Molecular dissection of Neurospora Spore killer meiotic drive elements.

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Recommendations:

Matthew Sachs
F1000 Cell Biology
Texas A&M University, College Station, TX, USA.

Very Good

17 Jul 2012

Nancy Keller
F1000 Infectious Diseases
University of Wisconsin, Madison, WI, USA.

31 Aug 2012

Good

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A meiotic drive (segregation distortion) element called Spore killer was identified in the fungus Neurospora more than 30 years ago. When a Spore killer strain mates with a sensitive strain, all of the meiotic products (ascospores) that do not contain the Spore killer genetic region fail to mature, and the surviving ascospore products of the cross all contain the Spore killer element. The Spore killer genetic region is identified as a large (approximately 30 map units) recombination block that also specifies "resistant to Spore killer" (RSK) activity. Importantly, RSK strains have been identified from natural isolates (more than 2000 wild-collected Neurospora strains are available from the Fungal Genetics Stock Center) that are not themselves Spore killers. This is useful for classical and molecular genetic studies because resistance segregates in a Mendelian fashion in crosses. Here, Hammond et al. took advantage of classical and molecular genetic tools to fine map, identify and sequence sensitive and resistant alleles of the RSK locus (gene NCU09151). While clues about the physiological functions of this fungus-specific hypothetical protein were not evident from the sequence analyses, the experimental data show that RSK is not itself necessary for ascospore development. The authors suggest that it neutralizes killer activity and that different RSKs are needed to neutralize different Spore killers.

Disclosures
None declared

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This paper identifies a long sought gene resistant to meiotic drive in the fungus Neurospora crassa. This gene, termed rsk (resistant to Spore Killer), confirms resistance to a spore killer element Sk-2. rsk encodes a lineage-specific protein that, when deleted, allows the killer to kill itself, e.g. meiotic spores containing Sk-2 die without Rsk. By finding this resistant gene, the authors are well placed to identify the killer.

Disclosures
None declared

Add a comment

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Abstract:
Meiotic drive is a non-Mendelian inheritance phenomenon in which certain selfish genetic elements skew sexual transmission in their own favor. In some cases, progeny or gametes carrying a meiotic drive element can survive preferentially because it causes the death or malfunctioning of those that do not carry it. In Neurospora, meiotic drive can be observed in fungal spore killing. In a cross of Spore killer (Sk) × WT (Sk-sensitive), the ascospores containing the Spore killer allele survive, whereas the ones with the sensitive allele degenerate.

Sk-2 and Sk-3 are the most studied meiotic drive elements in Neurospora, and they each theoretically contain two essential components: a killer element and a resistance gene. Here we report the identification and characterization of the Sk resistance gene, rsk (resistant to Spore killer). rsk seems to be a fungal-specific gene, and its deletion in a killer strain leads to self-killing. Sk-2, Sk-3, and naturally resistant isolates all use rsk for resistance. In each killer system, rsk sequences from an Sk strain and a resistant isolate are highly similar, suggesting that they share the same origin. Sk-2, Sk-3, and sensitive rsk alleles differ from each other by their unique indel patterns. Contrary to long-held belief, the killer targets not only late but also early ascospore development. The WT RSK protein is dispensable for ascospore production and is not a target of the spore-killing mechanism. Rather, a resistant version of RSK likely neutralizes the killer element and prevents it from interfering with ascospore development.

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