

Eutaxia myrtifolia

and phyllotaxy -

How leaves are arranged on stems

In spring we are besieged by an abundance of golden yellow pea-like flowers, most with touches of red and from many different genera, but all fondly referred to as *Eggs and Bacon*. *Eutaxia myrtifolia* is an *Eggs and Bacon* plant that has been extremely successful in cultivation and is now a popular garden plant Australia-wide. It is endemic to woodland, shrubland and heath along the coast of Western Australia.

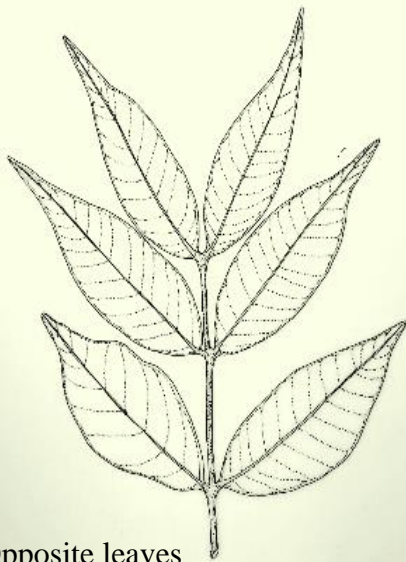


Distribution of *Eutaxia myrtifolia*. From *Atlas of Living Australia*.

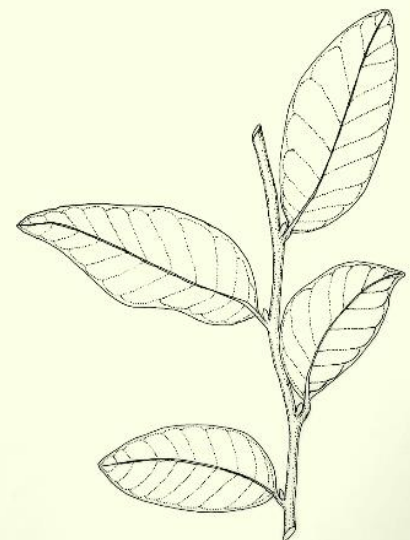
However, it's not just the flowers of *Eutaxia* that capture our attention, the arrangement of

leaves on the stems is also fascinating. In formal botanical parlance, the ordered leaf arrangement is referred to as *phyllotaxy* or *phyllotaxis*, from the Greek – *phyllon* (*leaf*); *taxis* (*arrangement*), i.e., the arrangement of leaves. One common arrangement is referred to as *two-ranked*, or

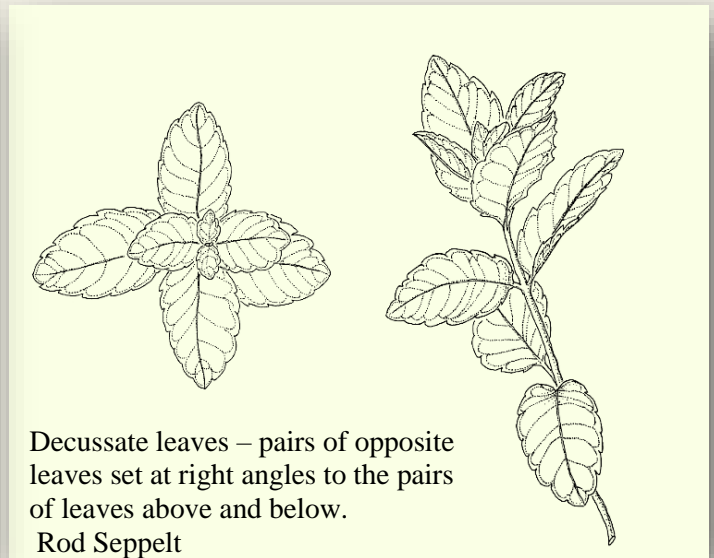
distichous. In this case, leaves are arranged on the stem in vertical rows or columns that are set at an angle of 180° to each other. In this case, the leaves can be either opposite or alternate.



Opposite leaves
Rod Seppelt

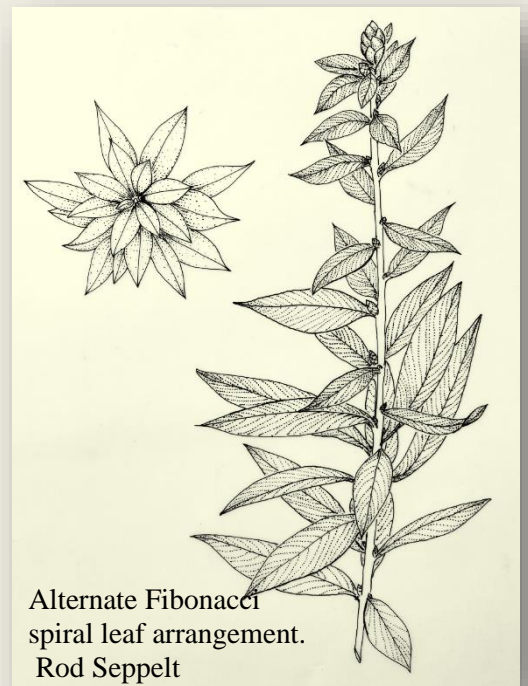


Alternate leaves
Rod Seppelt



If pairs of *opposite* leaves are set at 90° to each other, that is, each successive pair is at right angles to the pair below and the pair above, the arrangement is referred to as *decussate*. This characteristic is readily apparent in *Eutaxia myrtifolia*. This elegant arrangement of leaves is reflected in the name, *Eutaxia*, which comes from the Greek: *eu* (well) and *taxis* (arrangement), a reference to the regular arrangement of leaves on the stem.

Alternately arranged leaves can also *spiral* around the stem, and this arrangement is referred to as a *Fibonacci spiral*. (*Fibonacci numbers* are a sequence of numbers where each number is the sum of the two preceding numbers so starting from 0, the sequence is: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89... and so on.) However, leaves arranged in spirals do not always conform to Fibonacci sequences.



The angle from one leaf to the next leaf up the stem will be a fraction of the full rotation (360°) of leaves around the stem. So distichous (opposite) leaves can have $\frac{1}{2}$ a full rotation (180°), beech trees

have an angle of $\frac{1}{3}$ (120°), oak trees $\frac{2}{5}$

(144°), sunflowers $\frac{3}{8}$ (135°) and willow trees $\frac{5}{13}$ (138.46°). Remarkably, the numerator of these fractions is nearly always a Fibonacci number and the denominator will be the *second* Fibonacci number in the sequence. Often this results in leaves arranged in multiple vertical rows, referred to as *ranks*. (Fibonacci was a 13th



Epacris longiflora Alternate Fibonacci spiral leaf arrangement

century mathematician from Italy but the relevance of his work to Nature was not recognised until the 19th century).

Leaf arrangement (phyllotaxy) has long been thought to optimise leaf spacing to maximise light interception for photosynthesis. However, recent research not only confirms that the *golden angle*, 137.5°, is optimal for light capture for photosynthesis but that many other divergent angles that can be generated by Fibonacci sequences can also result in comparable light capture.



Homalanthus populifolius
Alternate – Fibonacci spiral leaf arrangement

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Atlas of Living Australia: <https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2911963>
Strauss S, Lempe J, Prusinkiewicz P, Tsiantis M, Smith R S. 2020. Phyllotaxis: is the golden angle optimal for light capture? *New Phytologist* 225(1): 499-510.
Wikipedia: https://en.wikipedia.org/wiki/Eutaxia_myrtifolia
Wikipedia: <https://en.wikipedia.org/wiki/Phyllotaxis>
Wilkins C F, Chappill J A, Henderson G R. 2010. An account of *Eutaxia* (Leguminosae: Mirbelieae) with a focus on the Western Australian species *Nuytsia* 20: 109–167.



Platylobium parviflorum
Two ranked opposite leaf arrangement



Bossiaea heterophylla
Two ranked alternate leaf arrangement



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Erica - Ericaceae
Leaves arranged in 8 ranks