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Neurospora tetrasperma helper strains using the E gene

David D. Perkins
Stanford University

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Abstract

In N. crassa, strains with an inactive mating type allele are available that can be used as one component of a forced heterokaryon, serving as a helper to shelter a second component that is infertile or otherwise disadvantaged because of some recessive trait (Griffiths and DeLange 1978 Genetics 88:239-254; Perkins 1984 Neurospora Newsl. 31:41-42). am1 ad-3B cyh-1 (FGSC 4564), which is heterokaryon- compatible with both A and a mating types in Oak Ridge background (het-C, -d, -e), has been especially useful. When such a phenotypically wild-type heterokaryon is used as one parent in a cross, the helper nuclei do not participate sexually and all progeny are parented by the disadvantaged component. Heterokaryons with the helper are also useful for stock preservation, assuring survival of genotypes that would otherwise be difficult to maintain.

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D. D. Perkins Department of Biological Sciences, Stanford University, Stanford CA 94305-5020
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No mutant with an inactive mating type is yet available in the four-spored pseudohomothallic species Neurospora tetrasperma. However, strains containing the dominant gene E (Eight-spore) can serve as helpers. Heterozygous E/E+ crosses are fertile, but homozygous E/E crosses are not, producing barren perithecia with effectively no ascospores (Dodge 1939 J. Hered. 30:467-474). Therefore a marked E strain can be used as a helper in crosses by putting it into a forced heterokaryon with a disadvantaged mutant strain that is E+ and of the same mating type. When such a heterokar- yon is crossed to any E strain of opposite mating type, all progeny will be parented by the E+ component of interest.

An example of the usefulness of E helpers is provided by col(119) (assigned by linkage group VII; Howe and Haysman 1966 Genetics 54:293-302). By itself, the mutant grows slowly as a nonconidiating colony which is difficult to maintain and to cross. In contrast, heterokaryons such as [col(119); pan(124); al(102); E+A + met(123) E A], FGSC No. 7568, and [col(119); pan(124); E+a + lys(112) E a], FGSC No. 7569, are phenotypically wild type and fully fertile when used either as protoperithecial or as fertilizing parent. (The linkage group I marker al(102) is a convenient tag for mating type, with which it does not recombine.) When one of these E + E+ heterokaryons is crossed with an E tester parent of opposite mating type, only the E+ colonial component of the heterokaryon contributes to the progeny.

Most ascospores are small and homokaryotic in heterozygous E/ E+ crosses. (A few large heterokaryotic ascospores are produced, but these are readily recognized and avoided when ascospores are isolated manually.) The small single-mating-type ascospores enable haploid genetic analysis to be carried out in conventional fashion, uncomplicated by heterokaryosis in f1 germlings of single-ascospore origin (Calhoun and Howe 1968 Genetics 60:449-459).

Helper heterokaryons have enabled crosses to be made that demonstrate linkage between col(119) and a new morphological mutant lwn (lawn), with about 15% recombination.