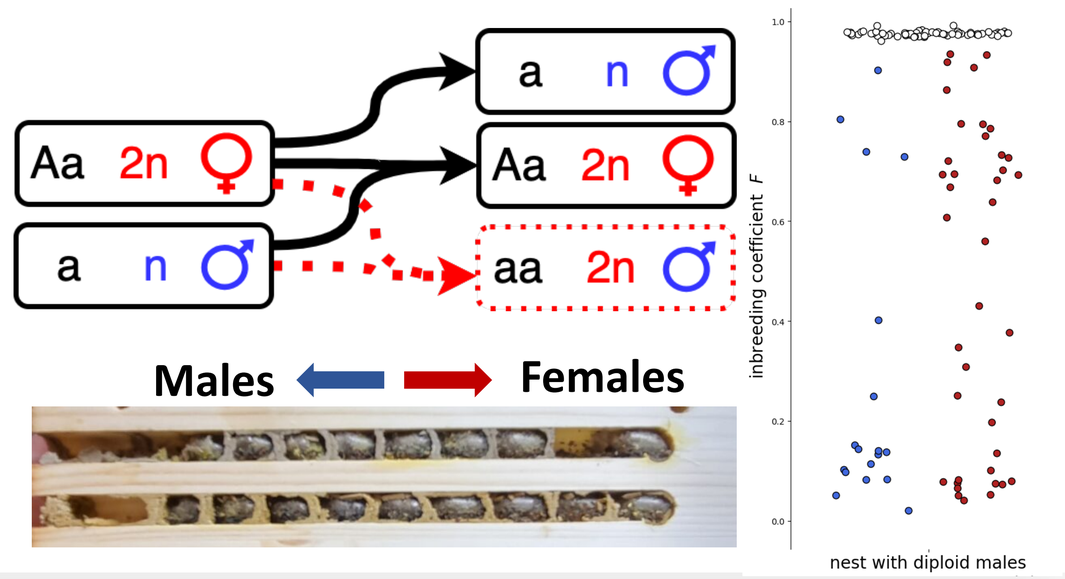
ANTSR is an ancient sex-determining locus in ants and bees

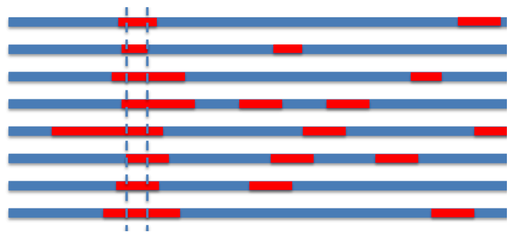
Background

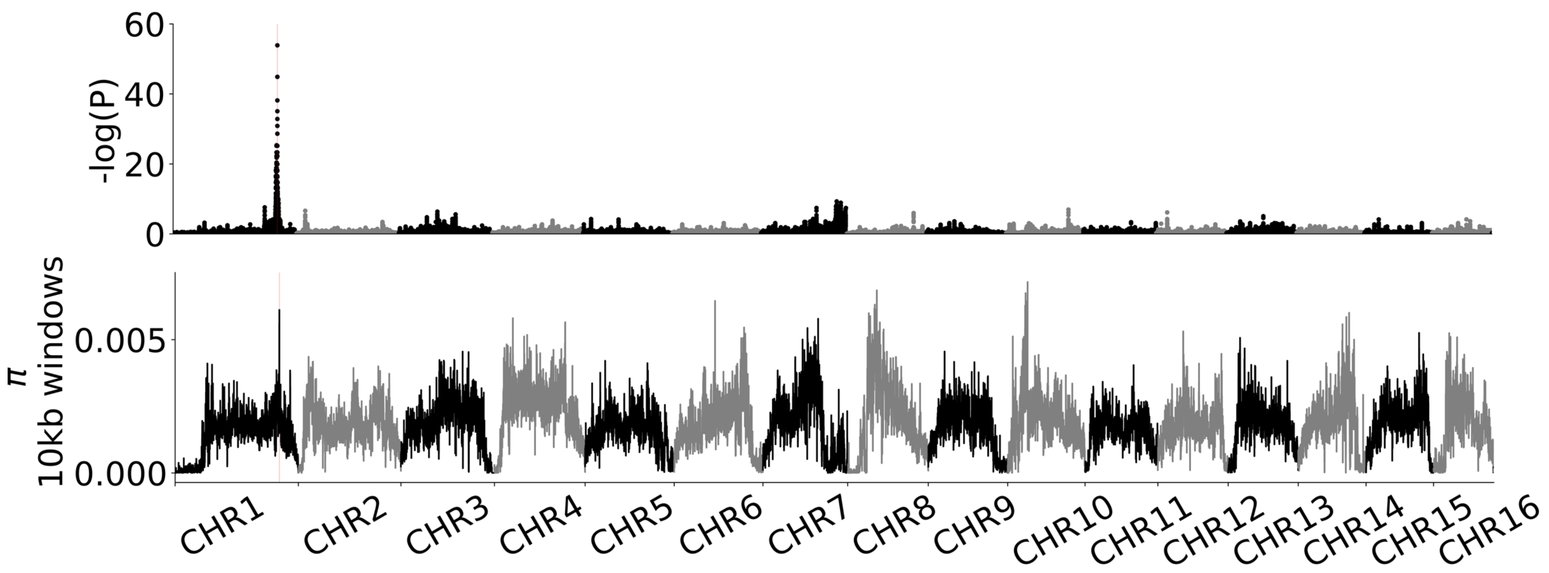
Haplodiploid sex determination systems are found in all species of Hymenoptera. In many haplodiploid taxa, the initial trigger is a complementary sex determination (CSD) locus, in which heterozygosity initiates a molecular pathway to generate females. This region is not known for many species. Here, we make use of the nesting habits of a solitary bee, *Osmia bicornis,* to identify rare diploid males and use them to map the CSD locus.



Diploid males must be homozygous, females must be heterozygotes: Mapping sex to runs of homozygosity (ROH)

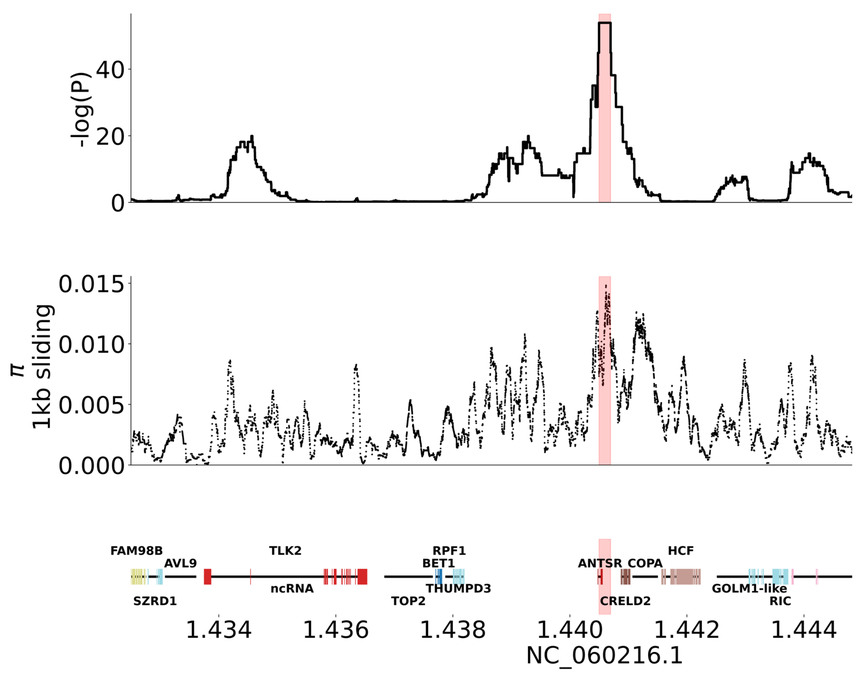
- N=96, N_{female}=78, $N_{diploid\_male}$=18
- Linear model for sex across ROH-segments
- Single candidate locus
- Also a local nucleotide diversity maximum





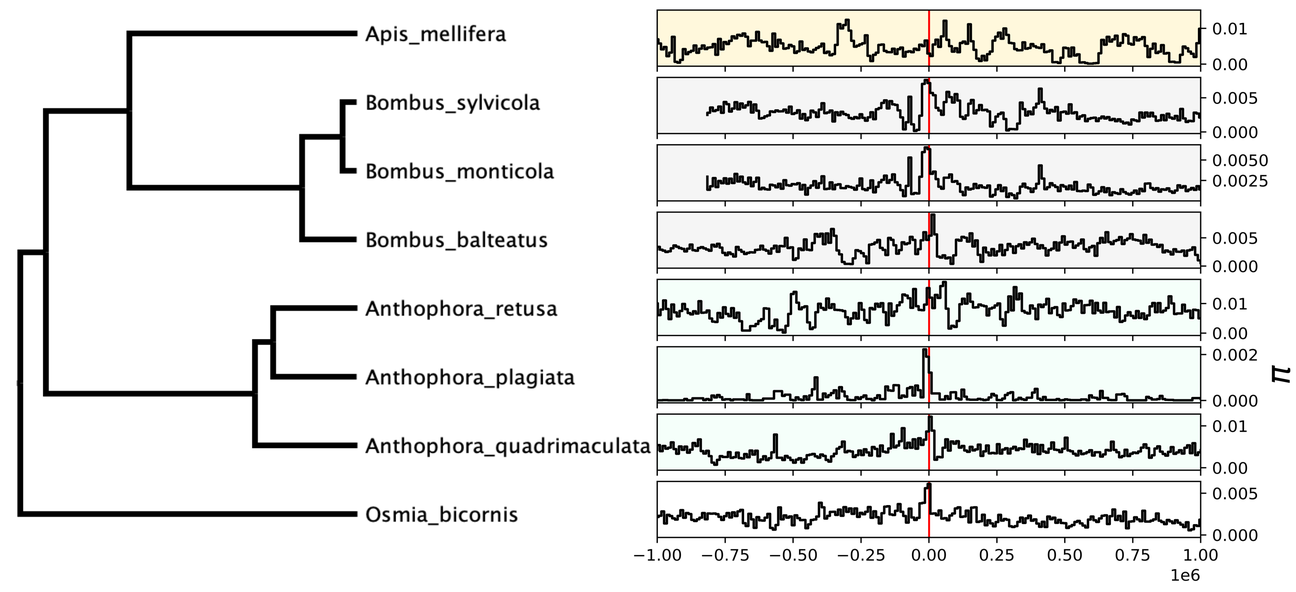
The Osmia CSD-locus and is homologous to ANTSR

- ANTSR is the recently discovered sex-determining locus of the Argentine ant, *L. humile*
- *The O. bicornis CSD locus* also replicates the genomic neighborhood around ANTSR



Nucleotide diversity across homologous regions in multiple bees

- Multiple Bee species, including from the Apidae, have local nucleotide diversity maxima in their homologous regions.
- Apis mellifera, with a known, different CSD, does not have any elevated nucleotide diversity in this region.



tl;dr

- We Identified the sex-determining locus of *Osmia bicornis*.
- This region is homologous to an ant sex-determining locus, but not to honey bees.
- This, and circumstantial evidence from other bee species leads us to conclude that this is an ancient and likely widespread sex-determining mechanism in Hymenoptera

Tilman Rönneburg[1], Demetris Taliadoros[1], Turid Everitt[1], Anna Olsson[1], Sara Magnusson[1], Linn Zetterberg Huser[1], Giselle C. Martín-Hernández[1], Muhammad Nafiz Ikhwan Bin Nor Fuad[1], Björn Cederberg[2], Robert Paxton[3], Karsten Seidelmann[3], Matthew T. Webster[1,4]*

1) Department of Medical Microbiology and Biochemistry, Uppsala University, Uppsala, Sweden
2) Swedish Species Information Centre, Swedish University of Agricultural Sciences, Uppsala, Sweden
3) Institut für Biologie, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany
4) Science for Life Laboratory, Uppsala University, Uppsala, Sweden

UPPSALA UNIVERSITET