

Research Article

Antifungal Efficacy of Panchgavya Formulations against *Rhizoctonia solani*: An Incitant of Rice Sheath Blight

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Abstract

The main rice-grown crop was found severely affected by sheath blight in the south Gujarat region. Sheath blight of rice symptoms were noticed on leaf blades and the sheath just above the water level. The isolation was done from infected parts and purified by the hyphal tip method on PDA which was maintained at 4 °C. The seven different panchgavya formulations of five cow products such as cow urine, dung, curd, ghee, and milk that designed as PG1, PG2, PG3, PG4, PG5, PG6, and PG7. The PG against test pathogen *Rhizoctonia solani* *in vitro* condition by the poisoned food technique and that tested at 2, 4, 6, 8, and 10 percent concentrations. It was observed that panchgavya were able to suppress the growth of *R. solani*. Among the different formulations, PG1 was significantly effective at all concentrations as compared to other PG formulations against *R. solani*.

Introduction

Rice (*Oryza sativa* L.) is the most important cereal crop of the family Poaceae. It is a staple food crop of 60% of the world's population. "Rice is life" is the theme of the International Year of Rice, 2004. In India, the major rice-growing states such as West Bengal, Uttar Pradesh, Punjab, Odisha, Assam, and Haryana etc, have their production occupying a cultivated area of 43.19 million hectares with an annual production of 110.15 million tonnes. In Gujarat state, the major growing districts are Navsari, Valsad, Surat, Dang, Panchmahal, Vadodara, Kheda, etc. which have production occupying a cultivated area of 0.84 million hectares with an annual production of 1.93 million tonnes in 2016-17 [1]. Rice suffers from many diseases caused by fungi, bacteria, viruses, phytoplasmas, nematodes, and other non-parasitic disorders, etc. Among them, are fungal diseases, blast, sheath blight, brown leaf spot, false smut, stem rot, etc. The sheath blight is causing a considerable loss in rice crops. In India, organic farming was a well-developed panchgavya in agriculture for the health of soil, plants, and humans [2]. Panchgavya, an ancient preparation has been used to enhance the growth and resistance to diseases of crops in traditional agricultural systems in India. In Sanskrit, Panchgavya means the blend of five products obtained from cows such as dung, urine, milk, curd, and ghee [3]. Panchgavya is also known to contain growth regulatory substances such as

IAA, GA, and cytokinin. It has the highest populations of total bacteria, actinomycetes, phosphate solubilizers, fluorescent pseudomonads, and nitrifiers. In addition, microbial biomass carbon and dehydrogenase activity were also found to be higher in panchgavya [4].

Materials and methods

Collection of samples

Infected samples that show typical symptoms of sheath blight of rice were collected from rice farms. The collected samples were washed and blotted dry placed in blotting papers under a herbarium press and preserved for further experiments.

Isolation of pathogen from infected plant materials

Isolation from the infected diseased tissue of Rice plants showing typical sheath blight symptoms was assessed. The infected area was subjected to tissue isolation. The infected portion of the plant was cut into small bits in such a way that each bit consisted of infected as well as healthy tissues and that transferred into the PDA medium. These Petri plates were incubated at room temperature (27 ± 2 °C) for seven days. The fungal hyphae developed from the infected tissues were sub-cultured aseptically on PDA plates or slants.

More Information

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Keywords: Panchgavya formulations; Rice; Sheath blight; *Rhizoctonia solani*





Preparation of Panchgavya formulations

Seven preparations of panchgavya were made and designated as PG1, PG2, PG3, PG4, PG5, PG6, and PG7. Their compositions are presented in Table 1.

All the components i.e., cow ghee, cow milk, cow curd, cow urine, and cow dung were added one after the other in the plastic bottles and thoroughly mixed. These were allowed to ferment in closed plastic bottles for a specific period of twenty days to one month with daily stirring by a glass rod. The crude preparations were diluted five and ten times with water, filtered through two layers of muslin cloth to remove the larger particles, and stored at room temperature [5]. The experiment was repeated thrice replications per treatment were maintained. Data on mycelial growth were recorded when check plates were fully covered with mycelial growth test pathogens and the percent growth inhibition (PGI) of the fungus in each treatment was calculated by using the following formula given by Vincent [6].

$$PGI = \frac{100 (DC - DT)}{DC}$$

Where,

PGI = Percent Growth Inhibition

DC = Average Diameter of mycelia colony in the Control set (mm)

DT = Average diameter of mycelia colony of the treated set (mm)

Results and discussions

The activity of panchgavya formulations was studied by adopting the poisoned food technique method using *Rhizoctonia solani* isolated. The effect of Panchgavya formulations with different concentrations of 2, 4, 6, 8, and 10%, respectively were separately tested against test fungi.

In present investigations, the panchgavya formulations such as PG1, PG2, PG3, PG4, PG5, PG6, and PG7 were evaluated at 2, 4, 6, 8, and 10% concentrations using poisoned food technique and were found significantly superior in inhibiting the mycelia growth of *R. solani*. The results revealed that as panchgavya concentration increased, the growth of the pathogen decreased. The observation regarding the percent inhibition of linear growth is presented in Table 2, Figure 1.

Table 1: Composition of seven preparations of panchgavya formulations.

Components	PG1	PG2	PG3	PG4	PG5	PG6	PG7
Ghee (ml)	2	2	2	2	2	2	2
Milk (ml)	5	5	5	5	5	5	5
Curd (ml)	5	5	5	5	5	5	5
Urine (ml)	40	38	36	34	32	30	28
Cow dung (g)	48	50	52	54	56	58	60
Total (ml)	100	100	100	100	100	100	100

Table 2: Efficacy of panchgavya formulations against *R. solani* in vitro condition.

Sr. No.	Panchgavya formulations	Conc. (%)	Percent inhibition over control
T ₁ -T ₅	PG-1	2	77.23
		4	84.14
		6	89.42
		8	94.10
		10	100.00
T ₆ -T ₁₀	PG-2	2	76.82
		4	83.74
		6	88.62
		8	93.69
		10	99.59
T ₁₁ -T ₁₅	PG-3	2	73.98
		4	82.10
		6	88.20
		8	92.89
		10	98.98
T ₁₆ -T ₂₀	PG-4	2	71.54
		4	79.67
		6	86.98
		8	92.89
		10	98.98
T ₂₁ -T ₂₅	PG-5	2	71.13
		4	78.04
		6	86.37
		8	92.07
		10	98.78
T ₂₆ -T ₃₀	PG-6	2	69.51
		4	76.82
		6	85.76
		8	91.86
		10	98.57
T ₃₁ -T ₃₅	PG-7	2	66.67
		4	76.01
		6	85.76
		8	91.46
		10	98.37
T ₃₆	Control	-	-
S. Em. ±			0.04
CD at 5%			0.12
CV %			5.34

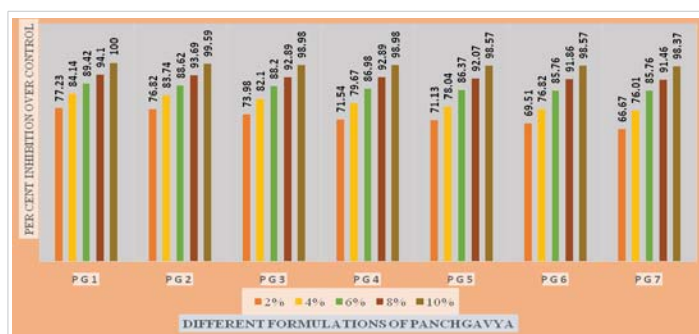


Figure 1: Antifungal efficacy of panchgavya formulations against *R. solani*.

Out of seven panchgavya formulations, the efficacy of PG1 was considered significant with the highest mean percent growth inhibition of the pathogen i.e., 100, 94.10, 89.42, 84.14, and 77.23 at 10, 8, 6, 4, and 2% concentration, respectively as compared to other panchgavya formulations in order of merit at 10% concentration was PG2 (99.59%), which was followed by PG3 (98.98%), PG4 (98.98%), PG5 (98.78%), PG6 (98.57%) and PG7 (98.37%). While, in case of the significance in the order of merit at 8% concentration was PG2 (93.69%), which was followed by PG3 (92.89%), PG4 (92.89%), PG5 (92.07%), PG6 (91.86%) and PG7 (91.46%). While, in case

of the significance in the order of merit at 6% concentration was PG2 (88.62%), which was followed by PG3 (88.20%), PG4 (86.98%), PG5 (86.37%), PG6 (85.76%) and PG7 (85.76%). The significance in the order of merit at 4% concentration was PG2 (83.74%), which was followed by PG3 (82.10%), PG4 (79.67%), PG5 (78.04%), PG6 (76.82%), and PG7 (76.01%). The significance in the order of merit at 2% concentration was PG2 (77.23%), which was followed by PG3 (76.82%), PG4 (71.54%), PG5 (71.13%), PG6 (69.51%), and PG7 (66.67%) inhibiting the growth of pathogen *R. solani*.

It is evident from the results that the growth inhibition of *R. solani* increased with an increase in the concentration of the respective panchgavya formulations. The results of the present investigation corroborate with the results obtained by Karthika, et al. [7] who observed that the most effective cent percent mycelial growth inhibition by panchgavya at 5% concentration against *R. solani* caused sheath blight of rice. The results were less or more similar to Ashlesha and Pual [8] who recorded more than 95% mycelia growth inhibition by panchgavya at 2, 4, 6, 8, and 10% concentrations against *R. solani* causing root rot of bell pepper.

It is proved from the results that growth inhibition of *R. solani* increased with an increase in the concentration of the panchgavya formulations and that PG1 was effective as compared to other formulations.

Conclusion

The panchayat formulations viz., PG1-7 were composed of cow urine, cow dung, curd, ghee, and milk and were evaluated at 2, 4, 6, 8, and 10% concentrations using the poisoned food technique. Out of seven panchgavya formulations, the efficacy of PG1 (10%) was considered significant with the highest mean percent growth inhibition of the pathogen *R. solani*.

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