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MAX-PLANCK-INSTITUT FÜR MULTIDISZIPLINÄRE NATURWISSENSCHAFTEN

Evolutionary Genomics: Consequences of Biodiverse Reproductive Systems (EvoReSt)

EvoReSt

B5

Genomic consequences of sexual and parthenogenetic reproduction for the co-evolutionary patterns of the mito-nuclear complex in oribatid mites (Acari: Oribatida)

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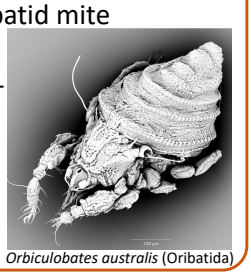
State of the art

- There is an unusual high number of parthenogenetic animal species in soil, especially in oribatid mites (10 %).
- Intra-genome interactions between mt and nc genes may contribute to the long-term maintenance of those parthenogenetic lineages [3].
- In parthenogenetic species mt and nc genes are passed on together, i.e. they are completely linked.
- Thus, the mito-nuclear complex in sexuals likely is genetically more variable than in parthenogens.

Objectives

- Understand the interaction of mt/nc genes (COI and 28S rDNA) in sexual and parthenogenetic oribatid mite populations
- Understand the long-term consequences of parthenogenesis on the variability of mt/nc genes.



Orbiculobates australis (Oribatida)

PhD 1 - Co-evolution of mito-nuclear genes in sexual and parthenogenetic populations

Aim: Investigate three populations of one sexual and one parthenogenetic species with 15 individuals per population (= 90 individuals). Focus on COI and 28S rDNA.

- Identify identical, similar and distant genotypes at all collection sites.
- Compare the variance and dN/dS ratios for all genes of the mito-nuclear complex to identify which genes coevolve.
- Examine if this differs between parthenogenetic and sexual species.

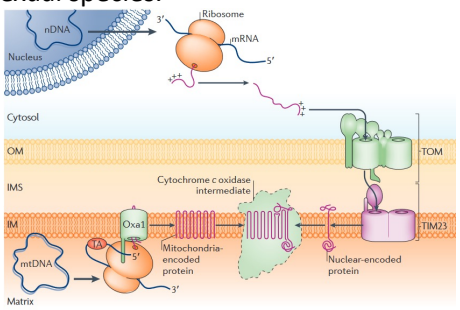


Fig. 1. The dual origin of cytochrome c oxidase subunits (from Mick et al. 2011).

PhD 2 - Consequences of long-term parthenogenesis on the variability of the mito-nuclear complex

Aim: Investigate the long-term consequences of mito-nuclear interactions in linked (parthenogenetic) and recombining (sexual) genomes in two parthenogenetic and two sexual species pairs of different evolutionary age.

- Compare the variation in mito-nuclear genes between reproductive modes and ages of lineages.
- Hypothesis: the phylogenetic age of the lineages correlate with the diversity and distinctness of the mito-nuclear genes.

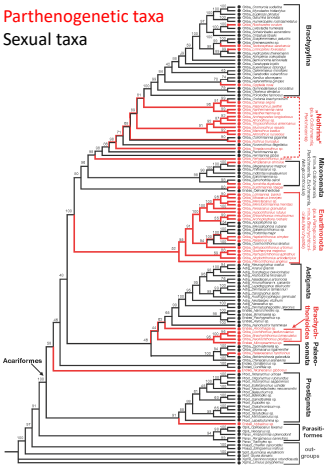


Fig. 2. Oribatid mite phylogeny, including parthenogenetic and sexual taxa (from Pachl et al. 2021).

References

1. Mick DU, Fox TD, Rehling P (2011) Inventory control: cytochrome c oxidase assembly regulates mitochondrial translation. Nat. Rev. Mol. Cell Biol. 12, 14-20
2. Pachl P, Uusitalo M, Scheu S, Schaefer I, Maraun M (2021) Repeated convergent evolution of parthenogenesis in Acariformes (Acari). Ecology and Evolution 11, 321-337
3. Wolff JN, Ladoukakis ED, Enríquez JA, Dowling DK (2014) Mitonuclear interactions: evolutionary consequences over multiple biological scales. Phil. Trans. R. Soc. Lond. B Biol. Sci. 369(1646), 20130443

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