



Incipient local adaptation to heavy metal pollution in a mycorrhizal fungus

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Local Adaptation

• Organisms match their environment

 Genomic signatures of selection highly differentiated genomic region







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Polygenic Local Adaptation

- Organisms match their environment
- Signatures of selection diffuse across genome
- The more genes are contributing to the adaptation, the more modest their contribution





Fungus Suillus Iuteus



- Mutualistic partner of pine
- Provides water and nutrients and receives carbohydrates in return



Photo by Noah Siegel



Heavy Metal Pollution

 Recent (~150 yrs) zinc smelter polluted areas in Belgium

• Zinc and Cadmium

Heavy metals cause
oxidative stress

Lommel Zinc smelter site in the Limburg district, Belgium





S. luteus shows variable Zn tolerance

• Zn-tolerant isolates grow more in high Zn and accumulate less metal



(Colpaert et al. 2011)

Questions



Is heavy metal tolerance in S. *luteus* a polygenic trait?

What are the main targets of selection?



Sequenced 38 whole genomes [JGI CPS #1776]

20 from polluted soil18 from unpolluted soil

Compiled SNP markers across the genomes



Absence of population structure



Genetic differences between isolates from polluted and unpolluted soils should be regions of the genome under selection



Allelic differentiation





Allelic differentiation in transporters



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Copy number variation on transporters



Transporters allow movement of ions across membranes





A - ions

Image from: https://themedicalbiochemistrypage.org/membranes.php



Heavy metal adaptation in S. luteus

- (1) Selection on the population is likely polygenic
- (2) The main targets of selection are trans-membrane transporters



Candidate genes underlying tolerance

• Transporters

 Metal ion binding (chelation)

• Antioxidants



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