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A systematic survey of the fatty acid composition of Neurospora strains

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Abstract

Numerous studies have examined aspects of lipid metabolism in *Neurospora crassa, N. tetrasperma and N. sitophila*, but little systematic comparison has been done on lipids of the different species. Most obviously missing, however, is comparison of the fatty acid composition of lipids among Neurospora species. Fatty acid composition (especially the production of particular polyunsaturated fatty acids) is often a key factor in genus or species identification, particularly in bacteria, but also in other fungi such as Aspergillus, Penicillium and Mortierella (Kock and Botha 1998 In Frisvad et al. (eds), Chemical Fungal Taxonomy, Marcel Dekker, NY, p. 219-246). Until this study, reports of the fatty acid composition of Neurospora lipids have been limited to a few laboratory strains of *N. crassa*.

A systematic survey of the fatty acid composition of Neurospora strains.

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Numerous studies have examined aspects of lipid metabolism in *Neurospora crassa*, *N. tetrasperma* and *N. sitophila*, but little systematic comparison has been done on lipids of the different species. Most obviously missing, however, is comparison of the fatty acid composition of lipids among Neurospora species. Fatty acid composition (especially the production of particular polyunsaturated fatty acids) is often a key factor in genus or species identification, particularly in bacteria, but also in other fungi such as Aspergillus, Penicillium and Mortierella (Kock and Botha 1998 In Frisvad *et al.* (eds), Chemical Fungal Taxonomy, Marcel Dekker, NY, p. 219-246). Until this study, reports of the fatty acid composition of Neurospora lipids have been limited to a few laboratory strains of *N. crassa*.

A characteristic of vegetatively-growing laboratory *N. crassa* strains is a high relative percentage of the polyunsaturate 18:2. Young cultures, particularly those growing at lower temperatures, also have high 18:3 (alpha-linolenate). We analyzed the fatty acid composition of 14 distantly-related wild-type Neurospora strains in order to determine whether the fatty acid composition of a standard *N. crassa* laboratory strain (FGSC #987) is characteristic of the genus. The strains (Table 1) were chosen to represent the geographic breadth of conidiating Neurospora species and to be comparable directly to the most recent study of Neurospora phylogeny (Skupski *et al.*, 1997 *Fungal Genet. Biol.* **21**:153-162). Four additional strains, particularly useful in other studies, were also included. We selected growth conditions (shaken for 2 d at 23°C in Vogel's medium N with 1% w/v sucrose) that should favor high levels of 18:3. Two cultures of each strain were extracted and analyzed by GC (Goodrich-Tanrikulu *et al.*, 1994, *Microbiology* **140**:2683-2690).

In all cases, the fatty acid profile of the 13 other strains resembled that of the *N. crassa* reference strain (Table 1). The greatest variability among strains was in the relative percentage of 18:3, although Neurospora species appear universal in producing high levels of 18:2 and 18:3. Although the strains were cultured under identical conditions to minimize variability, levels of 18:3 relative to 18:2 are known to depend upon many factors, including culture mass (Vokt and Brody 1985 *Biochim. Biophys. Acta* 835:176-182). Many of the strains tested did not grow as well as the reference strain under these conditions. Although we cannot rule out intrinsic differences among particular strains, the variability in relative percentage 18:3 observed among strains (9 to 34%, Table 1) is very similiar to the expected range for culture mass effects. The only other fatty acids detected at significant levels in the extracts were traces of 14:0 and 16:1. Thus, no consistent differences in fatty acid composition among species were observed that could be used as taxonomic characters in species identification.

Table 1. Fatty acid composition of selected Neurospora strains

			% total fatty acid				
Species	location	FGSC #	16:0	18:0	18:1	18:2	18:3
N. crassa	Louisiana	987	17.7 ± 4.8	5.1 ± 0.6	11.8 ± 0.3	42.8 ± 4.5	22.6 ± 0.7
	Panama	1131	15.1 ± 1.6	5.1 ± 4.1	10.0 ± 0.0	35.9 ± 2.8	33.8 ± 3.0
	Texas	2225	13.5 ± 1.0	3.8 ± 2.0	10.8 ± 3.5	42.5 ± 2.2	29.5 ± 3.6
N. intermedia	Fiji	435	12.2 ± 1.7	4.3 ± 1.6	16.7 ± 0.6	44.7 ± 6.6	22.2 ± 2.7
	Taiwan	1766	14.6 ± 0.3	3.8 ± 1.3	13.2 ± 1.4	44.0 ± 0.6	24.5 ± 1.0
N. sitophila	Virginia	2216	13.3 ± 0.7	4.9 ± 2.1	13.8 ± 0.2	47.9 ± 1.1	20.1 ± 0.6
	Nigeria	2009	20.7 ± 4.6	9.3 ± 0.8	10.5 ± 0.1	50.2 ± 1.8	9.3 ± 1.9
	Brazil	6673**	16.3 ± 0.1	3.7 ± 1.7	16.5 ± 0.0	37.5 ± 2.1	26.5 ± 0.4
N. tetrasperma	unknown	1270	15.7 ± 0.5	3.9 ± 1.4	16.5 ± 0.2	42.1 ± 0.2	21.9 ± 2.2
	Hawaii	2509	17.2 ± 0.5	3.0 ± 0.2	13.6 ± 2.8	46.5 ± 7.6	19.7 ± 4.2
	Mexico	7586	15.9 ± 0.2	3.4 ± 0.4	13.7 ± 0.7	46.2 ± 0.5	20.9 ± 1.9
N. discreta	Texas	3228	12.0 ± 4.2	6.2 ± 0.6	16.9 ± 1.3	50.8 ± 8.3	14.1 ± 2.1
	New Guinea	3269	15.1 ± 0.1	3.1 ± 0.2	11.7 ± 0.3	50.2 ± 0.2	19.9 ± 0.1
	Ivory Coast	P3665†	14.8 ± 4.3	4.0 ± 0.0	13.2 ± 0.0	55.1 ± 3.8	12.8 ± 0.4

* The average ± s.d. of two analyses for each strain

** Identical to fragrant strain ATCC # 46892 † This strain is officially classified as *N. discreta*-like (D. D. Perkins, pers. comm. This number is the Perkins collection designation; the collection is now being curated by the FGSC