Exploring causes and consequences of reproductive behavior in the fungal genus \textit{Neurospora}

**BACKGROUND QUESTIONS**

The fungal genus \textit{Neurospora} comprises haploid species showing a wide range of reproductive strategies, from sexual self-incompatibility to sexual self-compatibility and asexuality, i.e. dispersal through conidia. (Fig. 1). In fungi, mating-type and vegetative compatibility are controlled by the \textit{mat} genes. The \textit{mat} locus was previously characterized in the self-incompatible \textit{N. crassa} (Fig. 2). The boundaries of the \textit{mat} idiomorphs (A/a genes) were determined by inspecting local similarity in their immediate vicinity, that is, in a region less than 1 Kb [1, 2]. Mat genes from self-compatible species have also been sequenced [3, 5, 6], but their physical organization is unknown. For one species, \textit{terricola}, it was shown that \textit{A}- and \textit{a}-type genes are located in the same chromosome, but attempts to confirm close linkage have proven unsuccessful [5].

We sequenced, using Illumina technology, the genomes of 4 self-compatible species (Fig. 1). \textit{De novo} assemblies gave draft genomes of at least 20x average coverage. We are using these genomes to explore the genome-wide consequences of selfing and the loss of conidiation (paml analyses of 5000 orthologs, ongoing), but also to gain insights in the evolution of self-compatibility: Here, we describe the extended structure of the \textit{mat} locus and inspect the conservation of synteny across \textit{Neurospora} and a related genus, \textit{Sordaria} (Fig. 2).

**RESULTS**

-IN \textit{self-incompatible species} (\textit{crassa, discreta, tetrospersma}): strong conservation of both R, L flanks + content, except for 11203 (gained in \textit{crassa} after split with discreta?)
- The conservation of both R, L flanks in these species argues against a self-compatible ancestor and segregation event leading to self-incompatible species

- \textit{In self-compatible species}: \textit{A}- and \textit{a}-type genes co-localize in the same scaffold in all \textit{Neurospora} and \textit{Sordaria macrospora} species → self compatibility correlated with close linkage within the \textit{Sordariaceae} Locus structure less conserved as to: 1. presence of genes (previously shown, for ex: \textit{africana} lacks \textit{a} \textit{terricola} \textit{A3}) 2. left flank in \textit{sublineolata} 3. left and right flanks of \textit{a} gene, only conserved in \textit{terricola}

-> different unequal crossing-over events in a self-incompatible ancestor could lead to linkage of \textit{A-a} sequences, explaining the different structures above

Overall, our data suggest that self-compatibility has evolved multiple times in \textit{Neurospora}, from self-incompatible ancestors through unequal crossing-over events, additional losses of coding and non-coding regions and unknown events independent of the \textit{mat} locus (\textit{africana}).

**INDEPENDENT ORIGINS OF SELF-COMPATIBILITY**

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**Fig. 1** Phylogeny, reproductive mode and availability of sequence data for \textit{Neurospora} and \textit{Sordaria} species (adapted from Nygren, R., unpublished)

**Fig. 2** Representation of locally collinear blocks from multiple alignment using MAUVE, 150 Kbp, unscaled


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References
1. Glass et al., PNAS, 1990. 87
2. Staben & Yanofski, PNAS, 1990. 87
4. Dettman et al., FGB, 2001. 34