Fungal Genetics Reports

Volume 15 Article 26

Spore and ascus mutants in N. tetrasperma

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Abstract

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Novak, D. R. and A.M. Srb. Spore and ascus mutants in N. tetrasperma.

A dominant round spore mutant and both dominant and recessive oscus mutants hove been isolated following dimethyl sulfate mutagenesis of N. tetrasperma conidia. The characteristics of the dominant round spore mutant ore similar to those of the round spore mutant of N. crassa described by M. Mitchell (1966 Neurorporo Newsl. 10:6). Crosses in which both parents carry the round spore mutation are infertile. Each spore from a four-spored ascus germinates from two germ pores. In the infrequent case of a three-spored ascus, the exceptionally large round spore has four germ pores ond presumably con germinate from all four pores. Germination from more than two pores has been observed in multi-porate spores derived from single-spored" tetrasperma asci and also in the "giant" spore (gsp) mutant of N. crassa described in the note above by Leary and Srb.

Unlike the N. crassa round spore which Cameron has mopped as one of the outermost mutants in I R, segregating independently of mating type (1967 Neurospora Newsl. 11:6), N. tetrasperma round spore is in linkage group I and shows close linkage to the mating type locus (approx. 12 mop units). However, the linkage of round spore to mating type in N. tetrasperma need not be token to mean that round spore is located closer to mating type in N. tetrapserma than in N. crassa, nor con it be assumed that more than one gene on linkage group 1, when mutated, is capable of producing round spores. These reservations ore based on evidence that in N. tetrasperma crossing over is greatly reduced, at least in linkage group 1. Adenine purple, and several other N. tetrasperma linkage group I markers obtained in our lob, hove never shown recombination with the mating type locus.

Normal N. tetrasperma spores overage 16μ x 31μ while "round" spore dimensions average 18μ x 21μ. Round spores show a slight elongation near the germ pores and the 21μ is meowed along a line drown between the two germ pores. Unlike normal spores, round spores usually do not fill the length of the ascus, yet the volume of a round spore is calculated to be about 85-90% that of a wild type spore.

An occasional non-genetic reversal of dominance occurs; that is, in a cross heterozygous for round spores, one or two asci in a given perithecium may contain four phenotypically normal spores. However, given the absence of second division segregation in such exceptional asci, each of the normal heterocaryotic spores upon germination giver rise to a self-fertile mycelium which produces perithecio containing round-spored asci. Asci hove never been observed to contain mixtures of round and normal spores. Thus the dominance effects ore observed for the ascus as a whole and not for individual spores.

Ascus mutants: The vegetative mycelium of both the dominant and the recessive abnormal ascus mutants is colonial. The dominant ascus mutant has the effect of producing abnormal asci when crossed to a wild type parent, whereas with the recessive, only mutant x mutant crosser hove on effect on the ascus. The type of ascus produced by these mutants is similar to that produced by the peak-2 (pk-2, also called bis) mutant isolated in N. crassa (Pincheira ond Srb 1969 Am. J. Botany 56:846).

The dominant N. tetrasperma ascus mutant is allelic to the pk-2 N. crassa ascus mutant. Allelism could be tested for directly since the pk-2 gene has been transferred from N. crassa into N. tetrasperma. The recessive N. tetrasperma ascus mutant is not allelic with pk-2 but this is not surprising since recessive mutants affecting ascus morphology in N. crassa hove been found for at least seven different loci (Srb ond Basl 1969 Genet. Res. 13: 303). It is interesting to note that at present all dominant ascus mutants so far obtained in N. crassa mop at the pk-2 locus.

The transfer of genes between two evolutionarily distinct species of Neurospora is a valuable tool and has lead to interesting observations. One cannot accurately predict that morphological mutants - particularly those affecting the sexual reproductive apparatus - derived in a heterothallic species of Neurospora such or N. crassa will have on identical expression in a pseudohomothallic species (N. tetrorpermo). The pk-2 N. crassa mutant has undergone fifteen backcrosses to the N. tetrasperma wild type parent. Although in N. crassa pk-2 has on effect on the ascus only when homozygous, in N. tetrasperma the mutant has a partial dominant effect; that is, although the asci produced in a pk-2 x wild (N. tetrasperma) cross ore linear, a high frequency of them contain more than four spores. Only 1-2% of the asci in the corresponding wild type N. tetrasperma cross contain more than four spores. (DRN is supported by Grant T1 GM 1035, the research program by Grant GM 12953, National Instituter of Health, USPHS) - - - Section of Genetics, Development and Physiology, Cornell University, Ithaca, New York 14850.