

The ubiquitous *Agave attenuata* Foxtail Agave

This succulent monocot is so common in Australian gardens that it comes as quite a surprise to hear that it is not common, and possibly quite rare, in its natural habitat on the Central Mexican Plateau (*Altiplanicie Mexicana*), an area of deserts and arid shrublands, flanked by pine-oak forests. The rarity of the Foxtail Agave seems to be reflected by its inclusion in very few ecological studies.



Approximate location of Central Mexican Plateau – centre of the greatest diversity of *Agave* species.



There are about 200 species of *Agave*, most from arid or semi-arid areas of the Americas, but also some from the northern tropical regions of South America. *Agave* are perennials forming large rosettes of succulent leaves. The

Foxtail Agave is a little different from most as it doesn't have spiny tips to the leaves and rather than the tall, candelabra-type inflorescence typical of many species, it has an unusual arched inflorescence – hence the name, Foxtail Agave. The lack of spined tips to the leaves make it eminently suitable as a garden plant that can be placed close to footpaths and at the edge of gardens without risk to passers-by.

However, the flower stalks (inflorescences – the arrangement of flowers) is really intriguing. Most *Agave* have very tall, erect inflorescences to facilitate pollination by bats, hummingbirds and insects including bees and hawkmoths and to inhibit nectar and pollen theft by other predators. As the flower stalk of the Foxtail Agave grows, the weight of the young flower buds and opening flowers pull the tip of the stalk downwards to give it the elegant curve that gives it the name *Foxtail*, or sometimes





Tall, erect, candelabra-style inflorescence of *Agave americana*, the Century Plant, in Halifax Public Gardens, Canada. Photo: Paivi Torkkeli

Swan's Neck Agave. Back in the olden days, botanists included *Agave* in the Lily Family (Liliaceae) but molecular botanists now tell us that *Agave* is more appropriately included in the Asparagus Family (Asparagaceae).

Agave plants may take many years to flower, and many species are *monocarpic*, where individual plants flower only once, then die, but then again *Agave attenuata* is an exception.

Many *Agave*, but not Foxtail Agave, are chiropterophilous – bat pollinated. The flowers arranged at the tops of very tall stalks which can be up to 5 metres high. They open at night, smell like rotting fruit and are irresistible to bats. However, they are usually not exclusively bat-pollinated and other visitors include honey bees, hummingbirds, bumblebees and hawkmoths. Bees and other insects are the most likely pollinators of *Agave attenuata*.

Agave are well adapted to survive in hot, arid environments. They have a network of shallow

rhizomes that facilitate moisture capture from dew, condensation and from rain. The thick, succulent, fibre filled leaves store water and have a thickened epidermis and waxy cuticle that minimises water loss and protects from high radiation. Just by overlapping and shading the leaves below, the arrangement of leaves in the rosette also reduces exposure to heat and light. All *Agave* use the CAM photosynthetic pathway. Stomates open at night to take in CO₂ and close during the day to minimise water loss. This is reinforced the exposed curved upper surfaces of the leaves are that have a much smaller surface area than the lower. CAM plants also have the ability to put their metabolism into idle during periods of extreme heat and drought.

There are records dating back 10,000 years of *Agave* use for food and fibre by the Nahuatl, the original inhabitants of western Mexico. By 1520, the Spanish were already exporting *Agave* to





Blue Tequila (*Agave tequilana*)
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Europe. In modern times, two economically important species of *Agave* are Sisal (*Agave sisalana*), farmed for rope and twine, and the Blue Agave (*Agave tequilana*) from which the spirit drink tequila is produced. However commercial production of tequila generates problems for bats. Diversity of the species is dependent on bat pollination, but since tequila flowers stalks are cut prior to flowering and plants are propagated

vegetatively, there is no genetic diversity in the plantlets used on plantations. This may not be an immediate problem, but if a new disease appears within the tequila crops, because all individuals are genetically the same, they will all be equally affected. The Tequila *Agave* is also being assessed as a possible source of biofuel and is grown on the Atherton Tablelands of Far North Queensland.

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Pearson, G. Tequila, Booze, and Bats: <https://www.wired.com/2014/06/tequila-booze-and-bats/>
 Plantnet: <https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=gn&name=Agave>
 Schutler S. Bats and Tequila: an unexpected duo for your perfect Margarita. <https://stephanieschuttler.com/bats-and-tequila-an-unexpected-duo-for-your-perfect-margarita/>
 Ulaby N. Bats and Tequila: a once Boo-tiful Relationship cursed by Modern Demands. <https://www.npr.org/sections/thesalt/2017/10/29/560292442/bats-and-tequila-a-once-boo-tiful-relationship-cursed-by-growing-demands>
 University of Sydney. 'Tequila' powered biofuels more efficient than corn or sugar: Ethanol from agave could be used for transport fuel and hand sanitizer." ScienceDaily. ScienceDaily, 31 March 2020. <www.sciencedaily.com/releases/2020/03/200331130108.htm>.
 Wikipedia: https://en.wikipedia.org/wiki/Mexican_Plateau
 Wikipedia: <https://en.wikipedia.org/wiki/Agave>
 Wikipedia: https://en.wikipedia.org/wiki/Agave_attenuata



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