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EFFECT OF DIFFERENT SOURCES OF CARBON ON THE GROWTH OF SOME SPECIES OF *POLYPORUS* AND *FOMES*

BY

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The effect of different sources of carbon on the vegetative growth of all the test-fungi has been recorded. The experimental procedure for this investigation has been described. The different sources of carbon used include glucose fructose, sucrose, mannitol, lactose, galactose, starch, maltose, sorbitol, citric acid, formic acid, maleic acid, oxalic acid and succinic acid. Of these, sucrose has been found to be the best carbon source for *P. cinnabarinus*. For *F. lividus* it is glucose and for *P. zonalis* starch is the best carbon source.

INTRODUCTION

Carbon compounds serve two essential functions in the metabolism of fungi. Firstly, they supply the carbon needed for the synthesis of the compounds which go to make up the living cell-proteins, nucleic acids, cell-wall materials, reserve foods etc.. Secondly, they supply appreciable amounts of energy by their oxidation. Almost half of the dry weight of the fungus cells consists of carbon. In addition to being the main structural elements, carbon compounds play an equally important functional role. Knowledge of carbon nutrition is, therefore, fundamental to an understanding of the physiology of fungi. A wide variety of amino acids, organic acids, sugars and their derivatives, alcohals and other more complex organic compounds have so far been tested as the sole source of carbon in the medium for the growth of fungi (Ainsworth and Sussman, 1965). D-glucose is biologically the most important of the sugars, and is utilized for growth by virtually all cultivable fungi. However, there are a few fungi which are unable to utilize glucose or any sugar as a carbon source. *Leptomitus lacteus* utilizes none of the common hexoses but grows in presence of acetate or other fatty acids as the sole source of carbon.

Although much valuable work has, so far, been done on the carbon nutrition of fungi references in case of basidiomycetes are few and fragmentary. Hirayama (1938), on the basis of studies on the carbon requirements of three species of *Fomes* and three species of *Polyporus*, concluded that the best sources of carbon were mainly hexoses and pentoses. Herrick (1940) reported that two isolates of *Stereum gausapatum* grew on glucose, fructose, mannose and galactose. One isolate made significantly better growth on fructose but the other grew equally well on all the four sugars. This indicated that not all isolates of a species were alike in their ability to utilize a given sugar. *S. gausapatum* was found to utilize the carbon source studied in the following order : Xylose, arbinose and raphinose (Herrick, 1940). Maximum growth of *Psalliota bispora* was obtained when xylose was used as carbon source (Treschew, 1944). Nord and Vitucci (1947) found *Lentinus lepideus* to utilize xylose. Four species of *Lenzites* grew best when 5% sucrose was used a carbon source (Mizumoto, 1956). An excellent review on the utilization of carbon sources by fungi has been made by Tandon 1961).

Materials and Methods

For the present investigations three species of basidiomycetes, *viz.*, *Fomes lividus* Kalchbr, *Polyporus zonalis* Berk, and *Polyporus cinnabarinus* Jacq. ex Fries have been collected from Calcutta and its suburbs. The primary and the secondary mycelial cultures, prepared from basidiospores of each of these test-fungi, were used in the experiment.

The basal liquid medium used during these studies was *Glucose-casein-hydrolysate* medium (Leonian and Lilly, 1945). The other experimental procedures were same as described by Bhatnagar (1971).

The basal medium was first prepared without any carbon source. The carbon sources used were glucose, fructose, sucrose, mannitol, lactose, galactose, starch, maltose, sorbitol, citric acid, formic acid, lactic acid, meleic acid, oxalic acid, and succinic acid. These were seperatively autoclaved and added aseptically to the cooled sterilized basal medium at a rate which supplied 10 gm of carbon per litre. The flasks containing basal medium with different carbon sources were inoculated seperatively by the test-fungi and incubated in the usual way for 10 days. Adequate number of flasks with basal medium but without carbon source were kept as controls. The other necessary experimental procedures, however, remained same (Bhatnagar, 1971).

Results

The results obtained during the experimental period are given in the following Table 1.

Table No. 1. *Data (mean) showing dry weight of the mycelia (mg) of* P. cinnabarinus, F. lividus *and* P. zonalis *in presence of various sources of carbon.*

Sources of Carbon	Fungi					
	P. cinnabarinus		*F. lividus*		*P. zonalis*	
	Primary mycelium	Secondary mycelium	Primary mycelium	Secondary mycelium	Primary mycelium	Secondary mycelium
Glucose	40.20	52.40	62.20	99.60	85.00	79.90
Fructose	32.60	41.90	56.60	79.90	81.70	72.80
Sucrose	41.70	62.60	59.90	85.90	69.70	62.70
Mannitol	39.80	61.50	52.80	84.00	72.00	70.60
Lactose	11.30	41.90	34.10	73.30	63.80	53.30
Galactose	23.50	41.60	33.00	71.80	69.50	62.60
Starch	21.10	40.00	44.60	79.60	104.20	94.10
Maltose	33.80	51.40	40.60	73.20	71.80	67.30
Sorbitol	36.50	43.20	37.60	72.80	59.80	47.50
Citric acid	17.60	31.50	30 60	62.40	46 80	39.60
Formic acid	5.70	8.30	14.10	27.80	24.40	20.60
Lactic acid	5.60	9.80	12.30	21.90	15.30	14.80
Maleic acid	3.50	8.20	15.70	24.30	12.80	16.40
Oxalic acid	12.30	16.40	10.20	23.40	21.10	19.60
Succinic acid	9.50	12.80	8.80	17.80	11.10	10.80
Control	6.50	10.20	12.90	22.60	17.80	15.20

From the table it is evident that very insignificant growth occured in all the test-fungi without carbon. The best carbon source for both the types of mycelia of *F. lividus* is glucose where the vegetative growth is found to be maximum. They show good growth when fructose, sucrose, mannitol and starch are used. Lactose, galactose and sorbitol supported poor growth of the fungus. In case of the two types of mycelia of *P. zonalis* maximum fungul growth is obtained when starch is employed as a source of carbon Glucose, fructose, mannitol and maltose are also fairly well utilized. Sucrose and galactose show moderate growth whereas lactose and sorbitol are found to be poor sources. In case of *P. cinnabarinus,* however, it has been observed that sucrose is the best source of carbon for the growth of both the primary and the secondary mycelia. Glucose, fructose, mannitol and maltose have also been found to be suitable for the growth of the two types of mycelia of *P. cinnabarinus.* Organic acids used proved to be poor sources of carbon for all the test-fungi.

Discussion

It has been noted that the three fungi under consideration show variation in the utilization of carbon from different sources. The best source of carbon for

the vegetative growth of *P. cinnabarinus* is sucrose, for that of *F. lividus* it is glucose, while for *P. zonalis* it is starch. The present findings on the role of different carbon sources used for the experiment on the nutrition of the test-fungi can be explained with the help of investigations so far done on carbohydrate metabolism of fungi by previous investigators *P. cinnabarinus*, possibly breaks down sucrose into fructose and glucose. The responsible enzyme, namely, β-fructofurunosidase (invertase) and α-glucosidase are required for these reactions. (Cochrane, 1958). The stimultory effect of starch on the growth of *P. zonalis* might be due to greater amylase activity. Starch is broken down to dextrin, dextrin into maltose, and subsequently maltose into glucose before utilization with the help of the enzyme amylase. The glucose is, however, directly utilized by the fungus in question.

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