STUDIES ON THE NUTRITION OF FUNGI

Part III.—Comparative Study of Nutrition Requirements of Some Members of Moniliaceae and Dematiaceae

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A comparative study of the nutrition requirements of some members of families Dematiaceae and Moniliaceae has been carried out. *Penicillium lilacinum* Thom belonging to Moniliaceae yields the maximum amount of mycelial mat at all the five concentrations of carbon, not only in comparison with the members of Dematiaceae but also within members of Moniliaceae. *Botryotrichum* sp. Saccardo and Marchal a member of Dematiaceae utilized carbon from glucose less profitably as compared to other fungi of both families except *Dactylium fusarioides* Fragoso et Ciferri which at a carbon concentration of 2 per cent produced less growth than *Botryotrichum* sp.

Aspergillus sclerotiorum Huber of Moniliaceae, in general, utilized nitrogen from glycine most profitably while *Penicillium lilacinum* of the same family and *Alternaria tenuissima* (Fr.) Wiltshire of Dematiaceae poorly utilized nitrogen from glycine.

From the above results it appears that members of Moniliaceae are better adapted to the utilization of carbon and nitrogen from glucose and glycine respectively than members of Dematiaceae.

Introduction

The importance of carbon and nitrogen, the two elements playing a vital role in the nutrition and metabolism of fungi, is a recognized fact. It is well known that different organisms respond differently to the same food. Various fungus physiologists have concluded that species of the same genus behave differently to the same source of nitrogen and carbon[1] and even the strains are reported to be selective utilizing the same source.[2] Lilly and Barnett[1] observed that among the monosaccharides, glucose proved to be the best source of carbon. Steinberg[3] and Lilly and Barnett[4] reported the promoting effect of glucose on *Aspergillus niger* and *Sordaria fumicola* respectively. Hawker[5] reported that mycelium produced by *Melanospora destruens* was greater when grown on a medium containing glucose as source of carbon. Volkonsky[6,7] reported that alanine, serine, cystine and phenylalanine were superior amino acids for supporting the growth of the members of family Saprolegniaceae.

Steinberg[8] studied the effect of 22 amino acids on *Aspergillus niger* and concluded that 7 of these amino acids were the excellent source of nitrogen for *A. niger*. Stocks and Ward[9] observed considerable differences among the amino acids as sources of nitrogen for *Rhizopus nigricans*. Sarbhoy[10] studied the effect of different sources of carbon and nitrogen on six species of the genus *zygorhynchus*. Sorenson and Hesseltine[11] showed the stimulatory affect of glucose on disaccharides in promoting the growth of *Rhizopus oligosporus*.

The authors[12,13] have reported the affect of different concentrations and sources of carbon and nitrogen on the growth of *Fusarium dimerum* and *Helminthosporium anomalum*. The present investigation was undertaken for studying the different response between some members of Moniliaceae and Dematiaceae and also for differentiating among the members of the same family with regard to the utilization of glucose and glycine which were used as source of carbon and nitrogen respectively in various concentrations. Four representative members of Moniliaceae and three members belonging to Dematiaceae were used in this investigation.

Materials and Methods

Aspergillus fumigatus Fresenius, *A. sclerotiorum* Huber, *Penicillium lilacinum* Thom and *Dactylium fusarioides* Fragoso *et* Ciferri belonging to Moniliaceae and *Alternaria tenuissima* (Fr.) Wiltshire, *Curvularia verruculosa* Tandon *et* Bilgrami and *Botryotrichum* sp. Saccardo and Marchal representing Dematiaceae were used as representative members of the two families under investigation.

The fungi were grown in Czapek's culture solution. (sodium nitrate, 2.0g; potassium dibasic phosphate, 1.0g; potassium chloride 0.5g; magnesium sulphate, 0.5g; ferrous sulphate, 0.01g; and sucrose, 30 g). Sodium nitrate in the original medium was replaced with glycine and sucrose with glucose, the two sources of nitrogen and carbon respectively used in the present investigations. The medium was buffered.

Five different concentrations of nitrogen, 0.01, 0.05, 0.1, 0.5 and 1.0 per cent and carbon 0.5, 1.0, 2.0, 4.0 and 6 per cent calculated with the

help of molecular weight of glycine and glucose respectively were taken. Fifty ml of Czapek's medium with the respective concentrations of nitrogen and carbon was poured in separate flasks which were autoclaved at 15 lb pressure for 15 min. The medium was then allowed to cool before inoculating with 4 mm discs cut from the growing edges of a 4-day old culture of the 7 fungi used in these studies. The flasks were incubated at 27° ±2° for 15 days. Duplicates were employed for each concentration and the experiment was replicated thrice.

After incubation the mycelium was filtered on pre-weighed filter papers (No. 5 Whatman), dried at 50° for 24 hr in an oven and reweighed. The difference between the two weights of filter paper yielded the dry weight of the mycelium at different concentrations of carbon and nitrogen for each of the organisms used. The dry weight of the mycelium of various fungi used in this study has been divided with an even number, 200, in order to facilitate the making of histograms. Actual dry weights, however, have been given in Tables 1 and 2.

Results

Results of the above investigation show that at 0.01 percent nitrogen concentration *Curvularia verruculosa* belonging to Dematiaceae produced maximum growth of the fungus (650 mg) while *Alternaria tenuissima* of the same family yielded minimum growth (211 g) at that concentration among the seven fungi used (Table 1) As the concentration of nitrogen was increased from 0.01 to 1.0% with intermediate concentrations of 0.05, 0.1 and 0.5% it seems there was a general increase in the amount of growth of almost all fungi. At 0.1% the nitrogen concentration *Aspergillus sclerotiorum* of Moniliaceae produced the maximum growth (1672 mg), while *Alternaria tenuissima* of Dematiaceae yielded only 400 mg of mycelial mat, which is the lowest growth at this concentration. *Dactylium fusarioides* of Moniliaceae utilized 1.0% nitrogen to its maximum in producing a growth of 2174 mg. The minimum growth at this concentration was obtained in *Penicillium lilacinum* (1077 mg), also of Moniliaceae. Fig. 1 shows the growth of 7 fungi at different nitrogen concentrations.

Table 1.—Dry Weights (mg) of the Mycelium of 7 Fungi at Five Nitrogen Concentrations. (Better Growth of Members of Moniliaceae Has Been Observed).

% Nitrogen	The dry weight of mycelium (mg)						
	Moniliaceae				Dematiaceae		
	Aspergillus sclerotiorum	*Dactyluim fusarioides*	*Aspergillus fumigatus*	*Penicillium lilacinum*	*Curvularia verruculosa*	*Botryotri chum sp.*	*Alternaria tenuissima*
0.01	440	407	594	263	650	400	211
0.05	1011	525	750	287	704	692	319
0.1	1672	779	1100	550	1016	842	400
0.5	2422	1540	1150	780	1244	884	520
1.0	1770	2174	1420	1077	1756	1342	1251

Table 2.—Dry Weights (mg) of Mycelium of 7 Fungi at Five Carbon Concentrations. (Better Growth of the Members of Moniliaceae has been Observed).

% Carbon	The dry weights of mycelium (mg)						
	Moniliaceae				Dematiaceae		
	Penicillium lilacinum	*Aspergillus fumigatus*	*Aspergillus sclerotiorum*	*Dactylium fusarioides*	*Curvularia verruculosa*	*Alternaria tenuissima*	*Botryotrichum sp.*
0.5	770	400	262	200	150	300	100
1.0	962	841	450	323	520	632	250
2.0	1540	1065	1002	489	947	770	550
4.0	2440	1750	1486	1034	1980	1525	750
6.0	3280	2704	1835	1492	3060	2115	1090

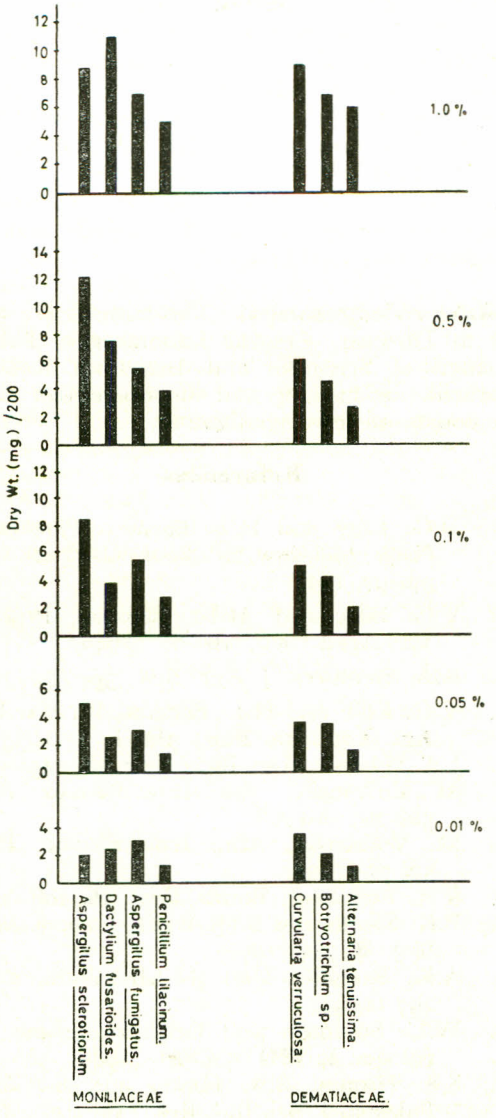

Fig. 1.—Comparative dry weight of the mycelium (mg/200 of members of families Moniliaceae and Dematiaceae at 0.01, 0.05, 0.1, 0.5 and 1.0% nitrogen.

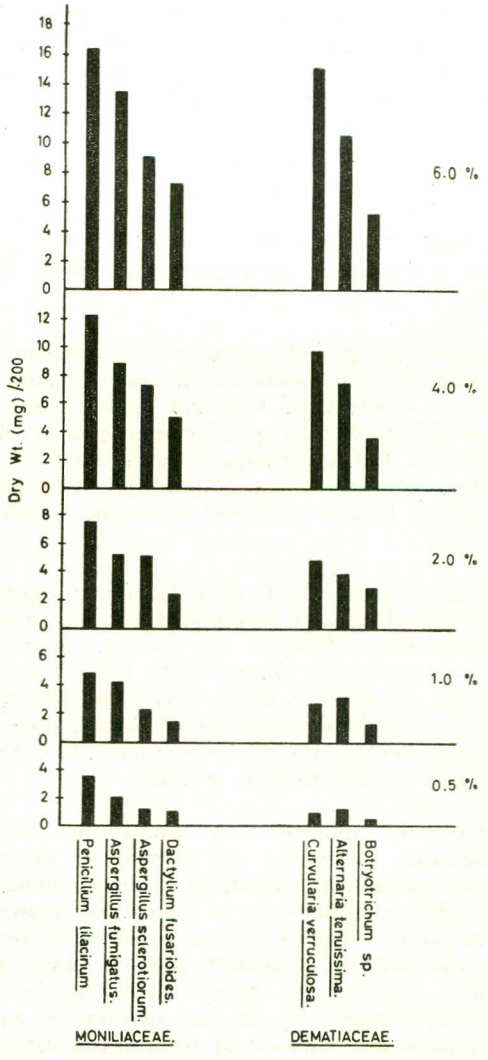

Fig. 2.—Comparative dry weight of the mycelium (mg)/200 of members of families Moniliaceae and Dematiaceae at 0.5, 1.0, 2.0, 4.0 and 6% carbon.

Penicillium lilacinum of Moniliaceae utilized carbon from glucose extremely well and at a concentration of 0.5% carbon it yielded a net mycelial weight of 770 mg. *Botryotrichum* sp., a member of Dematiaceae yielded the least amount of growth (100 mg) at this concentration. *Penicillium lilacinum* continued its best utilization of glucose carbon through all the concentrations (1,2,4 and 6%) and at a concentration of 6% carbon it yielded a growth of 3280 mg (Table 2) *Botryotrichum* sp. of Dematiaceae persisted with its comparatively little utilization of glucose carbon through all the concentrations except at 2% carbon where it surpasses *Dactylium fusarioides*, However, at the remaining concentrations of 1, 4 and 6% carbon, *Botryotrichum* sp. showed least growth as compared to other the fungi. Results of glucose carbon utilization of the representative members of the two families are given in Fig. 2.

Discussion

The comparative studies of the effects of various concentrations of carbon from glucose on representative members of Moniliaceae and Dematiaceae have shown that in general the members of Moniliaceae have a slightly better edge over the members of Dematiaceae as to the utilization of carbon with respect to the production of mycelial growth.

Penicillium lilacinum of Moniliaceae yields maximum amount of mycelial mat at all the five concentrations of carbon not only in comparison with the members of Dematiaceae but also within members of Moniliaceae as well. Different response to one given carbon source by different organisms has also been observed by other workers. Sarbhoy[10] studied the effect of glucose on six species of *zygorhynchus* and observed that *Z. exponens* and *Z. heterogamus* utilized carbon from glucose much more profitably than other four species.

Botryotrichum sp. belonging to Dematiaceae did not utilize glucose carbon well and yielded the minimum amount of mycelial mat. This behaviour of *Botryotrichum* sp. may be due to its selective nature. The utilization depends on the configuration of carbon compound and the ability of a certain fungus to utilize a specific source of carbon.[1]

It is interesting to note that *Penicillium lilacinum* while responding very favourably to glucose with respect to the utilization of carbon, does not behave in the same manner with respect to the utilization of glycine as a source of nitrogen. Actually *Penicillium lilacinum* of Moniliaceae is least supported by glycine as compared to other 6 fungi used in the present studies.

Among the members of Moniliaceae under investigation, *Aspergillus sclerotiorum*, in general, produces maximum growth in Czapek's medium where glycine is used as a source of nitrogen. It is noticed that at a nitrogen concentration of 0.5% the amount of growth is more (2422 mg) than at 1.0% nitrogen (1770). This may be due to increased alkalinity of the medium as more NH_2 groups are released in the culture medium at 1% nitrogen concentration which may not be conducive to good growth of this particular fungus. Sarbhoy[10] studying the effect of nitrogen on 6 species of *Zygorhynchus* has shown that glycine is a good source of nitrogen for *Z. moelleri* 2, *Z. californiensis* and *Z. exponens*, while the other 3 species utilize it only moderately. According to Ram Dayal[14] glycine proved to be a mediocre source for the growth of *Achlya aplanes* and *Isoachlya unispora* but poor for other members of Saprolegniaceae he used in his studies. Sorenson and Hesseltine[11] have also shown that glycine supports effects growth of *Rhizopus oligosporus* than other amino acids used. Studies on the nutrition of fungi with respect to the effect of pH and temperature are continuing.

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