

**REVIEW ON: MISTLETOE – VISCUM SPECIES**

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Mistletoe is the common name for obligate hemi parasitic plants which are distributed worldwide, which contains chlorophyll pigments and they carry out photosynthesis for some extent from their life cycle to make their own food. Many species of these parasitic plants from different families Loranthaceae, Santalaceae and Misodendraceae are called as mistletoe. Especially from the genera *Viscum* from family Santalaceae bear evergreen fleshy stem and leaves that carries photosynthesis within. The genus *Viscum* comprises approximately 100 species that are mainly distributed across Africa, Asia and Europe. It has a wide variety of biologically active compounds therefore the extracts and different preparations of *Viscum* species are widely used as common complementary and alternative medicines in the treatment of rheumatism, cancer and many other diseases.

This review aims to explore genus *Viscum* regarding botanical behaviour and potential therapeutic applications

Keyword: Parasitic plants, Mistletoe, *Viscum* species

#### PARASITIC PLANTS (Mistletoea)

Parasitism for plants is a relationship in which one organism uses the nutrients and water of another plant, the host. A hemiparasite is epitomized by a plant that can live either as a parasite or on its own, hence this plant is a facultative parasite.

Parasitic plants belong to about 15 families. The many flowering species of mistletoes, be in to Loranthaceae and Viscaceae, comprise about three-quarters from all parasitic species.

Parasites become habituated via germination. Seeds land on the host tissue, for stem parasites especially in bird droppings, and germinate after reading a chemical stimulus from the host. A modified lateral rootstock becomes an haustorium; this root is chemotrophic, i.e., responding to a chemical gradient, and reduces the host epidermis. These roots then attaches by pushing against the plant and developing a disc, called a hapteron, and secretes a polysaccharide adhesive. The root tip then mechanically penetrates the host, apparently without enzymatic digestion, and establishes a vascular connection by attaching vessels and positioning phloem next to leaky host phloem.

Mistletoes were formerly stated to obtain no host carbohydrates, but substantial heterotropic carbon gain has been counted in mistletoes. Direct xylem-to-xylem continuity between host and parasite is not easy to demonstrate. Mistletoes often exhibit high transpiration rates during the day, through stomates and cracks in the epidermis. Losing substantial water from the leaves and stems of the parasite results in a steep water potential gradient, favorable to drawing water into the mistletoe plant. Nitrogen is supplied to the parasite in the xylem stream, and the high transpiration rates, hence, high water demands appear instead to represent a nitrogen-gathering mechanism for the mistletoe.

Typical thick, fleshy root parasites generally lack any adaptations to restrict water loss from their achlorophyllous stems and leaves, because they tend to lack the waxy coating, cuticle.

Dodder and mistletoes are serious problems for plants. Dodder is weedy and can cover woody plants and damage certain economically important crop plants. But Mistletoe can become so abundant on a tree, that most of them are green foliage. In general, experts state that parasitic plants rarely, perhaps never, kill the host plant, so that the host and parasite live unhappily together. [1] [2] [3]

#### HEMIPARASITES

Especially in the family Scrophulariaceae are some common hemiparasites, such as Indian paintbrush and owl's clover (*Castilleja*), lousewort (*Pedicularis*), and bird's beak (*Cordylanthus*). These have green, photosynthetic leaves, but a substantial portion of the parasite's carbon is derived from the host plant, parasitized from the roots.

CALIFORNIA PARASITIC PLANTS

The most recent flora of California listed 45 species of parasitic dicotyledons that are native or introduced to the state, including the introduced European mistletoe, *Viscum album*. In Los Angeles County, species of two groups are most commonly seen: the twining vines of dodder (genus *Cuscuta*) and the woody mistletoes of the genus *Phoradendron*. In coniferous forests you may find the golden-colored dwarf mistletoes of the genus *Arceuthobium* (12 species). The flora also lists about 70 species of hemiparasites occurring in California, all but one species belonging to Family *Scrophulariaceae*. Of the hemiparasites, owl's clover and Indian paintbrush (*Castilleja*) are very common herbs.

There are five species of *Phoradendron* that can be easily observed during casual walks and drives through Southern California. [3] [4]

1. The California sycamore (*Platanus racemosa*) found throughout the urban region and canyons is the big-leaf mistletoe, *Phoradendron macrophyllum*, but this species also occurs on many other deciduous trees, including alder (*Alnus*), cottonwood (*Populus*), and walnut (*Juglans*).
2. On woody stems of oaks (*Quercus*) of oak woodland can often be found oak mistletoe, *Phoradendron villosum*, which has green leaves approximately the same size as in the big-leaf mistletoe.
3. Much narrower leaves characterize fir mistletoe, *Phoradendron pauciflorum*, which occurs often around 2000 meters in yellow pine forest growing on white fir, *Abies concolor*.
4. On the eastern, desert-facing slope of our mountains occurs pinyon-juniper woodland and in neighboring Joshua tree woodland. *Juniperus californica*, is a dominant plant species, and often this gymnosperm is heavily infested with juniper mistletoe, *Phoradendron juniperinum*. This stem parasite has shorter and narrow leaves, and from a distance may appear like the host plant, but host has instead very tiny, scale-like leaves.
5. In deserts of Southern California are sapling legumes, notably species of mesquite (*Prosopis*), palo verde (*Cercidium*), ironwood (*Olneya*), and catclaw acacia (*Acacia*), which can be infected by desert mistletoe, *Phoradendron californicum*. Desert mistletoe, reduced and scale-like leaves on its reddish stems

Mistletoe are those plants grow attached to and penetrating within the branches of a tree or shrub by a structure called the haustorium, through which they can absorb nutrients from host plant.



Fig. 1. The Genus *Viscum* Mistletoe.

The name was given originally to *Viscum album* (F:Santalaceae), European Mistletoe., This is the only species native in Europe and Great Britain. *Viscum album* is readily identified by its oval, smooth-edged and evergreen leaves borne in pairs along the woody stem. And clusters of 2 to 6 waxy white berries in abundance. In America *Viscum* genus grows rare.

*Viscum album* is a toxic mistletoe that causes gastrointestinal problems including acute stomach pain, and diarrhoea along with low pulse. However, both European Mistletoe and the North American species, *Phoradendron serotinum*, are commercially harvested for Christmas decorations.

[5] [6]

Viscum is a genus of about 70-100 species of mistletoes, native to climate and tropical regions of Europe, Africa, Asia and Australasia. Habitually, this genus has been placed in its own Viscaceae family, but by recent genetic research by Angiosperm Phylogeny Group shows that family Viscaceae to be correctly placed within the circumscription of sandalwood, family Santalaceae.

They are woody, restricted habitual hemi-parasitic bush with branches 15–80 centimetres length with woody trees hosts. The plant leaves are is verticillately or dichotomously branching, with opposite pairs of green leaves which perform e photosynthesis in small amount, but for that plant taking g its mineral and water requirements from host tree. Different Viscum species tend to utilize several host species.

The flowers are greenish-yellow, inconspicuous, 1–3 millimetres in diameter. The fruit are white, berries and red when mature which contains several seeds embedded in sticky juice. The seeds got dispersed by birds while eating fruits., they remove the sticky seeds from the beak by wiping them on tree branches where they starts germination.



Fig. 2. : **Viscum album** with white berries

*Viscum album* – European Mistletoe, *Viscum cruciatum*, *Viscum articulatum*, *Viscum capense* , *Viscum bancroftii*, *Viscum coloratum*, *Viscum fargesii*, *Viscum diospyrosicola*, *Viscum liquidambaricola*, *Viscum monoicum*, *Viscum loranthi*, *Viscum multinerve*, *Viscum minimum* , *Viscum orientale*, *Viscum nudum*, *Viscum whitei*, *Viscum ovalifolium*, *Viscum yunnanense*, *Viscum triflorum*

Loranthaceae, is the largest family of Mistletoes, which has 73 genera and 900 species. Mistletoe species habitat more in tropical and subtropical climates; in the plant kingdom Parasitism has evolved for nine times. And parasitic mistletoe habit has evolved separately for five times: Misodendraceae, Viscaceae, Loranthaceae, Eremolepidaceae and Santalaceae.. [8] [9]

Mistletoe plants grow on several host trees, and commonly reduce their growth and can kill them with heavy infestation. *Viscum album* can grow on more than 200 tree species. All mistletoes are hemi-parasites. Species more or less completely parasitic include the leafless aphyllus, quintral which lives inside the sugar-transporting tissue of plant, appearing only to show its small tubular red flowers. The genus *Arceuthobium* (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 after connection to the host. [9] [10] [11]

#### Ecological importance:

Earlier Mistletoe was known as a pest that kills trees, but was recently identified as an ecologically important species. A wide array of animals depends on mistletoe for food, by consuming the leaves and young shoots and help for transferring pollen between plants, and dispersing sticky seeds. Similarly, by birds, juicy berries are eaten and spread by birds. When eaten, if the birds' droppings happen on a suitable branch, the seeds may stick and further starts to germinate. This way of changes are observed in their name, Mistel is the Anglo-Saxon word for dung, , another popular name "witches' brooms". The Navajo name for mistletoe is "basket on high.". In Australia the diamond firetail and painted honeyeater are recorded as nesting in mistletoes. More than 240 species of birds nesting in Mistle foliage are reported in Australia.

Study on mistletoe in coniferous trees and shrubs concluded that more juniper berries germinate in mistletoe species, because mistletoe attracts berry-eating birds. Because of these interactions lead to influences on diversity of animals. Thus, now a pest, mistletoe can have a positive and good effect on biodiversity, providing high quality food and habitat for a wide range birds and animals worldwide. [12] [13]. In Christianity, the mystical or religious respect for the mistletoe plant, this may have led to widespread custom of kissing under the mistletoe plant during the Christmas season.[14]. Mistletoe is commonly used in Christmas decoration.[15]. *Viscum album* is used in Europe and *Phoradendron serotinum* is used in North America. As per the custom, between its cutting and its removal mistletoe must not touch the ground, it should remain hanging throughout the year, [16, 17]. *Viscum album* is still use as holy plant. [18] [19]

#### Medicinal use:

By the available clinical evidence does not support the mistletoe claims of anti-cancer effect, quality of life, use of mistletoe extracts medicinal outcomes.[20][21][22]. Mistletoe foliage and new twigs are used by herbalists. In Germany, used for treating circulatory and respiratory system disorders. In the treatment of cancer of mistletoe extract were used. [23][24]. Some mistletoes are formulated by diluted homeopathically.

Other uses: To trap small animals or birds the sticky juice of mistletoe berries was used as adhesive. Even a handful of ripe fruits are chewed and the mass is rubbed between the palms of the hands to form long which further coiled around small thin tree branches. When a bird lands on this it gets stuck can then easy to catch by hand. [25]

#### Conclusion:

*Viscum* species has been used for centuries for different purposes. It includes different herbal preparation, or homeopathy with more complex forms of preparation. This species are gaining more relevance each day in in vitro and in vivo studies mainly due to its cytotoxic and immunomodulatory activities. Therefore, due to its satisfactory clinical area results, these species gaining more attention from the scientific community. This review sought to gather as much information about the *Viscum* species regarding its botanical characteristics, bioactive compounds, and medicinal activity in cancer patients. Although known for a long time, few scientific evidences of the plant effects in the molecular field are known. Therefore, this is a new field for scientist to study isolation and identification of bioactive compounds, pharmacologic activities, interactions, and synergy among compounds and possible mechanisms of action.

#### References:

1. Sydney J. Tanner. There's more to mistletoe than just a prompter. Chippewa.com. 2009, December 10, 15-20
2. WS Judd, CS Campbell, E Kellogg, PF Stevens & MJ Donaghue. 2002. Plant systematics: a phylogenetic approach. Sinauer Associates, Inc., Sunderland Massachusetts, USA. ISBN 0-87893-403-0
3. B.A. Barlow (1983) A revision of the Viscaceae of Australia. *Brunonia* 6, 25–58.
4. Job Kuijt, *Biology of Parasitic Flowering Plants* (University of California) 1969.
5. Susan Milius, 2000. "Botany under the Mistletoe" *Science News* 158.26/27 10:412.
6. <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7437.html>
7. Torngren, T. S., E. J. Perry, and C. L. Elmore. 1980. *Mistletoe Control in Shade Trees*. Oakland: Univ. Calif. Agric. Nat. Res. Leaflet 2571
8. David M. Watson.2001. "Mistletoe-A Keystone Resource in Forests and Woodlands Worldwide" *Annual Review of Ecology and Systematics*. 32 :219–249).
9. Susan Milius.2002 "Mistletoe, of All Things, Helps Juniper Trees" *Science News* 161: 1- 6
10. Faulkes, Anthony .1995. *Everyman*. ISBN 0-460-87616-3. 48- 49
11. Pliny the Elder. *Natural History*. Book XVI.

12. Graham, Winston. 2002. *Bella Poldark*. Macmillan. Chapter 6.
13. Susan Drury. 1987. "Customs and Beliefs Associated with Christmas Evergreens: A Preliminary Survey" *Folklore* 98.2, 194 –199
14. Taylor, Pat & Ton 1997., *The Henge of Keltria Book of Ritual*, 4th ed. 285
15. E. Cobham Brewer., *Dictionary of Phrase and Fable*. 1898. "Kissing under the mistletoe" relates the custom to the death of Baldr, without authority.
16. "Christmas Eve" from Washington Irving, *The Sketch-Book of Geoffrey Crayon, Gent.*" (Rev. ed. 1852), 254 (available on Google Books).
17. Oklahoma Historical Society. *Oklahoma State Symbols*. Floral Emblem.
18. Plant life website *County Flowers*, 99-105
19. Ernst; Schmidt, K.; Steuer-Vogt, M. 2003 "Mistletoe for cancer? A systematic review of randomised clinical trials". *International Journal of Cancer*. 107 (2): 262–267.
20. Horneber, M.; Bueschel, G.; Huber, R.; Linde, K.; Rostock, M. Horneber, Markus. 2008. "Mistletoe therapy in oncology". 2008. American Cancer Society. 11-01. Retrieved 2009-10-11.
21. "Mistletoe: Natural doesn't always mean harmless". American Cancer Society. 2001-05-04. Retrieved 2009-10-11
22. Schneider, KS (2001-04-30). "A Matter of Choice". *People* and Retrieved 2009-10-11.
23. Ernst E, Schmit K, Steuer-Vogt MK. Mistletoe for cancer? A systematic review of randomised controlled trials. 2003; *Int J Cancer* 107:262-7, cited in *BMJ* 2006;333:1293–1294
24. Ernst, E. "Mistletoe as a treatment for cancer". *BMJ*. 2006. Clinical research 333 (7582): 1282–1283.
25. Menke K, Schwermer M, Eisenbraun J, Zuzak TJ, Schramm A 2020.. Anticancer Effects of *Viscum album* Extract on Medulloblastoma Cells in vitro. *Complementary Medicine Research*, 13, 1-8.