

ASYMMETRICAL STEMS

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Asymmetrical stems are common in lianas, especially in families Apocynaceae, Fabaceae, Malpighiaceae, Passifloraceae, Vitaceae and Polygonaceae. Ontogenetically, asymmetrical stems resulting from the activity of a single cambium, typically start with a regular, round stem, and only in later developmental stages becomes asymmetrical (Fig. 1). The asymmetry of stems is an important character in the identification of families, genera, and even species. However, because the description of this feature is based on mature stems, it becomes necessary to examine old stems to confirm their morphology. These asymmetries derive from the unequal activity of the cambium that produce more secondary xylem (wood) and secondary phloem (inner bark) in certain areas of the stem (Fig. 1). Stem asymmetry, however, can be quite variable and apparently random within species (e.g., Malpighiaceae, Apocynaceae) where stems of different forms are produced.



Fig. 1. Ontogeny of *Heteropterys bullata* (Malpighiaceae) stem, showing progressive stages of development from early (A) to mature (D) stem, becoming progressively asymmetrical with age (Reproduced from Pace, 2015).

In certain families, stem asymmetry is rather fixed and therefore diagnostic. For example, stems of lianescent *Coccoloba* (Polygonaceae) are always bilobed. Stems of several Bignoniaceae, in particular of *Pleonotoma tetraquetra*, *P. melioides* and *Tynanthus polyanthus* are typically square. In *Pleonotoma* it was shown that the four edges of the squared stem coincide with the region where the pericyclic fibers and major vascular bundles of the primary body are located (Ozório-Filho 2002), indicating a nonrandom pattern of formation. Stems of lianescent Fabaceae are usually flattened (e.g., *Machaerium spp.*).

Asymmetrical stems may also derive from the activity of multiple cambia. Where the first formed vascular cylinder is rounded while subsequent cambia are formed concentrically (Fig. 2A), semi-concentrically, or non-concentrically (Fig. 2B). These successive cambia are formed outside the original vascular cylinder, thus giving rise to the asymmetry. This pattern is very common in Menispermaceae (Mennega 1982; Fig. 2), and Fabaceae (Rajput et al. 2012; Fig. 3) of the Neotropics.

Asymmetries are believed to be important for the climbing habit by providing angles that help lianas anchor to their supports, and by giving the stems more flexibility.

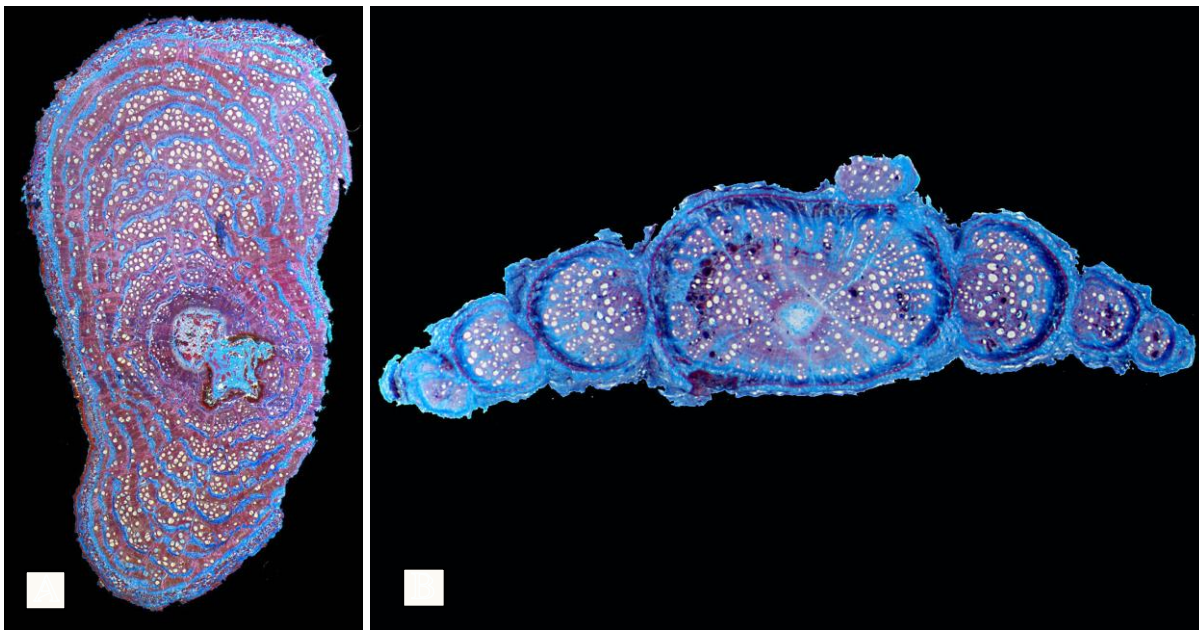


Fig. 2. Asymmetrical stems derived from multiple cambia. A. *Telitoxicum rodriguesii* (Menispermaceae). B. *Rhynchosia phaseoloides* (Fabaceae).

References

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