent concentrations were evaluated against *R. solani.* Garlic clove were found most effective against *R. solani* among 16 botanicals (Verma, 2011) [19] were assessed.

Table 1: List of botanicals, their scientific name, family and plant parts used.

S. No.	Botanicals	Scientific name	Family	Plant parts used
1.	Garlic	*Allium sativum*	Amaryllidaceae	Clove
2.	Ginger	*Zingiber officianlis*	Zingiberaceae	Rhizome
3.	Neem oil	*Azadirachta indica*	Neliaceae	Oil
4.	Onion	*Allium cepa*	Liliaceae	Bulb
5.	Tulsi	*Ocimum sanctum*	Lamiaceae	Leaf

The detailed description of plants and their parts used in this study are given in Table 1. Fresh leaves, bulb and rhizome were collected and washed thoroughly in double distilled water. Hundred gram of each washed plant material was grinded in Pestle and Mortar by adding equal amount (100 ml) of sterilized water (1: 1 w/v) and heated at 80^0C for 10 min in hot water both. The materials was filtered through double layered muslin cloth followed by filtering through sterilized What man No. 1 filter paper and treated as standard plant extract (100%). The 5.0% and 10.0% concentration was made by adding in requisite amount of sterilized potato dextrose agar medium. From the stock solution of these extract 5ml and 10 ml solution were added to 95.0 and 90.0 ml of sterilized cooled potato dextrose agar medium. The flasks were thoroughly mixed to obtain a homogenous mixture of the extracts and potato dextrose agar medium under aseptic condition before pouring it into the Petridishes. 20 ml medium was poured into each Petri dishes, 5 treatments having four replications were maintained. Control treatment was maintained by pouring potato dextrose agar medium without plant extracts. The five mm discs of four days old culture of *R. solani* were cut with sterilized cork borer and placed in the centre of Petridish contain botanicals amended PDA medium. The fungus grown on PDA without plant extracts served as control. The plates were incubated at 26 ± 1^0C in BOD. The observations were recorded at 8 days after inoculation. The growth diameter was recorded and percent inhibition was calculated by using formula (Vincent, 1947).
Where,

$$\text{Growth inhibition \%} = \frac{\text{DC} - \text{DT}}{\text{DC}} \text{X } 100$$

I = Per cent inhibition of fungal growth
C = Radial growth of control
T = Radial growth of treated Petridis.

3. Results and Discussion

3.1 *In vitro* effect of botanicals on radial growth of *R. solani*

Allium sativum (garlic) clove extract is most effective showed maximum inhibition of 63.55% and 68.70% @ 5% and 10% concentration respectively at 8 days after inoculation and it was found significantly superior to other extracts. This was followed by rhizome extract of *Zingiber officinale* (ginger) and *Azadirachta indica* (neem) leaf extract which showed an inhibition of (60.41, 67.77%) and (59.16, 64.63%) respectively, onion bulb (58.33, 63.52%) and tulsi leaves (58.05, 61.52 @ 5% and 10% concentration at 8 DAI. All the five aqueous plants extract showed less mycelial growth inhibition at 5% concentration as compare to 10% concentration of plants extract, data presented Table 2 and Plate 2.

Table 2: *In vitro* efficacy of botanicals (After 8 day) at different concentration against *R. solani* causing Sheath blight of rice.

S.No.	Botanicals	Radial growth (mm) Conc. (5%)	Inhibition %	Radial growth (mm) Conc. (10%)	Inhibition %
$T_{1.}$	Neem oil (*Azadirachta indica*)	36.75(37.31)	59.16	31.83(34.34)	64.63
$T_{2.}$	Garlic clove (*Allium sativum*)	32.80(34.93)	63.55	28.17(32.05)	68.70
$T_{3.}$	Onion bulb (*Allium cepa*)	37.50(37.75)	58.33	32.83(34.95)	63.52
$T_{4.}$	Ginger rhizome (*Zingiber officinalis*)	35.63(36.65)	60.41	29.00(32.50)	67.77
$T_{5.}$	Tulsi leaves (*Ocimum sanctum*)	37.75(37.90)	58.05	34.63(36.04)	61.52
$T_{6.}$	Control	90(71.56)	0	90(71.56)	0
	CD (P=0.01)	2.83		2.26	
	CV	2.56		2.17	

Figures in parentheses are transformed angular value.

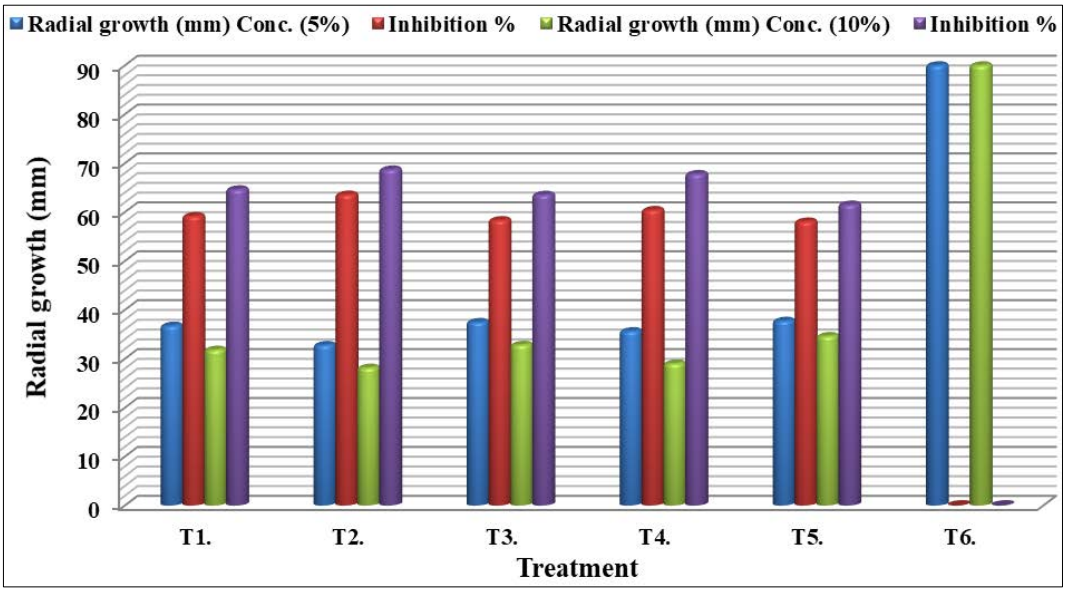

Fig 1: *In vitro* efficacy of botanicals (After 8 day) at different concentration against *R. solani.*

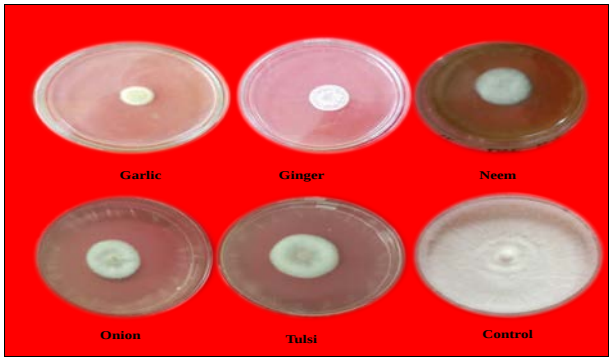

Plate 1: Effect of botanicals on the mycelia growth of *R. solani* at 10%.

Plant extract are not only easy to prepare but also nonpolluting to the environment and low priced as compare to commercial fungicides. This is supported bythe work of Alibi and Olorunju (2004) [1]. In their studies, plants sprayed with neem seed extract gave yields higher than the plants sprayed with black soap and cow dung extract. Mishra *et al.* (2005) [10] also found *Zingiber officinale*, *Ocimum sanctum*; *Azadirachta indica* and *Allium cepa* were effective against *R. solani* causing web blight disease in green gram. Yadav, (2007) [22] found out of 8 plant extracts, Garlic extract gave maximum inhibition in mycelial growth followed by Ginger, Neem, Onion, Dhatura, Tulsi against *R. solani* causing web blight of French bean. Gurjar *et al.* (2012) [6] reported that *A. indica* and *A. vera* showed inhibition of mycelial growth of the pathogen and can be utilized for the management of fungal diseases caused by the *Aspergillus niger*, *Aspergillu sflavus*, *R. solani*, *R. bataticola.* Sriraj *et al.* (2014) found *Madhuca longifolia* seed and oil extract most effective among the nine botanicals tested against the leaf blight of turmeric. In the present study, garlic bulb extract showed maximum inhibition and it was significantly superior to other plant extract.

All the tested botanicals (Neem oil, Tulsi leaves, Garlic clove, Onion bulb and Ginger rhizome) showed mycelial growth inhibition of *R. solani* over the control.

4. Conclusion

In the present study, five different botanicals showed as effective control agents against *R. solani* though their efficacy varied among botanicals extract. It was observed that among the five tested botanicals, garlic bulb extract @ 10% concentration show maximum mycelial growth inhibition and minimum redial growth of *R. solani* under *in vitro* condition, further studies are needed on these promising botanicals to identify potential compounds produced and evaluate other possible mode of actions before going to field studies.

5. References

1. Alibi O, Olorunju EP. Evaluation of neem seed extract, black Soap and cow dung for the control of Groundnut leaf spot at samara. Nigeria. Arch. Phytopathol. Plant Prot 2004;37:123-127.
2. Anonymous. Annual report central soil salinity research institute, Karnal 2017.
3. Anonymous. Standard Evaluation System for Rice. 4th Edition Int. Rice Res. Inst. Manila, Philippines 2019, 1-52.
4. Biswas A. Evaluation of neem formulations against sheath blight disease ofrice. Indian Journal of Plant Protection, 2007;35(2):296-298.
5. Dwivedi JL. Status paper on Rice in Uttar Pradesh. Rice Knowledge Management Portal (RKMP). Directorate of Rice Research, Rajendranagar. Hyderabad 2014.
6. Gurjar A, Shahid A, Masood A, Kangabam SS. Efficacy of plant extracts in plant disease management. Agricultural Sciences 2012;3;425-433.
7. Handiseni M, Brown J, Zemetra R, Mazzola M. Effect of Brassicaceae seed meals with different glucosinolate profiles on *Rhizoctonia* root rot in wheat. Crop Protection 2013;48:1-5.
8. Kohli CK. Pathogenicity and host range studies on paddy sheath blight pathogen *Rhizoctonia solani* Kühn. Journal and Research. P.A.U 1966;3:7-40.
9. Kumar RBP, Reddy KRN, Rao KS. Sheath blight disease of *Oryza sativa* and its management by biocontrol and chemical control *in vitro*. Electronic Journal of Environmental, Agricultural and Food Chemistry 2019;8(8):639-646.
10. Mishra BD, Sahoo KC, Sugata G, Rout MK. *In vitro* evaluation of plant extracts, oil cakes and agrochemicals against web blight of green gram caused by Rhizoctonia solani. J. Mycopatho. Res 2005;43:255-257.

11. Miyake I. Studies uber die pilze der Reisoplanze in Japan, J coll. Agric. Tokyo 1910;2:237-276.
12. Pane C, Spaccini R, Piccolo A, Scala F, Bonanomi G. Compost amendments enhance peat suppressiveness to *Pythium ultimum, Rhizoctonia solani* and *Sclerotinia* sp. Minor. Biological Control. 2011;56:115-124.
13. Park HJ, Lee JY, Moon SSB, Hwang K. Isolation and anti omycete activity of nyasol from *Anemarrhenaa sphodeloides* rhizomes. Phytochemistry 2003;64:997-1001.
14. Park M, Bertus ZS. Sclerotial disease of Rice in Ceylon. *R. solani.* Ceylon Journal of Science 1932;11:319-331.
15. Pracer CS, Chahal DS. Sheath blight of rice caused by *R. solani* Kuhn-A new record in India. Curr. Sci 1963;32:328-329.
16. Reinking OA. Philippine economic plant diseases. Philippine Journal of Science 1918;13:165-274.
17. Soledade M, Pedras C, Sarwae MG, Suchy M, Adio AM. The phytoalexins from cauliflower, caulilexins A, B and C: Isolation, structure determination, syntheses and antifungal activity. *Phytochemistry*. 2006;67:1503-1509.
18. Song ZW, Chen X, Du H, Zhang L, Lin Xu H. Chemical constituents of Piceaneoveitchii. Phytochemistry 2011;72:490-494.
19. Verma AK. Efficacy of certain botanicals and bio-agents against *Rhizoctonia solani* (kuhn) causing web blight of mungbean (*Vigna radiata*) M.Sc. (Ag.) thesis. N.D.U.A.&T. Kumarganj, Faizabad 2011.
20. Vincent JM. Distortion of fungal hyphae in presence of certain inhibitions. Nature 1947, 159-850.
21. Wei CT. Rhizoctonia sheath blight of rice. Bulletin, College of Agriculture and Forestry. University of Nan-king 1934;15:21.
22. Yadav BC, Gupta RP, Singh RV. Comparative performance of *Trichoderma* spp. as seed dresser and soil application against *Fusarium* wilt of Pigeonpea. J Mycol. Pl. Pathol 2007;35(3):541.
23. Zheng A, Lin R, Zhang D, Qin P, Xu L, Ai P *et al.* The evolution and pathogenic mechanisms of the rice sheath blight pathogen. Nature Communic 2013;4:14-24.