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Effect of Different Glucose and Sucrose Levels on Uredospore Germination of *Uromyces ciceris-arietini*

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Abstract The growth and development of the pathogen is influenced by supplementation of nutrients. Spore germination implies a change from an inactive to active growing condition. This is accomplished in most fungi by the formation of a germ tube, which continues to elongate and ultimately leads to the formation of vegetative body of the fungus. The constituents of the substrates are known to influence spore germination of some species of fungi. Some species germinate well in distilled water or tap water, while other requires certain special nutrients such as sugars, salts or nitrogen sources. In the present investigation, among the different concentrations of sucrose (0.5, 1.0, 1.5 and 2.0%), maximum spore germination (87.44%) was observed in two per cent sucrose solution than the remaining concentrations. Among the different concentrations of glucose (0.5, 1.0, 1.5 and 2.0%), maximum spore germination (64.66%) was observed in two per cent glucose solution than the remaining concentrations.

Keywords *Uromyces ciceris-arietini,* Glucose, Sucrose.

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Introduction

Chickpea rust is a foliar disease, not known to cause as widespread damage o chickpea as like other chickpea diseases. The pathogen causing rust in chickpea was first detected and described in 1863 in France as *Uromyces ciceris-arietini*. Boyer an Joczevski found the telial stage in 1893. Later the name was changed to *Uromyces-ciceris-arietini* var. *aetnensis* by Scalia in 1899 and then to *Uromyces ciceris-arietini*. Germination of the Uredospore depends on amount of sugar concentration, temperature, relative humidity [1].

Temperature is one of the important factors for all metabolic activities of the fungus. After temperature, relative humidity is cruicial factor for the infection, reproduction and survival of the fungus and malic acid plays an important role in resistance of chickpea against rust. Rust is a high sugary disease, hence for the development of the disease different sugar solutions plays an important role. Keeping all these view, spore germination study was carried out.

Table 1. Effect of glucose on uredospore germination of *Uromyces ciceris-arietini*. * Arc sine values.

Glucose (%)	Germination (%) at different time intervals 6 h	12 h	24 h	48 h
0.5	8.87 (17.23)*	33.97 (35.63)	38.08 (38.09)	51.99 (46.12)
1.0	10.14 (18.56)	34.85 (36.16)	43.34 (41.15)	55.95 (48.40)
1.5	23.49 (28.97)	38.56 (38.37)	49.95 (44.95)	62.5 (51.08)
2.0	26.48 (30.95)	40.24 (39.36)	53.56 (47.02)	64.66 (53.56)
Distilled water	4.17 (11.75)	11.44 (19.75)	32.88 (34.97)	51.11 (45.62)
SEm ±	0.73	0.47	0.46	0.60
CD at 1%	3.30	2.12	2.06	2.73

Table 2. Effect of sucrose on uredospore germination of *Uromyces ciceris-arietini*. * Arc sine values.

Sucrose (%)	Germination (%) at different time intervals 6 h	12 h	24h	48 h
0.5	23.47 (28.96)*	39.95 (39.19)	47.30 (43.43)	53.37 (46.91)
1.0	38.31 (38.22)	53.70 (47.10)	56.64 (48.80)	61.61 (51.71)
1.5	52.17 (46.22)	61.07 (51.38)	70.80 (57.27)	81.42 (64.46)
2.0	55.27 (48.00)	62.56 (52.27)	77.56 (61.71)	87.44 (69.30)
Distilled water	4.17 (11.75)	11.44 (19.75)	32.88 (34.97)	51.11 (45.62)
SEm±	0.42	0.84	0.73	1.08
CD at 1%	1.88	3.76	3.30	4.77

Materials and Methods

In vitro studies were conducted to assess the effect of different glucose and sucrose levels on spore germination. Uredospores were collected from infected susceptible chickpea genotype (Bheema) by scraping the uredia with a sterilized scalpel and these were used for the spore germination study.

Different concentrations of sucrose and glucose (0.50, 1.00, 1.50 and 2.00% in distilled water) were used to see their effect on the germination of uredospore in a cavity slide. In a cavity slide, 25 µl of above mentioned concentration of sucrose and glucose solutions were separately taken and one uredium per cavity was added. The cavity slides were kept in the moist chamber and were incubated at 20°C. Three replications were maintained for each treatment. Uredospore germination was observed at 6,12, 24 and 48 h after incubation. Per cent germination was worked out by observing 100 uredospores under microscope at 100 × magnification. Per cent utredospore germination was calculated by using the following formula.

$$\text{Per cent uredospore germination} = \frac{A}{B} \times 100$$

Where, A- Number of uredospore germinated, B- Number of uredospore observed.

Results and Discussion

Effect of glucose on uredospore germination of *U. ciceris-arietini*

Four different concentrations of glucose (0.50, 1.00, 1.50 and 2.00%) were tested to study the uredospore germination at 20°C. Glucose at 1.50% and 2.00% were on par with each other and significantly superior to other concentrations including control (distilled water) at different time interval (Table 1). Highest spore germination was observed in 2.00% glucose at 20°C (64.66%) followed by 1.50% glucose (62.50%) after 48 h of incubation. Least spore germination was observed at 0.50% glucose (51.99%) followed by distilled water (51.11%) after 48 h of incubation and both remained on par with each other.

Effect of sucrose on uredospore germination *U. ciceris-arietini*

Four different concentrations of glucose (0.50, 1.00, 1.50 and 2.00%) were tested to study the uredospore germination at 20°C. Sucrose concentration at 1.50% and 2.00% were on par with each other and significantly superior to control after 6 h after incubation, but at other time intervals sucrose 2.00% was significantly superior to all other concentrations including the check (Table 2). Highest germination was observed at 2.00% sucrose (87.44%) at 20°C followed by 1.50% sucrose (81.42%) after 48 h of in-

cubation . The least spore germination was observed in 0.50% glucose (53.37%) and remained on par with distilled water (51.11%) after 48 h of incubation . This finding confirms the work of Nalwar et al. [2].

Quicker germination in large number of spores plays a vital role in faster envelopment and spread of the disease leading to epidemics of the disease. Hence, different sugar levels required for the uredospore germination of *U. ciceris-arietini* investigated.

The growth and development of the pathogen is influenced by supplementation of nutrients. Spore germination implies a change from an inactive to active growing condition.

This is accomplished in most fungi by the formation of a germ tube, which continues to elongate and ultimately leads to the formation of vegetative body of the fungus. The constituents of the substrates are known to influence spore germination of some species of fungi. Some species germinate well in distilled water or tap water, while other requires certain special nutrients such as sugars, salts or nitrogen sources.

In the present investigation, among the different concentrations of sucrose (0.5, 1.0, 1.5 and 2.0%), maximum spore germination (87.44%) was observed in two per cent sucrose solution than the remaining concentrations. Among the different concentrations of glucose (0.5, 1.0, 1.5 and 2.0%), maximum spore germination (64.66%) was observed in two per cent glucose solution than the remaining concentrations. Therefore, it clearly indicates that *U. ciceris-arietini* is a sugar loving fungus, which requires sugar for germination of uredospores and infection on the host. This finding confirms the work of Khedekar [3] as they reported that maximum spore germination (77.3 to 83.03%) was observed in two per cent sucrose solution.

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