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Linear growth rates of strains representing 10 *Neurospora* species.

and assay the effect of varying nuclear ratios in heterokaryons (Davis 1966, in Ainsworth/Sussman (eds.), *The Fungi, an Advanced Treatise* 2:567-588), to study circadian rhythms (Sargent et al. 1966 *Plant Physiol* 41:1343-1349, Feldman et al. 1983 *Photochem. Photobiol. Rev.* 7:319-368), and to determine changes in growth rate that accompany decreases or increases in the number of genes specifying ribosomal RNA (Rodland et al. 1983 *Curr. Genet.* 7:379-384). Race tubes have also been used to detect and study senescence and mitochondrion-based stopper mutations in laboratory strains, and the stop-start growth shown by classes of mutagen-sensitive and DNA-repair deficient mutants (e.g. Sheng 1951 *Genetics* 36:199-212; Bertrand et al. 1976 *Can. J. Genet. Cytol.* 18:397-409; Newmeyer 1984 *Curr. Genet.* 9:65-74). In a survey of wild-collected strains, race tubes led to the discovery in one wild population of senescence due to mitochondrial defects (Rieck et al. 1982. *Can. J. Genet. Cytol.* 24:741-759).

Ryan et al. determined growth rates of representative strains of *N. crassa* and *N. sitophila*. Rieck et al. have measured the rate for *N. intermedia*. To our knowledge, linear growth rates have not been reported for *N. tetrasperma* or for the five homothallic species.

We were prompted to compare linear growth rates by the discovery of a fourth heterothallic species, which is being described and named *N. discreta*. Sexually compatible strains of *N. discreta* are highly fertile among themselves, but are genetically isolated from all the other species by sterility barriers. In preparing a species description it seemed of interest to compare growth rates of *N. discreta* with the other species. The results are summarized in Table 1, where rates are also shown graphically.

The method of measuring linear growth rate on agar medium in long tubes devised by Francis Ryan in 1941-1942 is simple, precise, and reproducible. These "race tubes" have been widely used for many purposes, such as to define optimal conditions for growth (Ryan et al. 1943 *Am. J. Bot.* 30:784-799), to measure complementation

TABLE I

Linear growth of strains representing all the known *Neurospora* species. Rate is mm/h at 25°C on minimal medium N in 30 cm long growth tubes. Each value is based on the linear phase of growth in a single tube.

SPECIES	STOCK NO.	NAME OF STRAIN	RATE	GRAPH OF LINEAR RATES
<i>N. crassa</i>	8203	ORS-SL6 a	3.7	
	2149	fl-P A	3.8	
	P538	Mauriceville-1c A	3.7	
	8063	Adiopodoume A	3.9	
	9359	Adiopodoume V7 A	4.0	
<i>N. intermedia</i>	P420	Clewiston-1h A	4.0	
	P405	La Belle-1 b a	4.0	
	8136	Shp-1 a	4.1	
	8135	Shp-1 A	4.2	
	P60	Kao-shong-1 a (ylo ecotype)	3.3	
	P201	Kelungkung-1 a (ylo ecotype)	3.4	
<i>N. sitophila</i>	P8085	Arlington A (Sk-1k)	3.8	
	P8086	Arlington a (Sk-1k)	3.8	
	8112	Sk-1s A	3.9	
	8111	Sk-1s a	3.9	
	8222	fl Sk-1k A	4.0	
<i>N. tetrasperma</i>	8055	85 A	3.3	
	8056	85 a	3.5	
	8219	85 A+a	3.6	
	P2300	Waitakere, N.Z. A+a	4.0	
	P202	Gianjor-1 A+a	4.0	
<i>N. discreta</i>	P851	Kirbyville-6 A	1.5	
	P846	Kirbyville-1 a	1.4	
	P390	Homestead-1k a	2.8	
	P755	Santa Maria a	2.8	
homothallics	8058	<i>N. africana</i>	1.7	
	8059	<i>N. dodgei</i>	2.1	
	8060	<i>N. galapagosensis</i>	1.5	
	D301	"", var. <i>dominicana</i>	1.8	
	FGSC 1889	<i>N. terricola</i>	0.8	
	FGSC 1910	<i>N. lineolata</i>	1.7	

Rather than prepare tubes in duplicate or triplicate for individual tests, only a single race tube was used for each strain, and rates were determined using several different strains to represent each species. This could not be done for the homothallic species where only a single isolate was available.

N. crassa, N. intermedia, N. sitophila, and N. tetrasperma differ little in rate of linear growth. An apparent exception is the yellow ecotype of N. intermedia (represented by P60, P201) which is found characteristically on nonburned substrates in the Eastern hemisphere.

In contrast, the five homothallic species grow at only half the speed of the heterothallics, or less. The slowest species, N. terricola, from soil in Wisconsin, is also set off from the others morphologically by having rounded ascospores with a single germ pore. Strain D301 from Dominica, West Indies, has been diagnosed as a variety of N. galapagosensis (H.L. Huang, personal communication). All the homothallic strains are devoid of conidia.

Representative strains of the new species N. discreta are also distinctly slower than the other heterothallic species. The Kirbyville isolates from Texas are slowest. P390 (Florida) and P755 (Guatemala) are somewhat faster.

Our growth-rate determinations based on single tubes are certainly not definitive. However, these results agree well with the more extensive data of other workers for species tested previously. Our 25° C rates compare with those of Ryan et al. (1943) as follows: 3.7-4.0 vs 3.7-4.2 mm/h for N. crassa; 3.8-4.0 vs 4.1-4.2 mm/h for N. sitophila. For N. intermedia, our 4.0-4.2 mm/h compares with about 4.2 mm/h of Griffiths et al. (personal communication). Ryan et al. calculated that a difference of less than 0.4 mm/h between two single race tubes is probably not significant. - - - Department of Biological Sciences, Stanford University, Stanford, California 94305