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MAX-PLANCK-INSTITUT FÜR MULTIDISZIPLINÄRE NATURWISSENSCHAFTEN

Evolutionary Genomics: Consequences of Biodiverse Reproductive Systems (EvoReSt)

EvoReSt

A1

Comparative analyses of genome evolution in sexual and asexual cirratulid annelids across time and space

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State of the art

- Annelids showcase a variety of reproductive modes, often also linked to the outstanding regenerative abilities of these animals [1].
- Species of the genus *Dodecaceria* (Cirratulidae) exhibit different reproductive strategies, with some reproducing strictly by parthenogenesis, whereas others reproduces either asexually or sexually [2].
- Two sympatrically occurring sister taxa (*D. ater* and *D. concharum*) show contrasting lifestyles [3].

Objectives

- Using *Dodecaceria* as model system we test if an asexual lifestyle is correlated with accumulation of deleterious mutations, changes in heterozygosity, and dynamics of transposable elements.
- We will analyse the geographical distribution of genomic signatures associated with parthenogenesis.

PhD 1 - Sexual and asexual genome evolution in cirratulid annelids

- Establishment of molecular phylogenetic framework for the genus *Dodecaceria* using genome skimming [4].
- Pinpointing origin of parthenogenetic taxa, divergence time estimation by molecular clock analyses.
- Generation of high-quality genome assemblies for *D. ater* and *D. concharum* (Fig. 1), as well as an outgroup species.
- Gene content and gene family evolution.

Fig. 1:
Dodecaceria concharum
(Foto A. Nygren)

PhD 2 - Comparative population genomic analyses of a closely related pair of sexual and parthenogenic cirratulid annelids

- Sampling of *D. concharum and D. ater* across different European populations.
- Population-scale re-sequencing of individual genomes based on Illumina short-reads.
- Analysis of the population genetic structure of these two species across their respective range using SNP and mtDNA sequence data.
- Mutation accumulation analysis by comparing the accumulation of SNPs across differently degenerated sites in protein coding genes.
- Phylogenetic analyses of SNP and mtDNA data will test the possibility of independent origin of asexual lineages.

References

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2. Gibson PH. 1978. Systematics of *Dodecaceria* (Annelida: Polychaeta) and its relation to the reproduction of its species. Zoological Journal of the Linnean Society 63:275-287.
3. Gibson PH. 1977. Reproduction in the cirratulid polychaetes *Dodecaceria concharum* and *D. pulchra*. Journal of Zoology 182: 89-102.
4. Thalén F, Köhne CG, Bleidorn C. 2023. Patchwork: Alignment-based retrieval and concatenation of phylogenetic markers from genomic data. Genome Biology and Evolution 15: evad227.

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