

Mistletoe

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Mistletoe is the common name for obligate hemi-parasitic plants in several families in the order Santalales. These plants attach to and penetrate the branches of a tree or shrub by a structure called the haustorium, through which they absorb water and nutrients from the host plant.



European mistletoe attached to a silver birch

Contents

- 1 Mistletoe in the genus *Viscum*
- 2 Other mistletoe groups
- 3 Life cycle
- 4 Ecological importance
- 5 Culture, folklore, and mythology
- 6 Use
 - 6.1 Medicine
 - 6.2 Other
- 7 Images
- 8 References
- 9 External links

Mistletoe in the genus *Viscum*

The name mistletoe was originally applied to *Viscum album* (European mistletoe, of the family *Santalaceae* in the order Santalales), the only species native in Great Britain and much of Europe. European mistletoe is readily recognized by its smooth-edged oval evergreen leaves borne in pairs along the woody stem, and waxy white berries in dense clusters of 2 to 6. It is a poisonous plant that causes acute gastrointestinal problems including stomach pain and diarrhea along with low pulse.^[1] The genus *Viscum* is not native to North America, but *Viscum album* has been introduced to California.^[citation needed]

Other mistletoe groups

Later the name mistletoe was further extended to other related species and even families, including *Phoradendron serotinum*, the eastern mistletoe of eastern North America. Eastern mistletoe is similar to European mistletoe, but has shorter, broader leaves and longer clusters of 10 or more berries.

The largest family of mistletoes, Loranthaceae, has 73 genera and over 900 species.^[2] Subtropical and tropical climates have markedly more mistletoe species; Australia has 85, of which 71 are in

Loranthaceae, and 14 in Santalaceae.^[3] Parasitism has evolved only nine times in the plant kingdom;^[4] of those, the parasitic mistletoe habit has evolved independently five times: Misodendraceae, Loranthaceae, and Santalaceae, including the former separate families Eremolepidaceae and Viscaceae. Although Viscaceae and Eremolepidaceae were placed in a broadly defined Santalaceae by Angiosperm Phylogeny Group II, DNA data indicates that they evolved independently.^[citation needed]

Life cycle

Mistletoe plants grow on a wide range of host trees, and commonly reduce their growth and can kill them with heavy infestation. *Viscum album* can parasitise more than 200 tree and shrub species. All mistletoes are hemi-parasites, bearing evergreen leaves that do some photosynthesis, and using the host mainly for water and mineral nutrients. Mistletoe seed germinates on the branch of a host tree or shrub and in its early stages of development is independent of its host. Later it forms a haustorium that penetrates the host tissue and takes water and nutrients from the host plant.^[citation needed] Species more or less completely parasitic include the leafless quintral, *Tristerix aphyllus*, which lives deep inside the sugar-transporting tissue of a spiny cactus, appearing only to show its tubular red flowers,^[5] and the genus *Arceuthobium* (dwarf mistletoe; Santalaceae) which has reduced photosynthesis; as an adult, it manufactures only a small proportion of the sugars it needs from its own photosynthesis but as a seedling it actively photosynthesizes until a connection to the host is established.



Mistletoe in winter

Some species of the largest family, Loranthaceae, have small, insect-pollinated flowers (as with Santalaceae), but others have spectacularly showy, large, bird-pollinated flowers.

Most mistletoe seeds are spread by birds that eat the fruits (drupes). There are various species of such birds, such as the Mistle Thrush in Europe, the Phainopepla in southwestern North America, and Dicaeum of Asia and Australia. Depending on the species of mistletoe and the species of bird, the seeds are regurgitated from the crop, excreted in their droppings, or stick to the bill, from which the bird wipes it onto a suitable branch. The seeds are coated with a sticky material called viscin. The viscin survives such treatment and any bare seed that touches a stem sticks tenaciously. The viscin soon hardens and attaches the seed firmly to its future host, where it germinates and its haustorium penetrates the sound bark.^[6] More specialist mistletoe eaters have adaptations for expediting the process; some pass the seeds through their unusually shaped digestive tracts so fast that a pause for defecation of the seeds is part of the feeding routine. Others have adapted patterns of feeding behaviour; the bird grips the fruit in its bill and squeezes the sticky coated seed out to the side. The seed sticks to the beak and the bird wipes it off onto the branch.^[7] Biochemically viscin is a complex adhesive mix containing cellulosic strands and mucopolysaccharides.^[8]

Once a mistletoe plant is established on its host, it usually is possible to save a valuable branch by pruning and judicious removal of the wood invaded by the haustorium, if the infection is caught early

enough. Some species of mistletoe can regenerate if the pruning leaves any of the haustorium alive in the wood.^{[9][10]}

Ecological importance

Mistletoe was often considered a pest that kills trees and devalues natural habitats, but was recently recognized as an ecological keystone species, an organism that has a disproportionately pervasive influence over its community.^[11] A broad array of animals depend on mistletoe for food, consuming the leaves and young shoots, transferring pollen between plants, and dispersing the sticky seeds. In western North America their juicy berries are eaten and spread by birds (notably Phainopepla, or silky-flycatcher). When eaten, some seeds pass unharmed through their digestive systems; if the birds' droppings happen to land on a suitable branch, the seeds may stick long enough to germinate. As the plants mature, they grow into masses of branching stems which suggest the popular name "witches' brooms". The dense evergreen witches' brooms formed by the dwarf mistletoes (*Arceuthobium* species) of western North America also make excellent locations for roosting and nesting of the northern spotted owl and the marbled murrelet. The Navajo name for mistletoe is "basket on high." In Australia the diamond firetail and painted honeyeater are recorded as nesting in different mistletoes. This behavior is probably far more widespread than currently recognized; more than 240 species of birds that nest in foliage in Australia have been recorded nesting in mistletoe, representing more than 75% of the resident birds.^[citation needed]

A study of mistletoe in junipers concluded that more juniper berries sprout in stands where mistletoe is present, as the mistletoe attracts berry-eating birds which also eat juniper berries.^[12] Such interactions lead to dramatic influences on diversity, as areas with greater mistletoe densities support higher diversities of animals. Thus, rather than being a pest, mistletoe can have a positive effect on biodiversity, providing high quality food and habitat for a broad range of animals in forests and woodlands worldwide.

Culture, folklore, and mythology

The word 'mistletoe' (Old English *mistiltan*) is of uncertain etymology; it may be related to German *Mist*, for dung and *Tang* for branch, since mistletoe can be spread in the droppings of birds moving from tree to tree. However, Old English *mistel* was also used for basil.

European mistletoe, *Viscum album*, figured prominently in Greek mythology, and is believed to be The Golden Bough of Aeneas, ancestor of the Romans.^[13]

Because of the scheming of Loki, according to the 13th century *Prose Edda*, the god Baldr is killed by his brother, the blind god Höðr, by way of a mistletoe projectile, despite the attempts of Baldr's mother, the goddess Frigg, to have all living things and inanimate objects swear an oath not to hurt Baldr after Baldr had troubling dreams of his death. Frigg was unable to get an oath from mistletoe, because "it seemed too young" to demand an oath from.^[14] In the *Gesta Danorum* version of the story, Baldr and Höðr are rival suitors, and Höðr kills Baldr with a sword named Mistilteinn (Old Norse "mistletoe"). In addition, a sword by the same name appears in various other Norse legends.

In cultures across pre-Christian Europe, mistletoe was seen as a representation of divine male essence (and thus romance, fertility and vitality).

According to Pliny the Elder, the Celts considered it a remedy for barrenness in animals and an antidote to poison.^[15]

When Christianity became widespread in Europe after the 3rd century AD, the religious or mystical respect for the mistletoe plant was integrated to an extent into the new religion. In some way that is not presently understood, this may have led to the widespread custom of kissing under the mistletoe plant during the Christmas season. The earliest documented case of kissing under the mistletoe dates from 16th century England, a custom that was apparently very popular at that time.

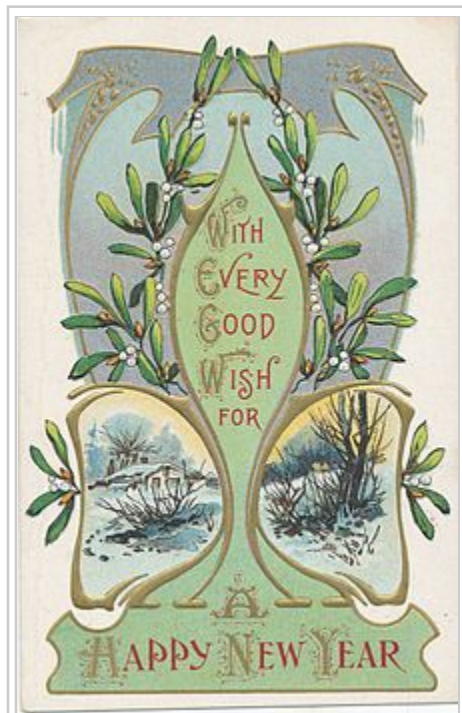
Winston Graham reports a Cornish tradition that mistletoe was originally a fine tree from which the wood of the Cross was made, but afterwards it was condemned to live on only as a parasite.^[16]

Mistletoe is commonly used as a Christmas decoration, though such use was rarely alluded to until the 18th century.^[17] *Viscum album* is used in Europe whereas *Phoradendron serotinum* is used in North America. Both are commercially harvested. According to custom, the mistletoe must not touch the ground between its cutting and its removal as the last of Christmas greens at Candlemas; it may remain hanging through the year, often to preserve the house from lightning or fire, until it is replaced the following Christmas Eve.^{[18][19]} The tradition has spread throughout the English-speaking world but is largely unknown in the rest of Europe.

The type of Mistletoe used during Christmas celebrations is of the same type as that believed to be sacred by ancient druids, but, outside northern Europe, the plant used is not the same species. The mistletoe that is commonly used as a Christmas decoration in North America (*Phoradendron flavescens*) grows as a parasite on trees in the west as also in those growing in a line down the east from New Jersey to Florida. In Europe, where the custom originates, the 'original' mistletoe, *Viscum album*, is still used. The European mistletoe is a green shrub with small, yellow flowers and white, sticky berries which are considered poisonous. Ancient druids considered the *Viscum album* plant holy, but had no knowledge of the *Phoradendron flavescens*. Modern druids focus on the parasitic habitat on oak (where it is



Each arrow overshot his head (1902) by Elmer Boyd Smith, depicting the blind god Höðr shooting his brother, the god Baldr, with a mistletoe arrow



Mistletoe postcard, circa 1900

very rarely found) as being the definer of a sacred mistletoe, and use *Phoradendron flavescens* as well as other mistletoe species.^[20]

According to ancient Christmas custom, a man and a woman who meet under a hanging of mistletoe were obliged to kiss. The custom may be of Scandinavian origin.^[21] It was described in 1820 by American author Washington Irving in his *The Sketch Book of Geoffrey Crayon, Gent.*:

The mistletoe is still hung up in farm-houses and kitchens at Christmas, and the young men have the privilege of kissing the girls under it, plucking each time a berry from the bush. When the berries are all plucked the privilege ceases.^[22]

See also *The Holly and the Ivy*.

Mistletoe (*Phoradendron serotinum*) is the state floral emblem for the state of Oklahoma. The state did not have an official flower, leaving mistletoe as the assumed state flower until the Oklahoma Rose was designated as such in 2004.^[23]

Mistletoe is the County flower of Herefordshire. It was voted such in 2002 following a poll by the wild plant conservation charity Plantlife.^[24]

Use

Medicine

Available clinical evidence does not support claims of anti-cancer effect, quality of life, or other outcomes from the use of mistletoe extract. Research has likewise shown little or no improvement in rigorous trials.^{[25][26][27]} Public interest in the United States was spurred in 2001 following actress Suzanne Somers' decision to use Iscador *in lieu* of chemotherapy following her treatment for breast cancer using surgery and radiotherapy.^{[28][29]}

Mistletoe leaves and young twigs are used by herbalists, and it is popular in Europe, especially in Germany, for treating circulatory and respiratory system problems.^{[30][31][32]} Use of mistletoe extract in the treatment of cancer originated with Rudolf Steiner, the founder of Anthroposophy. He compared the parasitic nature of the mistletoe plant to that of cancer, and believed that cancer represents a faltering of the body's spiritual defenses.^{[27][33]} Some anthroposophical mistletoe preparations are diluted homeopathically. Mistletoe extract is sold as Iscador, Helixor, and several other trade names.^[27]

Other

Mistletoe's use for Christmas decoration is discussed in a previous section (see above, Culture, folklore, and mythology.)

The sticky juice of mistletoe berries was used as adhesive to trap small animals or birds.^[34] In South Africa it is called "bird lime" in English and *voëlent* in Afrikaans. A handful of ripe fruits are chewed

until sticky, and the mass is then rubbed between the palms of the hands to form long and extremely sticky strands which are then coiled around small thin tree branches where birds perch. When a bird lands on this it gets stuck to the branch and is then easy to catch by hand.

Images



Mistletoe in an apple tree in Essex, England



Mistletoe in an apple tree in Essex, England



Mistletoe bush on a Eucalyptus tree



Mistletoe attached to Eucalyptus host



Mistletoe fruits



The sticky seed of the mistletoe on a branch



Red mistletoe, New Zealand



Mistletoe in San Bernardino Mountains



Mistletoe berries in Wye Valley



Mistletoe in abundance in Wye Valley



Mistletoe in North Central Texas



Mistletoe in France Versailles, France

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External links

- The Mistletoe Center (<http://www.rmrs.nau.edu/mistletoe/>)
- About mistletoe (<http://www.mistletoe.org.uk>)
- Parasitic Plant Connection. See families Misodendraceae, Loranthaceae, Santalaceae, and Viscaceae (<http://www.parasiticplants.siu.edu/>)
- Introduction to Parasitic Flowering Plants by Nickrent & Musselman (<http://www.apsnet.org/education/IntroPlantPath/PathogenGroups/Parasiticplants/>)
- *Phoradendron serotinum* images at bioimages.vanderbilt.edu (<http://www.cas.vanderbilt.edu/bioimages/species/frame/phle14.htm>)
- Scientific Studies, Research and Clinical Trials on Mistletoe Treatment in Cancer (<http://wissenschaft.mistel-therapie.de/?lang=1>)
- Deck the halls with wild, wonderful mistletoe, West Virginia Department of Agriculture (<http://sites.google.com/site/wvdaplanthpath/Home/mistletoe-feature>)
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