



Genetic basis and evolutionary consequences of the loss of sex in aphids

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Keywords

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Social-economic context

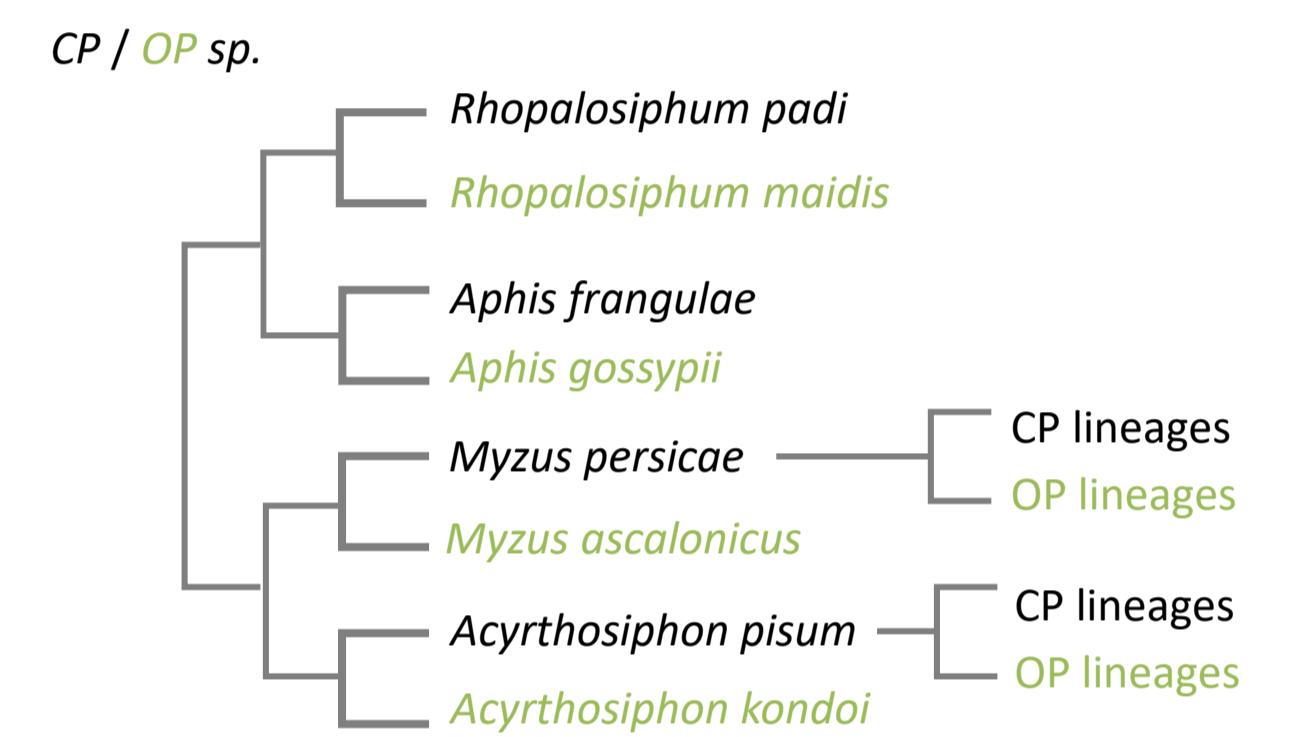
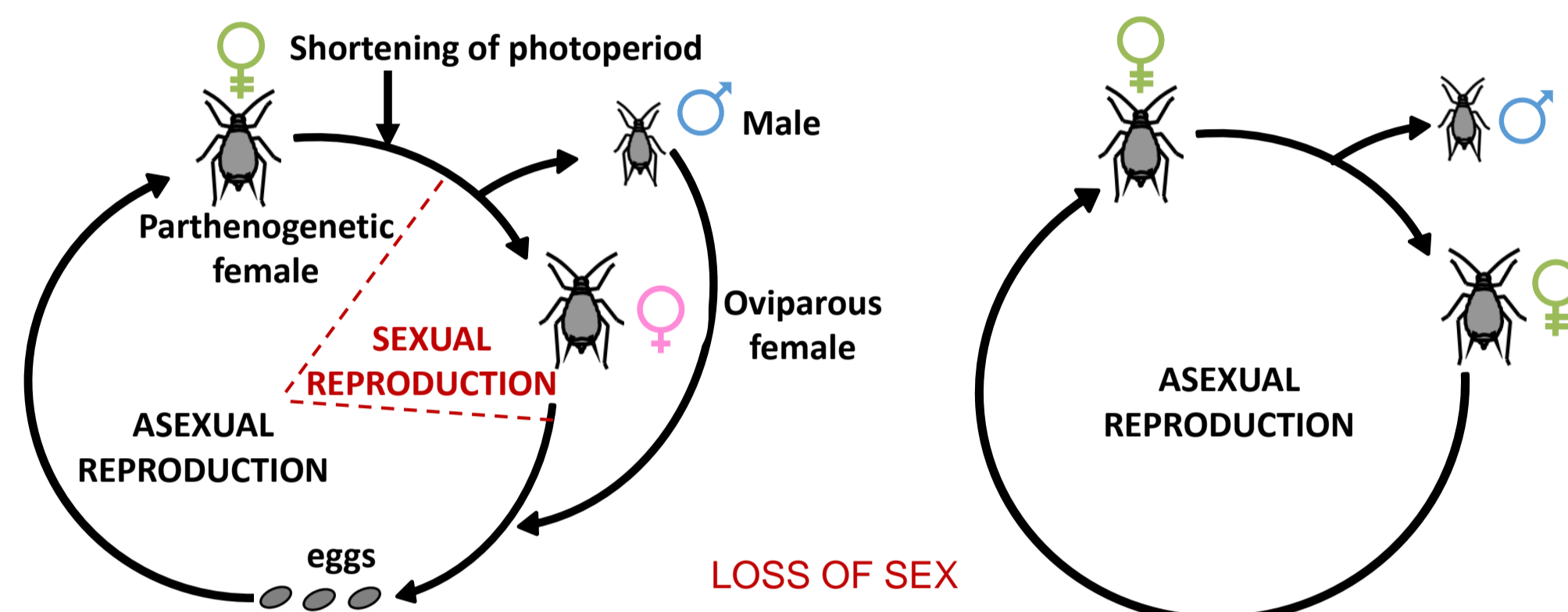
Sexual reproduction is the ancestral mode of reproduction of eukaryotes, but it has been lost several times during evolution in different taxa, including many animal or plant parasites. Among them are aphids, which are major crop pests and whose reproductive mode influences their agronomic impact. Sustainable management of these asexual pests therefore requires an understanding of their evolutionary potential, which might depend on the mechanisms of sex loss as well as the frequency of these events.

Scientific context

Understanding the mechanisms by which asexual lineages appear and coexist with sexual lineages is a major question in evolutionary biology. However, the genetic basis underlying the loss of sex, as well as its evolutionary consequences, are still poorly known.

The ancestral reproductive mode of aphids is cyclical parthenogenesis (an alternance between clonal and sexual generations), but obligate parthenogenesis has then arisen many times in this group.

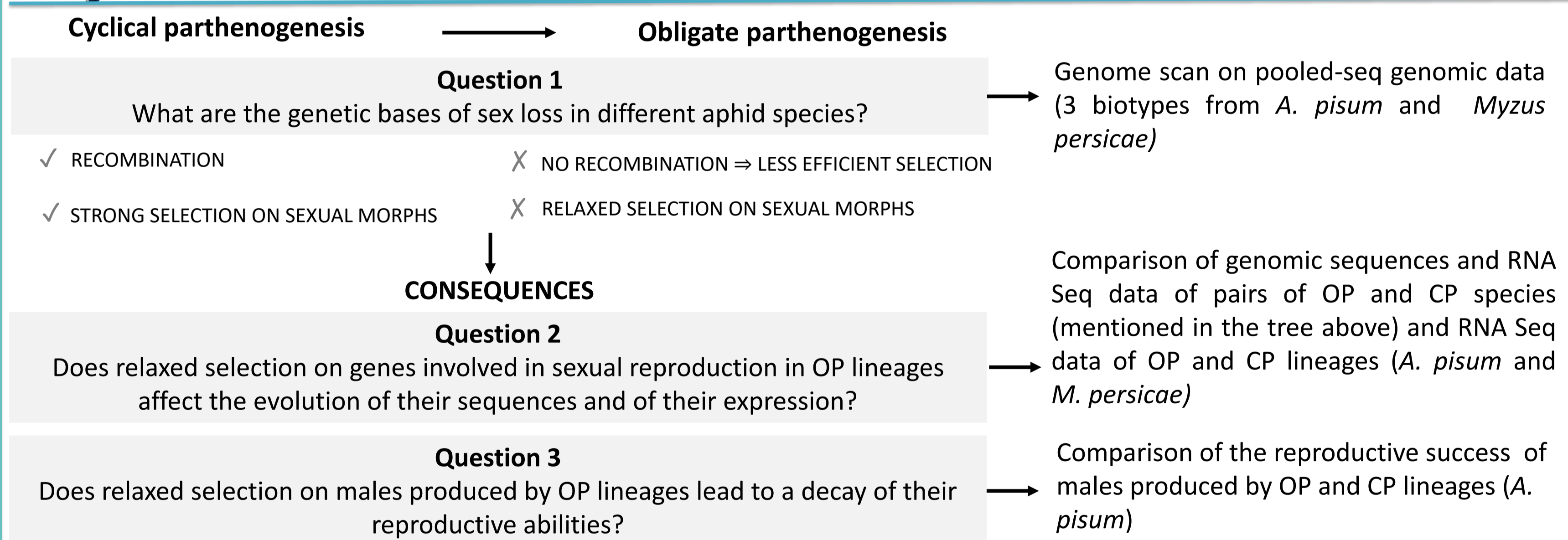
Remarkably, the aphid group includes many species that have either partially or totally lost the capacity of reproducing sexually, allowing for a broad study of the evolutionary dynamics of the loss of sex.



Cyclically parthenogenetic (CP) lineage \rightarrow \star Obligately parthenogenetic (OP) lineage

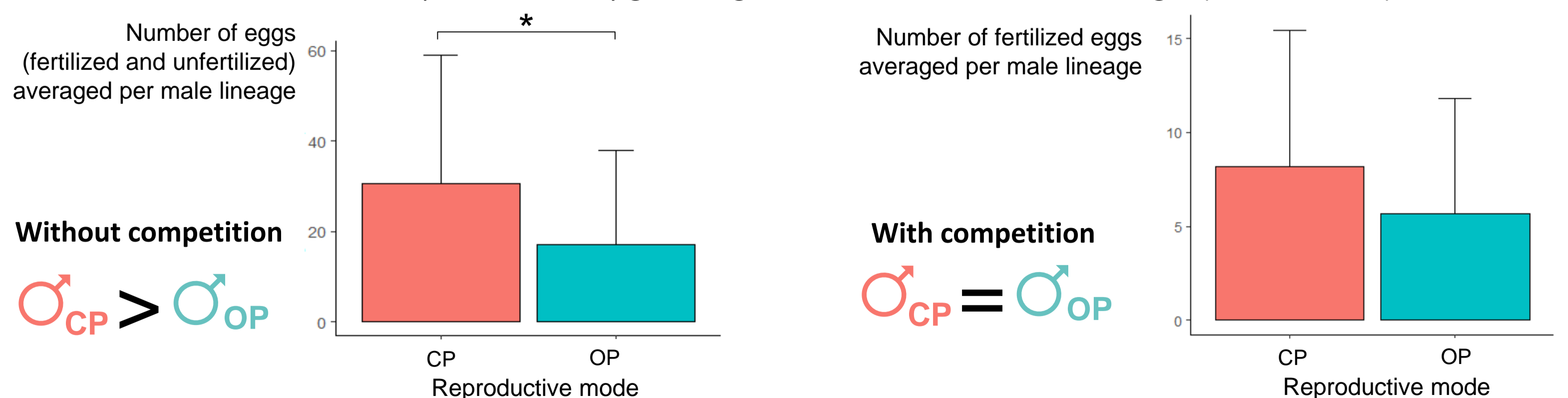
One main genomic region has already been identified as controlling obligate asexuality in the alfalfa biotype of the pea aphid *Acyrthosiphon pisum* (Jaqui ry et al, 2014 & Rimbault et al, in prep). Besides, different evolutionary forces apply on these CP and OP lineages, that may have different outcomes on the evolution of genome sequence, gene expression and phenotype

Objectives



Preliminary results

In order to test for a decay of reproductive ability of males produced by OP lineages (question 3), the reproductive success of CP and OP males were compared with and without competition: first, CP or OP males were alone with 5 sexual females for one week on a plant. Then, we increased the male-male competition level by gathering 10 males from 10 different lineages (5 OP and 5 CP) with 5 females.



\Rightarrow There is no evidence for a large decay of OP male reproductive success
 \Rightarrow Males from OP lineages are still functional and competitive relative to CP ones

Perspectives

My PhD project aims first at uncovering the genetic basis of transition to obligate asexuality in different aphid species, and secondly intends to assess the outcome of such a shift toward asexuality on traits and genes essential for sexual reproduction at different evolutionary time scales (intra- and inter-species). Further research could include functional studies on the candidate genomic region.

Jaqui ry, J., Stoeckel, S., Larose, C., Nouhaud, P., Rispe, C., Mieuze, L., ... & Simon, J. C. (2014). Genetic control of asexuality in the pea aphid. *PLoS Genet*, 10(12), e1004838.

