

Research Project

Sexual selection and sexual conflict in simultaneous hermaphrodites with divergent mating syndromes

Third-party funded project

Project title Sexual selection and sexual conflict in simultaneous hermaphrodites with divergent mating syndromes

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Mating interactions in copulating simultaneous hermaphrodites involve sexual conflicts over the preferred mating role, leading to sexually antagonistic coevolution between male persistence and female resistance traits. Specifically, since fitness often increases more gradually for the male role, individuals may prefer sperm donation over sperm receipt once they have obtained enough sperm to fertilize their available eggs. Theory suggests two types of conflict resolution, which involve contrasting mating interactions and reproductive adaptations. One type of resolution-characterized by the reciprocal mating syndrome-involves mating simultaneously in both sex roles in a mating posture that resembles a handshake. Here individuals receive sperm whenever they donate sperm, leading to sexual conflict over the fate of the received ejaculate, and thus favouring donor traits that force recipients to use their sperm and recipient traits that allow recipients to retain control over sperm use. Another type of resolution-characterized by the hypodermic mating syndrome-involves forced (unilateral) sperm donation. Here the donor injects sperm into the mating partner via a traumatic route, thus favouring donor traits permitting efficient injection and movement of hypodermic sperm, and recipient traits that permit avoidance of such matings and their associated costs. Specific aims: I propose to study these mating syndromes in the free-living flatworm genus *Macrostomum*, which we have recently shown to exhibit at least 7 convergent transitions from the reciprocal to the hypodermic mating syndrome among the currently >100 *Macrostomum* analysed species. Specifically, I propose to: 1) identify reproductive candidate genes in several selected species across the *Macrostomum* phylogeny using positional RNA-Seq 2) mine whole-body transcriptomes of >100 *Macrostomum* species for reproductive candidate genes with mating-syndrome-specific patterns of presence/absence, gene expression and sequence evolution 3) perform gene expression analyses and functional tests on identified reproductive candidate genes using in situ hybridization and RNA interference in multiple species 4) establish draft genomes of two closely related *Macrostomum* species that show divergent mating syndromes using state-of-the-art long-read NGS approaches 5) use that genome information to establish transgenic lines expressing fluorescent protein markers in genes coding for transcripts with ubiquitous and testis/sperm-specific expression 6) use these transgenic lines to study postcopulatory sexual selection and sperm function in both the reciprocally and hypodermically mating species. Wider scientific context: Simultaneous hermaphrodites that engage in copulation represent one of many different possible outcomes of the sexual cascade, a recently proposed evolutionary framework that aims to understand the emergence of complex sexual phenotypes as a result of a series of evolutionary transitions. The research I propose here investigates one such transition, namely shifts between the reciprocal and hypodermic mating syndromes. Since this transition has occurred conver-

gently many times in the studied clade-consistent with predictions from current sexual selection and sexual conflict theory for hermaphrodites-the proposed research offers a unique opportunity to evaluate statistically the genomic consequences that result from this transition, informing research on traumatic mating in other organismal groups. Moreover, using two newly established *Macrostomum* model organisms, one for each mating syndrome, we can perform experimental tests of specific sexual selection and sexual conflict processes, allowing insights into the evolutionary forces that are responsible for driving such transitions.

Keywords antagonistic coevolution; phylogenomics; sperm competition; comparative genomics; sex allocation; sperm morphology; transcriptome sequencing; functional genomics; simultaneous hermaphrodite; comparative analysis; anisogamy; genome sequencing

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