Disentangling the genomic basis underlying male reproductive strategies in a dwarf spider

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Sexual selection theory predicts strong directional selection for males that invest in traits to secure females. However, males of some species show remarkable and discontinuous variation in male ornaments, which may even exceed the variation between species. The evolutionary trajectories that lead to these male dimorphisms, and the genomic mechanisms that maintain these spectacular dimorphisms remain poorly understood.

Study system
We focus on a remarkable male dimorphism in the erigonid spider Oedothorax gibbosus. Males of the gibbosus morph develop a hunch-like structure with a setaceous groove on the dorsal side. Males of the tuberosus morph do not develop these structures and resemble females. The morphological variation between both types of males exceeds the variation between species. The trait shows Mendelian inheritance, with gibbosus (G) dominant over tuberosus (g).

Draft genome assembly
Two draft genome assemblies were generated using (i) the genome assembler Platanus based on paired-end (180bp, 500bp and 800bp) and mate-paired (2kb and 5kb) libraries and (ii) the SUPERNOVA assembler based on Chromium 10x generated libraries.

Phylogeny of the « gibbosus » locus
A phylogeny and divergence metrics of the homologous sequences of the two alleles reveals that they are highly divergent and thus likely subject to long-term balancing selection.

Conclusion and future prospects
In line with the theoretical expectations, our results suggest that the tuberosus allele is most likely derived and involved a single mutational step that deleted a >1Mb chromosomal fragment containing a gene that induces the expression of sexually dimorphic traits.

Candidate genes
While most ORF within the tuberosus deletion are related to transposable elements and are of retroviral origin, two ORFs refer to the gene doublesex/mab3, which contains the DM domain that has been shown to be involved in the expression of sexual dimorphic traits. The ORF is absent in tuberosus, but not in gibbosus and the two outgroup species.