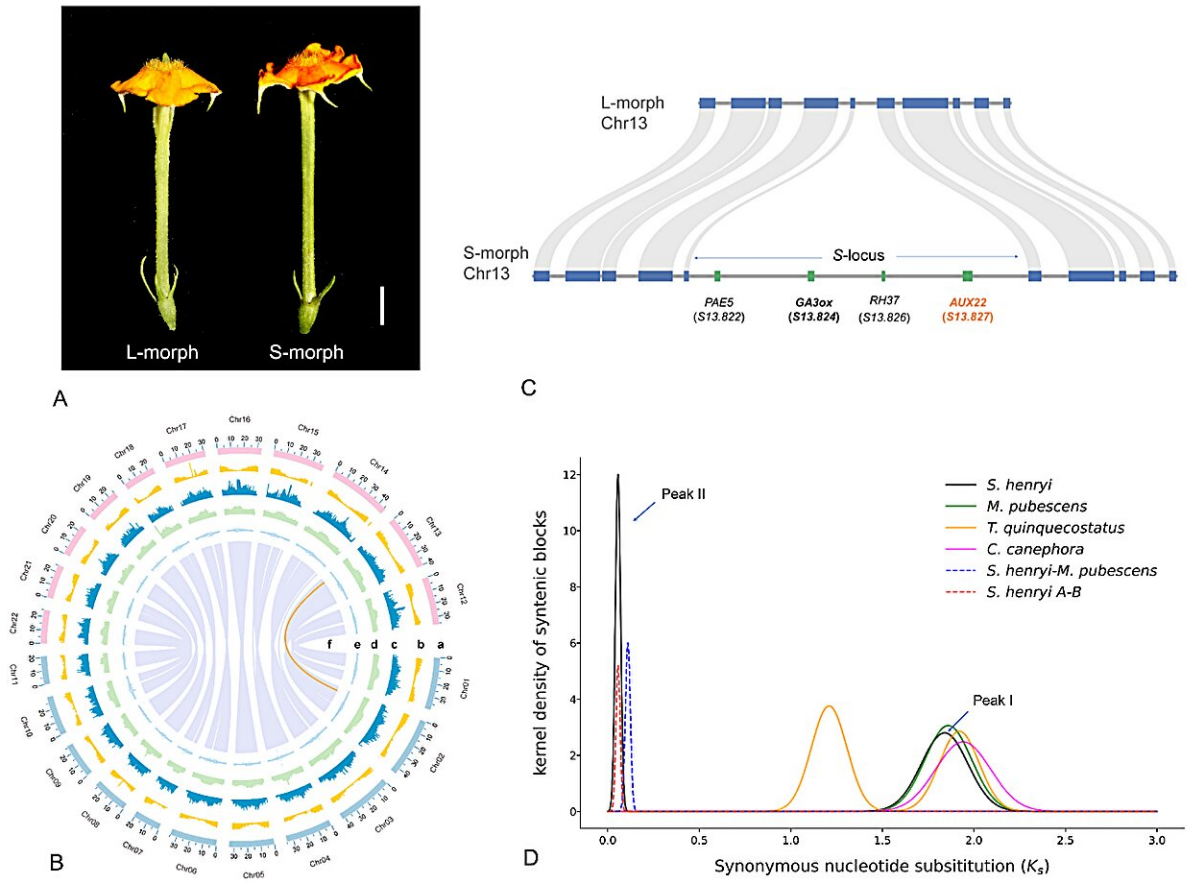
Polyploid plants maintain several distinct flower types through ancient genetic architecture, researchers discover

September 18 2025, by Li Yali



A. The L-morph and S-morph flowers ofSchizomussaenda henryi. B. Circos map illustrating basic information on the S. henryi genome (S-morph). C. Model of the genomic structure of S-locus genes in S. henryi. D. Ks distributions of paralogous genes in S. henryi (S-morph), Mussaenda pubescens, Coffea

canephora (Rubiaceae) and Thymus quinquecostatus (Lamiaceae). Credit: SHI Miaomiao et al

Heterostyly, a floral polymorphism where a species produces two or three distinct flower types with reciprocal arrangements of stigmas and anthers, boosts pollination accuracy, reduces sexual interference, and encourages cross-pollination. This intricate system is controlled by the S-locus supergene.

Whole-genome duplication, or polyploidization, often disrupts elaborate genetic systems and has long been believed to cause heterostyly to break down into a simpler form known as homostyly. However, most molecular studies of heterostyly have focused on diploid species, leaving a gap in understanding how polyploids handle this complex trait.

To address this gap, researchers from the South China Botanical Garden of the Chinese Academy of Sciences and Shandong University of Technology have analyzed the tetraploid species Schizomussaenda henryi (Rubiaceae) and discovered that its heterostyly remains intact and fully functional despite polyploidization. Their findings were recently published in the *New Phytologist*.

The team produced the first chromosome-level genome assembly for S. henryi. Comparative genomic and transcriptomic analyses revealed that the S-locus—found only in short-styled plants and present in a hemizygous state—contains four tightly linked genes. Among these, SchzAUX22, an auxin response factor, appears to be the key regulator of distyly development.

Phylogenetic and k-mer analyses suggest S. henryi originated from an allopolyploidization event about 3.6 million years ago. By measuring

synonymous substitution rates (Ks), the researchers determined the S-locus emerged about 50 million years ago—far earlier than the polyploid event. These findings demonstrate that polyploidization does not inevitably lead to the breakdown of heterostyly, highlighting the resilience of this supergene system.

The findings provide the first genome-level insight into heterostyly in polyploid plants, shedding new light on the evolution of floral diversity and breeding systems in flowering plants.

More information: Zhonglai Luo et al, Genetic architecture of the *S*-locus supergene revealed in a tetraploid distylous species, *New Phytologist* (2025). DOI: 10.1111/nph.70521

Provided by Chinese Academy of Sciences