

THE CARNIVOROUS PLANT TREE OF LIFE: THE PLACEMENT OF CARNIVOROUS PLANT GENERA WITHIN THE FLOWERING PLANT LINEAGE

JAMES HAIG STREETER • Penang • Malaysia • james@CarnivorousPlantHunter.com

Keywords: phylogenomic relationships, convergent traps, pitcher plant families, carnivory

Received: 22 April 2026

<https://doi.org/10.55360/cpn553.js425>

Abstract: The Carnivorous Plant Tree of Life diagram draws on published phylogenomic research to illustrate the broader evolutionary setting in which carnivorous plants have arisen and to contextualize their placement within the flowering plant lineage.

Interest in the evolutionary relationships among carnivorous plants dates back to Darwin (1875), who suggested that the diverse trap types found in different genera may have arisen independently. While the structure and function of these traps have been documented in detail, their positions within the wider angiosperm phylogeny became clearer only with the advent of large-scale molecular datasets. Early evolutionary interpretations relied primarily on morphology and therefore varied in their hypotheses about the number of times carnivory had evolved. Subsequent molecular studies, beginning with Albert *et al.* (1992), provided genetic evidence for multiple independent origins of carnivory among flowering plants.

The publication of the Plant and Fungal Trees of Life (PAFTOL) Project by the Royal Botanic Gardens, Kew (Zuntini *et al.* 2024) established a comprehensive phylogenomic framework sampling nuclear genes across all recognized angiosperm families. This dataset has since become a widely used reference for comparative studies of plant evolution and forms the basis of the diagram presented here.

When assembled into a single visual framework, three patterns well documented in the literature become apparent. First, carnivory appears in multiple, widely separated lineages across the angiosperm evolutionary tree rather than forming a unified group. Current research indicates that carnivory has independently arisen at least 11 times in different families, across 6 plant orders (Fleck *et al.* 2023). On the diagram (Fig. 1), these origins correspond to the red and pink branches representing families that contain carnivorous genera, illustrating a scattered distribution of carnivory across the broader flowering plant lineage.

Second, within certain families, most notably Droseraceae and Lentibulariaceae, closely related genera exhibit markedly different trap types despite their shared ancestry. In Droseraceae, *Drosera* produces adhesive flypaper traps, while *Dionaea* and *Aldrovanda* produce snap traps adapted to terrestrial and aquatic conditions, respectively. In Lentibulariaceae, *Pinguicula* produces adhesive traps, *Genlisea* produces subterranean corkscrew traps, and *Utricularia* produces suction traps. These examples show that closely related lineages can diverge substantially in trap structure, suggesting that shared ancestral traits may be modified along different ecological and developmental trajectories.

Third, morphologically similar pitcher-type traps occur in Nepenthaceae, Sarraceniaceae, and Cephalotaceae, yet these families are separated by deep evolutionary divergence. Their similarity represents a clear example of convergent evolution, in which comparable ecological pressures have produced similar functional structures in unrelated groups. This pattern is analogous to other



Genera of families containing 100% carnivorous plants:

1. *Aldrovanda* (waterwheel plant)
2. *Byblis* (rainbow plant)
3. ***Cephalotus* (Albany pitcher plant)**
4. *Darlingtonia* (cobra lily)
5. *Dionaea* (Venus flytrap)
6. *Drosera* (sundew)
7. *Drosophyllum* (dewy pine)
8. *Genlisea* (corkscrew plant)
9. *Heliamphora* (marsh pitcher plant)
10. ***Nepenthes* (tropical pitcher plant)**
11. *Pinguicula* (butterwort)
12. *Roridula*
13. ***Sarracenia* (trumpet pitcher plant)**
14. *Utricularia* (bladderwort)



Genera of families containing only some carnivorous plants:

15. *Brocchinia*
16. *Catopsis*
17. *Philcoxia*
18. *Triphyophyllum*

Key:

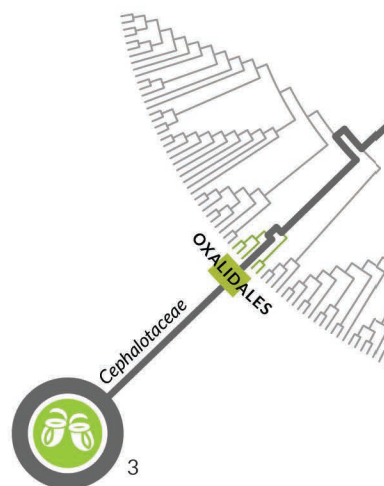
- Orders containing carnivorous plants
- Families with carnivorous plants
- *Cephalotus*, *Nepenthes* and *Sarracenia* pitcher plant lineage
- ➔ Pitcher plant lineage divergence point

Note: A digital version of this diagram, including additional taxonomic information, is available for download from the CPN website.

Figure 1.

Carnivorous Plant Tree of Life

Placement of carnivorous plant genera within the flowering plant lineage, highlighting the three pitcher plant lineages.



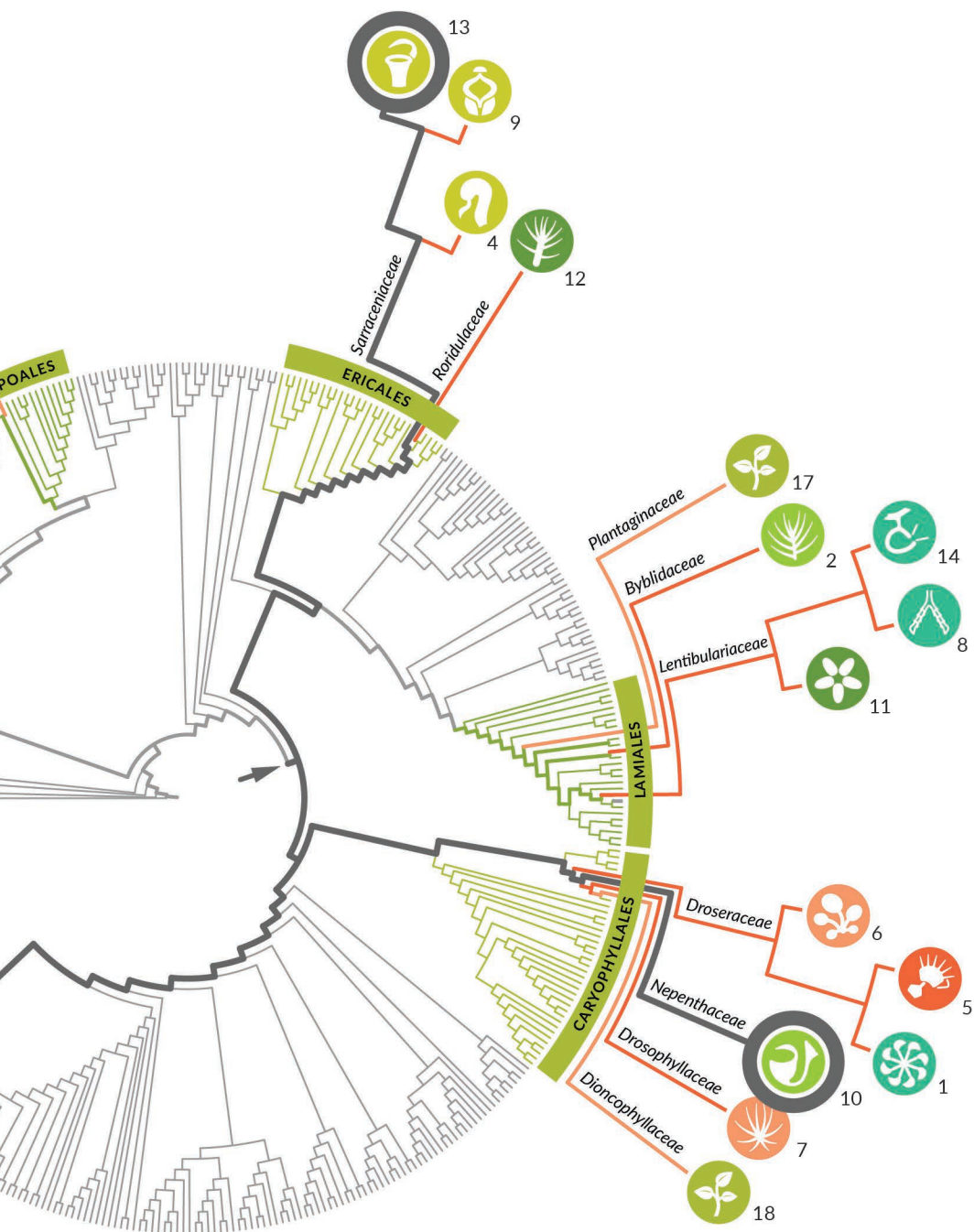


Image Credit: James Haig Streeter – CarnivorousPlantHunter.com

examples of convergence, such as the independent evolution of flight in birds and bats. However, the comparison is intended only as an illustrative framework, rather than a direct equivalence.

These three patterns highlight complementary aspects of carnivorous plant evolution. The broad distribution of carnivory across the angiosperm tree reflects repeated evolutionary responses to nutrient-poor environments. The divergence of trap types among close relatives illustrates how shared ancestral traits may give rise to specialized structures in response to specific ecological constraints. The repeated evolution of pitcher traps demonstrates how similar structural and functional outcomes can arise independently in unrelated plant families.

By depicting all recognized angiosperm families, the diagram gives a sense of the scale of flowering plant diversity and the comparatively small number of carnivorous lineages. At the same time, it shows that these lineages are not clustered in one part of the tree, but are distributed across several major branches of angiosperm evolution. This wider context helps illustrate why carnivorous plants are useful for understanding both convergent and divergent evolution. They show how similar ecological pressures can repeatedly favor nutrient acquisition from prey, while also demonstrating that the resulting structures may differ depending on lineage history, developmental constraints, and ecological setting.

The Carnivorous Plant Tree of Life is intended to serve both specialists and interested enthusiasts. For researchers, it consolidates the placement of carnivorous genera within a family-level angiosperm framework, although the printed version has been simplified for graphic clarity and is therefore not intended as a comprehensive taxonomic reference. A digital version with additional taxonomic information is available on the CPN website. For hobbyists, naturalists, and educators, this simplified presentation shows where familiar genera sit within the wider tree of flowering plants. By synthesizing published phylogenomic relationships into a single visual reference, the diagram invites readers to consider how carnivorous plants fit into the broader history of angiosperm evolution and how their diversity reflects repeated, independent responses to similar environmental pressures.

Materials and Methods: Phylogenomic data were derived from publicly available datasets generated by the Plant and Fungal Trees of Life Project (PAFTOL) at the Royal Botanic Gardens, Kew (Zuntini *et al.* 2024). No new phylogenetic analysis was undertaken. All evolutionary relationships shown in the diagram are based on previously published work.

A PAFTOL dataset was visualized using the Interactive Tree of Life (iTOL) platform in radial form, with each terminal branch representing one of the 416 recognized angiosperm families. All families were included in the underlying structure of the tree.

The positions of carnivorous genera follow Fleck *et al.* (2023), which also utilized PAFTOL data. Genera were added as icons adjacent to their respective families. The diagram is therefore intended as a visual synthesis of published phylogenomic relationships, rather than a new analytical phylogeny.

References

- Albert, V.A., Williams, S.E., and Chase, M.W. 1992. Carnivorous plants: phylogeny and structural evolution. *Science* 257: 1491–1495. <https://doi.org/10.1126/science.1523408>
- Darwin, C. 1875. *Insectivorous Plants*. London: John Murray.
- Fleck, S.J., and Jobson, R.W. 2023. Molecular phylogenomics reveals the deep evolutionary history of carnivory across land plants. *Plants* 12(19): 3356. <https://doi.org/10.3390/plants12193356>
- Zuntini, A.R., Carruthers, T., Maurin, O., *et al.* 2024. Phylogenomics and the rise of the angiosperms. *Nature* 629: 843–850. <https://doi.org/10.1038/s41586-024-07324-0>