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EFFECT OF DIFEREENT CARBON SOURCES ON SPORE GERMINATION OF *HELMINTHOSPORIUM ORYZAE*

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Abstract

Out of the monosaccharides and oligosaccharides D(+)—glucose and D(+)—sucrose were found to be the best carbon sources for the germination of spores of *Helminthosporium oryzae*. Whereas, D(+)—mannose did not favour spore germination at 2 to 5 per cent concentrations. Distilled water did not enhance the germination of spores but a stimulatory effect was observed in tapwater. There was no germination in any of the concentrations of oxalic and malic acids even after 5 days. Mostly mono and bipolar type of germination was noticed. A gradual change in colour of conidia from dark brown to light brown was observed.

Introduction

Germination is essentially the conversion of the resistant and dormant spores into a sensitive and metabolically-active form. Chemical constituents are known to influence spore germination of fungi. For spores deficient in food reserves, an external source of nutrient is necessary, while others with full complement of nutrients can germinate readily in distilled water (Gottlieb, 1950). Often spores require a simultaneous utilization of lipids and carbohydrates for their germination. Many fungi germinate better in the presence of ordinary nutrients and are sometimes entirely dependent on external sources of such material of the known constitution.

Duggar (1901) by placing spores in water-bean decoction or nutrient-salt solution demonstrated that fungi differ in their nutrient requirements for germination. Lin (1945) observed that conidia of *Glomerella cingulata* apparently have special nutrient requirements for germination. There was little or no germination in distilled water and in dextrose solution lacking minerals. He found no evidence that an external supply of any organic substance other than sugar, is necessary for spore germination. According to Emerson (1948) D-xylose gave a high percentage of ascospore germination of *Neurospora crassa* without heat treatment and it was more effective when autoclaved than when filtered.

The present study aims at investigating the effect of different concentrations of carbon sources on the percentage and type of germination of spores of *Helminthosporium oryzae*.

Materials and Methods

Culture of *H. oryzae* was obtained from diseased leaves of rice affected with leaf spots. Suspensions of 15-20 days old culture were made in five different concentrations of seven monosaccharides i.e. L(+)—arabinose, D(+)—xylose, D(+)—galactose, L(—)—sorbose, D(+)—glucose, D(+)—fructose, D(—)—mannose; three oligosacchari-

TABLE 1. Effect of different concentrations of carbon sources on the germination of spores of Helminthosporium oryzae.

Carbon Source	Concentrations	Germination %					Type of Germination				
		1	2	3	4	5	1	2	3	4	5
L (+)—Arabinose	1	7	42	44	50	50	M	M—B	M—B	M—B	M—B
	2	5	17	50	54	54	M	M—B	M—B	M—B	M—B
	3	—	12	80	85	85	—	M—B	M—B	M—B	M—B
	4	—	7	93	94	94	—	M—B	M—B	M—B	M—B
	5	—	8	21	21	21	—	M—B	M—B	M—B	M—B
D (+)—Xylose	1	3	66	80	100	100	M—B	M—B	M—B	M—B	M—B
	2	4	75	87	100	100	M—B	M—B	M—B	M—B	M—B
	3	5	76	90	100	100	M—B	M—B	M—B	M—B	M—B
	4	—	80	92	100	100	—	M—B	M—B	M—B	M—B
	5	—	72	91	83	83	—	M—B	M—B	M—B	M—B
D (+)—Galactose	1	14	58	71	100	100	M	M—B	B	B	B
	2	18	67	96	100	100	M	M—B	B	B	B
	3	22	92	100	100	100	M—B	M—B	B	B	B
	4	—	14	53	59	59	—	M—B	B	B	B
	5	—	—	—	3	3	—	M	B	B	B
L (—)—Sorbose	1	—	35	83	83	83	—	M—B	M—B	M—B	M—B
	2	6	82	100	100	100	M	M—B	M—B	M—B	M—B
	3	7	89	100	100	100	M	M—B	M—B	M—B	M—B
	4	—	73	89	93	93	—	M—B	M—B	M—B	M—B
	5	7	89	93	96	95	M	M—B	M—B	M—B	M—B
D (+)—Glucose	1	—	4	32	100	—	—	M—B	M—B	M—B	—
	2	—	57	91	100	—	—	M—B	M—B	M—B	—
	3	—	60	93	100	—	—	M—B	M—B	M—B	—
	4	—	62	95	100	—	—	M—B	M—B	M—B	—
	5	—	33	57	100	—	—	M—B	M—B	M—B	—
D (+)—Fructose	1	—	61	92	92	—	—	M—B	M—B	M—B	—
	2	—	67	92	92	—	—	M—B	M—B	M—B	—
	3	—	71	87	87	—	—	M—B	M—B	M—B	—
	4	12	95	97	92	—	M—B	M—B	M—B	M—B	—
	5	12	68	95	95	—	M—B	M—B	M—B	M—B	—

D (+)—Mannose	1	8	89	93	100	—	M—B	M—B	M—B	M—B	—
	2	4	6	10	10	—	B	M	M	M	—
	3	4	4	8	9	—	B	B	B	B	—
	4	—	—	4	5	—	—	—	M	M	—
	5	—	—	—	—	—	—	—	—	—	—
D (+)—Maltose	1	—	69	80	100	100	—	M—B	M—B	M—B	M—B
	2	—	85	100	100	—	—	M—B	M—B	M—B	—
	3	4	91	100	100	—	M	M—B	M—B	M—B	—
	4	—	77	84	84	84	—	M—B	M—B	M—B	M—B
	5	—	73	78	83	83	—	M—B	M—B	M—B	M—B
D (+)—Sucrose	1	3	75	100	—	—	M—B	M—B	M—B	—	—
	2	4	76	100	—	—	M—B	M—B	M—B	—	—
	3	10	78	100	—	—	M	M—B	M—B	—	—
	4	14	89	100	—	—	M	M—B	M—B	—	—
	5	54	96	100	—	—	M	M—B	M—B	—	—
D (+)—Lactose	1	57	47	80	88	100	—	M—B	M—B	M—B	M—B
	2	48	48	83	90	100	—	M—B	M—B	M—B	M—B
	3	—	62	83	93	100	—	M—B	M—B	M—B	M—B
	4	3	58	92	100	100	M	M—B	M—B	M—B	M—B
	5	—	54	90	100	100	—	M—B	M—B	M—B	M—B
Water	Tap Water	25	92	100	—	—	M—B	M—B	M—B	—	—
	Distt. Water	—	—	—	—	5	—	—	—	—	M—B

M=Monopolar
B=Bipolar

des i.e. D(+)—maltose, D(+)—sucrose, D(+)—lactose and two organic acids i.e. malic and oxalic acids. Concentrations of these sugars and organic acids were prepared in distilled water which ranged from one to five percent. For germination studies hanging drop technique was followed (Duggar, 1909). The volume of germination drop was kept almost equal in all the cases. Observation on the germination percentage and type of germination were recorded at 1 hr. interval upto 5 hr. at room temperature (± 22°C). Sterilised distilled and tap water were used as control. The criterion of germination was the emergence of short tube from the spore surface.

Results and Discussion

Results regarding the effect of different concentrations of carbon sources on per centage and type of germination of spores of *H. oryzae* are given in Table I. Out of the monosaccharides, D(+)—mannose did not favour germination of conidia of *H. oryzae* above 1% concentration, showing an inhibitory effect on germination at higher concentrations. A sudden decrease in germination of spores in L(+)—arabinose and D(+)—galactose at 5 % was observed, indicating a retarding effect at higher concentrations. Maximum germination of 100% was obtained at all the concentrations of D(+)—glucose after 4 hours giving a stimulatory effect on germination of spores. Of the oligosaccharides used, D(+)—sucrose activated the spore germination during early hours of incubation and rather late in D(+)—lactose. It shows that D(+)—sucrose has comparatively early stimulatory effect perhaps due to some impurities. Tap water stimulated spore germination perhaps due to the presence of some salts supporting spore germination, whereas distilled water lacked in such salts.

A gradual change in colour of condidia of *H. oryzae* from dark brown to light brown was observed during germination with passage of time. There was no germination of spores of *H. oryzae* even after 5 days in the two organic acid used i.e. malic and oxalic. But according to Sattar & Hafeez (1952) conidia of *Ascochyta rabiei* showed up to 95% germination in 0.09 % (N/50) and 0.18 % (N/25) concentrations of malic acid. The total lack of germination in our experiments may be due to higher concentrations of these acids.

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