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Fat Production by Some Mucorales

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Eight fungi of Mucorales were examined to ascertain their fat-forming capabilities when grown on Duggar's modified liquid basal medium. The most promising results have been obtained by three fungi, namely, *Cunninghamella elegans*, *Rhizopus nodosus* and *Absidia spinosa*. The fat content in dry mycelium was maximum with *A spinosa* (40.93%) followed by *R nodosus* (37. 19%) and *C elegans* (36.0%).

Key Words: Fat Production, Mucorales, *Cunninghamella elegans, Rhizopus nodosus* **and** *A. spinosa*

Introduction

Fat plays an important role in our daily life. These are required as one of the major constituents of diet for human beings and animals. During the last few years there has been an acute shortage of oils and fats in the world, and if the population continues to increase at the present rate, the demands for oil and fats will further increase at about 50% within the next two decades. The production of fat through the agency of microorganisms has, therefore, attracted great attention. Lundin (1950) observed that *Rhodotorula gracilis* proved to be the best yeast for the production of fat. Woodbine et al. (1951) reported the results of preliminary survey of the potentialities of 43 strains of moulds and observed that *Aspergillus nidulans*, *Penicillium spinulosum* and *P. javanicus* had good potentiality for fat production.

The present work represents an attempt to determine the fat-forming capability of eight Mucorales isolated from different substrata. No such studies have been carried out on these fungi previously.

Materials and Methods

Absidia spinosa Lendner, and *Rhizopus nodosus* Namyslowski were isolated from dung, *Cunninghamella elegans* Lendner from soil, *Mucor pusillus* Lindt and *Rhizopus nigricans* Ehrenb from *Dalbergia sissoo* Roxb., *Rhizopus Stolonifer* (Ehrenb ex. Fr.)

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Lind and *Rhizomucor pusillus* (Lindt) Schipper from *Anacardium occidentale* L., and *Syncephalastrum racemosum* (Cohn) Schroeter from *Prunus amygdalus* (Tourn.) Linn.

These fungi were maintained on PDA (peeled and sliced potatoes 200 g, dextrose 20 g, agar agar 20 g, and distilled water 1,000 ml) slants. The fungi were subcultured after an interval of two months.

The Duggar's modified liquid basal medium containing dextrose, 100 g, KNO_3 5 g; KH_2PO_4, 10 g; $MgSO_4.7H_2O$, 0.250g; $Fe_2(SO_4)_3.6H_2O$, 0.005 g, and distilled water 1,000 ml was employed for the growth of *C. elegans*, *R. nodosus*, *A. spinosa* and *S. racemosum*, but in place of KNO_3, ammonium sulphate (1.98 g/L) was employed in the basal medium for the growth of rest of the fungi. The *p*H of the medium was adjusted to 6.0. All the fungi were grown at 28°C for 10 days.

Twenty-five ml of the liquid basal medium were poured in each 100 ml of flask and five replicates were taken for each fungus. The media were then sterilized at 7 lbs/sq. inch steam pressure for 30 min. Each flask was inoculated with 1 ml of standardized spore suspension (8-16 spores per low power field of the compound microscope) in the case of each fungus. The cultures were filtered and dried at 60°C to a constant weight in hot air oven.

Estimation of fat

The dried mycelial mat from 5 flasks in each case was thoroughly powdered, added to Whatman extraction thimbles and extracted in Soxhlet extraction unit on a water bath for 12 hr using Petroleum ether (B.P. 60-80°C). Petroleum ether was recovered by distillation on a steam bath and fat left was weighed ater drying at 60°C.

Estimation of glucose

The filtrate and washing of 5 flasks in each case were collected and made up to a known volume. The glucose was estimated according to the method of Lane and Eynon (1923).

The results were statistically analysed and the standard error was calculated by the formula:

$$\text{Standard error} = \sqrt{\frac{\text{Mean square of error}}{\text{Number of replicates}}}$$

Results and Discussion

The data presented in table 1 indicate that maximum fat is synthesized by *Absidia spinosa* followed by *Rhizopus nodosus*, *Cunninghamella elegans*, *Mucor pusillus*, *Rhizopus nigricans*, *Syncephalastrum racemosum*, *Rhizomucor pusillus* and *Rhizopus stolonifer*. The greatest actual weight of fat was synthesized by *A. spinosa* giving a yield of 40.93% on dry mycelium. *R. nodosus* and *C. elegans* also showed promising overall behaviour in fat production. Woodbine et al. (1951) observed maximal of 39.7% of fat in the mycelium of *Aspergillus flavipes*. Gunasekaran and Weber (1975) reported that *Rhizopus arrhizus* had the highest lipid content in mycelium when grown on fructose. Recently Madan (1979) obtained the most promising results by four fungi, namely, *Aspergillus terreus*, *Botryodiplodia theobromae*, *Microxyphiella hibiscifolia* and *Pestalotia palmarum*. She found that the fat content in the dry mycelium was maximum with *P. palmarum* (45.71%), followed by *A. terreus* (43.18%), *B. theobromae* (42.50%) and *M. hibiscifolia* (30.91%). Several reports concerning the production of fat by various molds suggest that some strains of Mucorales like *A. spinosa*, *R. nodosus* and *C. elegans* are also of potential industrial importance (table 1).

Table 1 *Fat formation by eight Mucorales when grown on Duggar's modified liquid basal medium*

Fungus	Weight of mycelium (g)	Weight of Fat (g)	Fat as percentage of mycelium	Weight of glucose consumed	Economic coefficient	Fat coefficient
Cunninghamella elegans	0.240 (±.0016)	0.0864 (±0.002)	36.00 (±.39)	1.70 (±.026)	14.12	5.07
Rhizopus nodosus	0.052 (±.0034)	0.0192 (±.0002)	37.19 (±2.04)	1.68 (±.017)	3.08	1.14
Absidia spinosa	0.078 (±.0017)	0.0320 (±.0023)	40.93 (±2.05)	1.50 (±.023)	5.20	2.13
Mucor pusillus	0.072 (±.0023)	0.0150 (±.0023)	20.66 (±2.55)	1.09 (±.051)	6.60	1.37
Rhizopus nigricans	0.172 (±.0034)	.0260 (±.0017)	15.08 (±.70)	1.53 (±.028)	11.24	1.69
Rhizopus stolonifer	0.104 (±.0034)	.0030 (0)	2.87 (±.095)	2.20 (±.028)	4.72	0.13
Rhizomucor pusillus	0.093 (±.0023)	0.0116 (±.0003)	12.46 (±.063)	1.60 (±.028)	5.81	0.75
Syncephalastrum racemosum	0.128 (±.0015)	0.0170 (±.0015)	13.22 (±.69)	1.05 (±.028)	12.19	1.61

Values in parentheses show standard error

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