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Consequences of polyploidy events on angiosperm genome evolution

Clea Siguret¹, Cecile Huneau¹, Mamadou Dia Sow¹, Jérôme Salse¹

¹INRAE/UCA GDEC, UMR 1095, 5 Chemin de Beaulieu, 63100 Clermont Ferrand, France

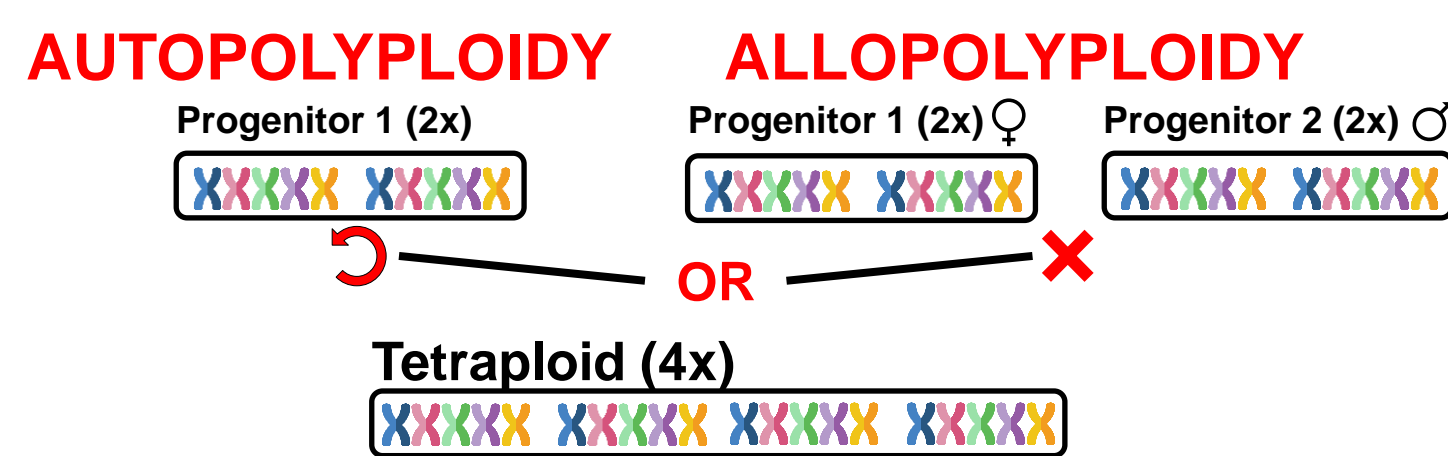
Context

What is Polyploidy?

A polyploid species contain more than **two complete sets** of chromosomes (i.e. triploid, tetraploid, hexaploid, etc.).

How?

A polyploid species can **have two origins**:



Why studying Polyploidy?

Polyploidy is considered as a **major process** in **phenotypic plasticity** and **genomic evolution** of plants.

Problematic

What is the **polyploidy impact** on gene evolution - conservation of flowering plants? Does polyploidization drive **sequence diversity**? Can we determine **divergence time** and the **age of polyploidization events** from sequence diversity?

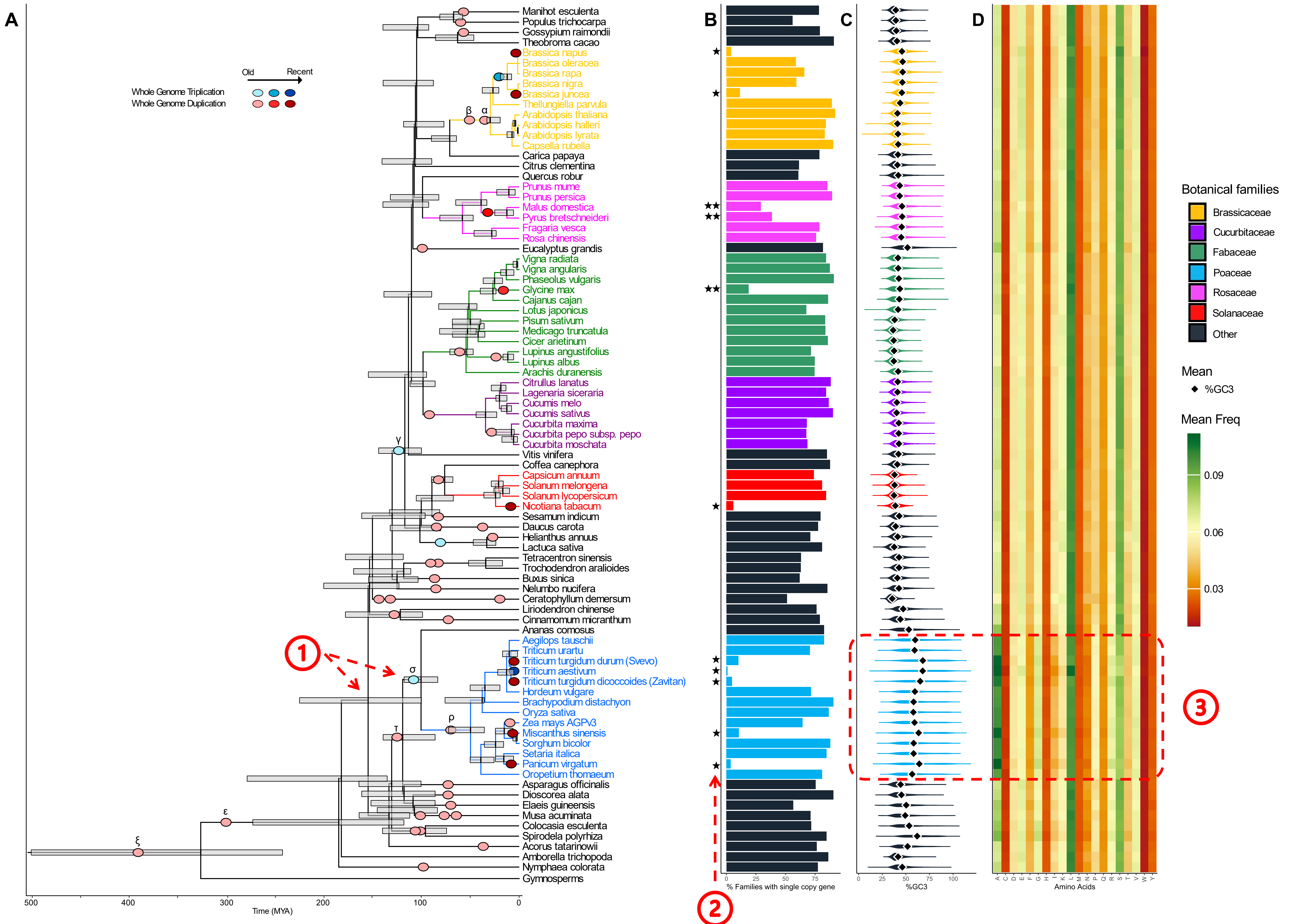
Data

Comparative Genomic: 81,700 conserved gene families between **84 angiosperm species** (including **61% with at least two species**). All species are **neo- or paleo-species** (few/no single copy genes conserved?). However, we have identified **3,249 gene families** containing **at least 50 species with singleton genes**.

Results

Figure 1. Known polyploidy events within the angiosperms and single copy analysis.

A. Species tree with polyploidy events and divergence time (Millions Years Ago) with the support of the literature and TimeTree^[1] interface. The boxplots represent the lower quartile, median and upper quartile of the synonymous substitution (Ks) analysis values of the inter-species analyses in Angiosperms and Gymnosperms (*G.biloba*) transcribed in divergence time. The colored dots represent the polyploidization events: in red the duplications and in blue the triplications. The color gradient indicates the age of the polyploidizations. From 3,249 gene families with at least 50 species with singleton genes, we represented: **B.** % Families with single copy genes; **C.** %GC3 in single copy genes; **D.** Amino acids composition in single copy genes (A - Alanine; R - Arginine; N - Asparagine; D - Aspartic acid/Aspartate; C - Cystine; Q - Glutamine; E - Glutamic acid/Glutamate; G - Glycine; H - Histidine; I - Isoleucine; L - Leucine; K - Lysine; M - Methionine; F - Phenylalanine; P - Proline; S - Serine; T - Threonine; W - Tryptophan; Y - Tyrosine; V - Valine).



Conclusion

① Divergence time and **Polyploidy events date** estimated through synonymous substitution (Ks) analysis

② Polyploidization followed by **Diploidization** (duplicated genes gradual loss)
→ Method to **categorize species** in recent (★), diploidizing (★★) or ancient polyploids (★★★)

③ Different %GC and amino acid composition **between botanical families**
→ Sequence diversity **not impacted** by Polyploidy